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SCOPING PLAN

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Acronyms and Abbreviations

AEM	Agricultural Environmental Management
AGM	New York State Department of Agriculture and Markets
AgNPS	Agricultural Nonpoint Source Abatement and Control
ASHP	air-source heat pump
AR5	IPCC Fifth Assessment Report
AR6	IPCC Sixth Assessment Report
AV	automated vehicles
BMP	best management practices
BOA	Brownfield Opportunity Area
Btu	British thermal unit
CALS	College of Agriculture and Life Sciences
CCA	Community Choice Aggregation
CCE	Cornell Cooperative Extension
CDR	carbon dioxide removal
CES	Clean Energy Standard
CJWG	Climate Justice Working Group
Climate Act	Climate Leadership and Community Protection Act
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide equivalent
COBRA	EPA's CO Benefits Risk Assessment
Code Council	New York State Fire Prevention and Building Code Council
CRF	Climate Resilient Farming
CRRA	Community Risk and Resiliency Act
CSRO	Chief State Resilience Officer
CUNY	City University of New York
DASNY	Dormitory Authority of the State of New York
DC	direct current
DEC	New York State Department of Environmental Conservation
DER	distributed energy resource
DFS	New York State Department of Financial Services
DHSES	New York State Division of Homeland Security and Emergency Services
DOH	New York State Department of Health
DOL	New York State Department of Labor
DOS	New York State Department of State
DOT	New York State Department of Transportation
DPS	New York State Department of Public Service
ECL	Environmental Conservation Law
EFC	Environmental Facilities Corporation
EGS	enhanced geothermal systems

EHAPWG	Extreme Heat Action Plan Work Group
EITE	energy-intensive and trade-exposed
EPA	U.S. Environmental Protection Agency
EPF	Environmental Protection Fund
EPR	Extended Producer Responsibility
EQIP	Environmental Quality Incentives Program
ESD	Empire State Development
ESF	College of Environmental Science and Forestry
E-TOD	equitable transit-oriented development
EV	electric vehicle
FERC	Federal Energy Regulatory Commission
GEIS	Generic Environmental Impact Statement
GHG	greenhouse gas
GSHP	ground-source heat pump
GSP	gross state product
GW	gigawatt
GWP	global warming potential
HCR	New York State Homes and Community Renewal
HFC	hydrofluorocarbon
HVAC	heating, ventilation, and air conditioning
IPCC	Intergovernmental Panel on Climate Change
ITS	New York State Office of Information Technology Services
JTWG	Just Transition Working Group
LDV	light-duty vehicle
LIPA	Long Island Power Authority
LMI	low- and moderate-income
mgd	million gallons per day
MHD	medium- and heavy-duty
MMT	million metric tons
MOD	mobility-oriented development
MPO	Metropolitan Planning Organization
MSW	municipal solid waste
MTA	Metropolitan Transportation Authority
MW	megawatt
MWBE	minority- and women-owned business enterprise
N ₂ O	nitrous oxide
NGO	nongovernmental organization
NO ₂	nitrogen dioxide
NO _x	nitrogen oxides
NPV	net present value
NRCS	Natural Resources Conservation Service

NYCRR	Official Compilation of Codes, Rules, and Regulations of the State of New York
NYISO	New York Independent System Operator
NYPA	New York Power Authority
NYSERDA	New York State Energy Research and Development Authority
OGS	New York State Office of General Services
OPRHP	New York State Office of Parks, Recreation, and Historic Preservation
ORES	Office of Renewable Energy Siting
OTDA	New York State Office of Temporary and Disability Assistance
PANYNJ	Port Authority of New York and New Jersey
PM _{2.5}	fine particulate matter
PSC	Public Service Commission
PV	photovoltaics
RD&D	research, development, and demonstration
REDC	Regional Economic Development Council
RGGI	Regional Greenhouse Gas Initiative
RNG	renewable natural gas
SAPA	State Administrative Procedures Act
SDVOB	service-disabled veteran-owned business
SEQRA	State Environmental Quality Review Act
SF ₆	sulfur hexafluoride
SO ₂	sulfur dioxide
SUNY	State University of New York
SWCC	Soil and Water Conservation Committee
SWCD	Soil and Water Conservation District
The Council	Climate Action Council
TOD	transit-oriented development
USDA	U.S. Department of Agriculture
VMT	vehicle miles traveled
VOC	volatile organic compound
WPDC	Wood Products Development Council
WRRF	water resource recovery facility
ZEV	zero-emission vehicle

Overview

Chapter 1. Executive Summary

The 2019 Climate Leadership and Community Protection Act (Climate Act), one of the most ambitious climate laws in the nation, called for the issuance of a Scoping Plan under the direction of a 22-member Climate Action Council (Council), to be completed by January 1, 2023. This Scoping Plan includes recommendations to meet the Climate Act’s nation-leading goals and requirements, including actions to achieve a reduction in economywide greenhouse gas (GHG) emissions of 40% by 2030 and 85% by 2050 from 1990 levels, which will put New York on a path toward carbon neutrality while ensuring equity, system reliability, and a just transition from a fossil fuel economy to a robust clean energy economy. This Scoping Plan prioritizes Disadvantaged Communities and the creation of good, family-sustaining, union jobs accessible to all New Yorkers. The Scoping Plan sets the course for New York to create new job opportunities, support healthier communities, and ensure that all New Yorkers will benefit from investments in the State’s growing green economy. It builds on New York’s unprecedented investments to ramp-up clean energy, including over \$35 billion for 120 large-scale renewable and transmission projects across the State, \$6.8 billion to reduce buildings emissions, \$1.8 billion to scale up solar, more than \$1 billion for clean transportation initiatives, and over \$1.6 billion in NY Green Bank commitments. This Scoping Plan also provides examples for other states and the nation to follow to mitigate the effects of climate change and adapt to climate change risks while protecting workers and uplifting historically marginalized populations.

This Scoping Plan is the result of more than two years of diligent and inclusive work. It builds upon contributions from seven sector-specific Advisory Panels and the Just Transition Working Group (JTWG), with significant input from stakeholders and the public at large. Scoping Plan recommendations were informed by detailed input from the Climate Justice Working Group (CJWG), which provided the foundation for integrating these recommendations and assessing their ability to meet the Climate Act requirements. The process included the issuance of the draft Scoping Plan on December 30, 2021, which initiated a six-month public comment period. After hearing testimony at 11 public hearings across the State and receiving more than 35,000 written comments, the Council considered this feedback, heard further analytical information, and consulted with the CJWG in developing this Scoping Plan.

This Scoping Plan provides recommendations for both sector-specific and economywide actions to achieve the Climate Act’s goals and requirements. New York’s climate action strategy is fundamentally

driven by the need to deliver on climate mitigation, justice, economic opportunity, and long-term job opportunities for New Yorkers.

1.1 Climate Action

The consequences of a changing climate are here globally and in New York State. Around the world thousands of scientific studies have documented changes in air and water temperatures, melting glaciers, diminishing snow cover, shrinking sea ice, rising sea levels, ocean acidification, and increasing atmospheric water vapor. Warming trends and incidences of intense heat waves will contribute to greater localized heat stresses; heavy rainfall events that exacerbate localized flooding will continue to impact food production, natural ecosystems, and water resources; and sea-level rise will increasingly threaten sensitive coastal communities and ecosystems. Additionally, climate-driven impacts are magnified in New York's historically marginalized communities that have been disproportionately affected by and are on the front lines of climate change. According to both the U.S. Global Change Research Program and the Intergovernmental Panel on Climate Change, substantial reductions in greenhouse gas emissions will be required by mid-century in order to limit the global average increase in temperature to no more than 2°C (and ideally 1.5°C), thus minimizing the risk of severe impacts from climate change. Climate change is adversely affecting New York's economic well-being, public health, natural resources, and environment. The severity of climate change and the threat of more severe impacts will be determined by the actions undertaken in New York and other jurisdictions to reduce GHG emissions.

A fundamental objective of New York's nation-leading climate and energy agenda is to advance New York's contributions to global climate change mitigation. As laid out in the Scoping Plan, the Council's recommendations will reduce GHG emissions consistent with the interim and long-term directives established in the Climate Act. The Scoping Plan is one of the most ambitious climate change mitigation plans in the world and distinguishes New York as a climate leader. It identifies actions needed for New York to achieve 70% renewable electricity by 2030, 100% zero-emission electricity by 2040, a 40% reduction in statewide GHG emissions from 1990 levels by 2030, an 85% reduction in statewide GHG emissions from 1990 levels by 2050, and net zero emissions statewide by 2050. It outlines a variety of regulatory and legal changes, market mechanisms, and technologies essential to achieving the goals and requirements of the Climate Act. Changes in energy consumption patterns and in how consumers relate to and use energy will further enhance New York's ability to achieve these goals and requirements. The various education and outreach initiatives identified in the Scoping Plan will lay a foundation from which the State can further explore those options in years to come.

As demonstrated in the analyses supporting the Scoping Plan, focused and continuous progress is necessary to reduce emissions in all sectors, and the interconnection of the various sectors informs how to realize the GHG emission limits. For example, New York will need to achieve a zero-emission electricity system to achieve deep emission reductions in the building and transportation sectors as those sectors become less dependent on fossil fuels. As these transitions occur, New Yorkers will benefit from greater levels of energy efficiency through installation of cold-climate heat pumps and the purchase of electric vehicles (EVs), providing more opportunities to manage energy use and reduce energy costs.

The development of the Scoping Plan included a comprehensive, science-based integration analysis of the benefits and costs of the recommendations that the Advisory Panels provided during the process. The integration analysis examined several pathways to achieving the GHG emission limits, governed by foundational principles of ensuring reliability of the energy system as fundamental to New Yorkers' welfare, safety, and prosperity and the cost-effectiveness of the approaches to achieving the required emissions limits. This integration analysis led to several key findings.

- **Achieving deep decarbonization is feasible by 2050:** Achieving the GHG emission limits requires action in all sectors, especially considering the Climate Act's GHG emissions accounting, as described in *Chapter 4. Current Emissions*. Every sector will see significant transformation over the next decade and beyond, which will require critical investments in New York's economy.
- **Energy efficiency and end-use electrification are essential parts of any pathway that achieves New York State emission limits:** Approximately 1 to 2 million efficient homes must be electrified with heat pumps by 2030. Approximately 3 million zero-emission vehicles (predominantly battery electric) will be needed by 2030.
- **The cost of inaction exceeds the cost of action by more than \$115 billion:** Achieving Climate Act GHG emission limits will require significant investment accompanied by even greater benefits. The GHG emission reduction strategies result in improvements in air quality, increased active transportation, and energy efficiency interventions in low- and moderate-income (LMI) homes, which generate health benefits. Reducing GHG emissions also avoids the economic impacts of societal damages caused by climate change.
- **Create hundreds of thousands of jobs:** In addition to health and avoided economic damage benefits, new jobs driven by Climate Act investments are estimated to outnumber potential displaced jobs by a ratio of ten-to-one in 2030, with as many as 211,000 jobs expected to be created in growing sub-sectors by 2030 and 318,000 by 2040.

- **Net direct costs are small relative to the size of New York’s economy:** Net direct costs are estimated to be up to 0.6% of New York State’s economy in 2030 and 1.3% in 2050. The passage of the federal Inflation Reduction Act is a major policy development that will likely reduce the costs of decarbonization economywide.

Notably, the integration analysis shows that climate investments are also health investments that will meaningfully reduce pollution in communities and buildings by decreasing harmful emissions and improving air quality. For New Yorkers, this means cleaner air, avoiding tens of thousands of premature deaths, thousands of non-fatal heart attacks, thousands of other hospitalizations, thousands of asthma-related emergency room visits, and hundreds of thousands of lost workdays. The information from the integration analysis also informed the development of the JTWG’s Jobs Study, which revealed that climate investments will create hundreds of thousands of good quality jobs and careers across New York State. These economic benefits are in addition to the benefits and avoided costs discussed above.

New York’s transition to clean energy will deliver benefits to communities by integrating measures that create stronger and more resilient energy systems; ensuring clean, affordable, and reliable transportation; supporting clean and safe energy-efficient homes and businesses; ensuring clean and reliable electric power; creating high-quality jobs; improving public health; and ensuring an equitable clean energy economy for everyone. Recommended investments in building and electric grid infrastructure, such as storm hardening, elevating equipment and substations, moving lines underground, and deploying energy storage or onsite renewables will improve the reliability and resilience of the electric grid in the face of worsening storms and other impacts of climate change. The transition will also spur investments in New York’s homes and commercial buildings. As a result of these investments there will be more energy-efficient, zero-emission buildings that use grid-interactive appliances and energy storage to actively manage building energy demand on the power grid and incorporate strategies to protect residents from high heat. The results will be concrete, “kitchen-table” benefits for New Yorkers.

- **Stronger and More Resilient Energy Systems:** Energy infrastructure will be strengthened and enhanced to be better prepared for and withstand, adapt, and quickly recover from disruptions such as severe weather and natural and man-made disasters.
- **Clean, Affordable, Reliable Transportation:** EVs cost less to fuel, operate, and maintain, which will save individuals and families money. The upfront purchase price for EVs is approaching that of gasoline vehicles and continues to decrease. Zero-emission trucks and buses and expanded low-cost clean transportation options like biking, walking, and transit will enable New Yorkers to trade gridlock and diesel fumes for fresh air and cleaner communities.

- **Clean and Safe Energy-Efficient Homes and Businesses:** Modern clean heating and cooling technologies, such as electric heat pumps and smart thermostats, combined with energy efficiency, will improve comfort, and save New Yorkers energy costs.
- **Clean and Reliable Electric Power:** Solar, wind, hydroelectric, and other zero-emission resources, combined with energy storage, will deliver safe and reliable electricity over the next decade and beyond, which will put an end to New Yorkers’ vulnerability to fossil fuel disruptions and energy price volatility.
- **Better Energy Choices:** When gasoline vehicles and fossil fuel heating or cooking appliances need replacement, State and federal incentives will help New Yorkers choose more efficient and higher-performing electric appliances and vehicles. Consumers may choose modern technologies that can save money and reduce emissions.
- **High-Quality Jobs:** New York’s energy transition will create tens of thousands of jobs, spur good quality union job employment, and drive job and wage gains across the economy and in every corner of the State.
- **Better Health:** New Yorkers will benefit from positive health outcomes as a direct result of reduced fossil fuel emissions in communities and homes.
- **An Equitable Clean Energy Economy for Everyone:** Every community, every trade, and every region will have access to clean energy solutions and the economic opportunities that the transition to a just and equitable energy system will provide.

1.2 Climate Justice

A fundamental objective of New York’s nation-leading climate and energy agenda is to ensure that New York’s transition to a clean energy economy addresses health, environmental, and energy burdens that have disproportionately impacted underrepresented or underserved communities (including people of color, indigenous populations, low-income individuals, and women) and to remedy the structural causes that underpin these burdens.

The Climate Act defines Disadvantaged Communities as “communities that bear burdens of negative public health effects, environmental pollution, impacts of climate change, and possess certain socioeconomic criteria, or comprise high concentrations of low- and moderate-income households.” As required by the Climate Act, the CJWG identified Disadvantaged Communities based on geographic, public health, environmental hazard, and socioeconomic criteria. The CJWG released the draft criteria for public comment in March 2022 and received more than 3,000 comments. The CJWG is considering those

comments as it works to finalize the criteria by early 2023. After final criteria are established, the CJWG will review them annually to ensure that they remain appropriate and effective.

As further laid out in the Scoping Plan, and through work led by the CJWG, New York will take comprehensive action to address climate justice and ensure that New York's transition to a low-carbon clean energy economy will create a model in which achieving a high standard of economic well-being and health in every community is the baseline condition of climate action. New York has witnessed how climate change heightens the vulnerability of Disadvantaged Communities, adversely affecting economic well-being, public health, and public safety through increased risk of extreme heat, flooding, or exposure to air pollutants emitted alongside GHG emissions. Through enshrining equity objectives in State investments, program design, and internal and external engagement strategies, the Scoping Plan describes how the Climate Act will work to address past discrimination.

The Scoping Plan includes recommendations from the Barriers and Opportunities Report, developed by the Department of Environmental Conservation (DEC), New York State Energy Research and Development Authority (NYSERDA), and the New York Power Authority (NYPA) pursuant to the Climate Act, in an effort to address past practices that excluded historically marginalized and overburdened communities from State decision-making processes. The Barriers and Opportunities Report identifies problems associated with access to, or community ownership of, services and commodities in Disadvantaged Communities in five key clean energy and climate resilient infrastructure areas. State entities will work to improve engagement with residents and representatives of Disadvantaged Communities to identify and understand barriers and opportunities at the local level to increase participation in the clean energy transition and enhancing community resilience. This work will include ensuring that agencies and authorities are creating conditions for communities that would not typically engage in administrative processes to do so.

The Climate Act requires that Disadvantaged Communities receive a minimum of 35%, with a goal of 40%, of the benefits of spending on clean energy and energy efficiency programs, projects, or investments in the areas of housing, workforce development, pollution reduction, low-income energy assistance, energy, transportation, and economic development. State agencies, in consultation with the CJWG and other relevant stakeholders, are developing a methodology for defining the benefits of State investments in Disadvantaged Communities. The definition of Disadvantaged Communities and the methodology for defining benefits will be provided to all State agencies to ensure a coordinated approach to directing benefits to Disadvantaged Communities as required by the Climate Act.

Prioritizing the reduction of GHG emissions and co-pollutants in Disadvantaged Communities, while not creating a disproportionate burden on such communities as required by the Climate Act, is woven throughout the recommended strategies in the Scoping Plan. These strategies are designed to target concrete benefits to individuals in Disadvantaged Communities in several ways:

- Addressing energy affordability concerns and reducing energy burden
- Reducing environmental burden from GHG emissions and co-pollutants
- Ensuring full participation in the new clean economy and corresponding job growth, including through access to good quality jobs and union-based employment opportunities
- Ensuring access to New York State’s significant and growing policies and programs that invest in clean local resources, like solar and energy efficiency
- Ensuring an inclusive process and full participation by Disadvantaged Communities and their representatives in the ongoing work of developing and implementing climate action policies and programs

1.3 Economic Opportunities and a Just Transition

A fundamental objective of New York’s nation-leading climate and energy agenda is to ensure the advancement of a low-carbon and clean energy economy that results in new economic development opportunities across New York and a just and equitable transition for New York’s existing and emerging workforce. The Scoping Plan prioritizes workforce support for New Yorkers who may be facing a shift from traditional jobs, particularly in the energy sector. The Scoping Plan identifies actions needed to advance a just transition to a clean energy economy that creates opportunities for new entrants to low-carbon and clean energy occupations; builds connections among industry, state, and local interests to realize business opportunities for New York manufacturers and service providers so they can grow and thrive; and creates economic conditions that will result in an improved quality of life for all New Yorkers.

The national and statewide clean energy transition provides opportunities for New York manufacturers to develop new products and expand their clients. It also offers the opportunity for new manufacturers to develop a base in New York for ready access to the State’s and the region’s large building, transportation, and energy sectors. The Scoping Plan advances workforce development and business development to actively promote clean technology manufacturing aimed at building out a robust clean technology supply chain in New York. This opportunity will be maximized through strategic planning and coordination in the short term to focus development in regions of the State where this could have the greatest impact, particularly in legacy/rust belt cities and Disadvantaged Communities. New York will also look to leverage State investments with new federal resources. The Inflation Reduction Act, the Infrastructure

Investment and Jobs Act, and the CHIPS and Science Act will provide unprecedented levels of federal funding to support job growth and economic expansion in the State.

New York will undertake a comprehensive strategy to ensure that its clean energy transition is a just transition. With new tools at the State's disposal, the achievement of a true, tangible just transition for New Yorkers across the State is more attainable than ever, both for existing workers in conventional energy industries who are concerned about risks to their livelihoods and for residents of underserved communities who want equitable access to the new jobs that will be created by investments under the Climate Act. The convergence of these challenges and opportunities offers the State a chance to initiate a renewed, holistic effort to realize this just transition – putting the protection of workers, residents, and communities across New York at the focal point of the Climate Act's realization. Union labor is important to Climate Act implementation, and State agencies will work with workers and their unions to ensure jobs created as a result of the State's energy transition are good union jobs and accessible to all New Yorkers.

The Jobs Study developed by the Council's JTWG projected that the clean energy transition in New York will add at least 211,000 new jobs by 2030 in key affected sectors. Major industry categories – including construction, professional services, manufacturing, and supply chain – will all see employment increases, and the buildings sector is expected to account for well over half of all jobs added in growing subsectors through 2030. The potential upside for New York State is even greater, as these estimates do not take into account the significant opportunity for the State to add jobs by manufacturing and producing clean, renewable technologies for export and use in other jurisdictions in the coming decades. Being the first to take advantage of these opportunities will be vital to securing local supply chains and locking in economic productivity that will exceed even the ambitious needs of the State.

This Scoping Plan presents and strengthens the work coordinated by the JTWG including the following actionable recommendations to ensure that New York's workforce is prepared for and stands to benefit from the State's transition to a low-carbon economy:

- **Provide direct displaced worker support** to mitigate any economic impact and ensure that current and former fossil fuel workers benefit from the transition to clean energy
- **Ensure application of labor standards** across all sectors and projects, helping create good union jobs and helping the State take advantage of new federal tax credit requirements and attract greater financial benefits to New York

- **Target financial support for businesses** to ensure access to contracting and procurement opportunities in the transition away from fossil fuels
- **Create new and comprehensive training curricula and programs** focused on opportunities for people from underserved communities that meet employer hiring needs
- **Expand comprehensive career pathway programs** into clean energy for both existing and future workers
- **Leverage community engagement, stakeholder input, and market assessments** to identify and assess industry skills gaps, employee demand, and curriculum and training needs
- **Create a new Office of Just Transition and a Worker Support and Community Assurance Fund** to guide ongoing program and policy support for the near- to medium-term: host community support, existing worker support, and new worker support

New York will re-tool existing businesses; attract new businesses; and seek opportunities to manufacture, assemble, and distribute the equipment and components that are needed to realize sector-specific outcomes and provide jobs for New Yorkers. For New York, this transition is a once-in-a-generation opportunity to implement decarbonization policies that bolster industry retention while providing sustainable economic development and growth.

1.4 Sector Summaries

The Scoping Plan recommends actions that advance the requirements of the Climate Act both within and across economic sectors. The sectors discussed in this Scoping Plan include transportation, buildings, electricity, industry, agriculture, forestry, and waste. The cross-sector topics include land use, local government, adaptation and resilience, and an innovative design for an economywide cap-and-invest program. The cap-and-invest program meets the need for assured emission reductions and allows for investments in technologies that help achieve emissions reductions and reduce the overall cost of this program.

Each sector-specific chapter includes an overview of the state of that sector including strategies New York currently employs to mitigate and adapt to climate change. The chapter overviews also envision the future for each sector, identifying the scale of change required to meet the GHG emission reduction requirements by 2030 and 2050. Each chapter's recommendations are organized into themes, which comprise key strategies that describe opportunities for programs, policies, legislation, regulation, and funding.

Transportation

By 2030 nearly all new light-duty vehicle sales and almost half of new medium- and heavy-duty vehicle sales will be zero-emission, and a substantial portion of personal transportation in urbanized areas will shift to public transportation. By 2050 nearly all vehicles in New York State will have zero tailpipe emissions, and New Yorkers will have substantially greater access to low-carbon modes of transportation including public transportation. Achieving the 2050 vision in the transportation sector will require a mix of regulatory action and investments. Four themes encompass the recommended strategies in the transportation sector.

Transition to Zero-Emission Vehicles and Equipment: Vehicles using zero-emission technologies, including vehicles that use either battery electric, hydrogen fuel cell, or future zero-emission propulsion technologies, must progressively replace existing vehicles that use gasoline or diesel fuel. The strategies to achieve these goals involve a combination of regulations requiring vehicle manufacturers to sell zero-emission vehicles, fleet requirements, incentives for purchasing zero-emission vehicles, expansion of easily accessible charging infrastructure, and other enabling strategies. Deployment of zero-emission vehicles, particularly replacing or converting trucks and buses to zero-emission vehicles and expanding light-duty zero-emission vehicle adoption, will be prioritized in Disadvantaged Communities that bear a disproportionate burden of transportation-related emissions.

Enhance Public Transportation and Mobility Alternatives: Enhancing the availability, accessibility, reliability, and affordability of public transportation services with an emphasis on unserved and underserved communities will be one of the more impactful supporting strategies for achieving the Climate Act's energy efficiency, housing, and land use GHG emission reduction requirements. The strategies to achieve these goals and requirements involve service enhancements, mobility-oriented development, convenience and connectivity, and fleet modernization. These strategies will help reduce vehicle miles traveled (VMT) by providing alternatives to driving personal vehicles.

Promote Smart Growth and Mobility-Oriented Development: Smart growth land use patterns facilitate reductions in GHG emissions in the transportation sector by reducing VMT and increasing the use of mobility alternatives, including walking, biking, and public transportation. A concentration of compact, mixed-use development around transit and in municipal centers such as downtown areas also provides a critical mass of energy users to support clean energy investments, such as EV charging stations and solar carports. Strategies like mobility-oriented development and expanded mobility options reduce

the environmental footprint of transportation in urban, suburban, and rural communities and increase access to jobs, education, and services such as healthcare, retail, hospitality, and entertainment.

Facilitate Market-Based Solutions and Financing: Public and private investments in transportation alternatives should be facilitated, in part, through market-based and other supportive policies to generate necessary resources. These policies can also provide a market signal, encouraging private action that reduces emissions from increased use of public transportation to the purchase of zero-emission vehicles. Potential strategies to achieve these goals include the development of a clean transportation standard that would support the replacement of petroleum fuels with electricity and possibly other fuels if they are shown to have lower co-pollutant emissions, with a primary emphasis on supporting electrification in Disadvantaged Communities.

Buildings

By 2030 heat pumps will be the majority of new purchases for space and water heating, with one to two million homes and 10% to 20% of commercial space using heat pumps by 2030, and hundreds of thousands of additional homes and commercial buildings becoming efficiently electrified each year. The 2050 vision for the buildings sector sees 85% of homes and commercial building space statewide electrified with a diverse mix of energy-efficient heat pump technologies and thermal energy networks. Four themes encompass the recommended strategies in this sector.

Adopt Zero-Emission Codes and Standards and Require Energy Benchmarking for Buildings:

Policy action to decarbonize buildings must address both energy efficiency and electrification. Advanced State codes is a key strategy for requiring residential and commercial buildings to be built to a zero-emission and highly efficient standard (without equipment used for the combustion of fossil fuels) starting in 2025 for low-rise residential new construction and in 2028 for commercial new construction, and for incorporating strategies for building resilience. In existing buildings, energy improvements can be realized through routine home and capital improvements and when retiring equipment from service. This Scoping Plan includes recommendations for the adoption of equipment standards that require buildings to transition to modern technologies such as heat pumps that achieve the needed emissions reductions in the sector when equipment is replaced. In addition, energy benchmarking with disclosure requirements and building performance standards will encourage efficient operation of buildings and capital investments in high-performance building envelopes and efficient heating, ventilation, and air conditioning (HVAC) systems.

Scale Up Public Financial Incentives and Expand Access to Public and Private Low-Cost Financing for Building Decarbonization: The integration analysis indicates that to meet the necessary contribution from the buildings sector, more than 250,000 housing units each year will need to adopt electric heat pumps and energy efficiency measures from 2030 onward – greater than a tenfold increase from current market activity – with a comparable pace of transformation in commercial buildings. Additional investment will expand jobs in energy efficiency and building electrification in communities statewide by adding a projected 100,000 new clean energy jobs by 2030. This Scoping Plan provides recommendations to redirect existing spending toward a more sustainable buildings sector. Public funding should be scaled up and used strategically to accelerate wide market adoption of weatherization, electrification, and additional energy efficiency and resiliency upgrades; to expand dedicated financial support for LMI households, affordable and public housing, and Disadvantaged Communities to make and benefit from these energy and resiliency upgrades while improving housing quality and comfort; and to promote thermal energy networks with support for transitioning the existing workforce and workforce development.

Expand New York’s Commitment to Market Development, Innovation, and Leading by Example in State Projects: Development of the workforce and product supply chain and technology innovation in coordination with financial incentives are important to ensure the delivery of affordable building decarbonization solutions that perform well and improve quality of life. These strategies should include the creation of jobs in clean energy businesses that are located in New York and in businesses that serve Disadvantaged Communities, with dedicated support for minority- and women-owned business enterprises to innovate and actively participate in the transformation of the buildings sector. Market development also involves increasing public and industry awareness through education, technical assistance and case studies, strategic partnerships, and publicizing private and State buildings that demonstrate high energy performance, lower embodied carbon, and resilient building construction.

Transition from Hydrofluorocarbons: Hydrofluorocarbon (HFC) use is currently widespread in refrigeration and HVAC equipment, including in heat pumps that are recommended to electrify space conditioning and water heating, and in other end uses such as foams that provide insulation for higher efficiency buildings. New York State agencies should continue to adopt regulations and coordinate with other states on HFC reduction policies to ensure an effective phase-down of HFCs. For this transition, the State should support technical resources and toolkits, workforce training, demonstration projects, incentives that make low-global warming potential refrigerant technologies and alternatives available and affordable, including a focus on natural refrigerants.

Electricity

The Climate Act requires that 70% of statewide electricity come from renewable energy sources by 2030 (70x30) and that the State achieve a zero-emission electricity system by 2040 (100x40). It also requires that the State install 6,000 megawatts (MW) of distributed solar by 2025, 3,000 MW of energy storage by 2030, and 9,000 MW of offshore wind by 2035. The Scoping Plan anticipates annual electricity demand will more than double by 2050, depending on the scale and timing of electrification and whether there are other clean alternatives for the transportation and building sectors. Three themes encompass the recommended strategies in this sector to be implemented through the State's Renewable Energy Program and other planning processes detailed in this Scoping Plan and as required by the Climate Act.

Transform Power Generation: Given the large amount of renewable energy that must be procured and developed to reach the Climate Act requirements, the State needs to incorporate load flexibility and controllability into the electric grid as sectors electrify to create a more manageable system. New and upgraded transmission and distribution systems will be needed statewide, including specific transmission and distribution investments that will be necessary to deliver energy from where the generation is located (both upstate and offshore), to where the load demand exists. To achieve stated Climate Act goals and requirements, New York must deploy clean energy resources such as land-based wind and solar, offshore wind, hydropower, fuel cells that use renewable fuels, and energy storage. While current programs have made significant progress, New York must continue to aggressively deploy clean resources while continually evaluating the effectiveness of programs and policies and amending them if renewable energy is not deployed at the pace necessary to achieve the requirements.

Enhance the Grid: While transformation of the power sector is critical to achieving the State's goals and requirements, it also presents an opportunity to make enhancements to the electric grid. Enhancements can improve the efficiency, delivery, and reliability of electricity, facilitate the integration of renewable energy, and prioritize clean resources consistent with the Climate Act.

Invest in New Technology: To achieve the 70x30 requirement, focus should be placed on energy delivery, energy efficiency, and aggressive deployment of existing renewable energy and energy storage technologies. However, Scoping Plan analysis and current studies show that the 100x40 goal requires 15 gigawatts (GW) to 45 GW of electricity from zero-emission, dispatchable resources in 2040 to meet demand and maintain reliability, although that gap may change over time depending on forecasted demand. Addressing this gap will require identifying and developing solutions for dispatchable

technologies, like storage or nuclear power, that can be called on as needed to balance supply and demand.

Industry

Strategies for the State's industry sector are intended to mitigate the direct GHG emissions attributable to certain industrial activities such as manufacturing, mining and quarrying, and other energy- and emission-intensive industries. These strategies are primarily incentive-based because non-incentive-oriented approaches are likely to cause leakage, where businesses leave or avoid the State and locate in other jurisdictions where they can emit higher levels of GHG emissions than they would have, had they remained in the State. Strategies designed to prevent emissions leakage also reflect the importance of protecting existing workers employed at such businesses and facilities.

Provide Financial and Technical Assistance: The State can provide financial and technical assistance to help alleviate unique industrial sector barriers and mitigate challenges to implementing GHG emission reduction measures, including risk aversion to manufacturing process interruption, lack of in-house expertise in new technologies, lack of time to commit to energy savings solutions, lack of trust that the solution will deliver the intended benefits, and intense competition for internal company capital. Using other economic incentives to develop an in-State supply chain of green economy businesses can provide further support for industrial decarbonization efforts.

Incentivize Procurement for Low-Carbon Products: Through the State's own procurement policies and practices, manufacturers may be incentivized to produce goods and products that are less emission-intensive. The State, including the GreenNY Council, should develop lists of products and standards and provide policy support to implement mechanisms that lead to greater utilization of low-carbon products.

Support Workforce Development: Expanding the State's green workforce and the focus on training workers on existing decarbonization solutions and new technology solutions as they become available are key strategies for industrial decarbonization. State agencies can build upon the long history of delivering successful clean energy workforce development and training programs in New York.

Facilitate Research, Development, and Demonstration: A robust research, development, and demonstration agenda will support accelerated changes, not only in the industrial sector, but in the buildings, transportation, and power sectors, all of which are likely to benefit from new solutions that likely can be realized at cost that is lower than that of current technologies. Solutions should be pursued

only if they meet benchmarks for environmental justice and equity along with economic and technical scalability.

Establish GHG Emissions Registry and Reporting System: A complete picture of the GHG emissions from a larger percentage of facilities than currently tracked will allow for a more focused effort to reduce GHG emissions from existing industrial sources, which can often be accomplished by reducing fuel combustion. In order to ensure the State has sufficient emissions data, it should establish a new GHG emissions registry and reporting system or expand existing GHG emissions reporting requirements.

Agriculture and Forestry

Agriculture and forestry encompass several economic sectors including livestock, crops, dairy, timber, wood products, and bioeconomy products. Strategies to achieve the Climate Act's requirements and goals include mitigation of agricultural GHG emissions, primarily methane and nitrous oxide, as well as carbon capture (or sequestration), primarily through the growth of trees and other plants. Maximizing the carbon sequestration and storage potential in the agriculture and forestry sectors is a key strategy for achieving net-zero emissions across all sectors of the economy by 2050. Four themes encompass the recommended strategies in the agriculture and forestry sectors.

Promote Sustainable Forest Management: Promoting a wide diversity of site-specific forest management strategies across the landscape, including harvesting, thinning, and/or leaving mature forests intact, will be most effective at increasing New York's carbon sequestration, storage, and climate resilience. New York's forests are managed for a wide variety of benefits including promotion of tree health, downstream water quality, recreation, wildlife habitat, and wood products. How a forest is managed has implications for long-term carbon storage and sequestration and depends on factors like forest age and health, tree species, and how the wood is utilized following harvest. The State should develop guidance to promote forest management regarding carbon storage and sequestration, climate resilience, and other climate-related issues, recognizing that almost 75% of forest land is privately owned, with the majority of landowners owning small parcels.

Advance Livestock Management Strategies: Livestock management strategies could contribute to the deepest reductions in agricultural emissions by mitigating methane through manure management practices and precision animal feeding. Alternative manure management strategies rely heavily on the advancement and expansion of current programs. Precision feed, forage, and herd management strategies rely mainly on increased training and support to the farm community, expanded use of monitoring and decision tools,

and continued and enhanced research and development of feed supplements and additives for further methane reductions.

Improve Soil Health, Nutrient Management, and Agroforestry: Strategies to improve soil health and nutrient management primarily focus on nitrous oxide reduction and increasing carbon sequestration. Agroforestry recommendations that add trees to areas of agricultural production have the potential to elevate local food production and resiliency; improve water and air quality; provide storm and flood mitigation; improve drought resiliency; provide habitat, scenic vistas, and agritourism; and increase economic development and jobs.

Promote a Climate-Focused Bioeconomy: Recommended climate-focused bioeconomy strategies include developing forestry training programs, expanding markets for sustainably harvested wood products, developing a sustainable biomass feedstock action plan, increasing market access and providing financial and technical assistance for New York’s low-carbon products, advancing bio-based products research, and deploying net negative carbon dioxide removal.

Waste

The waste management sector includes all aspects of materials management and wastewater treatment. Materials management includes waste reduction, reuse, recycling (including organics recycling), combustion, and landfilling. Significant opportunities exist to reduce or avoid GHG emissions by improving both materials and materials management practices. Three themes encompass the recommended strategies in the waste sector.

Reduce, Reuse, and Recycle Waste: Waste reduction, reuse, and recycling strategies in this Scoping Plan fundamentally shift the way New York currently produces, uses, and handles products and materials at end-of-life. Significant GHG emissions impacts from this sector include uncaptured emissions of methane from landfills, specifically from organic materials. The creation and distribution of products and packaging also produce significant GHG emissions. The recommended strategies address the full life cycle of materials and products from product creation to the beneficial use of materials that will otherwise be wasted.

Monitor, Detect, and Reduce Fugitive Emissions: Fugitive emissions at solid waste management facilities and water resource recovery facilities are currently under-reported and vary based on site-specific factors such as waste composition and facility design. Assessing these systems both during and

beyond the active life of operation and repairing equipment to minimize fugitive emissions (leaks) can significantly reduce waste sector GHG emissions.

Establish Markets for Recovered Resources and Biogas Utilization: Solid waste management facilities and water resource recovery facilities should follow the strategies in this Scoping Plan to achieve the maximum reduction, reuse, and recycling of waste, recognizing that some wastes (including biosolids) are unavoidable. Additionally, the organic fraction of waste already in landfills will produce methane in place for many years. Capturing these unavoidable gases for strategic and local use as the State transitions to electrification will help meet the requirements and goals of the Climate Act while avoiding future reliance on fossil fuels.

Land Use

Whether for development, conservation, or a mix of uses, land use directly affects the State’s carbon emissions, sequestration, and storage and impacts the achievement of Climate Act requirements and goals. Deciding where to conserve land, where to develop, and how to arrange and design that development are critical first steps in addressing climate change through land use strategies. Three themes encompass the recommended strategies in the land use sector.

Protect, Restore, and Monitor Natural and Working Lands: New York has more than 28 million acres of natural and working lands. Current and future use of natural and working lands has important implications for mitigation of GHG emissions and carbon sequestration and storage, including protecting high-value lands through acquisition, avoiding conversion and development, and land restoration. Afforestation and reforestation have the potential to greatly increase carbon sequestration and storage capacity in New York State. Another strategy includes protecting, restoring, monitoring, and maintaining the carbon stored in freshwater, non-tidal, coastal and estuarine tidal wetlands; submerged aquatic vegetation; and other coastal habitats.

Consider Forests and Farmland in Land Use Policies: The strategies to address forests and farmland in land use policies include equipping municipalities with the necessary tools and resources to effectively protect New York’s publicly and privately owned natural and working lands while also advancing renewable energy siting. Such tools and resources include technical guidance and support and direct grants to municipalities to include afforestation, reforestation, farmland protection, and clean energy siting in municipal comprehensive plans and zoning ordinances.

Promote Smart Growth: Smart growth land use strategies seek to achieve smart, sustainable, and equitable planning, zoning, and projects that align with supportive transportation, economic development, and housing policies and practices. While land use zoning falls mostly within municipal authority, the State can support local land use decisions through direct planning and zoning grants; regional/county planning; technical assistance and capacity-building; and State and local incentives, disincentives, and, where appropriate, mandates. Smart growth principles should be implemented appropriately among rural, suburban, and urban areas of the State accounting for local conditions and needs, and State resources should also be tailored to fit those different conditions and needs.

Local Government

Municipalities and other local government entities have an important role to play in meeting the Climate Act's requirements and goals. These entities are well positioned to have a far-reaching impact on community action because of their authority to enact codes and regulate land use and their leadership at the local level. State programs that partner with communities and local governments are already contributing to the move toward a more energy-efficient future. This Scoping Plan recommends strategies to build on this momentum and respond to input provided by local leaders.

Establish Statewide Dashboard of Community GHG Emission Inventories: This strategy calls for a dashboard that would promote local climate action planning, monitor equity considerations, measure progress, and ensure data consistency at the county and municipal levels. This dashboard would bring together data from several sources to describe the community GHG emissions picture. The dashboard must be easy to use and provide accurate, actionable information that local government officials and staff and community stakeholders can use to inform decision-making at the local level.

Develop Local Energy Policies: This strategy recommends development of model above-minimum energy conservation codes and construction policies to encourage local energy policy decisions that accelerate energy efficiency with a focus on equity. Recognizing that many local governments struggle with tight budgets and limited staff capacity, which limits their ability to take local climate action, this strategy also includes leveraging and expanding existing State programs to help support communities with a focus on equity.

Provide Clean Energy Siting Support: This strategy looks to foster collaboration among State and local governments to support renewable energy growth, such as development and promotion of model local laws and streamlined permitting for renewable energy and storage technologies.

Promote Municipal Leadership to Support Clean Energy Adoption: This strategy includes connecting homes, businesses, and community institutions with clean energy products and services through Community Choice Aggregation programs, microgrids, district systems, and community-scale campaigns to encourage adoption of innovative technologies that will generate savings and reduce GHG emissions for consumers in an equitable manner. The intent is to allow more consumers to participate in the energy markets in ways that advance Climate Act goals and requirements while improving project economics, saving money, and generating new sources of revenue and ownership for consumers. This strategy also includes expansion of workforce development programs focused on training and job placement in clean energy and emerging technologies.

Provide State Support and Local Guidance: These strategies include continuing and expanding program opportunities, incentives, technical assistance, financial support, and centralized procurement services to motivate local governments, local government municipal bodies, and related public entities to improve assets they control with high-impact actions. This includes LED lighting installations, energy efficiency upgrades, heat pump projects, methane recovery for energy production from wastewater treatment and landfills, solar installations on municipal premises, and municipal and school district fleet electrification.

Adaptation and Resilience

The Scoping Plan recognizes that climate change mitigation strategies alone are not sufficient to prepare for the effects of present and future climate change, the impacts of which are already being realized and are projected to accelerate. The Scoping Plan recommends strategies within three themes to take action to adapt to climate change and enhance resilience in communities, infrastructure, and living systems.

Build Capacity: The build capacity theme comprises strategies related to statewide planning, consideration of future conditions in State decision-making, enhancement of general understanding of climate change, improving the public's adaptive capacity, and identifying options for financing adaptation actions and reducing or shifting risk.

Enhance Community and Infrastructure Resilience: Enhancing resilience of communities and infrastructure includes strategies to help municipalities prepare for and react to increasingly severe climate hazards. Strategies include expanding State support for regional and local planning, assisting municipalities and local communities in their efforts to incorporate future conditions into local planning and regulatory decisions, addressing risks of flooding and extreme heat, and ensuring resilience of the

energy system. Implementation of all components of these strategies should prioritize the use of natural resources and nature-based features to enhance resilience.

Enhance Resilience of Living Systems: “Living systems” refers to the State’s natural ecosystems, agricultural systems, and forested lands. Strategies recommended to enhance resilience of living systems include addressing risks to ecosystems and biodiversity, enhancing resilience and adaptation of the agricultural sector, and protecting the ability of forests to serve as carbon sinks.

Gas System Transition

The Scoping Plan notes that, along with the full complement of sector-specific strategies, achieving the Climate Act’s emission limits will require a substantial reduction of fossil natural gas use and a strategic downsizing of the gas system. A well-planned and strategic transition of the gas system will require coordination across numerous sectors to integrate planning with the decarbonization of the power generation sector and the build-out of local electric transmission and distribution systems to meet anticipated increases in electric demand throughout the State. Integrated planning will ensure the transition is equitable and cost-effective for consumers without compromising reliability, safety, energy affordability, and resiliency.

This Scoping Plan discusses the key principles in the transition away from gas and the importance of reducing fugitive emissions from gas infrastructure during this transition. Specifically, the Scoping Plan includes a detailed framework through which agencies can develop a coordinated gas system transition plan. The framework provides strategies and guidance to ensure the transition plan sets a clear timeline for the transition while satisfying key principles such as GHG and co-pollutant emission reductions, equity considerations, workforce protections, affordability, safety and reliability, decision-making informed by independent analysis, coordination with electric system expansion, and consumer engagement.

Economywide Cap-and-Invest Program

The Scoping Plan recommends implementation of an economywide cap-and-invest program that would ensure the Climate Act’s emission limits are met while providing support for clean technology market development. By establishing a consistent market signal across all economic sectors, an economywide program will help individuals and businesses make decisions that reduce their emissions and yield the emissions reductions specified by the program. Revenues generated by the program will leverage federal

funding sources to implement policies identified in this Scoping Plan, including investments to benefit Disadvantaged Communities. A cap-and-invest program can be designed to complement other policies and programs in the Scoping Plan to realize the Climate Act’s emission limits and goals as efficiently and cost-effectively as possible. As the Climate Act requires programs to be designed to limit leakage, the proposed cap-and-invest program design must alleviate this risk through mechanisms designed to help support EITE Industries and protect workers, consistent with programs implemented elsewhere.

This Scoping Plan proposes that the State adopt an innovative program design that would meet the Climate Act requirements, including achieving the emission limits, promoting climate justice, and mitigating economic leakage. Design considerations to prioritize GHG and co-pollutant emission reductions in Disadvantaged Communities potentially include limits on trading allowances that preclude sources within or near Disadvantaged Communities from purchasing allowances from outside of Disadvantaged Communities, source-specific caps or other mechanisms designed to prioritize reduction of GHG or co-pollutant emissions from sources in or proximate to Disadvantaged Communities, and targeted air quality monitoring to ensure continued air quality improvement in Disadvantaged Communities. In addition, as required by the Climate Act, at least 35% of the investments made with program proceeds will benefit Disadvantaged Communities, with a goal of 40%. Offsets would have little, if any, role in a cap-and-invest program designed to comply with the Climate Act.

In addition, the strategy recommends rebates or other mechanisms to mitigate the program’s financial impacts on LMI households so these households will benefit from program investments without bearing any additional energy costs as a result of the program’s implementation.

1.5 Next Steps

The submittal of this Scoping Plan, approved by the Council, represents a critical milestone. It delivers on a central requirement of the Climate Act, establishing the pathway, or pathways, that the State should take to meet the requirements and objectives of the Climate Act; to take action on realizing necessary GHG emission reductions; to deliver on climate justice; to create economic opportunity and jobs across the entire State; and to ensure a just transition to a clean, affordable, and reliable energy system.

Issuance of this Scoping Plan initiates the next phase of work to realize the Climate Act’s outcomes. The Scoping Plan provides new analyses and assessments to inform ongoing and future planning. For the next several years and beyond, the implementation of the Climate Act necessitates an all-hands-on-deck approach across State government, with input from a broad array of stakeholders, technical advisors, and

experts. Many strategies in the Scoping Plan also require action on the part of local governments or the State legislature. The Climate Act requires the following actions after finalization of the Scoping Plan:

- DEC will have until January 1, 2024, to draft and promulgate enforceable regulations to ensure that the State meets the Climate Act’s statewide GHG emission limits (i.e., 40% reduction in Statewide GHG emissions by 2030 and 85% reduction by 2050, both from 1990 levels) as outlined in the Scoping Plan.
- The State Energy Plan will be updated to incorporate the recommendations of the Scoping Plan.
- Every four years, DEC will publish a report on the implementation of GHG emission reduction measures, in consultation with the Council and Climate Justice Working Group.
- Every five years, the Council will update the Scoping Plan as part of the ongoing process to meet the Climate Act targets and GHG emissions reduction limits.
- By July 1, 2024, and every two years thereafter, the PSC will issue a comprehensive review of the renewable energy program, including progress in meeting the overall targets for 70% renewable electricity by 2030 and 100% zero-emission electricity by 2040. This review will also include a progress update on the programs the PSC has established to require procurement of 9 GW of offshore wind by 2035, 6 GW of solar PV by 2025, and 3 GW of energy storage by 2030.
- The PSC will continue to advance programs that are designed to provide substantial benefits to Disadvantaged Communities in the implementation of the renewable energy, energy efficiency, and energy storage programs.

This Scoping Plan is a product of extensive collaboration and the State will continue to communicate with the public and engage with stakeholders across the State, particularly in Disadvantaged Communities, to help advance the requirements of the Climate Act. Robust and ongoing coordination and collaboration with the federal government, other states, local governments, community-based organizations, labor, and various businesses and industries will be necessary to develop the market for clean technologies that will help New York realize the recommendations of the Scoping Plan. Additionally, in the implementation of the Scoping Plan, including rulemaking processes, administrative planning, and investment strategies, relevant New York State agencies, authorities, and entities will seek to consult with recognized Indigenous Nations with whom it shares overlapping interests, in accordance with consultation processes.

Success requires a committed private sector working with New Yorkers ready to seize the benefits that the transition to a clean energy economy will create. New York will need industry partners to produce EVs, heat pumps, and more at an unprecedented scale and to invest in research and development to improve on existing technology options that will supply not only New York’s transition but also the

national and global clean technology markets. Such action will demonstrate in all communities throughout New York, whether rural, suburban, or urban, that climate action will continue to improve the quality of life in New York for current and future generations.

Chapter 2. The Time is Now to Decarbonize Our Economy

2.1 Scientific Evidence of Our Changing Climate

The consequences of a changing climate are here. The World Meteorological Organization found that in the 50-year period from 1970 to 2019, the number of disasters worldwide increased by a factor of five, and economic losses due to weather, climate, and water extremes have increased sevenfold.¹ New Yorkers have felt the devastation from several extreme weather events in recent years:

- Historic flooding from Hurricane Ida in 2021 not only left lasting damage to the Gulf Coast but also devastated the Northeast. The National Weather Service issued its first flash flood emergency warning for parts of northeastern New Jersey and its second ever flash flood emergency for New York City.²
- Tropical Storm Isaias left over 800,000 New Yorkers without power in 2020, with high winds causing damage to critical infrastructure.³
- In 2012, Superstorm Sandy killed dozens and left hundreds of thousands of New Yorkers without power. It brought storm surges over 13 feet high and devastated many parts of New York City.⁴ The Federal Emergency Management Agency spent over \$25 billion on recovery efforts in New York and New Jersey in the five years after Sandy.⁵
- In 2011, Tropical Storm Irene caused damage across many regions of the State, flooding main streets, washing out roads, overwhelming wastewater treatment plants, and leaving hundreds of thousands without power. Not two weeks later, Tropical Storm Lee came through New York and overwhelmed communities still dealing with the aftermath of Irene.

¹ World Meteorological Organization. 2021. *WMO Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes (1970-2019)*. Geneva. Accessed at https://library.wmo.int/index.php?lvl=notice_display&id=21930#.YaY979DMJ9N.

² Harvey, Chelsea. September 2, 2021. "Ida smashes rain records in glimpse of future warming." *E&E News*. <https://www.eenews.net/articles/ida-smashes-rain-records-in-glimpse-of-future-warming/>.

³ Zaveri, Mihir, and Ed Shanahan. August 4, 2020. "2.5 Million Lose Power and One Is Killed as Isaias Batters N.Y. Area." *The New York Times*. <https://www.nytimes.com/2020/08/04/nyregion/isaias-ny.html>.

⁴ Weissman Center for International Business, Baruch College/CUNY. 2021. "Disasters: New York City Hurricane Sandy – 2012." *NYCdata*. Accessed on November 30, 2021 at <https://www.baruch.cuny.edu/nycdata/disasters/hurricanes-sandy.html>.

⁵ Federal Emergency Management Agency. October 28, 2017. "Remembering Sandy Five Years Later." <https://www.fema.gov/press-release/20210318/remembering-sandy-five-years-later>.

New York's geographic and socioeconomic diversity will lead to a wide range of experienced climate-driven impacts. Warming trends and incidences of intense heat waves will contribute to greater localized heat stresses; heavy rainfall events that exacerbate localized flooding will continue to impact food production, natural ecosystems, and water resources; and sea-level rise will increasingly threaten sensitive coastal communities and ecosystems. Climate-driven impacts are magnified in New York's historically marginalized communities that have been disproportionately affected by and are on the front lines of climate change. Women, femmes, youth, and children in poverty commonly face higher risks and greater burdens from the impacts of climate change.

New York is feeling the impacts of a global issue. The Intergovernmental Panel on Climate Change (IPCC) is a body established by the World Meteorological Organization and the United Nations to assess scientific, technical, and socioeconomic information relevant for understanding climate change, its potential impacts, and options for adaptation and mitigation. The IPCC recently completed its Sixth Assessment cycle, releasing several reports, the entirety of which is the Sixth Assessment Report (AR6). The U.S. Global Change Research Program is currently developing its fifth National Climate Assessment, with anticipated delivery in 2023. The fourth assessment, released in 2017, states, "thousands of studies conducted by researchers around the world have documented changes in surface, atmospheric, and oceanic temperatures; melting glaciers; diminishing snow cover; shrinking sea ice; rising sea levels; ocean acidification; and increasing atmospheric water vapor." According to both the U.S. Global Change Research Program and the IPCC, substantial reductions in greenhouse gas (GHG) emissions will be required by mid-century in order to limit the global average increase in temperature to no more than 2°C (and ideally 1.5°C), thus minimizing the risk of severe impacts from climate change.

2.2 Climate Projections

New York has undertaken research to better understand what a changing climate means for the State. A report developed by the New York State Energy Research and Development Authority (NYSERDA), *The ClimAID Integrated Assessment for Effective Climate Change Adaptation in New York State* (ClimAID), discusses New York-specific climate risks and projections. The ClimAID report, released in 2011 and subsequently updated in 2014, provides projections of mean annual changes in precipitation, temperature, and sea-level rise through the year 2100. The report also projects the frequency and duration of extreme temperature and precipitation events through the 2080s for each of the seven regions of the State. The ClimAID projections for sea-level rise served as the basis for the Department of Environmental Conservation’s (DEC) adoption of sea-level rise projection regulations pursuant to the Community Risk and Resiliency Act (CRRRA), Title 6 of the Official Compilation of Codes, Rules, and Regulations of the State of New York (NYCRR) Part 490.

When considering impacts to New York, it is critical to discuss the impact that climate change has had on historically marginalized communities. An analysis released by the U.S. Environmental Protection Agency (EPA) in September 2021 shows that the most severe harms from climate change fall disproportionately upon underserved communities that are least able to prepare for and recover from heat waves, poor air quality, flooding, and other impacts. EPA’s analysis indicates that racial and ethnic

Use of the Term “Disadvantaged Communities”

This Scoping Plan uses the term “Disadvantaged Communities” to be consistent with the language in the Climate Leadership and Community Protection Act (the Climate Act). The Climate Act defines Disadvantaged Communities as “communities that bear burdens of negative public health effects, environmental pollution, impacts of climate change, and possess certain socioeconomic criteria, or comprise high-concentrations of low- and moderate-income households.”

As required by the Climate Act, the Climate Justice Working Group identified Disadvantaged Communities based on geographic, public health, environmental hazard, and socioeconomic criteria.

The Climate Action Council recognizes, however, that this growing body of literature often uses other terms that more appropriately describe these populations, such as “frontline communities,” “overburdened communities,” “historically marginalized communities,” and “environmental justice communities,” among others. This Scoping Plan often uses these terms to describe communities that have been disproportionately impacted by historical environmental policy and the effects of climate change, and uses Disadvantaged Communities when referring directly to actions or requirements that are contained in the Climate Act.

For more information on Disadvantaged Communities, see *Chapter 6. Advancing Climate Justice*.

minority communities are particularly vulnerable to the greatest impacts of climate change.⁶ The Climate Leadership and Community Protection Act (the Climate Act) requires, and this Scoping Plan reflects, a particular focus on actions and investments to improve outcomes for Disadvantaged Communities.

The impacts from climate change in New York are projected to grow. NYSERDA's ClimAID report discusses these impacts in detail and articulates, by sector, the likely effects of these changes across the State. NYSERDA has also launched a climate assessment, *New York State Climate Impacts Assessment: Understanding and Preparing for Our Changing Climate*, which will provide the following:

- Updated projections and methodologies
- In-depth economic analysis
- New regions
- More diverse perspectives and stakeholder engagement
- Adaptable formats to drive wider usage
- Technical workgroups that cover eight sectors, including agriculture, buildings, ecosystems, energy, human health and safety, society and economy (including finance and insurance), transportation, and water resources
- Cross-cutting topics such as the impact on Disadvantaged Communities, municipal perspectives, and the effect on marine and Great Lakes coastal zones

Draft core projections for the updated climate assessment have been completed, including for average and extreme temperatures and precipitation. These resources will be made publicly available once the assessment is complete, which is expected in early 2023.

On a global scale, the IPCC's AR6 applies new methods that greatly reduce uncertainty and can clearly attribute ongoing climate change and its effects to continuing man-made emissions of climate pollutants. It considers five scenarios to illustrate the range of possible futures based on trends in anthropogenic drivers of climate change. In summary, the report states several factors:

- The global mean surface temperature will continue to increase until at least the mid-century under all GHG emission scenarios considered by the IPCC

⁶ U.S. Environmental Protection Agency. 2021. *Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts*. U.S. Environmental Protection Agency, EPA 430-R-21-003.

- Between 1.5°C and 2°C warming will be exceeded this century unless deep reductions in carbon dioxide (CO₂) and other GHG emissions occur in the coming decades
- Changes in precipitation show:
 - Strengthened evidence since IPCC's Fifth Assessment Report (AR5) that the global water cycle will continue to intensify, leading to more variability in precipitation and surface water flows over most land regions (both seasonally and year over year)
 - The portion of global land experiencing detectable increases or decreases in seasonal mean precipitation is projected to increase
 - There will continue to be earlier onset of spring snowmelt
 - It is likely that heavy precipitation events will intensify and become more frequent in most regions with additional global warming
- Many changes due to past and future GHG emissions are irreversible for centuries to millennia, especially changes in the ocean, ice sheets, and global sea level
- Over the longer term, there is high confidence that the sea level will continue to rise for centuries to millennia due to ongoing deep ocean warming and ice sheet melt and will remain elevated for thousands of years
- It is virtually certain that the global mean sea level will continue to rise over the 21st century. Even under the very low GHG emissions scenario (Shared Socioeconomic Pathways), it is likely that the global mean sea-level rise by 2100 will be 0.28 to 0.55 meters (0.9 to 1.8 feet)

Although no single entity can solve this global problem on its own, the Climate Act established New York as a leader in the critical effort to maintain a livable planet. IPCC's AR6 makes the critical nature of this work more clear. The report notes that, while many of the changes observed in the climate are unprecedented, strong and sustained reductions in GHG emissions would limit climate change. It is imperative that New York take immediate action to aggressively reduce GHG emissions as well as invest in resiliency measures.

2.3 Benefits of Climate Action

Climate change is adversely affecting New York’s economic well-being, public health, natural resources, and environment. The severity of climate change and the threat of more severe impacts will be determined by the actions undertaken in New York and other jurisdictions to reduce GHG emissions. Such actions will have an impact on global GHG emissions, encourage other jurisdictions to implement complementary GHG emissions reduction strategies, and provide an example of how such strategies can be successfully implemented. The impacts of climate change are heightened in Disadvantaged Communities, which often bear disproportionate environmental and socioeconomic burdens as well as

What the Climate Act means for New York State

Clean Electric Grid of Tomorrow | Solar, wind, and other renewables, combined with energy storage, will deliver affordable and reliable electricity over the next decade and beyond.

Comfortable, Affordable, and Safe, Energy Efficient Homes and Businesses | Modern clean heating and cooling technologies, such as electric heat pumps and smart thermostats, combined with energy efficiency, will save New Yorkers energy and money.

Clean, Reliable Transportation | Zero-emission transportation options for families and neighborhoods will enable New York to trade gridlock and diesel fumes for fresh air and cleaner communities.

A Clean Energy Economy for Everyone | Every community, every trade, and every region will have access to clean energy solutions and the economic opportunities that the transition to a just and equitable energy system provides.

legacies of racial and ethnic discrimination. Although substantial GHG emissions reductions are necessary to avoid the most severe impacts of climate change, complementary adaptation measures will also be needed to address those risks that cannot be avoided.

New Yorkers stand to realize the extraordinary benefits of climate action across all sectors of society. The investments made today will drive value creation into the future, spurring a cleaner, more competitive economy. The Climate Act means that the electric grid will be cleaner, more affordable, and more reliable. New York homes and

businesses will be more energy-efficient, leveraging the latest clean heating and cooling and distributed energy resource technologies. Transportation will be clean, reliable, and zero-emission, and New York will be transformed into a clean energy economy that benefits everyone. These investments will support new jobs, new businesses, and new opportunities for all New Yorkers. From clean, renewable energy generation to advanced recycling and reuse programs, New York will witness a scale of change that has not been seen before.

The Climate Act recognizes communities that have historically witnessed and continue to bear the disproportionate health and socioeconomic burdens of environmental pollution and climate change. Disadvantaged Communities, by law, will benefit from the transition New York is undertaking. Foundational to the Climate Act and to this Scoping Plan is to pair climate action with equity. As sectoral progress rapidly increases, additional co-benefits and compounding benefits will be realized.⁷

Benefits of GHG Emission Mitigation

Mitigating GHG emissions will provide many direct and indirect benefits, including improved public health. Direct benefits will result from reducing the many public health impacts associated with climate change, such as heat-related morbidity and mortality; food-, water-, and vector-borne diseases; and injury and death following flooding. Indirect health benefits will occur when initiatives to mitigate GHG emissions also result in other beneficial outcomes such as reducing air pollutants produced by GHG emission sources (co-pollutants), encouraging active transport (such as walking and cycling), and reducing home health risks through building energy efficiency retrofit interventions. In addition to these public health benefits, GHG emissions and co-pollutant mitigation will result in improvements to the overall economy through economic stimulus, social community and labor, social inclusion and social justice, housing security, accessibility and quality of mobility services, avoided costs, and resources efficiency.

Benefits of Adaptation and Resilience

Adaptation and resilience planning is about protecting people and ecosystems from the changes caused by a changing climate. Individuals, communities, and regions have come to recognize the need to prepare for the risks posed to their quality of life, infrastructure, and physical safety by climate change. These risks are disproportionately high for Disadvantaged Communities. Investment in adaptation and resilience can improve quality of life, stimulate local economies, and protect the environment. The benefits of adaptation and resilience actions include improved economic opportunities, infrastructure, and equity in our rural and urban communities. New York will promote the integration of climate change adaptation and resilience planning into all relevant policies and programs using the best available science.

⁷ Bachura, Simeran, Arminel Lovell, Carly McLachlan, and Mae Angela Minas. 2020. *The Co-Benefits of Climate Action, Accelerating City-level Ambition*. London: CDP. Accessed at <https://www.cdp.net/en/reports/downloads/5329>.

2.4 Technology Advancement and Trends

Technology advancement will continue to be vital in determining the trajectory of climate change mitigation and adaptation success. Current projections rely on certain assumptions of technology adoption, prioritization, and acceptance. Technology advancements include several components:

- Better science, data collection technologies, modeling, and understanding the complex relationship of natural systems
- Advancement in mitigation, such as the continued development of renewable energy technologies, energy efficiency improvements, and new and emerging technologies (like energy storage, carbon capture and removal, hydrogen, and potential geoengineering)
- Advancement in adaptation and resilience, such as technologies that can mitigate impacts resulting from wave action and improved flood and thermal resilience in buildings, and improved understanding of nature-based solutions to address the urban heat island effect, stormwater runoff, and drought
- Accessibility, supply chains, funding, and prioritization needs to realize potential

Hydrogen

The Scoping Plan recommends following technological and research developments on the use of hydrogen as a tool to reduce greenhouse gas emissions. The Scoping Plan recommends the use of green hydrogen but acknowledges that in *Sector Strategies*, references to green hydrogen can also include pink hydrogen.

Green hydrogen | Hydrogen formed by splitting water through electrical processes supplied by renewable energy with preference given to creation when there is surplus renewable generation (e.g., from wind at night).

Pink hydrogen | Hydrogen formed by splitting water through thermal and/or electrical processes supplied by nuclear energy.

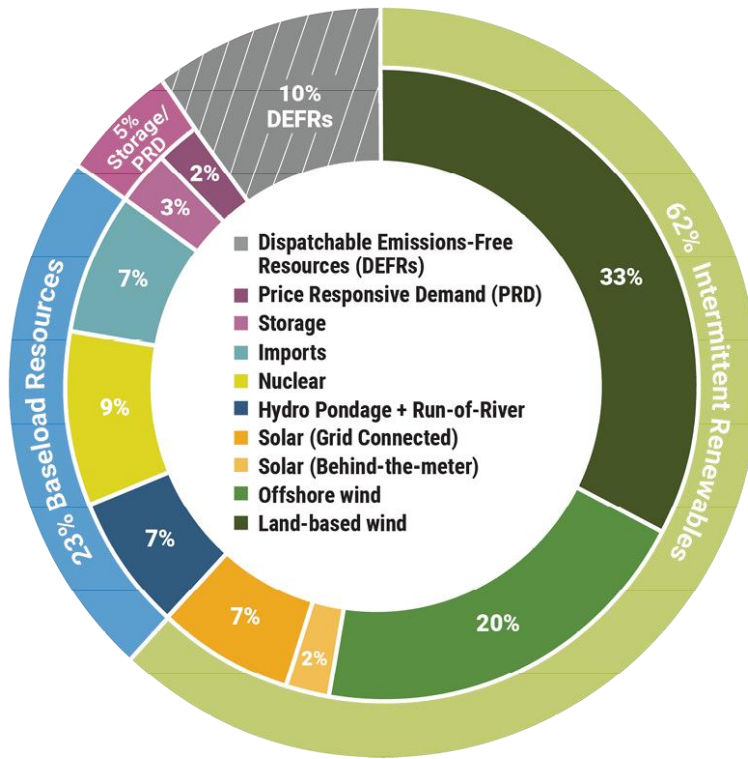
Future versions of this Scoping Plan will consider technology and market advancements when evaluating the production and use of hydrogen towards the achievement of the Climate Act emissions limits.

As science and technology continue to advance, the understanding of complex climate and environmental forces evolves, and new progress is incorporated into existing knowledge. Methodological advances and new datasets have contributed information that results in adding approximately 0.1°C to the current estimate of warming. In the Summary for Policymakers, IPCC’s AR6 states, “Since AR5, methodological advances and new datasets have provided a more complete spatial representation of changes in surface temperature, including in the Arctic. These and other improvements have additionally increased the

estimate of global surface temperature change by approximately 0.1°C, but this increase does not represent additional physical warming since the AR5.”⁸

To achieve a more resilient, efficient, and balanced grid, new technologies will be required to replace the phase-down of fossil fuel resources that are currently relied upon. The New York Independent System Operator (NYISO) has been evaluating potential impacts to system reliability and resource availability associated with climate change and extreme weather events. Through its *Climate Change Impact and Resilience Study*, which analyzes the Climate Act’s 2040 zero-emissions electricity target, NYISO has made it clear that innovation is critical to accelerating the development of new flexible and dispatchable resources to replace the existing reliability service capabilities of fossil fuel resources (see Figure 1).

Figure 1. 2040 Projected Climate Act Winter Energy Production by Resource Type



Source: NYISO Power Trends 2021.

⁸ Intergovernmental Panel on Climate Change. 2021. “Summary for Policymakers.” In *Climate Change 2021: The Physical Science Basis*. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press. Accessed at <https://www.ipcc.ch/report/ar6/wg1/#SPM>.

2.5 The National and Global Context for Climate Action

The United Nations Framework Convention on Climate Change was founded in 1992 to serve as the international forum for multilateral climate action. The original convention was supported by the Kyoto Protocol of 1997 and the 2015 Paris Climate Agreement. Under the agreement, signatories agreed to nationally determined contributions for GHG reductions within a specified timeframe. The goal of the agreement was to keep global warming below 2°C compared with preindustrial levels, with the recognition of scientific consensus that warming at or below 1.5°C is preferable to mitigate the worst effects of climate change.⁹ The IPCC's AR6 has highlighted an even more dire need for aggressive climate action.

In the face of uncertainty on climate action and commitment at the federal level in past years, New York and other states took up the mantle. The governors of New York, California, and Washington formed the U.S. Climate Alliance in 2017 with the aim of advancing policies that would help each state meet the Paris Agreement goals. Since its creation, the Alliance has grown to a sizeable representation of bipartisan governors, and each member state commits to:

- Reducing collective net GHG emissions at least 26% to 28% by 2025 and 50% to 52% by 2030, both below 2005 levels, and collectively achieving overall net zero GHG emissions as soon as practicable, and no later than 2050
- Accelerating new and existing policies to reduce GHG pollution, building resilience to the impacts of climate change, and promoting clean energy deployment at the state and federal level.
- Centering equity, environmental justice, and a just economic transition in their efforts to achieve their climate goals and create high-quality jobs
- Tracking and reporting progress to the global community in appropriate settings, including when the world convenes to take stock of the Paris Agreement¹⁰

The United States has since reaffirmed its commitment to climate action under the Paris Agreement. The U.S. developed and committed to an economywide target of a 50% to 52% net reduction in GHG emissions by 2030 compared with 2005 levels, and the Biden Administration has committed to reaching net zero emissions economywide by no later than 2050. President Biden also ordered that the U.S.

⁹ Intergovernmental Panel on Climate Change. 2018. "Summary for Policymakers." In *Global Warming of 1.5 °C. An IPCC Special Report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global GHG emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*. Accessed at <https://www.ipcc.ch/sr15/download/>.

¹⁰ U.S. Climate Alliance. "Alliance Principles." Accessed at <http://usca.squarespace.com/alliance-principles>, Nov 29, 2022.

government would lead by example to leverage its immense scale and procurement power to drive clean, healthy, and resilient operations of federal buildings, vehicles, construction, and other activity—designed to achieve net zero emissions from overall federal operations by 2050, including a 65% emissions reduction by 2030, among other important interim milestones and sector-specific goals.¹¹

¹¹ The White House. *Executive Order 14057: Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*. December 8, 2021.

Chapter 3. New York’s Climate Leadership

New York continues to set an international precedent for addressing climate change. This is only possible because so many diverse minds and tireless leaders are united in a common cause. Recognizing the complexity of the economywide transition and the imperatives to mitigate the worst scenario projections of a warming global climate, New York stands ready to continue its legacy of climate leadership. This Scoping Plan incorporates new, innovative strategies and expands upon existing efforts to combat the systemic risks associated with the impacts of a changing climate while also addressing the disproportionate impacts on historically marginalized communities.

3.1 Landmark Accomplishment of the Climate Act and Key Components of the Legislation

On July 18, 2019, the Climate Leadership and Community Protection Act (the Climate Act) was signed into law.¹² This historic legislation cements the State’s position as a leader in combating climate change. This act, which became effective on January 1, 2020,¹³ builds upon the State’s clean energy and GHG emission reduction policies described above, codifying critical goals as statutory requirements. The Climate Act will have far-reaching effects across all areas of the environment and economy.

The implementation of the Climate Act requires a significant regulatory undertaking by the Department of Environmental Conservation (DEC) as well as substantial action by the New York State Energy

New York’s Nation-Leading Climate Directives

- 40% reduction in GHG emissions by 2030
- 85% reduction in GHG emissions by 2050
- 100% zero-emission electricity by 2040
- 70% renewable energy by 2030
- 9,000 MW of offshore wind by 2035
- 3,000 MW of energy storage by 2030
- 6,000 MW of solar by 2025
- 185 trillion Btu of end-use energy savings

Research and Development Authority (NYSERDA), the Public Service Commission (PSC), and other State agencies and authorities. These efforts will be informed by the Climate Action Council (Council), this Scoping Plan, and, recognizing the importance of ensuring a just transition, essential groups that are focused on environmental justice issues.

¹² Chapter 106 of the Laws of 2019.

¹³ Climate Act § 14; Chapter 735 of the Laws of 2019.

For the next several years and beyond, the implementation of the Climate Act necessitates an all-hands-on-deck approach across State government, with input from a broad array of stakeholders, technical advisors, and experts. This section provides a summary of key provisions of the Climate Act as well as a description of the key milestones and implementation steps thus far.

Summary of Key Provisions

GHG Emission Reduction Requirements

The heart of the Climate Act is the addition of Article 75 to the Environmental Conservation Law (ECL), which, among other things, directs DEC to establish statewide greenhouse gas (GHG) emission limits, requiring a 40% reduction in statewide GHG emissions from 1990 levels by 2030 and an 85% reduction by 2050.¹⁴ The Climate Act also establishes a goal of net zero emissions across all sectors of the economy by 2050.¹⁵ Within four years of the effective date, the Climate Act requires DEC to promulgate regulations to ensure compliance with such statewide GHG emission limits.¹⁶

Clean Energy Generation Requirements

In addition to ECL Article 75 and its essential GHG emission reduction requirements, the Climate Act adds a new § 66-p to the Public Service Law, which requires the PSC to establish a program to decarbonize the electric sector. Specifically, the program must have two targets: 70% of the State's electricity deriving from renewable¹⁷ energy by 2030 (70x30) and 100% zero-emission energy by 2040 (100x40).¹⁸ The Public Service Law provisions also codify previously existing ambitious clean energy goals, including a requirement for the procurement of at least 9,000 megawatts (MW) of offshore wind by 2035, 6,000 MW of distributed solar generation by 2025, and 3,000 MW of energy storage by 2030.¹⁹

¹⁴ ECL § 75-0107(1). As set forth in the Climate Act, statewide GHG emissions include all emissions of GHGs from sources within the state, as well as GHGs produced outside the State but associated with either the generation of electricity imported into the State or the extraction and transmission of fossil fuels imported into the state. ECL § 75-0101(13).

¹⁵ ECL § 75-0103(11).

¹⁶ ECL § 75-0109.

¹⁷ PSL § 66-p(1)(b).

¹⁸ PSL § 66-p(2).

¹⁹ PSL § 66-p(5).

Council and Advisory Panels

Critical to the implementation of the Climate Act is the 22-member Council,²⁰ made up of the heads of various State agencies, as well as other members appointed by the governor and the New York State Legislature.²¹ The co-chairs of the Council are the DEC commissioner and the NYSERDA president.²² The Council includes Advisory Panels for particular subject areas including waste, transportation, energy-intensive and trade-exposed (EITE) industries, land use and local government, energy efficiency and housing, power generation, and agriculture and forestry.²³

The Council was charged with developing this Scoping Plan, which provides recommendations for achieving the statewide GHG emission limits, including regulatory measures.²⁴ The Council consulted with the Advisory Panels for subject-matter expertise when developing recommendations in the 2021 draft Scoping Plan.²⁵ This final Scoping Plan was developed after continued Council deliberations and extensive public input. The Scoping Plan will be reviewed and updated at least every five years.²⁶

Environmental and Climate Justice Provisions

Notably, the Climate Act recognizes historically Disadvantaged Communities and the fact that these communities suffer disproportionate and inequitable impacts from climate change and therefore establishes mechanisms to ensure that these communities benefit from the Climate Act. This includes a requirement that Disadvantaged Communities receive at least 35% of the overall benefits of spending on clean energy and energy efficiency programs, with a goal of 40%.²⁷

The Climate Act also creates the Climate Justice Working Group (CJWG) within DEC, which comprises representatives from environmental justice communities and State agencies.²⁸ Per the Climate Act, the CJWG established criteria to define and identify Disadvantaged Communities. During development of the 2021 draft Scoping Plan and this final Scoping Plan, the CJWG advised the Council to ensure that

²⁰ ECL § 75-0103.

²¹ ECL § 75-0103(1).

²² ECL § 75-0103(4).

²³ ECL § 75-0103(7).

²⁴ ECL §§ 75-0103(11)-(14).

²⁵ ECL § 75-0103(7).

²⁶ ECL § 75-0103(15).

²⁷ ECL § 75-0117.

²⁸ ECL § 75-0111.

Disadvantaged Communities are considered in the implementation of the Climate Act.²⁹ This is in addition to input from the Just Transition Working Group (JTWG) within the Council.³⁰

The Climate Act establishes a community air monitoring program to identify locations to deploy community air monitoring systems, to develop a strategy to reduce toxic and criteria air pollutant emissions in Disadvantaged Communities, and to select communities around the State in which to implement emissions reduction programs.³¹ The Climate Act also requires State agencies to ensure that permitting, licensing, contracting, and other approvals and decisions will not disproportionately burden Disadvantaged Communities and to prioritize reductions of GHG emissions and co-pollutants in Disadvantaged Communities.³²

Other Provisions

As previously noted, the Climate Act requires an all-hands-on-deck approach across State government, and various provisions affect all State agencies and their decision-making. Further, the Climate Act directs all State agencies to reduce their GHG emissions and gives them the authority to promulgate GHG emissions regulations to help achieve the statewide GHG emission limits.³³ The Climate Act also requires state agencies to consider GHG emissions and limits in permitting, licensing, contracting, and other approvals and decisions, and that wherever such decisions are deemed inconsistent or would interfere with the statewide GHG emission limits, State agencies must provide a detailed statement of justification for the action, notwithstanding the inconsistency, and identify alternatives or GHG mitigation measures.³⁴ The Climate Act also expands the scope of the existing Community Risk and Resiliency Act (CRRRA),³⁵ including by covering additional DEC permitting programs such as State Pollutant Discharge Elimination System permitting and Air Pollution Control permitting, and by allowing State agencies and other entities to require mitigation of climate risks, including adverse impacts on Disadvantaged Communities.³⁶

²⁹ ECL § 75-0111; ECL §§ 75-0103(10), (12).

³⁰ ECL §§ 75-0103(8), (12).

³¹ ECL § 75-0115.

³² Climate Act § 7(3).

³³ Climate Act §§ 7(1) and 8.

³⁴ Climate Act § 7(2).

³⁵ Chapter 355 of the Laws of 2014.

³⁶ Climate Act § 9.

Key Milestones and Implementation Steps To-Date

The Council released the draft Scoping Plan in 2021, and it served as the foundation for this final Scoping Plan. This Plan describes measures and other State actions to ensure attainment of the statewide GHG emission limits and net zero emissions goal. The statewide GHG emission limit rulemaking is the first regulatory action to implement the Climate Act, the foundation for multiple components of the Climate Act and critically important for successful implementation of the Climate Act. DEC promulgated 6 NYCRR Part 496 that established the two statewide GHG emission limits called for in the Climate Act: a limit for 2030 that is equal to 60% of 1990 GHG emission levels and a limit for 2050 that is equal to 15% of 1990 emission levels.

Specifically, using a 20-year global warming potential (GWP) and including upstream emissions from fossil fuels imported into New York as required by the Climate Act, the statewide GHG emission limit for 2030 is 245.87 million metric tons (MMT) of carbon dioxide equivalent (CO₂e), and the statewide GHG emission limits for 2050 is 61.47 MMT CO₂e.³⁷ DEC, in consultation with NYSERDA, continues to update the inventory of GHGs and will publish an annual statewide GHG emissions report that reflects these updates.

Further, DEC, in consultation with NYSERDA, established the Value of Carbon guidance to help State agency decision-making by placing a monetary value for the avoided emissions of GHGs.³⁸ The Value of Carbon guidance provides metrics that may be broadly applicable to actions by all State agencies and authorities—such as benefit-cost analyses, rulemaking processes, environmental assessments, and demonstrations of the benefits of climate change policies—to demonstrate the global societal value of actions to reduce GHG emissions. The guidance recommends a procedure for using a damages-based value of carbon along with a general review of the marginal abatement cost approach and recommends the use of a central discount rate of 2%, which should be reported alongside a 1% and 3% discount rate for informational purposes. For example, use of the 2% central discount rate translates into a 2020 central value of carbon dioxide (CO₂) of \$121 per ton, methane of \$2,700 per ton, and nitrous oxide (N₂O) of \$42,000 per ton. DEC updated the Value of Carbon guidance in 2022 to add values for hydrofluorocarbons (HFCs), revise the text to describe these values, and provide an example.

³⁷ 6 NYCRR § 496.4.

³⁸ ECL § 75-0113; New York State Department of Environmental Conservation. 2021. Establishing a Value of Carbon: Guidelines for Use by State Agencies. Accessed at https://www.dec.ny.gov/docs/administration_pdf/vocguidrev.pdf.

The Climate Act solidifies New York’s status as a climate leader. It establishes the country’s—and perhaps even the planet’s—strongest GHG emission reduction and clean energy requirements. Though the scale of the effort to implement the Climate Act is enormous, so is the challenge it is meant to address. Successful implementation of the Climate Act will not only provide direct environmental and economic benefits for the State, it will also serve as a model for other jurisdictions to address climate change.

3.2 Overview of New York’s Climate Policies

The enactment of the Climate Act and the development of this Scoping Plan builds upon decades of New York’s climate leadership at all levels. New York voters have also shown their support for environmental initiatives in recent years. In 2021, voters approved an amendment to the New York State Constitution with 70% of the vote, granting New Yorkers the right to “clean air, clean water, and a healthful environment.” In 2022, New York voters approved a \$4.2 billion Environmental Bond Act with 68% of the vote. The “Clean Water, Clean Air, and Green Jobs” Environmental Bond Act will provide funds to support the implementation of the Climate Act through GHG mitigation projects and other initiatives such as open space conservation, flood risk reduction, and continued funding for resilient infrastructure. The Bond Act is also aligned with the environmental justice provisions of the Climate Act in that Disadvantaged Communities must receive at least 35% of the benefit of the funds, with a goal of 40%.³⁹ The implementation of strategies in this Scoping Plan will be guided by past successes and informed by lessons learned here in New York and in other jurisdictions.

Executive Leadership

Governor Kathy Hochul signed the nation-leading Executive Order 22, *Leading by Example: Directing State Agencies to Adopt a Sustainability and Decarbonization Program, 2022*, to accelerate efforts to make State operations more sustainable. Through the Executive Order, the GreenNY Council will ensure that State agencies follow best practices in green purchasing and in their operations by building upon current green purchasing specifications and operational directives as well as by strengthening and issuing new specifications. Several strategies in this Scoping Plan align with this Executive Order. Required annual reporting from agencies and authorities will help ensure that the goals of the Executive Order are achieved.

³⁹ ECL § 58-1101.

The 2022 State of the State address directed DEC and NYSERDA to develop an Extreme Heat Action Plan in response to more frequent and intense extreme heat events driven by climate change.

Governor Hochul announced that State agencies and authorities, representing an estimated \$50 billion in investments, have committed to achieving net zero in their investment portfolios by 2040. This ensures New York's financial resources are aligned with the Climate Act. In September 2022, agencies and authorities submitted action plans outlining their path to a net zero investment portfolio.

DEC's Commissioner's Policy 49 (CP-49), revised December 14, 2022, provides guidance to agency divisions, offices, and regions regarding the incorporation of climate change considerations into agency activities. CP-49 was drafted to reflect the requirements of Sections 7 and 9 of the Climate Act. DEC's program policy Division of Air Resources 21 provides further guidance on Section 7(2) of the Climate Act regarding air pollution control permit applications.

New York signed a medium- and heavy-duty (MHD) zero-emission vehicles (ZEVs) Memorandum of Understanding on July 14, 2020, along with 14 other states and Washington, D.C., committing to work collaboratively to advance and accelerate the market for electric MHD vehicles. The mutual goal is to ensure that 100% of all new MHD vehicle sales will be zero-emission by 2050, with an interim target of 30% MHD ZEV sales by 2030. This Memorandum of Understanding builds off the success of the 2013 light-duty ZEV Memorandum of Understanding and the Multi-State ZEV Taskforce and Action Plans.

The Health Across All Policies Initiative (Executive Order 190, 2018) developed the necessary network and communications between agencies to address and improve public and individual health through collaborative efforts to address social determinants of health, like air quality, housing, and access to affordable energy.

Regulatory Action

Governor Hochul directed DEC to adopt regulations that will require all new passenger cars, pickup trucks, and SUVs sold in New York State be zero-emission by 2035 and be modeled on California's Advanced Clean Cars II regulation finalized in 2022.

Advanced Clean Trucks (DEC 6 NYCRR Part 218 Regulation), adopted in 2021, incorporated California's Advanced Clean Truck zero-emission vehicle standards for MHD trucks as well as large entity reporting requirements for owners and operators of MHD trucks as part of New York's existing low emission vehicle program.

Oil and Natural Gas Sector regulations (DEC 6 NYCRR Part 203 Regulations), adopted and effective in 2022 to support the goals and requirements of the Climate Act, lowers methane and volatile organic compound (VOC) emissions for sources in New York’s oil and natural gas sector.

Hydrofluorocarbon Standards and Reporting (DEC 6 NYCRR Part 494 Regulations) prohibits specific HFCs, potent GHGs in certain refrigerants, aerosol propellants, and foam-blowing agent end uses that represent avoidable HFC emissions where safer alternatives are available. In 2022, DEC began pre-proposal stakeholder outreach to update Part 494 to reflect the Scoping Plan recommendations.

Food Donation and Food Scraps Recycling (DEC 6 NYCRR Part 350 Regulations), adopted in 2022 pursuant to ECL Article 27, Title 22, requires large generators of food scraps to donate excess edible food and to recycle all remaining food scraps if they are located within 25 miles of an organics recycler, which will reduce methane and VOC emissions in support of the goals and requirements of the Climate Act.

Taxation of Forest Land (DEC Proposed 6 NYCRR Part 199 Regulations), proposed in 2022, seeks to improve the Forest Tax Law program by lessening administrative burdens while strengthening the sustainable forest management standards.

Projected Sea-Level Rise (DEC 6 NYCRR Part 490 Regulations), finalized in early 2017, establishes statewide sea-level rise projections for use in the consideration of permits and other decision-making processes specified under CRRA. Under CRRA, DEC is required to update these sea-level rise projection regulations at least every five years.

Regional Greenhouse Gas Initiative (RGGI; DEC 6 NYCRR Part 242 Regulations and NYSERDA 21 NYCRR Part 507) is the first mandatory market-based emissions trading program in the United States to reduce CO₂ emissions and the first anywhere to use the cap-and-invest model for reducing pollution. New York and other RGGI-participating states set a cap for total emissions of CO₂ from electric generation facilities in the region. Each state implements the program through its own regulations, which include emissions budgets in individual RGGI-participating states that are equal to shares of the regionwide cap. The RGGI cap declines over time, gradually lowering CO₂ emission limits.

Legislation

Chapter 628 of the Laws of 2022 established a two-year moratorium on the issuance of certain permits by DEC for cryptocurrency mining operations that use behind-the-meter electricity and proof-of-work

authentication methods to validate blockchain transactions. This law directs DEC, in consultation with the New York State Department of Public Service (DPS), to prepare a generic environmental impact statement on this type of cryptocurrency mining operation.

Chapter 563 of the Laws of 2022 directs DEC to study the impacts of disproportionate heat conditions, otherwise known as urban heat islands, in Disadvantaged Communities.

Chapter 375 of the Laws of 2022 (Utility Thermal Energy Network and Jobs Act) requires the PSC to develop a regulatory structure for utility thermal energy networks, including district geothermal and other community-scale thermal infrastructure projects, for heating and cooling homes and to direct utilities to launch pilot projects in their service territories.

Chapter 374 of the Laws of 2022 (Advanced Building Codes, Appliance and Equipment Efficiency Standards Act of 2022) bolsters New York’s regulatory and policy environment to support energy efficiency and GHG reduction strategies in buildings, expanded appliance standards, and changed building code law to allow the utilization of certain HFC substitutes.

Chapter 372 of the Laws of 2022 requires prevailing wage for renewable energy projects one megawatt and larger that involve the procurement of renewable energy credits from a public entity.

Chapter 724 of the Laws of 2021 established procurement guidelines for low-embodied carbon concrete.

Chapter 423 of the Laws of 2021, as amended by Chapter 109 of the Laws of 2022, related to ZEV sales states that new non-road vehicles and equipment sold in New York are targeted to be zero-emissions by 2035 and that new MHD vehicles sold in New York are targeted to be zero-emissions by 2045.

Chapter 58 of the Laws of 2020 established the Accelerated Renewable Energy Growth and Community Benefit Act as part the State Fiscal Year 2020–2021 budget to dramatically speed up the siting and construction of clean energy projects to combat climate change and help jumpstart the State’s economic recovery from the COVID-19 health crisis. This law created a first-in-the-nation Office of Renewable Energy Siting (ORES) to improve and streamline the process for the environmentally responsible and cost-effective siting of large-scale renewable energy projects across New York, while also delivering significant benefits to local communities. This law, which is being implemented by the New York State Department of State (DOS), NYSERDA, DPS, DEC, the New York Power Authority (NYPA), and

Empire State Development (ESD), will accelerate progress toward New York’s nation-leading clean energy and climate mitigation requirements, including the mandate to obtain 70% of the State’s electricity from renewable sources, as identified under the Climate Act.

Chapter 59 of the Laws of 2019 established the Metropolitan Transportation Authority (MTA) Reform & Traffic Mobility Act (Congestion Pricing) that directs MTA to design, develop, build, and run a toll program that applies to vehicles that enter or remain in Manhattan’s Central Business District. The purpose of the program is to reduce congestion and enhance mobility in Manhattan’s Central Business District. By reducing traffic and helping improve mass transit, the program would improve air quality and enhance equity by expanding access. MTA held public hearings on the proposal in fall 2021 and is undergoing an environmental assessment pursuant to the National Environmental Policy Act.

Chapter 355 of the Laws of 2014 established New York CRRA to build New York’s resilience to rising sea levels and extreme flooding. The Climate Act made modifications to CRRA, expanding the scope of climate hazards and projects for consideration, which became effective January 1, 2020. As part of the implementation of CRRA, DEC, in consultation with DOS and other stakeholders, developed the *New York State Flood Risk Management Guidance 1* to help ensure the health, safety, and well-being of New Yorkers now and in the future.⁴⁰

Chapter 388 of the Laws of 2011 established the Power NY Act, which directed DEC to promulgate rules and regulations limiting emissions of CO₂ by newly constructed major generating facilities. DEC adopted 6 NYCRR Part 251 in 2012, setting CO₂ emission limits that effectively prohibited new coal-fired power plants. In 2018, DEC adopted further revisions to this regulation applicable to existing facilities, effectively phasing out all remaining coal-fired power plants in the State. The last coal-fired power plant in the State was closed in 2020.

Chapter 433 of the Laws of 2010 established the State Smart Growth Public Infrastructure Policy Act, ECL Article 6, prohibiting a state infrastructure agency from approving, undertaking, supporting, or financing a “public infrastructure project” unless, to the extent practicable, the project is consistent with 11 smart growth criteria.

⁴⁰ New York State Department of Environmental Conservation. 2020. *New York State Flood Risk Management Guidance for Implementation of the Community Risk and Resiliency Act, Estimating Guideline Elevations*. Albany. Accessed at https://www.dec.ny.gov/docs/administration_pdf/crraestelevguidelines.pdf.

Chapter 433 of the Laws of 2009 related to the State Energy Planning Board reauthorizes Article Six of the Energy Law, regarding energy planning requiring comprehensive studies of the State's energy needs.

Programmatic Action

Several agencies have existing programs related to renewable energy, climate resilience and adaptation, and overall climate change mitigation. New York's Reforming the Energy Vision, including the NY-Sun program, the Clean Energy Standard (CES), Evolve NY, Drive Clean Rebates, Clean Energy Communities, and the Clean Energy Fund are all examples of existing climate leadership.

In addition, Climate Smart Communities is a multi-agency program that helps local governments take action to reduce GHG emissions and adapt to a changing climate, including grants for climate mitigation and adaptation projects, ZEV vehicles, and ZEV infrastructure. Charge NY is a multi-agency initiative aiming to create a statewide network of up to 3,000 public and workplace charging stations and to put up to 40,000 plug-in vehicles on the road. And, in an example of multi-state cooperation, the Engineering Department of the Port Authority of New York and New Jersey (PANYNJ) Climate Resilience Design Guidelines, produced in 2015, ensure that new port authority infrastructure and buildings are designed to account for projected changes in temperature, precipitation, and sea level. The guidelines provide PANYNJ architects and engineers with a framework for evaluating the vulnerability of projects to future climate impacts and addressing those impacts in the design of port authority infrastructure and buildings.⁴¹

In response to the 2022 State of the State directive to produce an Extreme Heat Action Plan, DEC and NYSERDA convened an interagency work group that is discussed further in *Chapter 21. Adaptation and Resilience*.

New York stands ready to deliver the results necessary to avoid the most catastrophic impacts of climate change while providing the necessary resources for New York to be more resilient and adaptable to the irreversible changes already embedded.

⁴¹ New York City Mayor's Office of Resiliency. 2020. *Climate Resiliency Design Guidelines*. New York City. Accessed at https://www1.nyc.gov/assets/orr/pdf/NYC_Climate_Resiliency_Design_Guidelines_v4-0.pdf.

Chapter 4. Current Emissions

DEC is required to release an annual report on GHG emissions as a measure of progress toward reaching the Climate Act's emission limits and net zero emissions goal. The first annual report was released in 2021 and covers the years 1990 through 2019. Additional details on data, methods, and historical trends are provided in that report. The second annual report is expected in 2022 and will cover the years 1990 through 2020. However, 2020 was an anomalous year for GHG emissions due to the economic impact of the COVID-19 pandemic. Emissions associated with certain sectors were significantly lower in 2020 compared with 2019 but are expected to have rebounded in 2021. As such, 2019 emissions are provided as more representative and appropriate for this Scoping Plan. In addition, some of the co-pollutants discussed in this Scoping Plan affect both human health and climate change, even if they are not included in the suite of greenhouse gases (GHGs) listed in the Climate Act. For example, actions to address particulate matter, including black carbon, also contribute to the State's broader climate strategy.

The Climate Act requirements for GHG emissions accounting are different in two important ways from the methodology provided by the Intergovernmental Panel on Climate Change (IPCC) Taskforce on National GHG Inventories. First, GHG emissions must be measured in terms of carbon dioxide equivalent (CO₂e) using a 20-year rather than a 100-year time interval. This results in a higher numeric value for some gases, such as methane, even if the emission rate was the same. Secondly, "statewide" GHG emissions under the Climate Act include out-of-state GHG emissions associated with imported electricity and the extraction and transmission of imported fossil fuels. This greatly expands the scope of GHG emission sources typically included in governmental GHG reduction goals and inventories. Addressing some of these GHG emission sources may require action at the federal level. Additionally, the emission values provided here include carbon dioxide (CO₂) associated with the combustion of biogenic fuels, although this comprises a very small portion of statewide emissions (less than 4%). Therefore, the emission values provided here are not comparable to those reported by other governments, nor are they comparable to values reported by New York State in the past. The economic sectors described here may not represent the same emission sources as presented in other GHG reports.

Based on this assessment, emission reductions are needed from all sectors of the economy to achieve the goals and requirements of the Climate Act. For the purposes of the Scoping Plan, emissions are categorized according to the economic sectors covered in *Sector Strategies* (Chapters 11 through 16), *Chapter 18. Gas System Transition*, and *Chapter 19. Land Use*.

The transportation, buildings, and electricity chapters include not only GHG emissions from fuel use, but also GHG emissions associated with imported fuels. In summary, *Chapter 11. Transportation* includes GHG emissions associated with on-road transportation; non-road transportation such as aviation, rail, and marine; and other mobile equipment, as well as HFCs used for mobile heating, ventilation, and air conditioning (HVAC) and refrigeration. *Chapter 12. Buildings* includes fuels used in residential and commercial buildings and HFCs used in HVAC and refrigeration. *Chapter 13. Electricity* includes fuels used for generating electricity within the State, imported electricity, and the transmission and distribution of electricity. The remaining economic sectors (Chapters 14 through 16) include industry, agriculture and forestry, and waste. Industrial emission sources include fuels used in industrial buildings and for industrial processes as well as emissions from the oil and gas industry in the State. The waste sector includes emissions associated with solid waste management, wastewater management, and waste combustion. GHG emissions from the agriculture and forestry sector are from livestock and soil management practices. These practices, as well as land use in general, also contribute to carbon removals.

Figure 2 provides an estimate of statewide GHG emissions across these major economic sectors. Gross total emissions for 2019 were 379.4 million metric tons (MMT) CO₂e (GWP-20). Figure 3 is an estimate of annual emission removals, or carbon sequestration. Net total emissions, or gross emissions minus emission removals and biogenic CO₂, were 338.5 MMT CO₂e (GWP-20) in 2019.⁴²

Importantly, emission removals were equivalent to less than 8% of gross emissions in 2019, suggesting that all emission sources from every segment of the economy must be addressed to achieve net zero emissions. More than half of current emissions are related to emission sources covered in *Chapter 11. Transportation* and *Chapter 12. Buildings* (approximately 60%). These sources include the direct use of fossil fuels, “upstream” emissions from the fuel system, and HFCs.

⁴² If measured using the methodology provided by the IPCC, gross emissions were 194.6 MMT CO₂e (GWP-100) and net emissions were 165.5 MMT CO₂e (GWP-100) in 2019.

Figure 2. 2019 New York State GHG Emissions by Scoping Plan Sector

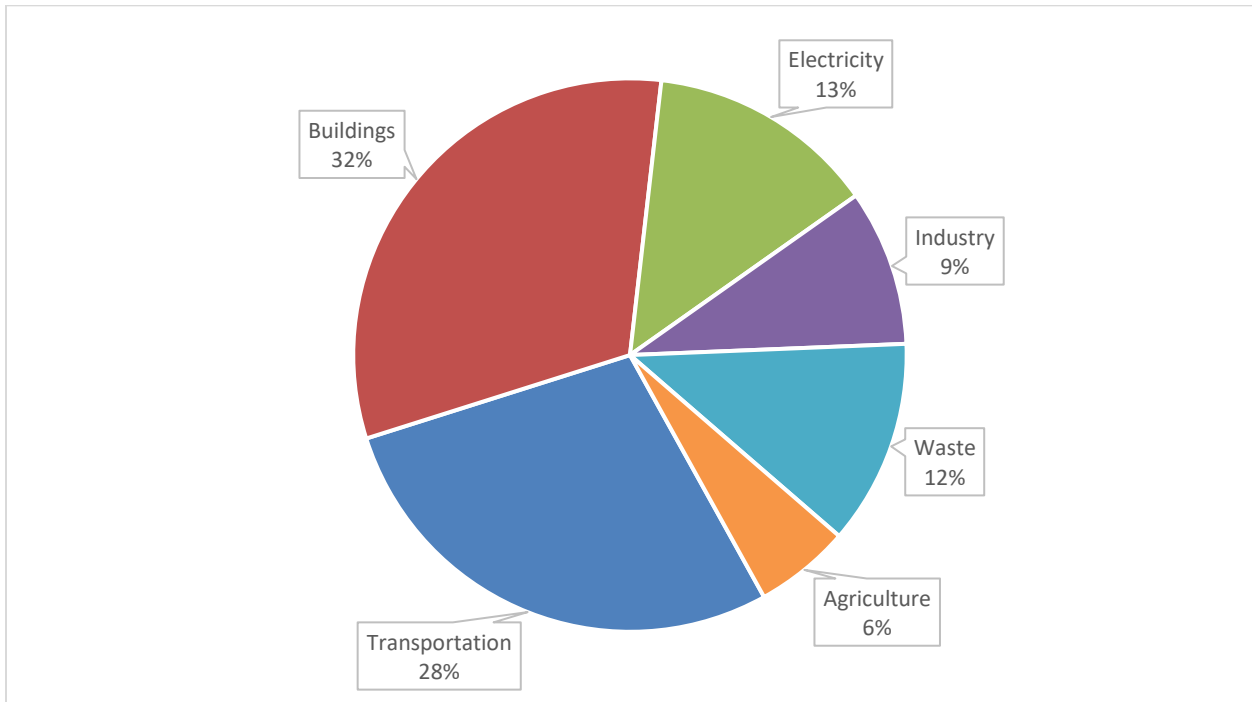
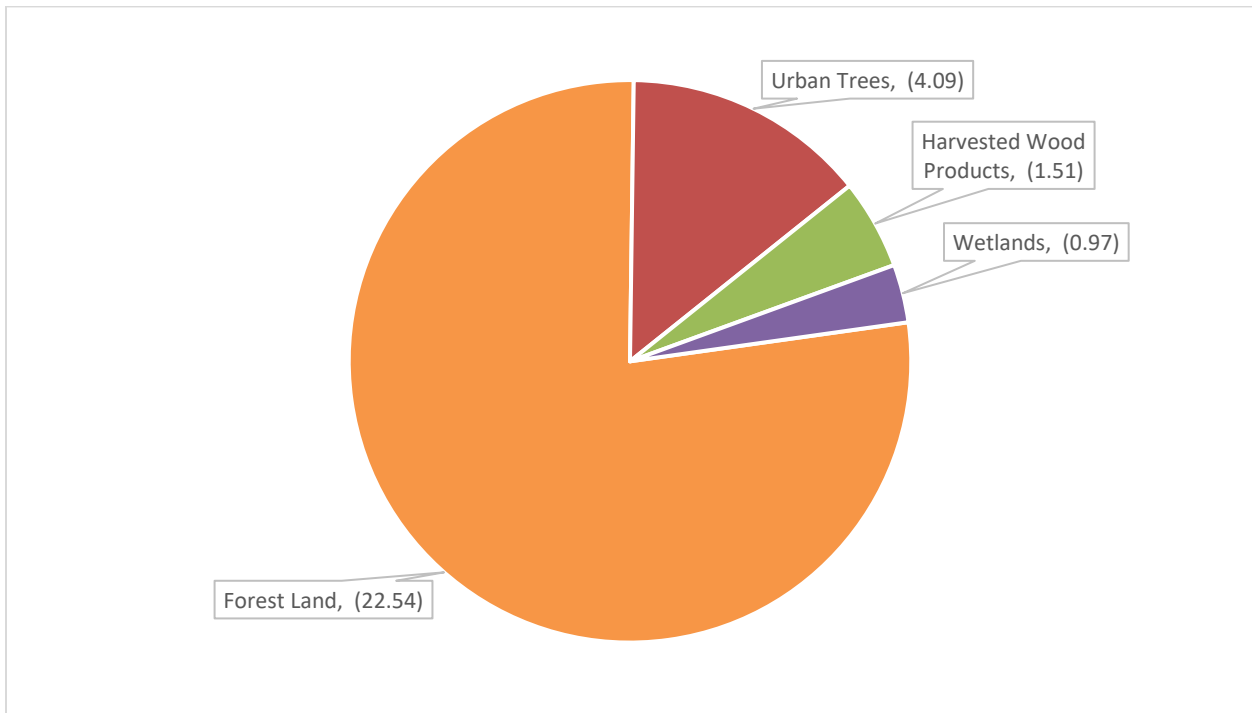


Figure 3. 2019 New York State GHG Emissions Removals by Sector (in MMT CO₂)



4.1 Summary of Sectoral Emissions

Transportation

The transportation sector was responsible for approximately 28% of the State's emissions in 2019, which includes on-road transportation (59%), non-road such as aviation (12%), emissions from imported fuels (26%), and HFCs used in vehicle air-conditioning and refrigeration (3%). Transportation sector emissions are about 16% higher today than they were in 1990. The transportation sector today is largely dependent on petroleum-based fuels such as gasoline, diesel, and jet fuel, but the State has made strong progress in transitioning from petroleum-based fuels to zero-emission technologies.

Buildings

The buildings sector was the largest source of emissions in 2019 and responsible for 32% of emissions, which includes the combustion of fossil fuels in residential (34%) and commercial buildings (19%), emissions from imported fuels (33%), and HFCs released from building equipment and foam insulation (14%). The fuels used in buildings today include fossil natural gas, distillate fuel (heating fuel oil #2), wood, propane, kerosene, and residual fuel oil.

Electricity

The electricity sector comprised 13% of emissions in 2019, including electricity generation within the State (44%), imported electricity (15%), emissions from imported fuels (41%), and the sulfur hexafluoride (SF₆) used in electricity distribution and transmission (<1%).

Industry

Industrial emissions made up 9% of emissions in 2019, including emissions from methane leaks and combustion from the oil and gas system in New York (45%), the direct combustion of on-site fuel (27%), emissions from imported fuels (20%), and non-combustion industrial processes (6%).

Agriculture and Forestry

Agricultural emissions represented approximately 6% of the statewide emissions in 2019 from livestock (92%) and soil management practices (8%). However, agriculture and forestry also provide carbon sequestration benefits and can provide significant contribution toward achieving net zero total emissions from all sectors in the State. For example, carbon sequestration in forestlands (77%) and urban forests (14%) and long-term storage of carbon in harvested wood products (5%) provided approximately 96% of the State's GHG emissions removals in 2019 – equal to mitigation of 11% of statewide emissions. Additional strategies related to agriculture and forestry are also included in *Chapter 19. Land Use*.

Waste

GHG emissions from the waste sector represent about 12% of statewide emissions, including landfills (78%), waste combustion (7%), and wastewater treatment (15%). Most of these emissions represent the long-term decay of organic materials buried in a landfill, which will continue to emit methane at a significant rate for more than 30 years. It also represents both the landfilling of waste in New York and the exporting of waste to landfills in other states.

Emissions Removals

The only current method for removing emissions from the atmosphere is through the process of natural carbon sequestration, which is a service provided by our forests, croplands, and wetlands. In 2019, these lands removed an amount of CO₂ equal to 8% of the State's GHG emissions.

Pillars of New York’s Planned Climate Action to Realize Net Zero Emissions

Chapter 5. Overarching Purpose and Objectives of the Scoping Plan

This Scoping Plan is designed to act as a plan that the State should follow to meet the requirements of the statewide greenhouse gas (GHG) emission limits and achieve statewide net zero emissions pursuant to the Climate Leadership and Community Protection Act (Climate Act). The Scoping Plan discusses strategies to meet Climate Act directives by the economic sector, as well as provides recommendations for economywide activities that the State should undertake. All of these strategies are guided by pillars of climate justice, just transition, and public health, each of which is described further in the following chapters.

5.1 New York’s Climate Vision

New York will undertake a sweeping set of measures to reduce the State’s GHG footprint, transform electricity generation in the State, and drive innovative solutions through technology advancement. This Scoping Plan establishes the path forward for New York to achieve 70% renewable energy by 2030 (70x30), 100% zero-emission electricity by 2040 (100x40), a 40% reduction in statewide GHG emissions from 1990 levels by 2030, an 85% reduction in statewide GHG emissions from 1990 levels by 2050, and net zero emissions statewide by 2050. The paths to 2030 and 2050 require a comprehensive vision and integrated approach to build new programs while significantly expanding existing efforts. Each economic sector discussed in this Scoping Plan establishes a vision for 2030 and 2050, along with a slate of detailed strategies in an effort to paint the picture of the future and show the direction the State must head.

Successful implementation of this Scoping Plan requires one cohesive voice across all State entities, but State government action alone will not be enough. The State can set the stage for action, but it is equally as important to ensure engagement with all New Yorkers through education and outreach. This Scoping Plan is the result of extensive collaboration and public input. Not only is it a synthesis of sector-specific strategies, but it is also designed as overarching strategic initiatives intended to work in parallel to achieve the requirements of the Climate Act. Successful implementation will also require rapid integration and assimilation of strategies designed to achieve real results across the State.

Inform State Action

This Scoping Plan is intended to act as a strategic plan for State agencies, authorities, and other entities that are responsible for passing new legislation and implementing new policies and programs. Many of the sector-specific chapters are organized by policy themes, and each of those themes includes several strategies that are intended to mitigate GHG emissions or enable the mitigation of GHG emissions. Each of these chapters acknowledges the existing work that the key stakeholders, including State agencies, in those economic sectors have done or are currently doing to address climate change, and when appropriate builds on those policies and programs. Beyond that, the sector-specific chapters include new strategies to guide New York in meeting the requirements of the Climate Act. It continues to be important that New York leverage action by coordinating within and between agencies and authorities. Linkages between programmatic actions across agencies should be highlighted.

In addition, pursuant to the Climate Act, this Plan will inform the New York State Energy Planning Board's adoption of an updated State Energy Plan in accordance with section 6-104 of the Energy Law.⁴³ The State Energy Plan, most recently adopted in 2015 and subsequently amended in 2020, is a comprehensive roadmap to build a clean, resilient, and affordable energy system for all New Yorkers. The State Energy Plan establishes how the State can ensure adequate supplies of power, reduce demand through new technologies and energy efficiency, preserve the environment, reduce dependence on imported gas and oil, stimulate economic growth, and preserve the individual welfare of New York citizens and energy users. The first State Energy Plan issued after the completion of the final Scoping Plan shall incorporate the recommendations found herein.⁴⁴

5.2 Process for Development

This Scoping Plan is the culmination of work of hundreds of professionals across the State and a robust public engagement process. The Climate Action Council (Council) convened its first meeting in March of 2020. Since that time, and throughout the COVID-19 pandemic, the Council continued its important work of developing a draft Scoping Plan of strategies to reduce New York's GHG emissions to meet the GHG emission limits and social justice requirements set forth in the Climate Act. In order to finalize the draft Scoping plan by the end of 2021, the Council held 18 meetings in which it, among other work, appointed seven Advisory Panels, approved work plans, received progress reports, received hundreds of recommendations, received feedback from the Climate Justice Working Group (CJWG) on the benefits

⁴³ ECL § 75-0103(11).

⁴⁴ Ibid.

and impacts to Disadvantaged Communities of the Advisory Panels' recommendations, and received data on costs and benefits of the mitigation strategies.

These Advisory Panels – Agriculture and Forestry, Energy Efficiency and Housing, EITE Industries, Land Use and Local Government, Power Generation, Transportation, and Waste – as well as the Just Transition Working Group (JTWG), comprised professionals from all across the State who provided their expertise in developing strategies that reduce GHG emissions in New York while benefiting New York's workers and Disadvantaged Communities. The Advisory Panels and JTWG held over 90 public meetings during their recommendation development process. At the direction of the Council, the panels sought the perspective of other panels, additional experts, and other stakeholders in the development of the recommendations. The Advisory Panels also engaged with the CJWG for feedback on the recommendations. The Advisory Panels delivered their GHG mitigation recommendations for Council consideration at the April and May 2021 Council meetings. The Council also received adaptation and resilience recommendations from the Land Use and Local Government Advisory Panel and recommendations on workforce opportunities and business impacts from the JTWG. The full slate of recommendations, along with CJWG feedback on the recommendations, and adaptation and resilience recommendations can be found in Appendices A, B, and H, respectively.

In 2021, the Council was presented with results from an integration analysis on a suite of mitigation strategy scenarios, which were built from recommendations provided by the Advisory Panels. This analysis provided data on the emission reductions and societal costs and benefits that can be expected from differing options of strategy sets. The analytical work continued with additional research and outputs from the integration analysis presented to the Council in 2022.

The Council spent the first half of 2022 receiving written and oral comment from the public on the draft Scoping Plan. The Council also continued working on key open issues identified when the draft Scoping Plan was released, the gas system transition, economywide policies, and the role of alternative fuels. The Council held 13 public meetings in 2022 in the development of this final Scoping Plan. These deliberations, informed by the public input and further consultation with the CJWG, are reflected in the strategies contained herein. This Scoping Plan identifies and makes recommendations on regulatory measures, legislation, funding, and other State actions that will ensure the attainment of the Climate Act requirements. Significant policy developments at the national and state level have emerged that offer major new tools for New York to utilize, adopt, and draw from in implementing the Scoping Plan recommendations.

Stakeholder Engagement

This Scoping Plan considers inputs from many stakeholders, as well as critical feedback during consultation with the CJWG, established pursuant to Environmental Conservation Law (ECL) § 75-0111. The Council's Advisory Panels were committed to a public process in the development of their recommendations, holding public engagement sessions, conducting public surveys, and accepting and incorporating public comment throughout. The recommendations that were delivered to the Council from the Advisory Panels included this stakeholder input. State agencies and other stakeholders representing many different perspectives were critical in developing this Scoping Plan and feedback was gathered at several different public webinars and workshops, including through outreach on the annual GHG emissions report, a technical conference on oil and gas emissions accounting, and outreach on net emissions accounting.

In addition, the New York State Energy Research and Development Authority (NYSERDA) held a Reliability Speaker Session to engage experts, including the New York Independent System Operator (NYISO) and the Utility Intervention Unit of New York State Department of State (DOS), on electric system reliability planning for the purposes of informing the development of this Scoping Plan. After the draft Scoping Plan was issued, the Council initiated a public comment process designed to ensure that all New Yorkers had the opportunity to provide input on the draft Scoping Plan.

The Council's public comment process exceeded the requirements of the Climate Act by extending the public comment period to six months and holding nine in-person public hearings across the State and two virtual public hearings. The Council received approximately 35,000 comments on the draft Scoping Plan. The feedback submitted during the public hearings and by written comments covered the full scope of the transition to a clean energy economy, including the gas system transition, climate and environmental justice, hydrogen, nuclear energy, alternative fuels, cost impacts, electrical grid capacity, reliability, and security, rural and upstate community needs, jobs, and the New York economy.

The Council welcomed feedback from the public on its work throughout the process. Continued engagement is encouraged as the Scoping Plan is implemented through laws, regulations, and policies, each of which will include opportunities for public input. Stakeholder outreach and engagement will be essential to continue moving New York forward on climate action.

Integration Analysis

The Climate Act requires that the Council evaluate the total potential costs and potential economic and non-economic benefits, considering the Value of Carbon established by New York State Department of Environmental Conservation (DEC) under the Climate Act, of this Scoping Plan for reducing GHGs. An integration analysis was developed to estimate the economywide benefits, costs, and GHG emissions reductions associated with pathways that achieve the Climate Act GHG emission limits and net zero emissions goal. This integration analysis incorporates and builds from Advisory Panel and Working Group recommendations, as well as inputs and insights from complementary analyses, to model and assess multiple mitigation scenarios. Key assumptions, drivers, and results of the analysis have been made publicly available throughout the analytic process, and feedback from Advisory Panels, State agency staff, the CJWG, and the Council has been incorporated. In addition, a Technical Advisory Group of experts from academia and national labs were consulted.

The results from the draft integration analysis were presented to the Council in summer and fall of 2021. Updated analysis and additional sensitivity analyses and research efforts were presented over the summer and fall of 2022. These are available to the public on the Climate Act website and in Appendix G. Additional information on the integration analysis is provided in *Chapter 9. Analysis of the Plan* and *Chapter 10. Benefits of the Plan*.

5.3 Summary of Strategies

Through the process of the developing this Scoping Plan, the Council recognized several key strategies that are fundamental to achieving the GHG emission limits and net zero GHG emissions:

- Energy efficiency measures that achieve the Climate Act energy efficiency requirement
- Transition from fossil natural gas to electrification in buildings
- Zero-emission electricity
- Transportation electrification
- Enhancement of transit, smart growth, and reduced vehicle miles traveled (VMT)

Fossil Natural Gas

6 NYCRR Part 203 defines “natural gas” as a naturally occurring mixture or process derivative of hydrocarbon and non-hydrocarbon gases. Its constituents include the greenhouse gases methane and carbon dioxide and may include natural gas liquids.

This Scoping Plan uses the term “fossil natural gas” to describe a fuel that is predominately methane formed over millions of years in geologic formations deep beneath the earth’s surface. This fuel is extracted, processed for sale and consumption, and delivered to end-use consumers primarily through intra- and inter-state pipelines.

- Transition to low global warming potential (GWP) refrigerants and enhanced refrigerant management
- Maximization of carbon sequestration in New York’s lands and forests
- Mitigation of fugitive methane emissions across the waste, agriculture, and energy sectors
- Diverse portfolio of solutions in industry, including efficiency, electrification, and strategic use of alternative fuels and carbon capture technologies for certain industrial applications

Biogas and Renewable Natural Gas

Biogas and renewable natural gas have the potential to reduce greenhouse emissions by mitigating methane emissions from waste sources and displacing fossil fuels, although there are emissions associated with their combustion and leakage. There are differences between these two fuels that influence their use in the strategies in this Scoping Plan.

Biogas | Biogas is gas resulting from the decomposition of organic matter under anaerobic conditions (such as in a landfill, manure pit, or wastewater recovery facility). The principal constituents are methane and carbon dioxide. Some engines can use biogas as a fuel source with minimal processing. Emissions from biogas can occur as a result of poor maintenance causing methane leaks, and from leftover solid waste.

Renewable Natural Gas | Renewable natural gas is biogas that has been processed and upgraded and can be used in place of fossil natural gas. To process biogas to renewable natural gas, the methane content is increased by removing water vapor, carbon dioxide, hydrogen sulfide and other impurities. The process of converting biogas to renewable natural gas can be a source of greenhouse emissions from fugitive methane released during refining, if fossil fuels are used in the conversion process, when poor maintenance of equipment or gas infrastructure results in methane leaks, and the improper management of the byproducts of renewable natural gas creation.

This Scoping Plan includes recommendations to reduce greenhouse gas emissions associated with the creation of renewable natural gas from biogas in the waste and agriculture sectors..

In addition to the realization of these fundamental strategies, reliability and resiliency of energy systems is critical to providing robust systems that respond to changing demand in real-time and withstand unexpected events. The strategies to implement and achieve the requirements and goals of the Climate Act must support the high reliability standards in place in the State by implementing improvements and enhancements where needed and sustaining the practices that provide high quality electric service. If reliability is properly integrated, the additional clean distributed energy resources (DERs), storage and large-scale renewables developed under the Climate Act will provide a more flexible and resilient grid to address and mitigate the impacts of climate change.

Strategies in this Scoping Plan, across all economic sectors, create new economic development opportunities and create new, high-value job growth associated with new and expanded business growth. To advance the State's emissions reduction and clean energy requirements and goals, the strategies in this Scoping Plan seek to leverage federal actions such as Infrastructure Investment and Jobs Act, the Inflation Reduction Act, and the CHIPS and Science Act to build out the clean technology supply chain in New York. New York's climate agenda is creating extensive economic development opportunities tied to manufacturing attraction, expansion, and production line repurposing for the clean energy technology and component manufacturing needed to achieve the emission limits required by the Climate Act while also positioning New York as a clean technology provider globally. Coordinated planning will ensure these benefits are captured in New York, especially in Disadvantaged Communities and legacy/rust belt cities.

As the State implements the Climate Act, it should incorporate economic development considerations into the existing planning processes underway at State entities as part of a multiagency approach to optimize businesses and economic development efforts needed to achieve the Climate Act's requirements related to emissions reductions, benefits to Disadvantaged Communities, and optimization of public and private funding opportunities. Empire State Development (ESD), in partnership with NYSERDA, the New York State Department of Public Service (DPS), the New York State Department of Labor (DOL), the Office of Just Transition, and other partner agencies, will spearhead economic development in the clean energy economy. The State's approach will advance workforce development and business development to create jobs in line with the Scoping Plan, leveraging available research and data to highlight areas poised for growth, and build on the work ESD is already doing to actively promote clean technology manufacturing throughout New York State, such as through the innovative Green Excelsior program, which is aimed at building out a robust clean technology supply chain in New York.

Chapter 6. Advancing Climate Justice

6.1 Climate Justice and the Climate Act

In addition to advancing New York’s nation-leading climate and energy agenda, a fundamental objective of the Climate Act is to ensure that New York’s transition to a clean energy economy works to address the structural disadvantages that have caused historically marginalized communities (e.g., people of color, indigenous, low-income, women) to bear a disproportionate burden of the impacts of climate change and pollution. Historically marginalized communities typically experience a lower life expectancy and quality of life as measured by environmental burdens, climate change risks, population characteristics, and health vulnerabilities. Through enshrining equity objectives in State investments, program design, and internal and external engagement strategies, this Scoping Plan demonstrates how the Climate Act will work to address past discrimination. Implementation will create a model where achieving a high standard of economic well-being and health in every community is the baseline condition of climate action.

The Climate Act requires all State agencies, offices, authorities, and divisions to prioritize reductions of GHGs and co-pollutants in Disadvantaged Communities and shall not disproportionately burden Disadvantaged Communities when considering and issuing administrative approvals and decisions.⁴⁵ Actions undertaken by the State to mitigate greenhouse gas (GHG) and co-pollutant emissions should prioritize the safety and health of Disadvantaged Communities, control for potential regressive impacts of climate change mitigation and adaptation policies, and prioritize the allocation of public investments to these communities. In addition, this Scoping Plan recognizes that women, femmes, youth, and children are more vulnerable to the climate crisis and acknowledges the need to specifically provide support and opportunities to these populations who are disproportionately impacted by the climate crisis.

In identifying those who bear a disproportionate burden of the impacts of climate change and pollution, a person’s race and wealth are the two most predictive factors. This is attributable to a history of marginalization, such as racial and ethnic discrimination across public institutions, which has created a structural disadvantage and made it particularly difficult for some New Yorkers to access basic needs such as clean air and water, affordable energy and housing, and quality employment opportunities. The stress and hardship of these struggles is heightened by the destructive impacts of climate change from both single extreme weather events and ongoing, low-intensity events.

⁴⁵ Climate Act § 7(3).

The Climate Act seeks to address the disproportionate burden that Disadvantaged Communities have borne from past and current emissions in many ways. The Climate Act ensures that Disadvantaged Communities will reap the benefits of New York’s transition to a clean energy economy, including by requiring that certain State investments deliver benefits to these communities.⁴⁶ Through the work of the Climate Justice Working Group (CJWG), the Climate Act ensures that these communities are consulted and will benefit from New York’s climate action. Input from the CJWG will inform the development of climate policies and investment programs designed to deliver meaningful and equitable benefits to Disadvantaged Communities. The Climate Act also contains important provisions that ensure agency decision-making does not disproportionately burden Disadvantaged Communities and prioritizes reductions of GHG emissions and co-pollutants in these communities. These are priorities that encompass all State agencies and authorities, and a coordinated approach to implementation is needed to ensure these provisions of law are integrated into agency actions.

The Climate Act requires the identification of the Disadvantaged Communities that bear such disproportionate burdens so the State may ensure that they benefit equitably from New York State’s transition to a clean energy economy. This objective is paramount in State efforts involving GHG emission and co-pollutant reduction, clean energy deployment, and climate adaptation and resilience, and it is foundational to the strategies in this Scoping Plan. The desired outcome is to make every neighborhood and community healthy and resilient to the unavoidable impacts of climate change and to provide quality jobs in safe work environments for all New Yorkers in a thriving clean energy economy.

Climate Justice Working Group

The Climate Act established the CJWG, which comprises representatives from environmental justice communities statewide, including three members from New York City communities, three members from rural communities, and three members from urban communities in upstate New York, as well as representatives from New York State Department of Environmental Conservation (DEC), the New York State Department of Health (DOH), the New York State Department of Labor (DOL), and the New York State Energy Research and Development Authority (NYSERDA). The composition of the CJWG was intended to ensure that the perspective of environmental justice communities from across New York State were included in the work of the group. Among other responsibilities, the CJWG was tasked with developing the definition of Disadvantaged Communities and has an important advisory role, providing

⁴⁶ ECL § 75-0117.

strategic advice to the Climate Action Council (Council) for incorporating the needs of Disadvantaged Communities in the Scoping Plan. The CJWG was formed in June 2020 and held 27 public meetings through 2022.

Identifying New York’s Disadvantaged Communities

A primary task of the CJWG is to develop the criteria by which a community in New York can be designated as a Disadvantaged Community under the Climate Act. The Climate Act defines Disadvantaged Communities as “communities that bear burdens of negative public health effects, environmental pollution, impacts of climate change, and possess certain socioeconomic criteria, or comprise high-concentrations of low- and moderate- income households...”⁴⁷ The establishment of the Disadvantaged Communities criteria is fundamental to many provisions of the Climate Act and key to successful implementation of this Scoping Plan in prioritizing reductions of GHG emissions and co-pollutants in these communities and ensuring no disproportionate burdens on such communities.

In developing the draft Disadvantaged Communities criteria, the CJWG considered climate change risk, environmental burden, public health, and socioeconomic factors, as outlined by the Climate Act. The CJWG assessed nearly 170 climate, health, and socio-demographic indicators and analyzed more than 100 indicators that had consistent, granular, and up-to date statewide data available. The CJWG members also brought their perspective, familiarity, and experience working with frontline communities across the State. This first-hand knowledge helped to incorporate the lived experiences of residents of frontline communities into the process. Such an approach represents an effort to create a holistic statewide standard of climate justice that incorporates a broad range of valid factors and knowledge inputs. Details on the methodology, including census tract scoring and analysis of each indicator, is available on the Climate Act website.⁴⁸

The CJWG finalized the draft criteria in December 2021 and released the draft criteria for public comment, along with mapping tool to visualize the Disadvantaged Communities identified by the draft criteria, on March 9, 2022. The Climate Act required the CJWG to undertake an extensive public input process before finalizing the criteria, including posting the draft criteria online, hosting at least six regional public hearings, and accepting public comments for at least 120 days. The CJWG, DEC, and

⁴⁸ The Climate Act website can be accessed at climate.ny.gov.

NYSERDA held 11 in-person and virtual public hearings and three educational webinars on the draft criteria during the public comment period. The public comment period closed after 150 days on August 5, 2022, with approximately 3,000 comments received. The CJWG will review and assess the public comments as they work to finalize the Disadvantaged Communities criteria. After finalization, the Climate Act requires the CJWG to meet annually to review the criteria and methodology for identifying Disadvantaged Communities, and to make updates where necessary.

Directing Benefits to Disadvantaged Communities

In transforming New York’s energy economy and mitigating climate change, the Climate Act mandates an investment of certain benefits of State agencies, authorities, and entities to Disadvantaged Communities. Disadvantaged Communities must receive a minimum of 35% of benefits of spending on clean energy and energy efficiency programs, projects, or investments in the areas of housing, workforce development, pollution reduction, low-income energy assistance, energy, transportation, and economic development, with a goal of 40%.⁴⁹ DEC and NYSERDA, in consultation with the CJWG and other relevant stakeholders, are developing a methodology for defining these benefits. The definition of Disadvantaged Communities and the methodology for defining benefits will be provided to all State agencies to ensure a coordinated approach to directing benefits to Disadvantaged Communities as required by the Climate Act.

New York State’s clean energy and energy efficiency investments should provide a path for Disadvantaged Communities to participate in and benefit from the clean energy transition. These investments can provide a number of benefits for Disadvantaged Communities, including air quality improvements associated with the reduction of fossil fuel combustion in buildings, transportation, and power generation; energy bill savings from energy efficiency improvements to homes and small businesses; workforce and small business development and employment opportunities; the advancement of community self-determination through community-based organization capacity-building; and the remediation or redevelopment of underused sites within Disadvantaged Communities such as brownfields, abandoned commercial sites, landfills, or otherwise dilapidated land. Given the underinvestment in New York’s Disadvantaged Communities, it will equally be important for the State’s clean energy portfolio to drive economic development and job growth within these communities. As a means of doing so, as discussed in *Chapter 7. Just Transition*, the State should utilize labor standards and

⁴⁹ ECL § 75-0117.

undertake concerted efforts to drive increased workforce diversity and equity through recruitment efforts, retention policies, and promotion opportunities. In demonstrating a commitment to meeting or exceeding the benefits requirements of the Climate Act, the State has already begun adapting clean energy and energy efficiency investments to prioritize Disadvantaged Communities. Examples of these actions are:

- **Clean Green Schools:** \$59 million was made available by NYSERDA to serve more than 500 P-12 schools in Disadvantaged Communities with clean energy and energy efficiency solutions, creating a healthier learning environment in schools across New York State. In addition, a minimum of \$3 million will be provided to schools in Disadvantaged Communities participating in the Clean Green Schools program to support education, career awareness, and training related to clean energy and energy efficiency retrofit projects, careers, and jobs.
- **NY Sun Solar Equity Framework:** \$200 million was directed to increase access to solar energy for low- to moderate-income (LMI) households, affordable housing, and environmental justice communities.
- **EmPower New York:** EmPower New York incorporated a geo-eligibility component, streamlining eligibility determinations for households located in communities with more than 50% of residents at or below 150% of the federal poverty level.
- **Regional Clean Energy Hubs:** \$52.6 million was made available to establish clean energy hubs in each of the 10 economic development regions of the State and to build capacity at the local level to position Disadvantaged Communities to benefit from the emerging clean energy economy. Initiatives will include outreach and education, increasing access to clean energy programs and resources, conducting equitable stakeholder engagement, and connecting residents and small businesses with workforce or business development opportunities.
- **Climate Justice Fellowships:** \$6 million was made available to support individuals residing in Disadvantaged Communities or from priority populations to gain experience working in clean energy or climate justice through entities such as community-based organizations, universities, municipalities, climate tech innovators/start-ups, and clean energy businesses to advance climate justice and clean energy priorities for Disadvantaged Communities, including assisting with community engagement activities (e.g., plan, policy, or project) or clean energy project development and implementation.
- **New York Clean Transportation Prizes:** In November 2022, NYSERDA, in collaboration with New York State Department of Public Service (DPS) and DEC, announced 10 awards funding innovative electric transportation approaches that improve air quality and expand access to mobility in Disadvantaged Communities across the state through this \$85 million program.

- **Large Scale Renewables and CES:** In an October 15, 2020 Order, the PSC directed NYSEERDA to take measures to ensure that interests of Disadvantaged Communities are valued in all future Clean Energy Standard (CES) procurements.

In addition, other policies established through Executive Orders or legislation can complement these investments by creating conditions for positive outcomes for Disadvantaged Communities. For example, the 2022 State of the State directed State entities to develop an Extreme Heat Action Plan to address the impacts of extreme heat on disadvantaged and other heat vulnerable communities. The interagency approach will ensure that the issue of extreme heat is addressed with a more holistic approach than any individual entity, program, or investment could accomplish. In addition, Executive Order 22 requires affected State entities to maximize efforts to lower the impact of their operations, including emissions released from State building and transportation operations and waste generation, and directs State entities to prioritize efforts to reduce emissions from their operations in Disadvantaged Communities.

To evaluate compliance with the Climate Act’s requirement for Disadvantaged Communities to receive at least 35% of the benefits of clean energy and energy efficiency spending, with a goal of 40%, the State’s program administrators will track and report on the investments and benefits occurring in Disadvantaged Communities. It is expected that reporting will include an accounting of clean energy and energy efficiency funding invested in Disadvantaged Communities and a quantification of measurable co-benefits of these investments such as energy savings, bill savings, workforce development, and projected health impacts. As data collection methods evolve, additional qualitative or quantitative outcomes for Disadvantaged Communities may be reported on, such as those associated with economic development or other aspects of the clean energy transition.

6.2 Prioritizing Measures to Reduce Greenhouse Gas Emissions and Co-Pollutants in Disadvantaged Communities

Prioritizing emissions reduction in Disadvantaged Communities should help to prevent the formation or existence of emission “hotspots” that occur when certain sources maintain or increase higher levels of co-pollutant emissions despite a reduction in emissions statewide. A broad range of factors may contribute to high concentrations of pollutants in a given location that create a hotspot. The result can be unhealthy air quality, particularly for sensitive populations such as expectant mothers, children, the elderly, people of low socio-economic status, and people with pre-existing medical conditions.

Fortunately, the risk of hotspots will be dramatically reduced by this Scoping Plan’s combination of sector-based investment and regulatory strategies designed to decarbonize and substantially reduce or eliminate the emission of unhealthy co-pollutants from mobile and stationary sources. Importantly, this

Scoping Plan also leverages multiple initiatives involving the State’s partnership with Disadvantaged Communities to target hotspots. In addition to monitoring the air quality of Disadvantaged Communities, the State should align programmatic resources to increase the adoption of clean energy solutions across sectors by tailoring incentive programs to address the specific barriers and opportunities within Disadvantaged Communities and by increasing outreach and awareness through community-based initiatives such as the Regional Clean Energy Hubs. Together, these elements will ensure that Disadvantaged Communities experience improved, healthy air quality in a socially beneficial and holistic manner.

The Climate Act requires that the State prioritize measures to maximize reductions of GHG emissions and co-pollutants in Disadvantaged Communities. Strategies that reduce New York’s reliance on fossil fuels not only reduce GHG emissions but also reduce co-pollutants, leading to corresponding benefits to Disadvantaged Communities. As New York approaches full decarbonization by 2050, emissions of unhealthy pollutants like fine particulate matter (PM_{2.5}), nitrogen oxides (NO_x) (which contribute to particulate matter and ozone formation), and various toxic pollutants will see commensurate declines statewide, prioritized in Disadvantaged Communities.

In this Scoping Plan, benefits and impacts to Disadvantaged Communities are woven throughout the recommended strategies for reducing GHG emissions and co-pollutants as described in more detail in *Sector Strategies*. Examples of these strategies are:

- Financial incentives for the electrification of trucks and buses are being targeted in the first instance to vehicles operating in areas overburdened by air pollution. Zero-emission vehicles sales mandates and fleet electrification requirements will drive the electrification of fleets operating in and through these Disadvantaged Communities, including drayage fleets serving port areas. In addition, until the supply chain and infrastructure capacity for an electric trucking sector can be fully brought to fruition around midcentury, the more immediate replacement of diesel with renewable diesel and green hydrogen fuel cells, which is non-combusted hydrogen generated entirely by renewable energy, will reduce harmful PM_{2.5} emissions.
- In the power sector, incentives for distributed energy resources (DERs) and energy storage will be targeted to Disadvantaged Communities, reducing GHG emissions from peaking power plants in those locations.
- In residential and commercial buildings, incentives for energy efficiency upgrades and clean heating and cooling, including heat pumps, will be targeted to LMI and Disadvantaged

Communities, reducing both costs and emissions in those communities. Reducing fossil natural gas combustion in buildings results in improved indoor air quality and healthier living spaces.

- Diverting organics and capturing methane from landfill facilities in Disadvantaged Communities reduces landfill odors that significantly impact the quality of life and pose potential health impacts for those communities. Waste reduction and increased recycling will reduce waste hauling and related emissions.
- Alternative manure management strategies in the agricultural sector can help prevent excessive ammonia, hydrogen sulfide, methane, and N₂O emissions in rural Disadvantaged Communities.

Collectively, implementation of these and other measures in this Scoping Plan will ensure substantial reductions of GHGs and co-pollutants in communities overburdened with harmful pollution. As the Scoping Plan is implemented, State entities are required to ensure that the State's actions do not disproportionately burden Disadvantaged Communities and adhere to the requirements of the Climate Act to prioritize reductions of GHG emissions and co-pollutants in Disadvantaged Communities in their programs and policies.⁵⁰ This includes the requirements of Section 7(3) of the Climate Act in agency decision-making. State agencies will also prioritize compliance with the Climate Act's investment provision that requires that Disadvantaged Communities receive at least 35% of the benefit of the funds of clean energy and energy efficiency spending, with a goal of 40%.⁵¹

Community Air Monitoring in Disadvantaged Communities

The Climate Act created a program to measure and record air pollutant concentrations in the ambient air at or near places like hospitals, schools, and day care centers in Disadvantaged Communities and to use this information to create a strategy to reduce emissions of toxic air contaminants and criteria air pollutants in Disadvantaged Communities with high exposure burdens. The Climate Act requires that DEC conduct this Statewide Community Air Monitoring program in no less than four Disadvantaged Communities that have been identified as the highest priority due to high air pollution exposure burdens.

In consultation with the CJWG and community leaders, DEC and NYSERDA developed air pollution burden indicators that were used to identify Disadvantaged Communities to deploy mobile air monitoring sensor technology to collect air quality data on a more local level. Exceeding the four required by the Climate Act, 10 communities were identified as having a disproportionate air pollution burden. These

⁵⁰ Climate Act § 7(3).

⁵¹ ECL § 75-0117.

communities are Buffalo/Niagara Falls/Tonawanda, Capital Region, Bronx, Manhattan, Rochester, Syracuse, Mount Vernon/Yonkers/New Rochelle, Brooklyn, Queens, and Hempstead/Uniondale/Westbury/New Cassel. Monitoring will include GHG emissions and other co-pollutants. The monitoring data, along with other air monitoring data, will help provide a comprehensive picture of air quality in communities that are home to up to five million New Yorkers. The results of this monitoring effort will advance the Climate Act's directive to reduce emissions in communities disproportionately impacted by air pollution and to help address health disparities due to this pollution.

The air monitoring effort will be bolstered by an additional \$2 million in grants that will support community-led, complementary air monitoring efforts, and \$1 million in Community Air Monitoring Capacity Building Grants. The statewide community air monitoring program is scheduled to be completed in the third quarter of 2023. DEC will provide quarterly project updates to the 10 communities and post these preliminary data summaries to the DEC website.⁵² By June 1, 2024, DEC will prepare, in consultation with the CJWG and community-based organizations, strategies to reduce emissions of toxic and criteria air pollutants in Disadvantaged Communities. These strategies will include methods for assessing and identifying the emissions sources, estimating their relative contribution to elevated exposure to air pollution, and assessing measures to reduce emissions from these sources. DEC will use the strategies to design community emissions reduction programs in Disadvantaged Communities.

6.3 Barriers and Opportunities Report

Pursuant to Section 6 of the Climate Act, to ensure that the material benefits of mitigating and adapting to climate change are realized in Disadvantaged Communities, DEC worked with NYSERDA, NYPA, other State agencies, the Council, and the CJWG to prepare a report on barriers to and opportunities for access to and/or community ownership of several services and commodities in Disadvantaged Communities. The final report was published in December of 2021 and provides a suite of recommendations for New York State agencies to design climate mitigation and adaptation programs through a lens of justice.⁵³

The requirement that at least 35%, with a goal of 40%, of the benefits of spending on clean energy and energy efficiency programs be realized in Disadvantaged Communities is meant to ensure Disadvantaged Communities will benefit from State actions promoting clean energy. However, for these benefits to

⁵² Additional information on DEC's Community Air Monitoring Initiative can be accessed at <https://www.dec.ny.gov/chemical/125320.html>.

⁵³ New York State. December 2021. *New York State Disadvantaged Communities Barriers and Opportunities Report*.

effectively eliminate climate and pollution burdens, the programs delivering them must account for the circumstances that created the structural disadvantages faced by communities. A continuation of the status quo in the way programs are designed and administered would constrain the extent and impact of the benefits they deliver. Cognizant of the need to understand and update these methods, the Climate Act established a process to examine how the State’s current approach to program design and administration could be improved to yield greater results for Disadvantaged Communities as they are implemented.

The Barriers and Opportunities Report identifies the barriers to, and opportunities for, access to, or community ownership of, services and commodities in Disadvantaged Communities in the following five areas:

- Distributed renewable energy generation
- Energy efficiency and weatherization investments
- Zero-emission and low-emission transportation options
- Adaptation measures to improve the resilience of homes and local infrastructure to the impacts of climate change, including but not limited to microgrids
- Other services and infrastructure that can reduce the risks associated with climate-related hazards, including but not limited to:
 - Shelters and cool rooms during extreme heat events
 - Shelters during flooding events
 - Medical treatment for asthma and other conditions that could be exacerbated by climate-related events

Notably, the inclusion of climate adaptation measures and climate-related hazard risk reduction in this report demonstrates the Climate Act’s intent to embed equity within both State clean energy and climate resilience programs.

Pursuant to the Climate Act, the recommendations from the Barriers and Opportunities Report are included in this Scoping Plan.

Barriers and Opportunities Report Findings

The report identifies four categories of barriers that prevent Disadvantaged Communities from receiving fair and equal access and ownership in the five areas of services and commodities listed above.

- **Physical and Economic Structures and Conditions:** Baseline conditions of physical or economic systems that impede access, use, or ownership of programs or solutions

- **Financial and Knowledge Resources and Capacity:** Insufficient resources, including financial resources, time, staffing or individuals on the household, agency, organization, or municipal level
- **Perspectives and Information:** Limited information, competing priorities and preferences, or lived experiences, including historical patterns of interaction that have eroded trust and impede awareness of and access to programs or services
- **Programmatic Design and Implementation:** Data and knowledge gaps related to lack of alignment between agencies and program design constraints

The report describes examples of each of these barriers, the scale at which they exist, and the relevant service and commodity areas they apply to. To overcome them, the report makes eight recommendations, considered as high-level principles, which are organized under three themes, as provided in Table 1.

Table 1. Barriers and Opportunities Report Recommendations by Theme Area

Ensure Processes are Inclusive	1. Co-design programs or projects with and for communities.	As appropriate, all State entities are expected to incorporate these three themes and eight recommendations into their program administration and process activities related to implementation of the Climate Act.	
	2. Provide meaningful opportunities for public input in government processes and proceedings.		
	3. Work across intersecting issues and interests to address needs holistically.		
Streamline Program Access	4. Transition to program models that require little to no effort to participate and benefit.		
	5. Establish people-centered policies, programs, and funding across local, State, and federal governments.		
	6. Find and support resource-constrained local governments.		
Address Emerging Issues	7. Mobilize citizen participation and action.		The Barriers and Opportunities Report recommends that State
	8. Improve housing conditions and adherence to local building codes.		

agencies and authorities conduct a self-assessment and barriers analysis related to their policies and programs guided by the findings in the Report. In conducting the self-assessment and barriers analysis, each State entity should be expected to:

- Identify appropriate program staff to conduct the work and phase it in according to a feasible and impactful timeline
- Conduct a self-assessment and barriers analysis that includes identifying the barriers and opportunities identified in the Report that are applicable to the agency or authority’s portfolio

- Translate the results into a plan that identifies the relevant barriers and opportunities, specific workstreams that the agency or authority will undertake to address these barriers and opportunities, a timeline for each workstream, and the expected outcome of each workstream

The self-assessment and barriers analysis will help State entities systematically identify the barriers and opportunities to serving Disadvantaged Communities that are unique to their missions and create calibrated implementation strategies.

6.4 Engagement on the Scoping Plan

The consideration of benefits and impacts that GHG emissions mitigation strategies may have on Disadvantaged Communities was integral to the development of this Scoping Plan. The Council sought robust engagement with environmental justice organizations throughout the process to ensure these perspectives were prioritized in this Scoping Plan. Members of environmental justice organizations were represented on all the Council’s Advisory Panels and the Just Transition Working Group (JTWG), which was vital to ensuring that the perspective of Disadvantaged Communities was included in the development of their respective recommendations.

In addition, the Advisory Panels and JTWG consulted with the CJWG as they were developing their recommendations. These bodies delivered their recommendations to the Council in the spring of 2021. The Council consulted with the CJWG on the Advisory Panel and JTWG recommendations. The CJWG provided feedback on all Advisory Panel and JTWG recommendations at Council meetings in the summer of 2021, with slides and recorded presentations available on the Climate Act website. The sectoral strategies in this Scoping Plan incorporate CJWG feedback and note where the group provided feedback on specific strategies. A compilation of the feedback provided by the CJWG is provided in Appendix B. The Council continued engagement with and received feedback from the CJWG in 2022 on the development of the Scoping Plan, particularly on the development of *Chapter 17. Economywide Strategies*.

In addition, in recognition of the unique government-to-government relationship and shared values around environmental protection, the State provided information and offered consultation with all State and federally recognized Indian Nations with territories that share boundaries in New York State on matters before the Council and CJWG. Presentations on the Climate Act were provided at the 2021 and 2022 Indian Nations Leadership Meetings hosted jointly by DEC, U.S. Environmental Protection Agency

(EPA), and Nations' leadership, which included information and discussions about the draft Scoping Plan and draft Disadvantaged Communities criteria.

The Scoping Plan intends to address past practices where historically marginalized and overburdened communities were excluded from State decision-making processes. The Council expects that all State entities will work to improve engagement with residents and representatives of Disadvantaged Communities to identify and understand the barriers and opportunities at the local level to increase participation in the clean energy transition. This includes ensuring that agencies and authorities are creating conditions for communities that would not typically engage in administrative processes to do so. In addition, in the implementation of this Scoping Plan, including rulemaking processes, administrative planning, and investment strategies, relevant New York State agencies, authorities, and entities will seek to consult with recognized Indigenous Nations with whom they share overlapping interests, in accordance with consultation processes.

Chapter 7. Just Transition

As the State continues implementation of the Climate Act, which demands a transition away from traditional energy sources and industries, New York will ensure this is a just transition. A just transition is one that builds connections, creates opportunity, and ensures a good quality of life for New Yorkers from all different walks of life. The Just Transition Working Group (JTWG) was convened by the Climate Action Council (Council), as required by Environmental Conservation Law (ECL) § 75-0103(8). The Climate Act specifically requires the JTWG to advise the Council on various issues related to workforce development and opportunities, conduct a climate jobs study, advise on potential impacts of carbon leakage risk to New York industries and communities, identify sector specific impacts, and identify electric generating sites that may be closed as a result of a transition to a clean energy sector, including the issues and opportunities that are presented by reuse of those sites.⁵⁴ The materials developed by the JTWG are included in Appendices C, D, and E. The Climate Act requires that this Scoping Plan include recommendations to aid in the transition of the State workforce and rapidly emerging clean energy industry, which is discussed below.

In addition to the work New York is undertaking, new federal resources under the Inflation Reduction Act, the Infrastructure Investment and Jobs Act, and the CHIPS and Science Act provide promising opportunities to strengthen New York's clean energy workforce with enhanced avenues of support for a just transition. New and expanded federal tax credits integrating bonuses for prevailing wage and apprenticeship requirements assure that New York's expanded focus on applying these labor standards will be met with greater financial benefits for the State. Across all these areas and others that may emerge, New York should work to leverage federal tax credits, grants, and financing for infrastructure reuse wherever possible to deploy clean energy options that support the State's future energy mix and the State's current and future energy workforce and trades. To maximize federal support, the technology mix should remain flexible to include beneficial technologies incentivized by federal statute. In addition, federal resources should be prioritized to assist the State in making needed grid infrastructure investments, particularly in legacy/rust belt neighborhoods and other Disadvantaged Communities to supplement State and utility processes and investments. The importance of federal and other partnerships to achieve the requirements of the Climate Act is discussed further in *Chapter 22. Essential Elements*.

⁵⁴ ECL § 75-0103(8)(a)-(f).

A truly just transition means that the State must enact measures to ensure that any worker who loses their job as a result of climate change mitigation efforts be promptly reemployed with the same or better wages, benefits, and terms and conditions of employment, while maintaining their choice of collective bargaining representative. Further, jobs created as a result of the State’s climate change mitigation efforts should be good, family-sustaining, union jobs, and accessible to all New Yorkers. This can be achieved by requiring robust labor standards and worker-focused procurement standards on clean energy, resilience, and other emissions reduction and adaptation projects, coupled with concerted efforts to drive increased workforce diversity and equity statewide through recruitment efforts, retention policies, and promotion opportunities. Finally, a just transition cannot permit privatization of public employment.

7.1 Just Transition Principles

The JTWG’s just transition principles, shown in Table 2, were developed to serve as a guide for Advisory Panel recommendations with the acknowledgement that each principle may have different applicability depending on economic sector. The principles have been developed to support a fair and equitable movement from fossil fuel-based economies toward the achievement of the carbon neutral future envisioned by the Climate Act. The Climate Act presents economic development opportunities for the State and its communities. Accordingly, the principles were also defined with local, regional, and statewide job creation and workforce development in mind.

Table 2. Just Transition Principles

Category	Principle Language
Stakeholder-Engaged Transition Planning	Engage a diverse range of stakeholders via early, inclusive engagement in communities’ transitions to local low-carbon economies, including New York’s workforce and the State’s Disadvantaged Communities.
Collaborative Planning for a Measured Transition Toward Long-Term Goals	Encourage collaborative State and community-based long-term planning, capacity-building, and robust social dialogue in order to ensure a gradual and supported transition.
Preservation of Culture and Tradition	Ensure that transition plans, policies, and programs reflect and respect local wisdoms, cultures, and traditions, including recognition of Indigenous sovereignty.
Realize Vibrant, Healthy Communities Through Repair of Structural Inequalities	Seek to lift up New Yorkers in the transition to a low-carbon economy by implementing transition policies and programs that promote cross-generational prosperity and gender and racial equity, in recognition of the disproportionate burden of environmental pollution and climate change on Disadvantaged Communities.
Equitable Access to High Quality, Family-Sustaining Jobs	Promote the creation of high-quality, family-sustaining jobs, including union jobs, and ensure that new jobs are created in transitioning and Disadvantaged Communities, connecting workers to employment opportunities through career services, skills training, and infrastructure investments.
Redevelopment of Industrial Communities	Promote diversified, strengthened economies in the transition to a low-carbon economy, examine opportunities for community-centered ownership structures, and promote industry recovery, retention, and growth for regions and sectors in transition.

Category	Principle Language
Development of Robust In-State Low-Carbon Energy and Manufacturing Supply Chain	Develop a robust in-State low-carbon supply chain, spanning full product life cycles, to increase focus on exporting low- and no-carbon products and to ensure that jobs in these emerging sectors become more accessible to the local workforce and to Disadvantaged Communities.
Climate Adaptation Planning and Investment for a Resilient Future	Integrate climate adaptation into transition planning, including through promotion of community resilience and investment in sustainable infrastructure.
Protection and Restoration of Natural and Working Lands Systems & Resources	Promote the restoration, conservation, and resiliency of the State’s agricultural and natural systems, improving local food security and supply and fostering healthy ecosystems, particularly in Disadvantaged Communities through sustainable land and natural resource use.
Mutually-Affirming Targets for State Industrialization & Decarbonization	Implement decarbonization policies that simultaneously bolster industry retention and sustainable economic development and growth and ensure that economywide programs and policies address the social, environmental, and economic challenges of workers and communities in transition.

7.2 Workforce Impacts and Opportunities

Achieving a just and equitable transition will generate numerous opportunities for New York’s existing and emerging workforce. At the same time, where certain sectors and occupations face a risk of job displacement, the State must work to ensure that job losses are minimized and that any losses come with meaningful support and reemployment protections. The State must enact measures to ensure that any worker who loses their job as a result of climate change mitigation efforts be promptly reemployed with the same or better wages, benefits, and terms and conditions of employment, while maintaining their choice of collective bargaining representative. Workers who are reemployed must receive support necessary to succeed in their new roles, including comprehensive training on their new role, safety and health, and other matters. Since the Council’s JTWG and seven multi-sector Advisory Panels were launched, representatives from public, private, academic, environmental, and community groups; labor unions; environmental justice communities; impacted industries; and renewable energy developers have met on several occasions to debate and analyze the impacts of transitioning to clean energy on the labor market. This Scoping Plan identifies the following recommendations to help ensure that New York’s workforce is prepared for and stands to benefit from the State’s transition to a clean economy.

Direct Displaced Worker Support

New York’s transition toward a cleaner, greener power grid will create both opportunities for economic success as well as risks of disruption in communities that have historically relied on fossil fuel power plants. New opportunities and challenges will similarly be faced in other sectors of the economy, transitioning away from the use of fossil fuels and associated technologies, including buildings, transportation, and fuel distribution. As New York leaves fossil fuels behind, and transitions to cleaner

alternatives as infrastructure and appliances reach the end of their useful life, some power plants and other centers of conventional energy employment will inevitably close. To mitigate any economic impact and ensure that current and formerly employed fossil fuel workers benefit from the transition to clean energy, it is imperative to support displaced workers as much as possible and early on. This means establishing continuing education, Registered Apprenticeships, certifications, and licensing in trades and professions for current workers and supporting companies in transitioning their workforce to building operations and maintenance, design, construction, and other clean energy jobs. This also means creating a bridge to retirement for displaced workers nearing retirement age at the time of a plant or facility closing. The State should also provide and coordinate other discrete benefits for displaced workers facing a gap in employment or wishing to pursue an alternative path, including transitional unemployment benefits (including, but not limited to, supplemental payments), federal and state Continuation of Health Coverage insurance, and grants/credits for post-secondary education at two- and four-year programs at public institutions (such as through New York's existing full- and part-time Tuition Assistance Program for City University of New York [CUNY] and State University of New York [SUNY]). Support for these measures is envisioned to be provided in part from the proposed Office of Just Transition fund (discussed further below) working in concert with existing federal and state programs. Consideration should be given to businesses and jobs not only in installation, but also in manufacturing and the entire supply chain. Engagement with clean energy providers will be important to evaluating current and future workforce needs, aligning training with business demand, including by geographical area and, ultimately, developing a successful talent pipeline.

In cases when continued operation of a power plant or other facility/system is needed, even as it winds down, efforts should focus on retaining workers while retraining them for new, clean energy jobs. In other cases, when facility closures and system transitions are known ahead of time, training and supportive services should be implemented while individuals are still working to prepare workers for the transition to clean energy. Areas identified to support fossil fuel workers include securing wage support and setting aside a fund for on-the-job training, providing resume-writing support and career coaching, and hosting job fairs with relevant clean energy employers, while also leveraging opportunities at multi-commodity utilities, which will include all major New York utilities pursuant to newly authorized utility and community thermal energy network development, for gas utility workers and contractors. Where business interests of employers align, other decarbonization-related roles should also be leveraged, for instance, via the substantial growth forecasted for electricity transmission and distribution jobs, as well as through decarbonization and operation of the gas delivery system during its transition. Periodic surveys will also be a useful tool to identify workers' career status, future interests, timing needs, and other considerations.

Distinct strategies and responses must be developed for key existing traditional energy sectors, namely electric power generation, transmission, distribution, storage, fuels, and motor vehicles. In electric power generation, displaced power plant workers must be supported through retraining, retention, early retirement/pension support, and mutual aid/work agreements. For retention, this means paying particular attention to the continued employment of workers who learn during the transition period that their jobs will be eliminated in the future, using financial incentives to retain these workers in the interim and preserve sufficient workforce levels prior to facility closure, thereby enhancing reliability. One option would require a cost share by and other forms of support from plant owners, while focusing support on workers rather than plant executives. In the transmission, distribution, and storage sector, natural gas utility workers should be supported by Public Service Commission (PSC) rules to retrain for roles on the electric and/or thermal side of multi-commodity utilities (supported by cost recovery), with specific wage floors and protections. In the fuels industry, it will be important to address changes to business-models that allow employers to retrain and reorient their workforce for new roles, such as new amenities at gas stations and delivery of energy efficiency services at companies previously focused on delivery of home heating fuels. Finally, greater attention must be paid to addressing the shift in work for other sectors that are central to the transition to a low-carbon economy, such as automotive workers and service technicians as internal combustion engines are replaced with electric vehicles (EVs).

Ensuring Application of Labor Standards

To ensure a just transition, jobs created as a result of the State's climate change mitigation efforts should be good, family-sustaining, union jobs, and accessible to all New Yorkers. As such, the State should apply robust labor standards across all sectors and projects. During implementation, the application of any such labor standards by relevant public entities should take into consideration unique sector- and project-specific characteristics, so as to tailor the standards accordingly.

As discussed further below, these labor standards should include provisions related to prevailing rate requirements and compliance; project labor agreements for construction projects; labor peace agreements and employer neutrality agreements for operations and maintenance activity and other permanent positions; maintenance of all current state, county, and municipal licensing standards for all trades; and apprenticeship utilization. These standards should apply across the range of construction, operations, maintenance, and repair activities, as well as where incentives are provided to support new clean energy manufacturing facilities. As with existing clean energy contracts, violations or other lack of adherence to specific standards should result in incentives being clawed back and other remedies. These standards

should also apply to projects undertaken by any political subdivision of the state, including but not limited to Industrial Development Authorities and Local Development Corporations.

Further, the State must enact measures to ensure job security for all workers displaced from their positions as a result of climate change mitigation efforts. This support should ensure the prompt reemployment of displaced workers with the same or better wages, benefits, and terms and conditions of employment, while maintaining their choice of collective bargaining representative. Finally, to ensure that the State's investment in climate change mitigation provides the greatest benefits to New Yorkers, Buy American provisions and preferences for New York-based manufacturing should be included in all relevant solicitations.

As New York continues to work toward the Climate Act mandates and the overall energy landscape changes, labor standards should be further applied and enhanced to promote family-sustaining wages and comprehensive benefits across all sectors and projects, as well as employer-led pre-apprenticeship and Registered Apprenticeship training, thereby supporting the development of pathways into good-paying union jobs. Project labor and community workforce agreements, prevailing rate requirements, neutrality, and labor peace agreements, as well as local and targeted hiring provisions, should be employed across all sectors and projects, particularly to incentivize the hiring of workers from Disadvantaged Communities, including environmental justice and New York's Opportunity Zones. Enacting fair pay provisions will be particularly important in ensuring that new, clean energy jobs pay as well as or better than former or existing jobs. Prevailing wage and project labor agreements, neutrality and labor peace agreements, as well as the use of Registered Apprenticeship programs, can help ensure that jobs turn into long-term careers for New York residents who live in the local communities hosting clean energy industries.

As new technologies and solutions emerge to help New York achieve the Climate Act, the State should ensure that appropriate labor standards are applied. This is true for applications like large-scale EV charging station installation work, green hydrogen infrastructure projects, utility and community thermal energy networks, and others. Expanding labor standard application to these emerging sectors will build on the foundation of labor standards already in place for sectors such as large-scale renewables and community solar.

Strengthening New York's application of labor standards should reflect and buttress new rules at the state and federal level for labor-related protections, most notably with respect to prevailing wage. At the federal level, as discussed further below, prevailing wage requirements and bonuses are included in

numerous provisions within the Infrastructure Investment and Jobs Act and the Inflation Reduction Act, such that New York’s existing application of and familiarity with prevailing wage will only serve to enhance the benefits and savings New Yorkers realize from the federal government, via higher federal tax credit levels and greater project uptake. At the State level, new legislation in 2022 expanded the application of prevailing wage requirements to cover community solar installations above 1 megawatt (MW), also reflected in the State’s main community solar program rules and approvals. These measures represent positive steps toward expanded labor standard coverage that should be replicated across sectors at appropriate junctures throughout the remaining work of Climate Act implementation, and again should apply across all construction, operations, maintenance, and repair activities.

Exploring Emerging Climate Act-Aligned Technology Opportunities

From a technology and resource standpoint, the particular mix of climate solutions that New York considers and pursues is highly relevant to the achievement of a just transition. For the state’s energy workforce and specifically the energy and construction trades working on energy infrastructure, the breadth of climate solutions able to be explored and pursued ties directly to the occupations and skillsets that will see support and growth in the decades ahead. In the respective sector-specific chapters of this Scoping Plan, the technology types and resources available to deliver emissions reductions are covered in extensive detail. As a cross-cutting principle, however, where newly emerging technologies and resources arise that are aligned with the Climate Act and supportive of the occupations and skillsets of the State’s energy trades, those resources should be prioritized – an ‘all of the above clean energy’ approach to emerging technology exploration and development.

Evaluation of these resources should occur on an ongoing basis to monitor trends in cost, availability, technology maturity, and other factors. In the last year alone, several relatively nascent resource types have seen considerable advancements and show strong promise in meeting these dual characteristics of alignment with the Climate Act and support for unionized energy labor and a just transition. These resources include community thermal energy networks, green hydrogen, enhanced geothermal, and advanced nuclear, among others. While generally not considered emerging technologies, biofuels such as renewable natural gas (RNG) have potential to serve as flexible and dispatchable resources, yet many are unproven at commercial scale. The evaluation should be consistent with the evaluation of alternative fuels as discussed in *Chapter 13. Electricity*. These resources are also relevant to a just transition given the alignment in skillsets of many existing workers and trades who may be involved in their future use, as discussed in other chapters such as *Chapter 18. Gas System Transition*. Notably (and as discussed further

below), many of these emerging resource types are poised to benefit substantially from newly available federal investments.

- **Community thermal energy networks:** In 2022, the State enacted the Utility Thermal Energy Network and Jobs Act, advancing a new initiative to develop regulatory structures and pilot/demonstrate utility thermal energy networks across the state’s utility service territories. These thermal energy networks are rapidly emerging as a key strategy to scale up building decarbonization from a “building-by-building” to a “community-by-community” approach, and critically, they provide overlapping job needs with the skilled pipe trades workforce that has historically worked on gas pipelines. Specifically, advancing thermal energy networks will mean significant job opportunities across multiple trades, from trenching and drilling, pipeline and plumbing installation, and electrical work to heating, ventilation, and air conditioning (HVAC) and ductwork, construction and assembly, and ongoing maintenance and operations activities. As they are piloted, and gain benefit from federal tax credits for commercial geothermal installations and thermal energy storage systems, these thermal energy networks have the potential to help establish a major transition strategy for gas utilities and their workforces and contractor bases to shift to being clean thermal energy providers. In addition, many state campus facilities (State University of New York [SUNY], New York State Office of General Services [OGS], New York State Department of Corrections and Community Supervision, etc.) are ideal candidates for the installation of thermal energy networks, particularly at higher education institutions where demonstration projects can be paired with research and student learning opportunities.
- **Green hydrogen:** As described in several sectoral chapters of this Scoping Plan, green hydrogen, as defined in *Chapter 2. The Time is Now to Decarbonize Our Economy*, has seen notable advancements, offering new opportunities for the production and consumption of hydrogen in important strategic applications, including where electrification is difficult. Coming out of the Infrastructure Investment and Jobs Act, the U.S. Department of Energy has released the Funding Opportunity Announcement for the establishment of multiple Hydrogen Hubs across the country, with up to \$1 billion in funding to ultimately be available to each winning hub. New York is leading a coalition of northeast states and partners to compete for one of these Hydrogen Hubs, with the intent of securing a Hub award and cementing a durable hydrogen ecosystem in the northeast. Furthermore, the federal Inflation Reduction Act includes brand new and substantial production and investment tax credit incentives for hydrogen, which will provide a significant boost to the economic competitiveness of hydrogen in the near future. Hydrogen offers strong workforce promise for numerous energy trades, including those working in construction and installation, operations and maintenance, distribution and storage, and other occupational roles.

- **Enhanced geothermal:** Enhanced geothermal systems (EGS) create human-made geothermal reservoirs in locations where naturally favorable amounts of permeability and/or water are lacking. EGS reservoirs are created by first drilling wells and then pumping water to create permeability, thereby providing the three principal elements necessary for water to be circulated continuously and be used for electricity production or direct use. New York will be able to benefit from progress made at a national level, including through the U.S. Department of Energy’s Enhanced Geothermal earth shot, a department-wide effort to dramatically reduce the cost of EGS by 90%, to \$45 per megawatt hour by 2035. From a labor and workforce perspective, EGS provides the opportunity to learn from the tools and expertise of the oil and gas sector and to easily pivot oil and gas workers to this new geothermal application. This resource would provide opportunities for existing in-State workers and allow for the attraction of new workers from across state lines. These and other learnings from the active research and demonstration activity underway at the Cornell University Borehole Observatory should inform future EGS activity across the state.⁵⁵
- **Advanced nuclear:** Advanced nuclear technologies are another emerging resource that could contribute to New York’s achievement of 100% zero-emissions electricity by 2040 and help realize a just transition for the state’s energy trades. Advanced small modular reactors (SMR) encompass a variety of sizes, technology options, capabilities, and deployment scenarios, from tens up to hundreds of megawatts and with potential use for power generation, process heat, desalination, or other industrial uses. According to the U.S. Department of Energy, advanced SMRs offer many advantages, such as relatively small physical footprints, reduced capital investment, ability to be sited in locations not possible for larger nuclear plants, and provisions for incremental power additions, along with offering distinct safeguards, security, and nonproliferation advantages. However, key issues pertaining to waste management and storage will still need to be addressed and resolved for advanced nuclear to see adoption at scale, and the State must rigorously scrutinize these and other challenges as part of any future evaluations of advanced nuclear. Nonetheless, with considerable new federal tax credit incentives, along with vital research and development funding from the federal CHIPS and Science Act and other bills, the prospects of economically competitive advanced nuclear have grown substantially. And, in many of the same ways that New York’s existing upstate nuclear fleet strongly supports a variety

⁵⁵ Cornell University. “Earth Source Heat: Creating carbon neutral, deep geothermal heating systems.” Earth Source Heat. <https://earthsourheat.cornell.edu/>.

of energy trades, advanced nuclear offers the potential for a zero-emission power plant setting that current power plant workers could transition into readily.

These promising resources and other emerging technologies supporting Climate Act requirements and goals and a just transition should take on special consideration in future planning, policies, and programs, such as current and future proceedings to define and achieve 100% zero-emissions electricity by 2040, to undertake utility gas system planning, and beyond.

Targeted Financial Support for Businesses and Related Entities

To build a diverse, equitable, and inclusive clean energy economy, businesses must be supported with targeted financial support to ensure access to contracting and procurement opportunities in the transition away from fossil fuels. Funding must provide for supported on-the-job, recruitment, training, hiring, and job retention for businesses in Disadvantaged Communities, minority- and women-owned businesses (MWBs), service-disabled veteran-owned businesses (SDVOBs), employee-owned businesses, cooperatives, design and installation firms, community-based organizations, start-ups, and unions, as well as pre-apprenticeship and apprenticeship programs. Government support for MWBs and SDVOBs should include support on bonding, insurance programs, and access to public financing to support the business and the payroll for prevailing wages and apprenticeships. Concurrently, manufacturing of clean energy components and equipment must be promoted locally to stimulate the economy and increase job growth, with an emphasis on revitalizing legacy/rust belt cities and Disadvantaged Communities.

Government support must target efforts both specific to clean energy technologies and to affected regions. The focus must be on creating stable, well-paid jobs as opposed to takeover by out-of-state workers in the gig-economy. Entrepreneurship training and small business start-up support could further increase small business creation and ownership in climate adaptation and resilience products and services, particularly by MWBs and SDVOBs. In general, eligibility for such targeted financial support should include strong preference for entities with unionized workforces or labor peace agreements.

Bolstering Training Curriculum and Programs

New training curricula, trained trainers, and comprehensive training programs will be critical to this economywide transition. These programs must be developed with a focus on Disadvantaged Communities and be designed to meet employer hiring needs. The New York State Energy Research and Development Authority (NYSERDA) Climate Justice Fellowship is one example of a program that funds fellows from Disadvantaged Communities to advance climate justice and clean energy in their respective communities. Programs that target individuals with barriers to employment must include support for wrap-around

services and leverage other state and local programs that can provide more comprehensive support with case managers shadowing and mentoring trainees through hiring and while on the job. Additional efforts should target career awareness, education outreach, and clean energy training at traditional education channels such as P-12 schools, Pathways in Technology Early College High Schools, Boards of Cooperative Education Services, labor unions, community colleges, and four-year colleges and universities, with a strong focus on integrating new, emerging technologies across these efforts. Some of the most successful education outreach programs feature ambassador programs, mentoring, job shadowing, science fairs, career days, guest speakers, and work site visits to generate excitement around clean energy and expose students to different career pathways early on. General science, technology, engineering, and mathematics programming should be expanded to include clean energy content leading to industry-recognized certificates, advanced training, internships, pre-apprenticeship programs, Registered Apprenticeship, and job placement. Within community and four-year colleges and universities, the State should support the development of decarbonization curricula by qualified subject matter experts and training entities for the fields of engineering, architecture, construction, and related programs. New curricula should be shared across SUNY and CUNY campuses. Collaborations with professional organizations, unions, and for-profit training groups can further be beneficial in developing training programs that advance worker rights, climate justice, and GHG mitigation efforts and scaling them statewide.

To directly enhance the benefits of new training curricula and programming for underserved communities and other priority populations, energy code education and training should be brought to frontline contractors. This can be achieved by working with local contractor networks to bring energy code training – including new building or installation practices – to their sites, workplaces, or events; continuing support for younger New Yorkers (ages 16 to 24) as well as older workers in green building and technology training and apprenticeships; and designing and funding training to be accessible in terms of mode or channel, time and resource commitment, language, and educational level (e.g., increased online trainings, abbreviated guidelines, translation, staff resources for live training or support). Collaboration on new training curricula between NYSERDA, New York State Department of Labor (DOL), and existing apprenticeship programs to support clean, green, and zero-emission technologies should also supplement what can be achieved through local contractor networks. Such curricula can also be informed by other labor management-sponsored training programs that exist for operations, maintenance, and supply chain jobs. Finally, pre-apprenticeship programs with direct entry status can be a resource for recruitment of local workforce with a direct pathway into union apprenticeship programs.

Expanded Comprehensive Career Pathway Programs

The State must develop comprehensive programs to develop career pathways into clean energy for both existing and future workers. Existing workers include workers from transitioning fossil fuel, clean energy industries, manufacturers, community-based organizations, MWBEs, SDVOBs, as well as State/public workers. Existing workers must be given access to technical skill development (upskilling) based on the most current, nationally recognized curricula and state-of-the-art labs and training equipment. This includes training on energy efficiency, building electrification, and healthy homes/buildings in coordination with adjacent industries that work in homes. Working with unions will be crucial to incorporating renewable energy and decarbonization training into existing and new Registered Apprenticeship programs. Additionally, workers must be provided with opportunities for career advancement, including management and leadership training. Future workers are new entrants (primarily entry-level) to clean energy, often young adults (ages 16 to 24) with high school degrees whose success depends on workforce development programs such as Youth Build and Job Corps, pre-apprenticeships, internships, and jobs with clean energy employers. Career awareness and supportive services are key to ensuring job placement and retention, particularly for members of Disadvantaged Communities and other underrepresented segments of the population (such as women, single parents, and formerly incarcerated individuals). Technical skills should further be complemented by professional skills, such as communication, leadership development, and workplace etiquette to ensure long-term success. Climate Justice Job Corps Fellowships for both entry-level and transitioning workers, as well as employer-sponsored on-the-job and Registered Apprenticeship programs, can serve as a meaningful pipeline to good-paying clean energy careers.

Community Engagement, Stakeholder Input, Market Assessments

Finally, it is imperative to continue stakeholder engagement to identify and assess industry skills gaps, employee demand, as well as curriculum and training needs. Open dialogue among relevant stakeholders will be key to sharing needs and best practices, support industry opportunity awareness, and enhance recruitment efforts for new, transitioning, and existing workers. Particular attention must be placed on unions, unionized workforces, and other fossil fuel workers to understand and leverage transferrable skills with complementary training in both energy and non-energy roles. In addition, the needs of people in frontline communities, indigenous community members, formerly incarcerated New Yorkers, women in nontraditional trades, new immigrants, and people transitioning from unemployment must be prioritized. Strategies must be in place to reach underrepresented communities and to include them in the development of clean energy policies, strategies, and solutions, ensuring their voices are not only heard but also drive the successful achievement of New York's clean energy future. These strategies include

campaigns to build public awareness of climate change effects and solutions, including co-benefits of actions to mitigate and adapt to climate change through public calls for ideas and projects to advance Climate Act requirements in Disadvantaged Communities. Finally, all such strategies for community engagement and stakeholder awareness should be accompanied by robust Specific, Measurable, Achievable, Relevant, Time-bound (SMART) targets.

The State should build on the 2021 JTWG Jobs Study and recurring New York Clean Energy Industry Reports to develop market assessments that can help understand emerging sectors and technologies, surrounding workforce needs and opportunities, and how to ensure job prospects are equitably realized amongst new, transitioning, and existing workers, with careful attention to those from Disadvantaged Communities. This should include ongoing tracking of employment trends along with prospective analysis to identify existing and potential workforce development assets and the additional market needs to support growth across the clean energy economy. In the near term, such studies should focus on critical existing decarbonization activities needed to rapidly accelerate within this decade, such as building efficiency and electrification and offshore wind, but should also be planned for nascent technologies including thermal energy networks, green hydrogen production and use, geothermal, and advanced nuclear, as well as for more established alternative fuels such as RNG and biofuels. Direct engagement with Registered Apprenticeship programs is vital to understand existing skills and various career pathways and properly develop curricula and training requirements to assist both new workers and existing workers. This direct engagement will supplement contractor-/employer-based workforce development initiatives and engagement.

Such assessments should also evaluate the labor impacts of the gas system transition including jobs and occupations that will be needed to support leak detection and repair, the decommissioning of systems, transitioning customers to thermal energy networks, and more. Analysis for new clean energy technologies should incorporate skills transferability to evaluate which existing jobs can be readily transitioned to support clean energy deployment. In addition, future analysis should collect and examine the anticipated total cost of wage and benefit packages for jobs that are created. Finally, workforce analysis should consider the timeline of transition, including special attention to the pace of potential displacement relative to creation of replacement job opportunities.

General Considerations

As New York and the world at large adapts to a new reality in the wake of the COVID-19 pandemic, workforce development and training initiatives will also be required to adjust. Flexibility and resilience

are two important characteristics of successful workforce training models, enabling online and in-person training with courses offered in multiple languages and at different times to accommodate various health, safety, and learning needs. The most effective workforce development efforts further combine robust diversity, equity, and inclusion initiatives; generous wrap-around services; and relevant safety training (such as the Occupational Safety and Health Administration and EPA) as applicable. To the extent possible, training entities should leverage State, federal, or other funding to cover training and education costs and, thereby, eliminate barriers for both employers and individuals. Collaboration among relevant State entities, such as NYSERDA, CUNY, SUNY, New York Power Authority (NYPA), Empire State Development (ESD), DOL, and an Office of Just Transition (see below) will be critical in ensuring an “all government approach” to designing, implementing, and resourcing the above-referenced workforce development and training efforts. Finally, since the path to a carbon neutral economy requires new skills and expertise and likely new job titles, and since agencies already have hiring needs that do not align perfectly with existing civil service titles, the Department of Civil Service should also be directly involved in collaboration and engagement.

Office of Just Transition and Worker Support and Community Assurance Fund

Taking this information into consideration, New York has a need for a state apparatus to guide the ongoing programmatic and policy work needed to implement the measures described above. That apparatus should take the form of a newly created, dedicated state office charged with realizing a just transition and resourced with an accompanying fund, which would be overseen and administered by the office in consultation with DOL and NYSERDA, to provide support for workers, communities, and other transitional priorities. The Office of Just Transition will help coordinate all funding and financial incentives for workforce development, community support, existing worker support, and new worker support related to the Climate Act transition.

In recent years, other U.S. states contending with power plant closures and other energy transition impacts have begun to establish similar offices and funds dedicated to the achievement of a just transition for affected workers and communities.⁵⁶ While this activity has generally been concentrated in states with vertically integrated utility markets and specifically those facing impending coal plant closures, several of the states advancing these frameworks share with New York both ambitious climate laws and

⁵⁶ Takemura, Alison. October 3, 2022. “The best policies to help coal towns weather the switch to renewables.” *Canary Media*. Accessed at <https://www.canarymedia.com/articles/just-transition/the-best-policies-to-help-coal-towns-weather-the-switch-to-renewables>.

membership in the U.S. Climate Alliance, most notably, Colorado, Illinois, and New Mexico. While New York's circumstances differ in important ways compared with these states, there is merit in New York advancing a similar framework of a dedicated office and fund to guide and centralize the implementation of a just transition as the state works to realize the goals of the Climate Act. As New York establishes an office of just transition and an accompanying fund to support workers, communities, and other related transition priorities, it can draw upon the experience of these sister states and fellow U.S. Climate Alliance members.

The office could be an independent entity, housed within an existing agency, administered jointly by multiple agencies, or reside as an office within the Governor's Office (for similar example, see the Office of Language Access). Housing the office within the Governor's Office could be the most effective way to give it the prominence and importance it will need to be influential in working across the full breadth of state government.

As the mission and programmatic priorities of the office and fund are built out, there are three main areas to focus on in the near- to medium-term: host community support, existing worker support, and new worker support.

- **Host community support:** New York should enact legislation to expand and extend the Electric Generation Facility Cessation Mitigation Program and transfer administration of the program to this proposed Office of Just Transition. The program was created to provide funding assistance to support counties, towns, cities, villages, school districts and special districts that experience a reduction in real property taxes and/or payments in lieu of taxes stemming from the closure of an electric generation facility. Currently, ESD administers the program in consultation with NYSERDA and New York State Department of Public Service (DPS). As of April 2021, New York has authorized a total of \$140 million for the program largely through Regional Greenhouse Gas Initiative (RGGI) and the Clean Energy Fund. The program is currently scheduled to close to new applicants on July 1, 2025. It is likely that more funding will be needed to address future eligible closures, based on tax data compiled by the JTWG (see the power plant inventory in Appendix D: Power Generation Sites Identified by the JTWG). The program should be extended beyond 2025 and increased with new funding in order to help meet future needs beyond currently available budgets. A portion of new funding should also be available to provide energy transition and economic development planning grants for communities, building on and aligning with existing resources available – and ensuring that the office can help with continued support for communities already navigating the energy transition, including localities previously hosting coal

power plants. Finally, through this category, the Office would also seek to provide funding and other measures to support community-led visions for just transition transformations at a local and neighborhood level across the State.

- **Existing worker support:** The Office of Just Transition should provide support to existing energy workers facing known or potential displacement from their current positions/occupations, through mechanisms described above. Significant new funding should supplement existing support programs already available through state agencies and authorities. This funding should provide, among other efforts, wage and benefit bridge funding for retirees and re-trainees facing a decline in their compensation and benefits. The office should also create incentives for retention of workers at a plant or facility that is closing but requires continued operations in the interim. For the roughly 150,000 traditional energy workers currently employed in the state, funding should help provide resources for a meaningful portion of workers facing known or potential displacement, especially after factoring in natural rates of retirement as well as sectors/occupations not expected to face displacement (e.g., electricity transmission and distribution employment). To ensure that displaced workers are promptly and successfully reemployed, the Office of Just Transition would work with DOL to actively track all displaced workers, conduct skills assessments for each such worker, and facilitate training that will equip them to succeed in their new placement – among other measures to ensure such workers are prioritized for filling newly created clean energy positions. In addition, as mentioned above, the office’s programming in this category would also be intended to provide and coordinate additional benefits for displaced workers, including transitional unemployment benefits (including, but not limited to, supplemental payments), federal and state Continuation of Health Coverage insurance, and grants/credits for post-secondary education at two- and four-year programs at public institutions.
- **New worker support:** Another key portion of the office’s work and funding should be set aside to support new workers seeking entry into emerging clean energy occupations. This support can take the form of a number of mechanisms as outlined above, including for apprenticeships, pre-apprenticeships, and other forms of early-career training, and it should be focused on expanding access to clean energy jobs in underserved and historically marginalized communities. Given the scale of new clean energy workers that will be needed to fill the 2030 jobs forecast and beyond – more than 200,000 new jobs – it is expected that significant new funding will be needed to provide this new worker support, which is typically more costly on a dollar-per-capita basis than retraining/upskilling support for existing workers.

Finally, when the Office of Just Transition is working with any State or municipal employees, any efforts to support workers will need to be consistent with New York State Civil Service Law and in cooperation with any applicable collective bargaining representatives.

7.3 Measures to Minimize the Carbon Leakage Risk and Minimize Anti-Competitiveness Impacts

In its transition to a net zero emission economy, the State must also consider the issue of GHG emissions “leakage.” The Climate Act defines leakage as, “a reduction in emissions of greenhouse gases within the state that is offset by an increase in emissions of greenhouse gases outside of the state.”⁵⁷ The concept of leakage is important given the fact that climate change is a global problem, whereas the State’s policy authority is confined to activities within its borders. New policies that increase the cost of energy, reduce the reliability of energy, or increase the cost of emitting GHGs could cause businesses to shift their production outside of New York State, or avoid the State altogether, and instead invest in out-of-state locations with lower energy costs and/or less stringent environmental and GHG emission reduction policies. Mitigating leakage risk is of interest to the State for both climate and economic reasons, which is further demonstrated by the Climate Act requirements related to mitigating anti-competitive impacts and for the emission reduction regulations ultimately adopted by New York State Department of Environmental Conservation (DEC) to incorporate measures to minimize emissions leakage. Throughout any future potential policies and programs, the State should consider and enact measures to minimize the risk of energy-intensive and trade-exposed (EITE) industries moving out-of-state as a result of emissions reduction actions, including as discussed in *Chapter 14. Industry* and *Chapter 17. Economywide Strategies*.

As the State implements this Scoping Plan, it will need to carefully monitor the potential for unintended emissions and economic leakage. The following are potential measures to mitigate this risk. A more detailed analysis can be found in Appendix C.

- **Recognize early action:** The State should credit emitters for early investments to reduce their GHG emissions. The absence of early action credit could discourage short-term emission reductions by firms as they await the onset of a new system and the establishment of their baseline.

⁵⁷ ECL § 75-0101(12).

- **Set industry-specific benchmarks:** If assigning emission reduction targets to individual emitters, the State should apply benchmarks for the emissions intensity of their production, taking into account current technology and types of emissions and adjusting them over time to reduce the risk of leakage caused by the imposition of infeasible reduction requirements.
- **Utilize market forces:** The State should consider measures to financially incentivize emission reductions while also providing emitters with compliance methods intended to mitigate leakage, thereby increasing the cost-effectiveness of reducing emissions, such as through a cap-and-invest program.
- **Minimize business impacts on industry:** Consistent with the approaches to mitigate anti-competitive impacts put forward in Appendix E, the State should give careful consideration to EITE industries when establishing economywide emissions reduction policies. Such policies should avoid placing outsized compliance burdens on these industries, look to identify measures to mitigate compliance costs, and consider opportunities for allowing alternative compliance measures.
- **Buy American and Buy New York:** Requirements and preferences for the content of manufactured goods can limit leakage by incentivizing the procurement of components manufactured consistent with more stringent environmental regulations. Buy American and Buy New York policies can furthermore prioritize in-State companies that support local hiring and bring high-road green jobs to New York.

7.4 Power Plant Retirement and Site Reuse

On the road to achieving the power sector goals within the Climate Act – namely, the 70x30 and 100x40 mandates – the existing power sector will undergo significant evolutions and transformations, leading to uncertain outcomes for conventional power plants (primarily fossil fuel) and their workers and host communities. These impacts were contemplated by the Climate Act as something New York would have to proactively plan around. Specifically, the Climate Act tasked the JTWG with two discrete deliverables, which they considered with the leadership of a Power Plants Subgroup formed specifically to tackle these power plant topics. These two tasks are identifying generation facilities that “may be closed as a result of a transition to a clean energy sector” and identifying issues and opportunities presented by the reuse of those sites.

The JTWG and Power Plants Subgroup set about to tackle these two tasks with a robust, data-driven approach rooted in real-world case-studies and the “facts on the ground” as much as possible, while acknowledging that future scenarios would not be known and fixed. These full work-products are made

available in Appendix D, with the results making clear that power plant reuse is an area where there are both challenges as well as promises of opportunity moving forward.

7.5 Jobs Study

In accordance with the Climate Act, the JTWG also provided oversight to a Jobs Study, serving to forecast clean energy job growth tied to the State’s decarbonization goals, with the following specific objectives:⁵⁸

- The number of jobs created to counter climate change, which shall include but not be limited to the energy sector, building sector, transportation sector, and working lands sector
- The projection of the inventory of jobs needed and the skills and training required to meet the demand of jobs to counter climate change
- Workforce disruption due to community transitions to a low-carbon economy

The Jobs Study team leveraged its modeling framework and analysis to better understand and characterize job requirements and how those requirements can be constructed into workforce training and development pathways, including for priority populations and Disadvantaged Communities.

Summary of Jobs Study Findings

The Climate Act tasked the JTWG with conducting a study of the jobs needed to counter climate change, with explicit direction to focus on the buildings, fuels, electricity, transportation, and natural working lands sectors. A competitive process was established to select a team of leading consultants in the field of clean energy workforce to undertake this new analysis to accompany and complement the integration analysis work.

The Jobs Study team, which consisted of BW Research, NYSERDA, DOL, and members of other State agencies including DEC, ESD, New York State Department of State (DOS), NYPA, and Long Island Power Authority (LIPA), conducted and supported a rigorous literature review to derive the analytical framework and methodology deployed to this analysis. Further, the Jobs Study team qualified and calibrated its analytical model by benchmarking its outputs against other modeling frameworks that have been previously validated. The Jobs Study focuses its analysis on a baseline year of 2019 and provides data outputs in five-year increments through 2050 (i.e., 2019, 2025, 2030, 2035, 2040, 2045, and 2050).

⁵⁸ ECL § 75-0103(8)(g).

The Jobs Study findings have been updated to align with the “2022 vintage” of the integration analysis described in *Chapter 9. Analysis of the Plan*.

Grounded by projected investments in the State’s clean energy economy, the Jobs Study focuses on the opportunity to create jobs associated with New York’s decarbonization pathways. Currently, the Jobs Study does not provide additional sensitivity analysis nor does it articulate the potential for low-carbon, export-oriented economic development. Nonetheless, that opportunity represents a potentially significant additional upside in an emerging global marketplace much greater in size than New York. The Jobs Study modeling framework comprised energy supply and energy demand represented by four primary sectors (electricity and fuels for energy supply, and buildings and transportation for energy demand). Further, a total of 28 subsectors were included in the modeling framework and analyses.

The following key highlights from the Jobs Study are presented as evidence of the significant growth anticipated over the next 30 years:

- Across 21 subsectors, total employment increases by over 60% from 2019 to 2030, adding at least 211,000 new jobs in the state of New York. Just seven subsectors experienced displacement of 22,000 jobs, or 14%, in this time period. Overall employment in the four primary sectors increases by at least 189,000 jobs from 2019 to 2030, or a 38% increase in the workforce. The number of jobs added from growing subsectors outnumbered jobs lost in displaced subsectors by a ratio of approximately 10 to one.
- Overall employment in the four primary sectors from 2019 through 2050 increases by at least 269,000 jobs, or a 54% increase in the workforce.
- The buildings sector accounted for well over half of all jobs added in growing subsectors from 2019 to 2030, with the most sizeable increases in added jobs found in the residential HVAC and residential shell subsectors. This finding indicates the need to expand the residential and commercial building workforce training considerably before 2030 to meet the expected need.
- Conventional fueling stations (gas stations) account for over one-third to almost one-half of all displaced jobs in the primary sectors from 2019 to 2030, as more drivers shift to lower-cost charging of EVs. This finding indicates that traditional fueling stations will likely need to adapt beyond providing gasoline for cars to avoid diminishing opportunities for revenue and employment.
- In the electricity sector, more mature subsectors like transmission, distribution, and solar will see strong growth between 2019 and 2040, while more nascent subsectors like offshore wind, storage, and hydrogen are expected to experience exponential growth. This finding indicates that parts of

the growing electricity sector will be able to build upon their current established workforce, while other parts of this sector will almost need to start from the beginning because they have little, if any, existing workforce foundations.

The Jobs Study also provides an estimate of how jobs will change from 2019 to 2030, by industry, occupation, wages, and geography across the state of New York, under both modeled scenarios, in the four primary sectors. All the major industry categories for the Jobs Study, which include construction, professional services, manufacturing, and other supply chains, saw a net increase of employment in the four primary sectors.

The largest net employment increases were found in the construction and manufacturing industries. In the growth subsectors, over three-quarters of total added jobs will be found in the construction industry. In the displaced subsectors, over four out of five industry jobs lost will be found in the other supply chain industries, which include transportation and warehousing, utilities, wholesale, and retail industries.

Additional key findings from the 2021 Jobs Study include the following:

- Geographically, the net job increases from 2019 to 2030 are found in every corner of the State, with each of New York’s five regions seeing an increase of between 10,000 and 48,000 net new jobs. This finding indicates that each of the regions should prioritize workforce development efforts and training to supply a well-prepared labor force for these growing positions. While not a direct finding from the Jobs Study, the Council observes that as energy activities increasingly shift from predominantly supply-oriented to demand-side oriented (buildings, transportation, distribution, etc.), this creates the opportunity to drive significant overall job creation as well as company ownership in the communities where energy use is most concentrated, including in urban areas.
- Occupationally, the largest job increases from 2019 to 2030 will be found in installation and repair occupations. They are expected to account for almost two-thirds of added jobs in the growth subsectors. This finding indicates that additional research should be done to understand the education and training resources that lead into these positions and the different career paths that can be found in this category of occupations.
- Though there is clear growth in job opportunities at all parts of the income spectrum, the wage profile of jobs in the four sectors – energy, building, transportation, and working lands – shows

the largest increase from 2019 to 2030 in middle wage positions (\$28 to \$37 an hour),⁵⁹ while high wage (>\$37 an hour) and low wage positions (<\$28 an hour) grow at slower rates. This finding goes against national and statewide trends that have seen middle wage positions decline over the last 50 years.

⁵⁹ Boehm, Michael. February 8, 2014. "Job polarization and the decline of middle-class workers' wages." Vox EU. <https://voxeu.org/article/job-polarisation-and-decline-middle-class-workers-wages> and Chicago Metropolitan Agency for Planning. May 25, 2018. Technology, Tastes, and Demographic Shifts Contribute to Job Polarization in the U.S. Accessed at https://www.cmap.illinois.gov/updates/all/-/asset_publisher/UIMfSLnFfMB6/content/technology-tastes-and-demographic-shifts-contribute-to-job-polarization-in-the-u-s-.

Chapter 8. Public Health

8.1 Principles

Climate change will have vast and varied impacts on public health and is already affecting the people and resources of New York. New York continues to make progress on its goal to becoming the healthiest State through continued implementation of the New York State Prevention Agenda and recent adoption of the Health Across All Policies approach.⁶⁰⁻⁶¹ The Prevention Agenda is the State health improvement plan, the blueprint for State and local action to improve the health and well-being of all New Yorkers and promote health equity. It is based on several cross-cutting principles and has goals ranging from reducing worker injury and illness to reducing exposure to air pollution. The Health Across All Policies approach is a collaborative effort that considers health across many sectors such as housing, transportation, education, environment, parks, and economic development.

Cross-Cutting Principles of the Prevention Agenda

To improve health outcomes, enable well-being, and promote equity across the lifespan, the Prevention Agenda has several cross-cutting principles:

- Focuses on addressing social determinants of health and reducing health disparities
- Incorporates a Health Across All Policies approach
- Emphasizes healthy aging across the lifespan
- Promotes community engagement and collaboration across sectors in the development and implementation of local plans
- Maximizes impact with evidence-based interventions for State and local action
- Advocates for increased investments in prevention from all sources
- Concentrates on primary and secondary prevention, rather than on health care design or reimbursement

Embodiment of these principles is critical for developing a successful climate policy. The Climate Act provides a foundation that incorporates these principles in that it requires consideration of impacts to public health and Disadvantaged Communities, as well as mitigation actions that will address health impacts. This Scoping Plan goes further, identifying specific opportunities to reduce emissions, support communities, reduce existing health risks, and avoid introducing new risks. This chapter seeks to describe

⁶⁰ New York State Department of Health. 2019. “Prevention Agenda 2019-2024 New York State’s Health Improvement Plan.” Accessed at https://www.health.ny.gov/prevention/prevention_agenda/2019-2024/.

⁶¹ New York State Department of Health. “Health-Across-All-Policies Initiative Launched to Support the Prevention Agenda Goal of Becoming the Healthiest State.” Accessed on November 23, 2021 at https://www.health.ny.gov/prevention/prevention_agenda/health_across_all_policies/.

both the direct and indirect human health impacts of climate change and the health co-benefits of climate change mitigation and adaptation strategies and policies.

8.2 Climate Change Impacts on Public Health

Climate change directly and indirectly impacts physical, social, and mental health and will intensify some health stressors and cause other new health threats to emerge. Possible health impacts are far-reaching, even if not all are equally likely to occur among New Yorkers in the immediate future.

In 2021, the 26th Conference of Parties emphasized public health more than ever before and referred to climate change as a “public health emergency.”⁶² Recently, the editors of over 200 medical journals united to issue a call for urgent government action to address global warming and protect public health and nature.⁶³ The New York State Energy Research and Development Authority (NYSERDA) ClimAID report describes the impacts and adaptation strategies for New York’s water resources, coastal zones, ecosystems, agriculture, energy, transportation, and telecommunications sectors, as well as vulnerabilities and adaptation strategies related to climate change and public health. According to the New York State Department of Health (DOH) Climate and Health Profile,⁶⁴ there are several potential climate-related health impacts in the State:

- Increased heat stress (such as heat edema, heat stroke, heat cramps, heat stress, and dehydration) and other heat-related morbidity and mortality
- Exacerbation of respiratory conditions (including pneumonia, asthma, and chronic obstructive pulmonary disease) and cardiovascular disease
- Increased risk for food- and water-borne diseases due to increasing temperatures and flooding
- Increased duration and severity of allergy symptoms due to increased duration and intensity of pollen season
- Increased risk for vector-borne diseases (such as Lyme disease, West Nile virus, and other pathogens)
- Increased risk of injury and death following extreme precipitation events and flooding

⁶² Romanello, M., et al. 2021. “The 2021 report of the *Lancet* Countdown on health and climate change: code red for a healthy future.” *The Lancet*. 398(10311): 1619-1662.

⁶³ Atwoli, Lukoye, et al. “Call for Emergency Action to Limit Global Temperature Increases, Restore Biodiversity, and Protect Health.” See for example the *New England Journal of Medicine*, September 5, 2021.

⁶⁴ New York State Department of Health. 2015. *Building Resilience Against Climate Effects (BRACE) – Climate and Health Profile*. Accessed at climatehealthprofile6-2015.pdf (ny.gov).

Other significant impacts associated with public health that are not listed above include droughts, rising sea levels that threaten infrastructure, saltwater intrusion of the State’s groundwater resources (which may impact drinking water supplies), poor indoor air quality (such as mold and moisture), and deteriorating outdoor air quality, particularly ground-level ozone that increases with rising temperature.⁶⁵ Climate change will add uncertainty to the continuity of the food system, which may have impacts on food security, particularly in low-income communities.⁶⁶ Heatwaves and extreme heat events result in greater risk of heat stress, and there is a greater risk of death in those who have mental illness due, in part, to medications that interfere with the body’s thermoregulation.^{67,68,69,70,71} Heavy rainfall associated with the remnants of Hurricane Ida resulted in flooded subways and drowning deaths in basement apartments and cars. Superstorm Sandy resulted in the deaths of 44 New York City residents and caused \$19 billion in damages.⁷² These kinds of extreme weather events have been associated with anxiety and post-traumatic stress disorder. Some populations are more vulnerable to certain climate and health impacts than others, whether due to demographic factors, socioeconomic status, physiological condition, place, or occupation. Workers will be uniquely affected by climate change. Heat-related morbidity and mortality risks may be greatest in agriculture, but other outdoor occupational sectors, including construction, transportation, landscaping, firefighting, and other emergency response operations are also at risk.⁷³

Many impacts of climate change disproportionately affect Disadvantaged Communities. In New York, as well as other parts of the U.S., significant disparities in health outcomes exist for certain groups by age, race, ethnicity, and socioeconomic status. Disparities are observed in life expectancy and rates of

⁶⁵ Stowell, Jennifer D., et al. “The impact of climate change and emissions control on future ozone levels: Implications for human health.” *Environment International* 108 (2017): 41-50.

⁶⁶ U.S. Department of Agriculture. 2015. *Climate Change, Global Food Security, and the U.S. Food System*. Accessed at <https://www.usda.gov/sites/default/files/documents/FullAssessment.pdf>.

⁶⁷ New York State Department of Health. Revised May 2020. “About Heat Stress.” Accessed at https://www.health.ny.gov/statistics/environmental/public_health_tracking/about_pages/heat_stress/about_hs.

⁶⁸ American Psychological Association. 2017. *Mental Health and Our Changing Climate: Impacts, Implications, and Guidance*. Washington, DC.

⁶⁹ New York State Department of Health. Revised May 2020. “About Heat Stress.” Accessed at https://www.health.ny.gov/statistics/environmental/public_health_tracking/about_pages/heat_stress/about_hs

⁷⁰ Bark, N. 1998. “Deaths of psychiatric patients during heat waves.” *Psychiatr Serv.* 49(8):1088-90.

⁷¹ Löhmus, M. 2018. “Possible Biological Mechanisms Linking Mental Health and Heat-A Contemplative Review.” *Int J Environ Res Public Health.* 15(7):1515.

⁷² Centers for Disease Control and Prevention. October 2005. “Health concerns associated with mold in water-damaged homes after Hurricanes Katrina and Rita--New Orleans area, Louisiana.” *MMWR Morb Mortal Wkly Rep.* 2006 Jan 20;55(2):41-4. PMID: 16424858.

⁷³ Applebaum, K.M., J. Graham, G.M. Gray, et al. “An Overview of Occupational Risks from Climate Change.” *Curr Envir Health Rpt* 3, 13–22 (2016). <https://doi.org/10.1007/s40572-016-0081-4>.

diabetes, cancer, heart disease, asthma, infant mortality, and low birth weight.^{74,75,76} Cardiovascular disease is the leading cause of death nationally and in New York.⁷⁷ Research studies have shown an association between exposure to air pollutants, which are released through combustion of fuels, and increased hospitalization rates and mortality from cardiovascular disease.^{78,79,80,81} Nationally and in New York, there are disparities in heart disease mortality and stroke mortality by race. Rates are highest in Black non-Hispanics among all race and ethnic groups.^{82,83} Hospitalization rates for heart disease are also highest in Black non-Hispanics.⁸⁴ In addition to cardiovascular disease, asthma is a major health problem nationally and in New York. Asthma is a multifactorial disease that has many contributing causes. This includes four components of air pollution – ozone, sulfur dioxide (SO₂), nitrogen oxides (NO_x), and particulate matter – that are known to exacerbate asthma and to cause eye and respiratory tract irritation,

⁷⁴ Centers for Disease Control. January 14, 2011. “Health Disparities and Inequities Report, United States.” *Morbidity and Mortality Weekly Reports*. January 14, 2011.

⁷⁵ Insaf, TZ, T. Talbot. “Use of Spatial Epidemiology in Identifying Areas at Risk of Low Birth Weight: Small Area Surveillance Study.” *Preventive Medicine* 2016, 88:108–114; doi: <https://doi.org/10.1016/j.ypmed.2016.03.019>.

⁷⁶ New York State Department of Health. 2007. *New York State Minority Health Surveillance Report: Public Health Information Group*. Accessed at http://www.health.state.ny.us/statistics/community/minority/docs/surveillance_report_2007.pdf.

⁷⁷ New York State Department of Health. 2018. “Vital Statistics of New York State: 2018 Tables.” Accessed at https://apps.health.ny.gov/public/tabvis/PHIG_Public/lcd/reports/#state.

⁷⁸ He, M.Z., V. Do, S. Liu, et al. “Short-term PM_{2.5} and cardiovascular admissions in NY State: assessing sensitivity to exposure model choice.” *Environ Health* 20, 93 (2021). <https://doi.org/10.1186/s12940-021-00782-3>.

⁷⁹ Brook, Robert. “Air Pollution and Cardiovascular Disease: A Statement for Healthcare Professionals from the Expert Panel on Population and Prevention Science for the American Health Association.” *Circulation: Journal of the American Health Association*. 109:2655-2671. 2004.

⁸⁰ Al-Kindi, S.G., R.D. Brook, S. Biswal, et al. 2020. “Environmental determinants of cardiovascular disease: lessons learned from air pollution.” *Nat. Rev Cardiol* 17, 656–672 (2020). <https://doi.org/10.1038/s41569-020-0371-2>.

⁸¹ World Health Organization. Regional Office for Europe. 2018. “Environmental noise guidelines for the European Region. World Health Organization.” Accessed at <https://apps.who.int/iris/handle/10665/279952>.

⁸² New York State Department of Health. 2012. *New York State Minority Health Surveillance Report*. Accessed at https://www.health.ny.gov/statistics/community/minority/docs/surveillance_report_2012.pdf.

⁸³ Centers for Disease Control. 2011. *CDC Health Disparities and Inequalities Report*. Accessed at <https://www.cdc.gov/minorityhealth/chdir/2011/chdir2011.html>.

⁸⁴ Ibid.

cough, shortness of breath, and reduced lung function.^{85,86,87,88,89,90} Asthma hospitalization rates in New York are higher in low-income areas than in higher income areas.^{91,92} Asthma surveillance in New York has shown that the age-adjusted asthma emergency department visit, hospital discharge and mortality rates were higher among non-Hispanic Black and Hispanic New Yorkers than non-Hispanic White.⁹³ For more detail, see Appendix F. In July of 2022, DOH established a new Office of Health Equity and Human Rights to address health disparities like these, and work to improve diversity, equity, and inclusion within the DOH. It will comprise the current offices of Minority Health and Health Disparities Prevention and Language Access, the AIDS Institute, and the Office of Gun Violence Prevention. The goal is to apply an equity lens across all DOH operations. The Office of Health Equity and Human Rights also has the responsibility to provide leadership in the development of culturally specific and culturally responsive policy and service delivery models, as well to as create standardized guidance. In consideration of these health disparities and environmental burdens, it is of critical importance that climate change mitigation policies that seek to reduce overall greenhouse gas (GHG) emissions in New York do not inadvertently increase emissions of co-pollutants, particularly in Disadvantaged Communities (i.e., create hotspots), and prioritize reductions of GHG emissions and co-pollutants in Disadvantaged Communities.

Climate change mitigation and adaptation policies are crucial in reducing the public health impacts described above, particularly for vulnerable communities, such as those that can be identified by the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry Social Vulnerability Index, and Disadvantaged Communities. DOH has worked to support public health adaptation efforts. For example, DOH’s scientific research on the health effects associated with heat

⁸⁵ U.S. Environmental Protection Agency. December 2019. *Integrated Science Assessment (ISA) for Particulate Matter (Final Report, Dec 2019)*. Washington, DC. EPA/600/R-19/188, 2019.

⁸⁶ Guarnieri, M., J.R. Balmes. “Outdoor air pollution and asthma.” *Lancet*. 2014;383(9928):1581-1592. doi:10.1016/S0140-6736(14)60617-6.

⁸⁷ U.S. Environmental Protection Agency. 2004. *Air Quality Criteria Document for Particulate Matter*.

⁸⁸ Burnett, Richard, et al. “Global estimates of mortality associated with long-term exposure to outdoor fine particulate matter.” *Proceedings of the National Academy of Sciences* 115.38 (2018): 9592-9597.

⁸⁹ Samet, M. Jonathan. 2000. *The National Morbidity, Mortality, and Air Pollution Study. Part II: Morbidity and Mortality from Air Pollution in the United States*. Research Report Health Effects Institute. 2000. 94(pt 2):5-70, 71-79.

⁹⁰ Gauderman, W. James. 2000. “Association between Air Pollution and Lung Function Growth in Southern California.” *American Journal of Respiratory Critical Care Medicine*. 162(4Pt1):1383-1390.

⁹¹ Lin, Shao, Edward Fitzgerald, Syni-An Hwang. 2002. “Asthma Hospitalization Rates and Socioeconomic Status in New York State 1987-1993.” *Journal of Asthma*. 2002. 36:239-251.

⁹² New York State Department of Health. 2013. *New York State Asthma Surveillance Summary Report*. Accessed at https://www.health.ny.gov/statistics/ny_asthma/pdf/2013_asthma_surveillance_summary_report.pdf.

⁹³ Lin, Shao, Edward Fitzgerald, Syni-An Hwang. 2002. “Asthma Hospitalization Rates and Socioeconomic Status in New York State 1987-1993.” *Journal of Asthma*. 36:239-251.

contributed to the National Weather Service lowering its Heat Advisory Threshold and led to the development of County Heat and Health Profiles, where users can view county temperature trends and projections, along with heat-related health effects and vulnerabilities.⁹⁴ DOH staff are working with the New York State Association of County Health Officials to encourage local health departments to take action around climate and health adaptations at the local level, in coordination with local partners.⁹⁵ DOH staff have worked with local partners to enhance awareness of and accessibility to programs providing cooling in the home and cooling centers during heat advisories.⁹⁶ DOH also identified populations that are vulnerable to extreme heat by developing a Heat Vulnerability Index. Studies have sought to increase awareness about climate impacts on health in New York,⁹⁷ and they have explored associations between temperature and respiratory outcomes, cardiovascular outcomes, renal diseases, and birth defects. Additional studies have explored climate change trends in New York, impacts of air pollutants on health (which could assist in understanding co-benefits to improved air quality through climate policy), and impacts of specific events that could stem from extreme weather. Recently enacted legislation requires the State to conduct a study on the impacts of the urban heat island effect in Disadvantaged Communities.⁹⁸ The State could conduct additional studies to continue to increase its understanding of the health impacts of climate change and the health benefits of climate policy.

The health co-benefits of climate policy will have long term effects on health outcomes and may be reflected in health outcome data tracked by DOH. Health co-benefits can be estimated as progress is made toward climate objectives. Although the cause and exacerbation of many health outcomes are multifactorial, tracking health outcomes over time provides an indication of increasing or decreasing trends and potential changes in trends associated with the implementation of health policies. DOH

⁹⁴ Chow, N.A., M. Toda, A.F. Pennington, et al. 2017. "Hurricane-Associated Mold Exposures Among Patients at Risk for Invasive Mold Infections After Hurricane Harvey - Houston, Texas." *MMWR Morb Mortal Wkly Rep.* 2019;68(21):469-473. Published 2019 May 31. doi:10.15585/mmwr.mm6821a1.

Nayak, S.G., S. Shrestha, P.L. Kinney, Z. Ross, S.C. Sheridan, C.I. Pantea, W.H. Hsu, N. Muscatiello, and S.A. Hwang. 2018. "Development of a heat vulnerability index for New York State." *Public Health.* 161:127-137.

⁹⁵ New York State Association of County Health Officials and New York State Department of Health. "Climate and Health Adaptation Initiative and Workshops." Available at <https://www.nyscho.org/topic/climate-and-health-adaptation/>.

⁹⁶ Nayak, Seema G., Srishti Shrestha, Scott C. Sheridan, Wan-Hsiang Hsu, Neil A. Muscatiello, Cristian I. Pantea, Zev Ross, et al. 2019. "Accessibility of cooling centers to heat-vulnerable populations in New York State." *Journal of Transport & Health* 14 (2019): 100563.

⁹⁷ Insaf, T.Z., S. Lin, and S.C. Sheridan. 2013. "Climate trends in indices for temperature and precipitation across New York State, 1948-2008." *Air Quality, Atmosphere & Health* 6(1): 247-257.

⁹⁸ Chapter 563 of the Laws of 2022.

currently maintains a dashboard to track progress on key indicators of the Prevention Agenda.⁹⁹ The dashboard includes a number of health outcomes, as well as other climate-related measures including “% population living in a certified Climate Smart Community” and “% population that uses alternate forms of transportation.” New York’s Environmental Public Health Tracking Program provides data for a number of environmental exposures, hazards, and health outcomes, including heat-related illness.¹⁰⁰ Ongoing work seeks to add more geographically granular, subcounty data, especially for health outcome metrics including respiratory and cardiovascular disease, while maintaining confidentiality as required by existing laws and policies. County level heat-related illness data has been published in the DOH County Heat and Health Profile reports and is updated periodically. Health Data NY also serves as a repository for a number of health-related datasets.¹⁰¹ The DOH website also provides other datasets that may be useful for tracking progress on Climate Act requirements and goals.¹⁰²

8.3 Considering Health in Climate Policy

The development of sound policy to mitigate GHG emissions and adapt to the changing climate will provide direct and indirect public health benefits. Direct benefits will result from mitigating GHG emissions and adapting to global climate change by reducing the many public health impacts associated with climate change. Indirect health benefits will occur when initiatives to mitigate GHG emissions also result in other beneficial outcomes such as reducing air pollutant emissions (co-pollutants), encouraging active transport (such as walking and cycling), and reducing home health risks through building energy efficiency retrofit interventions. Improved air quality will reduce premature mortality and incidences of asthma and cardiovascular disease and increased physical activity will reduce obesity and negative cardiovascular outcomes. Cardiovascular disease is the leading cause of death nationally and in New York, with almost 44,000 New Yorkers dying of cardiovascular disease every year. As previously stated, asthma is a major health problem nationally, and in New York 1.4 million adults and 315,000 children suffer from this disease.¹⁰³

⁹⁹ New York State Department of Health. Accessed at https://webbi1.health.ny.gov/SASStoredProcess/guest?_program=/EBI/PHIG/apps/dashboard/pa_dashboard&p=sh.

¹⁰⁰ New York State Department of Health. Accessed at https://www.health.ny.gov/environmental/public_health_tracking/.

¹⁰¹ New York State Department of Health. Accessed at <https://health.data.ny.gov/>.

¹⁰² New York State Department of Health. Accessed at https://www.health.ny.gov/prevention/prevention_agenda/2013-2017/sources.htm.

¹⁰³ Centers for Disease Control and Prevention. “Most Recent Asthma State or Territory Data.” Accessed on November 23, 2021, at https://www.cdc.gov/asthma/most_recent_data_states.htm.

State and federal government programs to control air pollutant emissions through regulations and permitting have contributed to greatly improved air quality in New York over the last 40 years (see Appendix F). Although the State currently complies with the requirements of, or is “designated attainment for,” the National Ambient Air Quality Standards for the criteria pollutants carbon monoxide, lead, nitrogen dioxide (NO₂), and particulate matter, substantial additional health benefits will be achieved through continued emission reductions. For SO₂, a small portion of St. Lawrence County has been designated as nonattainment. Nine counties, in which 65% of the state’s population reside, are currently not in attainment for the 2015 ozone standard. Concentrations of non-criteria pollutants attributed to fuel combustion have also decreased significantly over the last decade, due in part to programs and regulations directed at reducing transportation source pollution, including the adoption of reformulated gasoline programs and improvements in vehicle emissions technology, the statewide adoption of the California Low Emission Vehicle program, and emission reductions from oil refineries and other stationary sources under federal and State air pollution control programs. Recent studies of long-term air quality trends in New York City demonstrate that enactment of local and regional clean air regulations, as well as changes in fuel usage (e.g., fossil natural gas out-competing coal), significantly reduced ambient levels of particulate matter.

COVID-19 is one of the most significant emerging diseases of the 21st century. Air pollution, in particular fine particulate matter (PM_{2.5}), which is released during combustion, can exacerbate symptoms of respiratory illness.¹⁰⁴ Long-term exposure to PM_{2.5} from the 2020 wildfires in the western United States, which are increasing in frequency due to climate change, has also been shown to increase the risk of death from COVID-19. Disadvantaged Communities are likely to have greater health disparities (or inequities) and shoulder more significant environmental burdens than other communities. Elevated levels of NO₂,¹⁰⁵ found in Disadvantaged Communities due to fuel combustion, are associated with higher rates of

¹⁰⁴ Croft, D.P., W. Zhang, S. Lin, et al. 2019. “The Association between Respiratory Infection and Air Pollution in the Setting of Air Quality Policy and Economic Change.” *Ann Am2 Thorac Soc.* 2019;16(3):321-330. doi:10.1513/AnnalsATS.201810-691OC.

¹⁰⁵ Liu, T., L.J. Mickley, M. Cooper, and F. Dominici. August 13, 2021. “Excess of COVID-19 cases and deaths due to fine particulate matter exposure during the 2020 wildfires in the United States.” *Sci Adv.* 2021 Aug 13;7(33):eabi8789. doi: 10.1126/sciadv.abi8789.

COVID-19 infection and higher rates of death.^{106,107} By mitigating climate change, New York can reduce air pollution and respiratory illnesses, including COVID-19 infection, address underlying economic and social inequities using asset-based approaches, and protect and improve public health.

8.4 Sector-Specific Health Co-Benefits of Climate Policies

In addition to the health impacts associated with climate change, the production, storage, distribution, use, and disposal of fossil fuels (and certain biofuels) can have many other health impacts. These impacts can arise from routine operations, accidents, and catastrophic events. Health impacts resulting from routine fuel use and production can range from local to global in scale and examples include degradation of air quality due to the combustion of fuels and accidents such as fires, fuel oil spills, contamination of groundwater and gas pipeline explosions, and other occupational and nonoccupational accidents. Reduction of these impacts through GHG emissions reductions strategies results in health co-benefits. Some of these impacts are discussed in the sections below. Table 3 summarizes the human health effects that are associated with GHG emissions (climate change) and exposure to some air pollutants commonly associated with fuel combustion.

¹⁰⁶ Liang, D., L. Shi, J. Zhao, P. Liu, J.A. Sarnat, S. Gao, J. Schwartz, Y. Liu, S.T. Ebel, N. Scovronick, H.H. Chang. 2020. "Urban Air Pollution May Enhance COVID-19 Case-Fatality and Mortality Rates in the United States." *The Innovation* 1(3), <https://doi.org/10.1016/j.xinn.2020.100047>.

¹⁰⁷ Lipsitt, J., A.M. Chan-Golston, J. Liu, J. Su, Y. Zhu, and M. Jerrett. 2021. "Spatial analysis of COVID-19 and traffic-related air pollution in Los Angeles." *Environ Int.* 2021 Aug;153:106531. doi: 10.1016/j.envint.2021.106531. Epub 2021 Mar 22. PMID: 33812043; PMCID: PMC7983457.

Table 3. Health Effects Associated with Fossil Fuel and Biofuel Combustion Pollutants

Air Pollutant	Human Health Effects
GHGs	Climate-related effects on morbidity and mortality (such as increased mold and pollen allergy incidence and severity, heat stress, heat-related mortality, vector-borne disease, injury, and death due to flooding)
Carbon monoxide ¹⁰⁸	Likely causal effects on existing cardiovascular disease
NO ₂ ¹⁰⁹	Respiratory effects (causal)
Ozone ¹¹⁰	Respiratory effects (causal)
PM _{2.5} ¹¹¹	Cardiovascular effects and pre-mature mortality (cardio-pulmonary) (causal)
SO ₂ ¹¹²	Respiratory effects (short-term exposures) (causal)
Metals ¹¹³	Effects vary depending on specific metal
Polycyclic aromatic hydrocarbons ¹¹⁴	Cancer (not all polycyclic aromatic hydrocarbons)
VOCs ¹¹⁵	Effects vary depending on the specific chemical (some examples are central nervous system effects; liver or kidney toxicity; eye, skin, and respiratory tract irritation; and cancer)

Many volatile organic compounds (VOCs), such as toluene, can cause central nervous system effects, and some, like benzene, are carcinogens. In addition to VOCs and GHGs (discussed earlier), non-criteria pollutants that can be emitted from fuel combustion include chlorinated dibenzo-p-dioxins, chlorinated dibenzofurans, polycyclic aromatic hydrocarbons, and various metals, particularly mercury from coal combustion. Exposure to high levels of chlorinated dioxins and furans is associated with cancer and effects on the liver and skin. Health effects associated with exposure to metals vary by the metal. For example, mercury, after being transformed to methylmercury in the environment and entering the food chain, can cause effects on the nervous system, especially for children and fetuses. Exposure to high levels of some polycyclic aromatic hydrocarbons is associated with lung cancer. Polycyclic aromatic

¹⁰⁸ U.S. Environmental Protection Agency. 2010. *EPA/600/R-019F/January 2010: Integrated Science Assessment for Carbon Monoxide.*

¹⁰⁹ U.S. Environmental Protection Agency. 2016. *EPA/600/R-15-068/January 2016: Integrated Science Assessment for Oxides of Nitrogen – Health criteria.*

¹¹⁰ U.S. Environmental Protection Agency. 2020. *EPA/600/R-20/012, April 2020 U.S. EPA. Integrated Science Assessment (ISA) for Ozone and Related Photochemical Oxidants.*

¹¹¹ U.S. Environmental Protection Agency. 2019. *EPA/600/R-19/188, December 2019: Integrated Science Assessment (ISA) for Particulate Matter.*

¹¹² U.S. Environmental Protection Agency. 2017. *EPA/600/R-17/451/December 2017.: Integrated Science Assessment for Sulfur Oxides- Health Criteria.*

¹¹³ Agency for Toxic Substances and Disease Registry. “Toxicological Profiles for Specific Metals.” <http://www.atsdr.cdc.gov/toxprofiles/index.asp>.

¹¹⁴ Agency for Toxic Substances and Disease Registry. “Toxicological Profiles for specific PAHs.” <http://www.atsdr.cdc.gov/toxprofiles/index.asp>.

¹¹⁵ Agency for Toxic Substances and Disease Registry. “Toxicological Profiles for specific VOCs.” <http://www.atsdr.cdc.gov/toxprofiles/index.asp>.

hydrocarbons can have endocrine effects, as well.¹¹⁶ Biomarkers for this type of exposure have been associated with incidence of diabetes.¹¹⁷ Polycyclic aromatic hydrocarbons in air are usually found in the particulate phase, and a recent study determined that other indicators of combustion emissions, including PM_{2.5} (fine particulate matter less than or equal to 2.5 microns in aerodynamic diameter), were associated with an increased risk of mortality from the endocrine disorder, diabetes.¹¹⁸ There is evidence that PM_{2.5}, SO₂, carbon dioxide (CO₂), and NO₂ are associated with reduced fecundity and increased miscarriage and stillbirth.¹¹⁹ Modeling changes in health outcomes associated with exposure to air pollutants can be helpful to inform policy, but modeling those for non-criteria pollutants is more challenging and uncertain.

Power Generation

The transition in the power generation sector away from fuel combustion to meet the requirements of the Climate Act will result in the same kinds of health co-benefits achieved through this transition across all sectors. However, there are health concerns specific to this sector, and they have been considered in the development of this Scoping Plan. The health risks associated with combustion emissions and combustion waste products are not associated with renewable power generation and will substantially decrease with large-scale reduction in combustion for power generation. Coal, a fuel with significant emissions and associated health impacts, has already been phased out in New York power generation following New York State Department of Environmental Conservation's (DEC) adoption of CO₂ emission limits for power plants, as part of 6 NYCRR Part 251. Although emissions from power plant stacks can travel great distances, power generation facilities also contribute to air quality impacts in nearby communities, including Disadvantaged Communities.

Health concerns associated with onshore generation of wind energy are limited. Physical safety concerns can be mitigated through the choice of appropriate minimum setbacks (the minimum allowable distances between turbines and roads, property lines, or structures). Annoyance,¹²⁰ associated with wind turbines

¹¹⁶ Teil, M.J., E. Moreau-Guigon, M. Blanchard, F. Alliot, J. Gasperi, M. Cladière, C. Mandin, S. Moukhtar, M. Chevreuil. 2016. "Endocrine disrupting compounds in gaseous and particulate outdoor air phases according to environmental factors." *Chemosphere*.146:94-104.

¹¹⁷ Alshaarawy, O., M. Zhu, A.M. Ducatman, B. Conway, M.E. Andrew. 2014. "Urinary polycyclic aromatic hydrocarbon biomarkers and diabetes mellitus." *Occup Environ Med*. 71(6):437-41.

¹¹⁸ Lim, C.C., R.B. Hayes, J. Ahn, Y. Shao, D.T. Silverman, R.R. Jones, C. Garcia, G.D. Thurston. 2018. "Association between long-term exposure to ambient air pollution and diabetes mortality in the US." *Environ Res*. 165:330-336.

¹¹⁹ Conforti, A., M. Mascia, G. Cioffi, et al. 2018. "Air pollution and female fertility: a systematic review of literature." *Reprod Biol Endocrinol*. 16(117).

¹²⁰ Noise annoyance is defined by the World Health Organization as a (long term) feeling of displeasure, nuisance, disturbance, or irritation caused by a specific sound.

producing characteristic sounds or noise as wind passes over the rotating blades, is a health effect according to the *Environmental Noise Guidelines for the European Region*, published by the World Health Organization in 2018.¹²¹ Data indicate that noise from wind turbines may be more noticeable, annoying, and disturbing than other community or industrial sounds of the same level. Reviewing acceptable noise thresholds for wind turbine siting as scientific understanding evolves will be important as onshore wind energy is increasingly adopted. DOH will continue to review the scientific literature on wind turbine noise and health effects like annoyance in order to inform siting policies and programs. Another potential health concern associated with renewable energy is related to the disposal of hardware and components. Toxic metals such as lead could leach from end-of-life solar panels if they are not disposed of properly.^{122,123} However, proper recycling can reduce this hazard, and panels can be designed to facilitate future recycling of panel modules. In addition, batteries, such as lithium-ion batteries, which can be used for electric grid storage, can release as lithium, manganese, and cobalt if not recycled or disposed of properly.¹²⁴

Finally, there are emerging energy technologies that may pose new opportunities as well as new risks that have yet to be fully understood. Hydrogen combustion does not directly generate most combustion byproducts such as particulate matter, thus conveying a potentially large health benefit, but does result in the formation of NO_x (which are precursors to ozone and particulate matter formation) at levels that may be higher than those from fossil fuel combustion because of hydrogen's high combustion temperature. Opportunities to further reduce NO_x emissions from hydrogen combustion exist and need to be further studied. Recent data indicate that turbines can be designed to combust hydrogen with substantially reduced NO_x emissions, even potentially below levels achieved from natural gas combustion.¹²⁵ The use of hydrogen for fuel cells would not result in any NO_x formation and would therefore be preferable to

¹²¹ World Health Organization Regional Office for Europe. 2018. *Environmental Noise Guidelines for the European Region*. Copenhagen. Accessed at https://www.euro.who.int/__data/assets/pdf_file/0008/383921/noise-guidelines-eng.pdf.

¹²² Sharma, H.B., K.R. Vanapalli, V.K. Barnwal, B. Dubey, J. Bhattacharya. 2021. "Evaluation of heavy metal leaching under simulated disposal conditions and formulation of strategies for handling solar panel waste." *Sci Total Environ*. 2021 Aug 1;780:146645. doi: 10.1016/j.scitotenv.2021.146645.

¹²³ Centers for Disease Control and Prevention. 2020. "ATSDR toxicological profile on lead." <https://www.atsdr.cdc.gov/toxprofiles/tp13.pdf>.

¹²⁴ Wojciech, M., et al. 2021. "Environmental impacts, pollution sources and pathways of spent lithium-ion batteries." *Energy Environ. Sci*. 14: 6099-6121.

¹²⁵ National Energy Technology Laboratory. August 31, 2022. "Addressing NO_x Emissions from Gas Turbines Fueled with Hydrogen." August 31, 2022. <https://www.energy.gov/eere/fuelcells/2022-hydrogen-and-fuel-cell-technologies-office-webinar-archives#09152022>

hydrogen combustion from a public health perspective. The combustion of renewable natural gas (RNG) is likely to result in pollutant emissions similar to fossil natural gas combustion.

While transitioning away from fossil fuel use, maintaining reliable access to power, whether through centralized or distributed energy sources, is crucial for maintaining good public health in our energy-dependent society. Increasing the reliability of electric systems and delivery can reduce health effects during high temperatures, when air conditioning is the principal means to prevent heat-related morbidity and mortality. A study of citywide and localized power outages in New York City during warm weather found associations with respiratory disease, renal disease, and all-cause mortality, though these associations were not necessarily consistent across outages.¹²⁶ During summer, power outages pose specific health-related impacts such as spoiled food and digestive tract illness, spoiled vaccines, and increased rodent populations as a result of discarded perishables.¹²⁷⁻¹²⁸⁻¹²⁹ Winter outages also pose specific risks to public health.¹³⁰⁻¹³¹ One study found that the health risks are greater following winter storms with power outages, compared with winter storms alone.¹³² Localized cold weather power outages in New York City were associated with all-cause mortality and cardiovascular disease hospitalizations but fewer respiratory disease hospitalizations.¹³³ Increases in carbon monoxide poisoning during storm-related power outages have been reported in several studies.¹³⁴⁻¹³⁵ Following a 2006 winter storm in Western New York that resulted in extensive power outages, 264 people visited emergency departments

¹²⁶ Dominianni C., et al. 2018. "Health Impacts of Citywide and Localized Power Outages in New York City." *Environ Health Perspect* 126(6): 067003.

¹²⁷ Bell, K.N. 2001. "Risk Factors for Improper Vaccine Storage and Handling in Private Provider Offices." *Pediatrics*. 107(6): art-e100.

¹²⁸ Marx, A. Melissa. 2006. "Diarrheal Illness Detected Through Syndromic Surveillance after a Massive Power Outage: New York City, August 2003." *American Journal of Public Health*. 96:547-553.

¹²⁹ Beatty, Mark. 2006. "Blackout of 2003: Public Health Effects and Emergency Response." *Public Health Reports*.

¹³⁰ Daley, W. Randolph. 2000. "An Outbreak of Carbon Monoxide Poisoning after a Major Ice Storm in Maine." *The Journal of Emergency Medicine*. Vol. 18, No. 1, pp. 87-93.

¹³¹ Muscatiello, Neil, G. Babcock, R. Jones, E. Horn, and S.A. Hwang. 2010. "Hospital Emergency Department Visits for Carbon Monoxide Poisoning Following an October 2006 Snowstorm in Western New York." *Journal of Environmental Health*. Volume 72, Number 6, pages 43-48.

¹³² Lin, S., et al. 2021. "The immediate effects of winter storms and power outages on multiple health outcomes and the time windows of vulnerability." *Environ Res*. 196: 110924.

¹³³ Dominianni, C., et al. 2018. "Health Impacts of Citywide and Localized Power Outages in New York City." *Environ Health Perspect*. 126(6): 067003.

¹³⁴ Daley, W. Randolph. 2000. "An Outbreak of Carbon Monoxide Poisoning after a Major Ice Storm in Maine." *The Journal of Emergency Medicine*. Vol. 18, No. 1, pp. 87-93.

¹³⁵ Graber, Judith M. 2007. "Results from a State-Based Surveillance System for Carbon Monoxide Poisoning." *Public Health Reports*. 122:145-154.

to be evaluated for carbon monoxide poisoning.¹³⁶ After Hurricane Sandy, 80 carbon monoxide poisoning cases were reported.^{137,138} At least 57 deaths were attributed to this weather event, and there was over \$195 million in property damage. By improving the reliability of the available electricity, the State can prevent millions of dollars in damages and prevent premature mortality.

Transportation

Opportunities for health co-benefits associated with transportation sector climate policies include reductions in traffic noise and accidents and reductions in morbidity and mortality associated with improved air quality and increased availability and use of active transportation options. Transportation sector emissions are usually concentrated at the ground level, often in densely populated areas, resulting in a tendency toward higher levels of exposure for more people than emissions associated with other pollutant sources. Some of the co-pollutants emitted are associated with an increased risk of respiratory and cardiovascular effects, among others. Numerous studies have investigated the increased risk of these effects by looking at the relationship between traffic patterns and the distance from roadways and the associated pollutant concentrations and health endpoints. Studies have found associations between asthma exacerbation or emergency room visits for respiratory illness and transportation-related factors such as traffic proximity or traffic density¹³⁹ and diesel traffic density in particular.¹⁴⁰ Associations with other health effects have been found. For example, two Ontario-based studies demonstrated that, where air

¹³⁶ Graber, Judith M. 2007. "Results from a State-Based Surveillance System for Carbon Monoxide Poisoning." *Public Health Reports*. 122:145-154.

¹³⁷ Center for Disease Control and Prevention. 2012. "Notes from the Field: Carbon Monoxide Exposures Reported to Poison Centers and Related to Hurricane Sandy - Northeastern United States." *2012 Morbidity and Mortality Weekly Report*. 66(44):905-905.

¹³⁸ The University of Texas at Austin Energy Institute. 2021. "The Timeline and Events of the February 2021 Texas Electric Grid Blackouts." Accessed at <https://energy.utexas.edu/ercot-blackout-2021>.

¹³⁹ Lin, S., J.P. Munsie, S.A. Hwang, E. Fitzgerald, M.R. Cayo. 2002. "Childhood Asthma Hospitalization and Residential Exposure to State Route Traffic." *Environmental Research*. Section A (88): 73-81; Lwebuga-Mukasa, James S. 2003. "Traffic Volumes and Respiratory Health Care Utilization among Residents in Close Proximity to the Peace Bridge Before and After September 11, 2001." *Journal of Asthma*. 40(8): 855-864; Kim, Janice. 2008. "Residential Traffic and Children's Respiratory Health." *Environmental Health Perspectives*. 16(9):1274-9.

¹⁴⁰ McCreanor, James. 2007. "Respiratory Effects of Exposure to Diesel Traffic in Persons with Asthma." *New England Journal of Medicine*. 357(23):2348-58.

pollution is generally low, living in close proximity to high-traffic roads and higher levels of PM_{2.5} and NO₂ are associated with increased risk of developing dementia.^{141,142}

The recommendations for reducing single-occupancy vehicle travel and reducing gasoline and diesel use, discussed further in this Scoping Plan, could improve health outcomes. Transportation emissions have been concentrated in Disadvantaged Communities for generations and decarbonizing the transportation sector provides an opportunity to focus emission reductions in the communities that have historically been overburdened by pollution.¹⁴³ In addition, transportation planning that use Complete Streets policies ensures that considerations are made for the safety of all roadway users (pedestrians, bicyclists, public transportation users, and motorists). Not getting enough physical activity is a risk factor for diabetes and obesity (which are also risk factors for those with high blood pressure and a family history of these health risks). Almost 1.7 million New Yorkers (10.5%) had diabetes in 2016, and obesity has reached epidemic proportions with more than half (60.8%) of New York adults reported to be overweight or obese in 2016. Being obese or overweight is currently the second leading preventable cause of death in the U.S. and may soon overtake cardiovascular disease as the leading cause of death. In addition, one-third of New York's children are obese or overweight. A reduction in the reliance on personal automobiles by incorporating smart growth and Complete Streets policies into transportation planning has the benefit of increasing opportunities for physical activity. In recent years, studies have begun to examine the relationship between neighborhood walkability and physical activity levels, body mass index, waist circumference, obesity, and hypertension. These studies have generally shown that neighborhood walkability is associated with increased physical activity and decreased body mass index, waist circumference, obesity, and hypertension.

Health risks associated with transportation emissions can be reduced with a shift toward technologies that do not rely on fuel combustion and the enhancement of public transportation systems and other low-carbon mobility options (e.g., walking, cycling). Currently, most mobile source emissions result from the combustion of gasoline and traditional petroleum-based diesel fuel. Compared with petroleum-based

¹⁴¹ Chen, H, J.G. Kwong, R. Copes, K. Tu, P.J. Villeneuve, A. van Donkelaar, P. Hystad, R.V. Martin, B.J. Murray, B. Jessiman, A.S. Wilton, A. Kopp, R.T. Burnett. 2017. "Living near major roads and the incidence of dementia, Parkinson's disease, and multiple sclerosis: a population-based cohort study." *Lancet*. Feb 18;389(10070):718-726. doi: 10.1016/S0140-6736(16)32399-6. Epub 2017 Jan 5. PMID: 28063597.

¹⁴² Chen, H., J.C. Kwong, R. Copes, P. Hystad, A. van Donkelaar, K. Tu, J.R. Brook, M.S. Goldberg, R.V. Martin, B.J. Murray, A.S. Wilton, A. Kopp, R.T. Burnett. 2017. "Exposure to ambient air pollution and the incidence of dementia: A population-based cohort study." *Environ Int*. Nov;108:271-277. doi: 10.1016/j.envint.2017.08.020. Epub 2017 Sep 13. PMID: 28917207.

¹⁴³ New York State Department of Transportation. "Complete Streets." Accessed on November 23, 2021 at <https://www.dot.ny.gov/programs/completestreets>.

fuels, alternative fuels may not have lower co-pollutant emissions. Alcohol-based fuels have higher levels of combustion emissions of respiratory irritants and some ozone-precursors such as formaldehyde and acetaldehyde.^{144,145} In 2007, it was estimated that increasing ozone levels from widespread use of concentrated ethanol in the transportation sector could lead to significant increases in ozone-related asthma, hospitalization, and mortality.¹⁴⁶ Formaldehyde and acetaldehyde are also carcinogens. At the time of the 2007 study, the estimated cancer risk associated with widespread use of higher ethanol fuel was offset by the decreased use of gasoline and associated carcinogenic benzene and butadiene emissions, with no net change in cancer risk.¹⁴⁷ However, the Federal Mobile Source Air Toxics standards phased in from 2007 to 2014 caused the average benzene levels in conventional gasoline to decrease by nearly 50% (and ethanol levels to increase to 10%).¹⁴⁸ This suggests that widespread replacement of gasoline with high ethanol fuel at the current time would result in an increase in risk for cancer as well as ozone-related respiratory outcomes, although recent emissions controls may also have had effects on ethanol combustion emissions. Substitution of biodiesel or renewable diesel for conventional diesel does not significantly reduce particulate matter emissions in most on-road transportation applications (where advanced emissions control technology prevails).¹⁴⁹ Renewable diesel does not significantly affect NO_x emissions in these on-road engines, but biodiesel likely increases NO_x emissions. Lower particulate matter emissions in older non-road engines are likely for both biodiesel and renewable diesel, but biodiesel use in these engines slightly increases NO_x emissions. This increase can be mitigated if

¹⁴⁴ Karavalakis, G., et al. 2012. "Impacts of ethanol fuel level on emissions of regulated and unregulated pollutants from a fleet of gasoline light-duty vehicles." *Fuel*. 93: 549-558.

¹⁴⁵ Frutuoso, Felipe S., Camila M.A.C. Alves, Saul L. Araújo, Daniel S. Serra, Ana Luiza B.P. Barros, Francisco S.Á. Cavalcante, Rinaldo S. Araújo, Nara A. Policarpo, Mona Lisa M. Oliveira. 2002. "Assessing light flex-fuel vehicle emissions with ethanol/gasoline blends along an urban corridor: A case of Fortaleza/Brazil." *International Journal of Transportation Science and Technology*. ISSN 2046-0430, <https://doi.org/10.1016/j.ijst.2022.04.001>.

¹⁴⁶ Jacobson, M.Z. 2007. "Effects of ethanol (E85) on cancer and mortality in the United States." *Environ. Sci. Technol* 41(11): 4150–4157.

¹⁴⁷ Jacobson, M.Z. 2007. "Effects of Ethanol (E85) versus Gasoline Vehicles on Cancer and Mortality in the United States." *Environ. Sci. Technol.* 41, 4150-4157; NYSERDA. "Renewable Fuels Roadmap and Sustainable Biomass Feedstock Supply for New York." Accessed on November 23, 2021, at <https://www.nyserdera.ny.gov/About/Publications/Research-and-Development-Technical-Reports/Biomass-Reports/Renewable-Fuels-Roadmap>; Vieira da Silva, M.A., B.L.G. Ferreira, L.G. da Costa Marques, A.L.S. Murta, and M.A.V. de Freitas. 2017. "Comparative study of NO_x emissions of biodiesel-diesel blends from soybean, palm and waste frying oils using methyl and ethyl transesterification routes." *Fuel* 194: 144-156.

¹⁴⁸ U.S. Environmental Protection Agency. October 2017. "Fuel Trends Report: Gasoline 2006 – 2016, EPA-420-R-17-005." <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100T5J6.pdf>

¹⁴⁹ Biodiesel is produced by transesterification of vegetable oils and animal fats. Renewable diesel is a biomass-based diesel fuel similar to biodiesel that is chemically equivalent to petroleum diesel and can be used and transported as a drop-in biofuel with or without blending with petroleum diesel. Renewable diesel production uses a hydrogenation process rather than the esterification process used to produce biodiesel.

blending with renewable diesel, which slightly reduces NO_x emissions in uncontrolled engines.¹⁵⁰ (For a broad review of the potential effect of alternative fuels on criteria pollutant emissions, see NYSERDA's *Effect of Low-Carbon Fuels and Energy Technologies on Co-Pollutant Emissions* memo.¹⁵¹) It would be beneficial, from a public health perspective, to limit use of alternative fuels to those scenarios where it can be demonstrated that co-pollutant exposures are reduced or at least not increased when compared with fossil fuel use.

Widely used public transportation results in considerably less fuel use and air contaminant emissions per person-mile traveled than other modes of transportation such as personal cars. Therefore, targeted geographic and temporal expansion of public transportation availability could reduce health risks associated with transportation emissions. Electrifying transit buses can ensure that emissions are reduced even further. Investments in transit bus electrification will benefit overburdened communities, both because many bus depots are located in these areas and because buses provide essential transportation services in these areas. Regulations limit school bus and heavy-duty vehicle idling, which produces harmful emissions, to protect the health of school children and others exposed to this type of air pollution and electrification of vehicles will reduce these harmful pollutants even further.¹⁵² Electrification of school buses would also prevent exposure of school children to diesel exhaust, which often leaks into the cabin of buses posing a larger health threat than outdoor idling emissions. Electrification of heavy-duty equipment such as port, farm, and construction engines, that are typically diesel-powered, will protect the health of workers and reduce emissions (and noise) in rural and urban areas that are often in close proximity to residents and pedestrians. While not all engine types are currently available with electric or other zero-emission technology options, availability is increasing and will continue to do so in the future. In many construction settings, diesel generators can be eliminated in favor of temporary electrical grid connection. Emissions associated with transportation can also be reduced through carpools and investments in infrastructure that support safe walking and bicycling. These mechanisms can be supported through integrated local and regional transportation planning using Complete Streets principles.

¹⁵⁰ Durbin, T.D., et al. 2021. *Low Emission Diesel (LED) Study: Biodiesel and Renewable Diesel Emissions in Legacy and New Technology Diesel Engines*. Prepared for California Air Resources Board.

¹⁵¹ Abt Associates. October 18, 2022. Memorandum for NYSERDA: "Effect of Low-Carbon Fuels and Energy Technologies on Co-Pollutant Emissions, revised October 18, 2022." <https://www.nyserda.ny.gov/About/Publications/EA-Reports-and-Studies/Greenhouse-Gas-Emissions>.

¹⁵² New York State Department of Environmental Conservation. "Heavy Duty Vehicles." Accessed at <https://www.dec.ny.gov/chemical/8585.html>.

Reductions in fuel use and emissions can also be achieved through congestion mitigation and smart growth planning that facilitates the establishment of more walkable communities, with sidewalks, bike lanes, and bike paths. Policies and technologies to reduce congestion, such as congestion pricing and traffic signal synchronization, can alleviate major bottlenecks and improve local air pollution, especially in communities located near busy roads. Bike sharing programs have become a popular feature in cities across the nation, providing additional opportunities for physical activity. Active transport for shorter journeys has both the benefits of reduced emissions and of exercise, leading to reduced risk for obesity, cardiovascular disease, and other health impacts. Nevertheless, in spite of the emission reductions associated with bicycling and walking for transportation and the health benefits, exercising in polluted air can also have health impacts, especially for vulnerable populations.¹⁵³ However, among healthy adults, moderate to high-intensity exercise may neutralize any short-term negative effects of air pollution. While the benefits of increased physical activity have been found to outweigh the risks of exercise in polluted air,¹⁵⁴ air quality in areas of heavy traffic should still be considered in the choices made for siting of bicycle lanes and paths.¹⁵⁵ Further, traffic accidents have been found to increase in number and severity with increased active transport. Therefore, as active transport options continue to be made available, efforts to minimize accident potential become increasingly important.

Vehicle electrification can also contribute to reduced traffic noise, especially at slower and medium speeds where tire and wind noises are low. Particularly in cities, with high volumes of traffic, noise reduction is an important health co-benefit for the deployment of electric vehicles (EVs). However, silent EVs can also pose a safety risk for pedestrians. For this reason, minimum sound levels for EVs are required of manufacturers.¹⁵⁶ Charging lithium-ion batteries used in vehicles such as E-bikes can pose fire risks.¹⁵⁷ Also, it is important to properly recycle or dispose of the lithium-ion batteries that currently power most EVs.

¹⁵³ Mittleman, Murray A. September 13, 2007. "Air Pollution, Exercise and Cardiovascular Risk." *New England Journal of Medicine* 357(11):1147- 9.

¹⁵⁴ Tainio, M., A. de Nazelle, T. Götschi, S. Kahlmeier, D. Rojas-Rueda, M. Nieuwenhuijsen, T. Hérick de Sá, P. Kelly, J. Woodcock. 2016. "Can air pollution negate the health benefits of cycling and walking?" *Preventive Medicine* 87:233-236.

¹⁵⁵ Hertel, Ole. 2008. "A Proper Choice of Route Significantly Reduces Air Pollution Exposure – A Study on Bicycle and Bus Trips in Urban Streets." *Science of the Total Environment* 389(1):58-70.

¹⁵⁶ National Highway Traffic Safety Administration, U.S. Department of Transportation. 2002. "Federal Motor Vehicle Safety Standards; Minimum Sound Requirements for Hybrid and Electric Vehicles." <https://www.federalregister.gov/documents/2022/07/13/2022-14733/federal-motor-vehicle-safety-standards-minimum-sound-requirements-for-hybrid-and-electric-vehicles>

¹⁵⁷ Rubin, April. "Lithium-Ion Batteries in E-Bikes and Other Devices Pose Fire Risks." November 14, 2022. *New York Times*.

Buildings and the Built Environment

The building industry presents a unique and largely untapped resource for integrating climate action and public health. Workforce education, training, job placement, and job development equips New York's current and future workforce to design, install, inspect, maintain, and operate healthy, comfortable, low-carbon buildings while increasing clean energy job placement for Disadvantaged Communities and advancing industry diversity. This could be accomplished by promoting broad public awareness and education to create strategic partnerships with trusted community leaders, and by scaling-up targeted outreach and decision-making to increase market demand and accelerate the transition to low-carbon, energy-efficient, all-electric buildings.

Outdoor Built Environment

The built environment is the primary environment people are exposed to because people spend approximately 90% of their time indoors.¹⁵⁸ However, outdoor green space is also part of the built environment, and it can have health benefits (mental health, exercise, etc.) for those who have access. Consequently, there are significant opportunities for improving public health while reducing GHG emissions by introducing green space, such as parks, especially in urban environments and Disadvantaged Communities. Green spaces, such as parks, urban greenery, and street trees, as well as blue space, that comprise water elements, can have beneficial health effects, particularly in urban environments. Effects include decreasing risk of cardiovascular disease and type 2 diabetes mellitus while improving mental

¹⁵⁸ U.S. Environmental Protection Agency. 1989. *Report to Congress on indoor air quality: Volume 2. EPA/400/1-89/001C*. Washington, DC.

health and quality of sleep and increasing birth weight.¹⁵⁹⁻¹⁶⁰⁻¹⁶¹⁻¹⁶²⁻¹⁶³⁻¹⁶⁴⁻¹⁶⁵⁻¹⁶⁶ In urban environments, which experience the “heat island effect,” trees and other green spaces can cool their surrounding areas by up to 1°C.¹⁶⁷⁻¹⁶⁸ Disadvantaged Communities can have less access to green space, and poverty is associated with greater distances to parks.¹⁶⁹ A recent study found that visibility of green space was associated with fewer emergency visits for mental disorders in neighborhoods with high social vulnerability index in New York City.¹⁷⁰ To reduce inequality, New York State Department of Agriculture and Markets (AGM) and DEC have provided grants to support community gardens in urban areas, and more can be done to bring accessible green space to Disadvantaged Communities.¹⁷¹⁻¹⁷²

¹⁵⁹ Hartig, T. 2007. “Three Steps to Understanding Restorative Environments as Health Resources.” In: Thompson, C. W., and P. Travlou (Eds.). *Open Space: People Space*. Abingdon: Taylor & Francis.

¹⁶⁰ Hartig, T., M. Mang, and G.W. Evans. 1991. “Restorative Effects of Natural Environment Experiences.” *Environment and Behavior* 23, 3-26.

¹⁶¹ Beyer, K. M., A. Kaltenbach, A. Szabo, S. Bogar, F.J. Nieto, and K.M. Malecki. 2014. “Exposure to neighborhood green space and mental health: Evidence from the survey of the health of Wisconsin.” *International Journal Of Environmental Research & Public Health* 11, 3453-72.

¹⁶² Völker, S., and T. Kistemann. 2015. “Developing the Urban Blue: Comparative Health Responses to Blue and Green Urban Open Spaces in Germany.” *Health & Place* 35, 196–205.

¹⁶³ Astell-Burt, T., X. Feng, and G.S. Kolt. 2014. “Is Neighborhood Green Space Associated with a Lower Risk of Type 2 Diabetes? Evidence from 267,072 Australians.” *Diabetes Care* 37, 197-201.

¹⁶⁴ Maas, J., R.A. Verheij, S. De Vries, P. Spreeuwenberg, F.G. Schellevis, and P.P. Groenewegen. 2009. “Morbidity Is Related to a Green Living Environment.” *Journal Of Epidemiology And Community Health* 63, 967-973.

¹⁶⁵ Bodicoat, D.H., G. O’donovan, A.M. Dalton, L.J. Gray, T. Yates, C. Edwardson, S. Hill, D.R. Webb, K. Khunti, M.J. Davies, and A.P. Jones. 2014. “The Association between Neighbourhood Greenspace and Type 2 Diabetes in a Large Cross-Sectional Study.” *British Medical Journal Open* 4, E006076.

¹⁶⁶ Dzhambov, A.M., D.D. Dimitrova, and E.D. Dimitrakova. 2014. “Association between Residential Greenness and Birth Weight: Systematic Review and Meta-Analysis.” *Urban Forestry & Urban Greening* 13, 621-629.

¹⁶⁷ Bowler, D. E., L. Buyung-Ali, T.M. Knight, and A.S. Pullin. 2010. “Urban Greening to Cool Towns and Cities: A Systematic Review of the Empirical Evidence.” *Landscape And Urban Planning* 97, 147-155.

¹⁶⁸ Laforteza, R., G. Carrus, G. Sanesi, and C. Davies. 2009. “Benefits and well-being perceived by people visiting green spaces in periods of heat stress.” *Urban Forestry & Urban Greening* 8, 97-108.

¹⁶⁹ Wen, M., X. Zhang, C.D. Harris, J.B. Holt, and J.B. Croft. “Spatial disparities in the distribution of parks and green spaces in the USA.” *Ann Behav Med*. 2013 Feb;45 Suppl 1(Suppl 1):S18-27. doi: 10.1007/s12160-012-9426-x. PMID: 23334758; PMCID: PMC3590901.

¹⁷⁰ Yoo, E.H., J.E. Roberts, Y. Eum, X. Li, K. Konty. “Exposure to urban green space may both promote and harm mental health in socially vulnerable neighborhoods: A neighborhood-scale analysis in New York City.” *Environ Res*. 2022 Mar;204(Pt C):112292. doi: 10.1016/j.envres.2021.112292. Epub 2021 Oct 30. PMID: 34728238.

¹⁷¹ New York State Department of Agriculture and Markets. “Community Gardens and Urban Agriculture.” Accessed at <https://agriculture.ny.gov/community-gardens-and-urban-agriculture>.

¹⁷² New York State Department of Environmental Conservation. “Environmental Justice Grant Programs.” Accessed at <https://www.dec.ny.gov/public/31226.html>.

Housing/Residential Built Environment

Building energy efficiency measures provide significant energy savings and health benefits. These include the basic benefits of affordably maintaining a comfortable living and working environment, preventing hypo- and hyperthermia, and combatting fuel poverty (facing the choice between heating the home or feeding the family).

Tight insulation in residential buildings without ensuring appropriate ventilation and filtration, and/or inadequate weatherproofing, can negatively impact indoor air quality. Ensuring adequate ventilation can provide substantial health benefits and can be coupled with heat exchange for energy efficiency.

Disadvantaged Communities in particular experience indoor air quality issues related to poor ventilation and inadequate weatherproofing (causing mold), which can worsen health disparities. The New York Building Codes and Property Maintenance Code designates minimum air ventilation rates for new and existing buildings. Inadequate ventilation increases exposure to air contaminants such as VOCs (including but not limited to those from consumer care products and off-gassing from building materials), radon gas, dust, allergens, mold, carbon monoxide (e.g., from leaking fossil fuel heating systems), and CO₂.

NYSERDA has programs to use accrediting organizations to set standards and best practices for conducting energy efficiency upgrades. Program requirements concerning source removal, ventilation systems, minimum ventilation rates, and proper sizing and installing of HVAC systems help avoid and alleviate indoor air quality problems in existing buildings and associated health effects. NYSERDA also strives to support advanced sustainability standards and tools by partnering with organizations like the Collaborative for High Performance Schools, the U.S. Department of Energy, the U.S. Environmental Protection Agency (EPA), and the U.S. Green Building Council.

Energy efficiency upgrade programs could benefit public health, particularly if indoor air quality and other related environmental health factors are given adequate consideration. When effectively combined with other home intervention programs (such as the New York State Healthy Neighborhoods Program), energy efficiency upgrades can have direct and indirect health benefits for residents.¹⁷³ For example, these combined measures can reduce hot and cold thermal stress, arthritis symptoms, asthma hospitalization or emergency department visits, missed days of work, carbon monoxide poisonings, home fires, and trip and

¹⁷³ Gomez, Marta, MS; Amanda L. Reddy; Sherry L. Dixon, PhD; Jonathan Wilson, MPH; David E. Jacobs, PhD, CIH. 2017. "A Cost-Benefit Analysis of a State-Funded Healthy Homes Program for Residents with Asthma: Findings from the New York State Healthy Neighborhoods Program." *Journal of Public Health Management and Practice*: March/April 2017 - Volume 23 - Issue 2 - p 229-238.

fall injuries for residents.¹⁷⁴ These programs could also consider identifying code violations which increase risks associated with flooding, and thus contribute toward increased community resiliency. Public health and safety should be a primary consideration in the strict enforcement of building codes that are protective of residents during flood periods, particularly in flood-prone areas.

Electrification of the building sector will also reduce the health risks associated with combustion-based appliances for heating, cooking, and other uses. Leaking fossil fuel home heating systems were the primary cause listed among the 15,000 carbon monoxide poisonings resulting in emergency department visits in the United States annually.¹⁷⁵ In New York alone, there are approximately 1,500 emergency department visits and 160 hospitalizations for carbon monoxide poisoning annually.¹⁷⁶ Electrification of home heating systems could prevent many of these poisonings going forward.

In addition, combustion of fossil natural gas for cooking releases NO_x, PM_{2.5}, and carbon monoxide. Homes with gas stoves have, on average, 50% to 400% higher concentrations of NO₂ indoors than those without.¹⁷⁷ Residential indoor emissions of NO_x have been found to be linearly related to the amount of gas burned in stoves.¹⁷⁸ Adequately functioning range hoods have been shown to remove some but not all of this indoor air pollution.¹⁷⁹ Children living in homes with gas stoves have an increased risk of being diagnosed with asthma.¹⁸⁰ Individuals in Disadvantaged Communities are disproportionately affected by asthma and may be more likely to have unvented and/or piloted gas stoves. Thus, electrification of cooking appliances can reduce the risk of asthma in Disadvantaged Communities and improve the health

¹⁷⁴ Bureau of Environmental and Occupational Epidemiology, Center for Environmental Health, New York State Department of Health. Based on Analysis of Statewide Planning and Research Cooperative System Hospital Outpatient Emergency Department Data. Statewide Planning and Research Cooperative System (ny.gov).

¹⁷⁵ Centers for Disease Control and Prevention. 2008. “Nonfatal, Unintentional, Non-Fire Related, Carbon-Monoxide Exposures-U.S.”

¹⁷⁶ Bureau of Environmental and Occupational Epidemiology, Center for Environmental Health, New York State Department of Health. Based on Analysis of Statewide Planning and Research Cooperative System Hospital Outpatient Emergency Department Data. Statewide Planning and Research Cooperative System (ny.gov).

¹⁷⁷ U.S. Environmental Protection Agency. 2008. *Integrated Science Assessment for Oxides of Nitrogen – Health Criteria*. Research Triangle Park, NC.

¹⁷⁸ Lebel, Eric D., Colin J. Finnegan, Zutao Ouyang, and Robert B. Jackson. 2022. “Methane and NO_x Emissions from Natural Gas Stoves, Cooktops, and Ovens in Residential Homes.” *Environmental Science & Technology* 56 (4), 2529-2539. DOI: 10.1021/acs.est.1c04707

¹⁷⁹ Singer, Brett C., Rebecca Zarin Pass, William W. Delp, David M. Lorenzetti, Randy L. Maddalena. 2017. “Pollutant concentrations and emission rates from natural gas cooking burners without and with range hood exhaust in nine California homes.” *Building and Environment*, Volume 122, Pages 215-229, ISSN 0360-1323, <https://doi.org/10.1016/j.buildenv.2017.06.021>.

¹⁸⁰ Lin, W., B. Brunekreef, U. Gehring. “Meta-analysis of the effects of indoor nitrogen dioxide and gas cooking on asthma and wheeze in children.” *Int J Epidemiol*. 2013 Dec;42(6):1724-37.

of all New Yorkers. Note that cooking itself also releases pollutants, especially particulate matter (including PM_{2.5}), from charring, grilling, and frying, regardless of the heat source.¹⁸¹ While this indoor air quality impact cannot be addressed through building electrification, it underscores the importance of ensuring adequate ventilation in homes and commercial buildings, especially in coordination with building efficiency upgrades. Indoor concentrations can be significantly decreased with the use of range hoods, especially if they vent to the outdoors. However, even with range hoods, some pollution due to cooking and gas combustion will remain in the home.¹⁸²

Gas stoves may also increase indoor air concentrations of some hazardous air pollutants found as trace constituents of leaking natural gas, such as formaldehyde, and in some cases, benzene. Any hazardous air pollutants introduced indoors due to leaking natural gas while not cooking would not be vented or removed with the use of a range hood, which typically only operates during cooking. In a recent study of California homes, estimated benzene concentrations due to leaking natural gas from stoves varied depending on the source of the natural gas, by gas leakage rates, and by natural and active ventilation rates. With poor ventilation, natural gas from one source with high levels of benzene (a carcinogen) was projected to result in indoor air concentrations exceeding a California eight-hour Reference Exposure Level in some homes.¹⁸³⁻¹⁸⁴ Further study is needed to assess the potential for trace constituents of fossil natural gas sources in New York to impact the indoor air quality of homes through leakage from stoves during periods between cooking.

Biomass is burned in New York for heat and combined heat and power for the residential, commercial, and industrial sectors. Of these energy use sectors, the residential sector has the greatest use of wood for heating. New York is the nation's second largest consumer of wood for heating. While wood contributes less than 2% of the energy used for residential heating, estimated PM_{2.5} emissions from residential wood heating in New York State are greater than the emissions from all other heating fuels in the residential,

¹⁸¹ Bhangar, S., N.A. Mullen, S.V. Hering, N.M. Kreisberg, W.W. Nazaroff. "Ultrafine particle concentrations and exposures in seven residences in northern California." *Indoor Air*. 2011 Apr;21(2):132-44. doi: 10.1111/j.1600-0668.2010.00689.x. Epub 2010 Oct 28. PMID: 21029183.

¹⁸² Singer, Brett C., Rebecca Zarin Pass, William W. Delp, David M. Lorenzetti, Randy L. Maddalena. 2017. "Pollutant concentrations and emission rates from natural gas cooking burners without and with range hood exhaust in nine California homes." *Building and Environment, Volume 122*. Pages 215-229, ISSN 0360-1323, <https://doi.org/10.1016/j.buildenv.2017.06.021>.

¹⁸³ The California Environmental Protection Agency Office of Environmental Health Hazard Assessment defines a Reference Exposure Level as an airborne concentration of a chemical that is not anticipated to result in adverse non-cancer health effects for specified exposure durations in the general population, including sensitive subpopulations.

¹⁸⁴ Lebel, E.D., et al. 2022. "Composition, Emissions, and Air Quality Impacts of Hazardous Air Pollutants in Unburned Natural Gas from Residential Stoves in California." *Environmental Science Technology*. <https://doi.org/10.1021/acs.est.2c02581>

commercial, and industrial sector combined, and greater than the emissions from the entire transportation sector.¹⁸⁵ PM_{2.5} emissions from wood smoke vary by device and use conditions, with the highest intensity (emissions per energy unit) associated with hydronic heaters and fireplaces, followed by fireplace inserts and freestanding units, and the lowest intensity associated with pellet-fired units. While current EPA certification suggests that EPA-certified non-catalytic fireplace inserts and freestanding units have somewhat lower emissions, recent studies suggest that these units may have much higher emissions than suggested by the current testing methods. EPA is moving to adopt new testing protocols, developed by NYSERDA and the Northeast States for Coordinated Air Use Management, which will allow for better evaluation of real-world wood emissions from various systems and certification of cleaner systems.^{186,187} In general, the PM_{2.5} emissions intensity for all residential wood systems is higher than other heating fuels. Adverse health effects associated with exposure to wood smoke are consistent with those identified for PM_{2.5} (a major component of wood smoke) including exacerbation of cardiovascular symptoms (e.g., chest pain, heart rhythm changes, heart attack, stroke), and respiratory symptoms (e.g., asthma). The elderly, people with heart and lung diseases, people of low economic status, and children are particularly vulnerable to the effects of fine particle exposures in wood smoke. Wood smoke is often found in particularly rural areas of the State, and some wintertime smoke impacts are significant.¹⁸⁸ Increasing electrification of the building sector could reduce the impacts of combustion of biomass.

Commercial/Industrial Built Environment

In the industrial sector, in addition to the potential use of green hydrogen as described above for the power generation sector, carbon capture and sequestration could reduce GHG emissions. Depending on the specific technology, carbon capture and sequestration may also reduce emissions of some other pollutants, but in many cases does not. While carbon capture technology requires energy, which can lead

¹⁸⁵ Northeast States for Coordinated Air Use Management (NESCAUM). April 2016. *New York State Wood Heat Report: An Energy, Environmental, and Market Assessment Final Report*. Prepared for New York State Energy Research and Development Authority. NYSERDA Report 15-26 April 2016.

¹⁸⁶ “Special Issue on Wood Combustion.” *Journal of the Air & Waste Management Association*, 72.

Burkhard, Ellen. “Introduction to Special Issue on Residential Wood Combustion.” *Journal of the Air & Waste Management Association* 72(7), pp. 617–618

Marin, Arthur, Lisa Rector, Barbara Morin, and George Allen. “Residential wood heating: An overview of U.S. impacts and regulations.” *Journal of the Air & Waste Management Association* 72(7), pp. 619-628

Morin, Barbara, Mahdi Ahmadi, Lisa Rector, and George Allen. “Development of an integrated duty cycle test method to assess cordwood stove performance.” *Journal of the Air & Waste Management Association* 72(7), pp. 629-646.

¹⁸⁷ U.S. Environmental Protection Agency. “Process for Developing Improved Cordwood Test Methods for Wood Heaters.” <https://www.regulations.gov/docket/EPA-HQ-OAR-2016-0130>. Accessed 11/16/2022.

¹⁸⁸ George, Allen, and Lisa Rector. “Characterization of Residential Woodsmoke PM_{2.5} in the Adirondacks of New York.” *Aerosol and Air Quality Research* 20 (2020): 2419-2432.

to additional power sector emissions,¹⁸⁹ potential increases in emissions for powering carbon capture and sequestration would depend on the energy generation source.

¹⁸⁹ Jacobson, M.Z. “The health and climate impacts of carbon capture and direct air capture.” *Energy Environ. Sci.* 2019,12, 3567-3574.

Evaluation of the Plan

Chapter 9. Analysis of the Plan

9.1 Integration Analysis Approach

The objective of the integration analysis is to develop greenhouse gas (GHG) mitigation scenarios for the Scoping Plan that capture and account for how various strategies interact across sectors and evaluate the benefits and costs of the suite of strategies for achieving the Climate Act’s GHG emissions reduction requirements and goals. These mitigation scenarios incorporate Advisory Panel and Working Group recommendations, feedback from the Climate Action Council (Council), and Climate Justice Working Group (CJWG) input. The integration analysis is built within the New York Pathways model, which is a multi-model framework that includes a representation of all categories of GHG emissions in New York and takes as inputs relevant complementary analyses, including the Power Grid Study, building and transportation roadmap efforts, oil and gas system analysis, and refrigerant management analysis.

This chapter contains a high-level summary of the integration analysis results. The analysis has been updated since original publication of results in the draft Scoping Plan to align with the latest information available, including the Statewide GHG Emissions Report, key technology and fuel price forecasts, and other general improvements where appropriate (this update has been referred to as the “2022 vintage”).¹⁹⁰ This update does not affect the modeling structure, scenario definitions, key pathway themes, adoption trajectories, and performance of key technologies and measures. Detailed technical information on the mitigation scenarios presented in this chapter, including further description of the 2022 vintage updates, can be found in the Integration Analysis Technical Supplement (Appendix G).

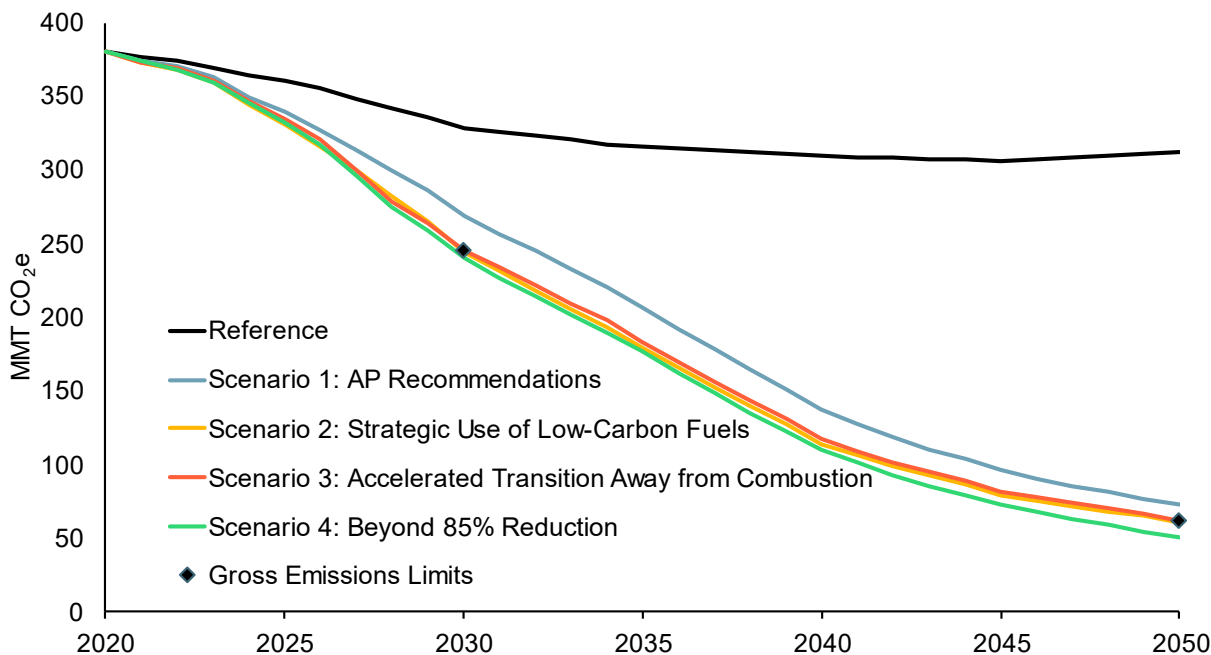
9.2 Scenario Design

The initial runs of the integration analysis evaluated a business-as-usual future (Reference Case) and a representation of a future based on an ambitious interpretation of the recommendations from the Council’s Advisory Panels (Scenario 1). Analytical results indicated that the Advisory Panel recommendations alone were not sufficient to achieve the Climate Act emission limits (Figure 4). These results were presented to the Council in July 2021 and initiated a scenario design planning exercise by the Council, facilitated by the analytical team and informed by feedback from the CJWG on the Advisory Panel recommendations, to develop scenarios with additional GHG emissions reductions. This exercise

¹⁹⁰ The latest Statewide GHG Emissions Report can be found at <https://www.dec.ny.gov/energy/99223.html>.

resulted in three additional scenarios designed to meet or exceed GHG limits and achieve carbon neutrality. Scenarios 2, 3, and 4 all share foundational themes based on findings from Advisory Panels and supporting analysis but represent different approaches based on Council feedback and CJWG input. The Council continued deliberations on these scenarios in 2022, informed by public comment on the draft Scoping Plan.

Figure 4. Greenhouse Gas Emissions by Mitigation Scenario



- **Reference Case:** Business as usual plus implemented policies.¹⁹¹
- **Scenario 1: Advisory Panel Recommendations:** Representation of the Advisory Panel recommendations, which provide a foundation for all scenarios; however, scenario modeling shows that further effort is needed to meet Climate Act emission limits.
- **Scenario 2: Strategic Use of Low-Carbon Fuels:** Advisory Panel recommendations adjusted for strategic use of bioenergy derived from biogenic waste, agriculture and forest residues, and limited purpose grown biomass, as well as a critical role for green hydrogen for difficult-to-electrify applications. This scenario includes a role for negative emissions technologies to reach carbon neutrality.
- **Scenario 3: Accelerated Transition Away from Combustion:** Advisory Panel recommendations adjusted to include accelerated electrification of buildings and transportation

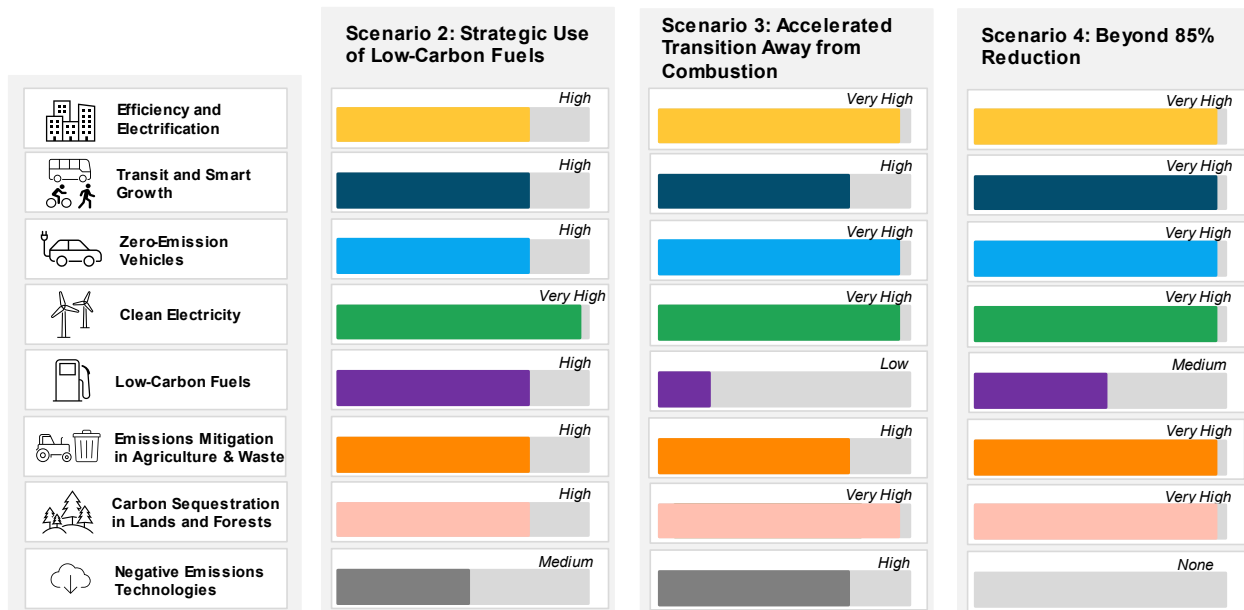
¹⁹¹ The Reference Case is used for evaluating incremental societal costs and benefits of GHG emissions mitigation.

and a very limited role for bioenergy and hydrogen combustion. This scenario includes a role for negative GHG emissions technologies to reach carbon neutrality.

- Scenario 4: Beyond 85% Reduction:** Advisory Panel recommendations adjusted to reflect accelerated electrification and targeted use of low-carbon fuels. This scenario includes additional reductions in vehicle miles traveled (VMT) and innovation in methane abatement. This scenario reduces gross GHG emissions beyond the 2050 limit and avoids the need for negative emission technologies.

Figure 5 highlights the key differences in assumptions across the three scenarios that meet or achieve New York’s GHG emission limits and achieve carbon neutrality by 2050. All scenarios share common foundational themes of decarbonization, including a zero-emission power sector by 2040, enhancement and expansion of transit, unprecedented rapid and widespread efficiency and electrification, electric end-use load flexibility, and methane mitigation in agriculture and waste.

Figure 5. Level of Transformation by Mitigation Scenario



Note: More detailed scenario assumptions are available in Appendix G: Integration Analysis Technical Supplement.

Transformative, challenging, and potentially disruptive levels of effort are required across all sectors, and all three scenarios include high levels of electrification, including Scenario 2, which also incorporates the strategic use of low-carbon fuels. Scenario 3 pushes harder on accelerated electrification to meet the GHG emission limits using a very low-bioenergy and low-combustion mix of strategies. Scenario 4 pushes beyond 85% direct reductions in 2050 by layering some low-carbon fuels back in, examining very high

VMT reduction, and assuming high (but also highly uncertain) levels of innovation in the waste and agriculture sectors. Scenario 4 is the only evaluated scenario that achieves carbon neutrality without the use of negative emissions technologies like direct air capture of carbon dioxide (CO₂), which is also subject to high uncertainty, but is required in Scenarios 2 and 3 to address the gap between remaining gross emissions in 2050 and the ambitious assumed projections of natural sequestration. Figure 6 shows the emissions reductions under Scenario 1. Key assumptions for scenarios 2, 3, and 4 are shown in Figure 7, Figure 8, and Figure 9. Additional documentation of scenario assumptions can be found in the Integration Analysis Technical Supplement (Appendix G).

Figure 6. Advisory Panel Recommendations

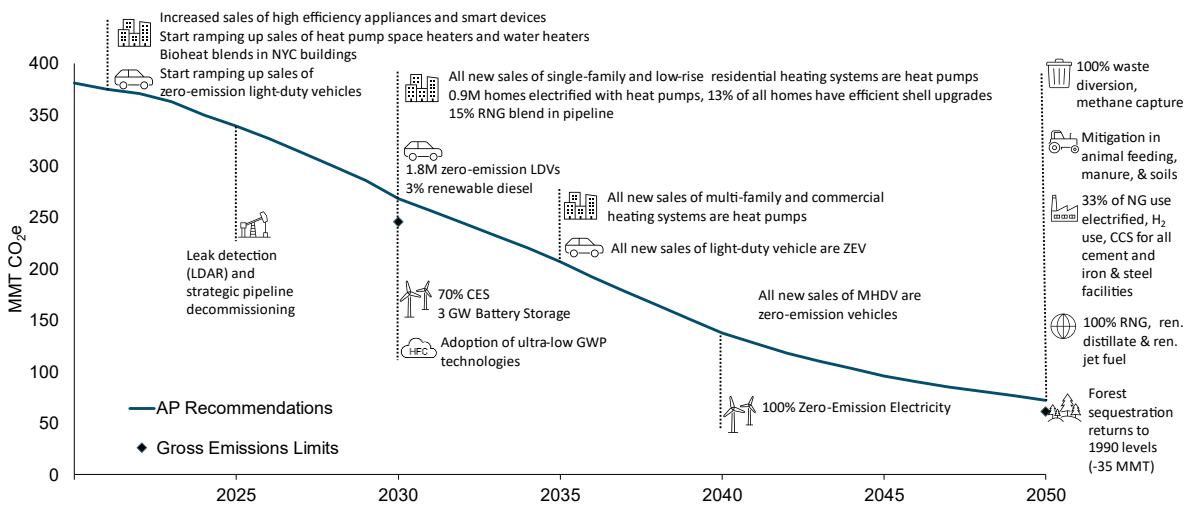


Figure 7. Key Assumptions in Scenario 2: Strategic Use of Low-Carbon Fuels

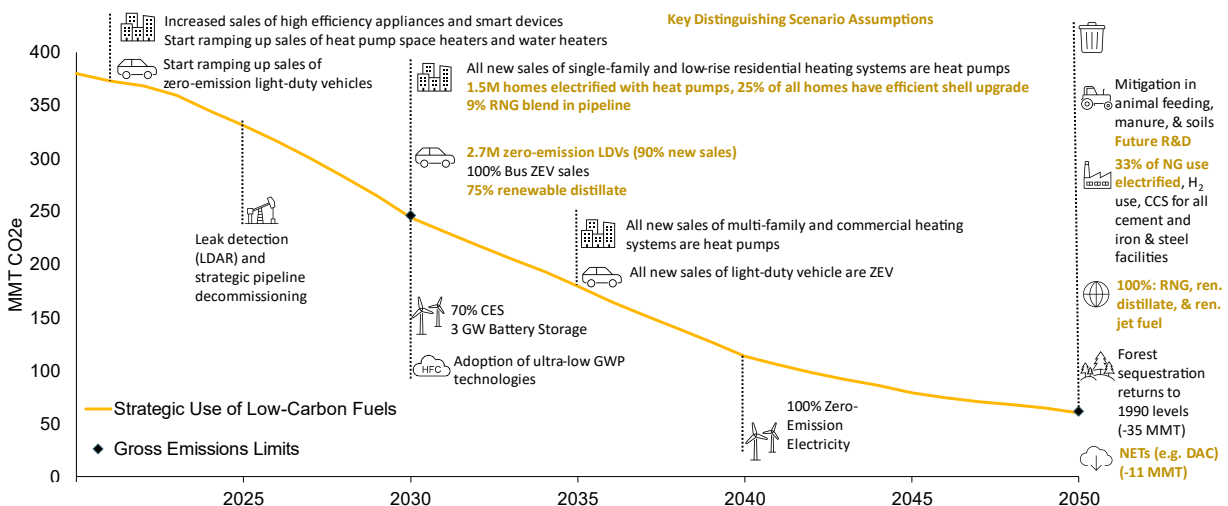


Figure 8. Key Assumptions in Scenario 3: Accelerated Transition Away from Combustion

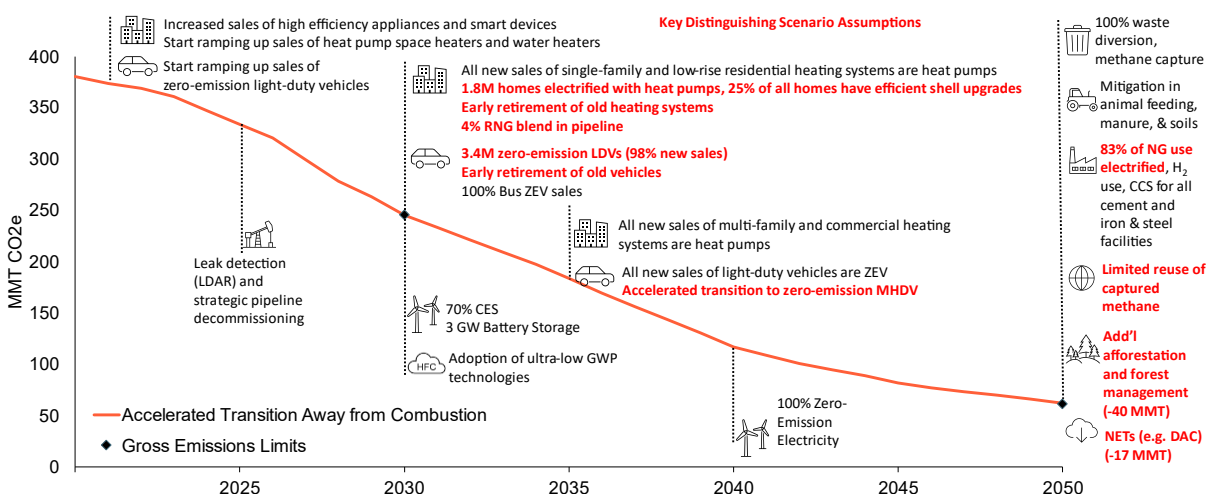
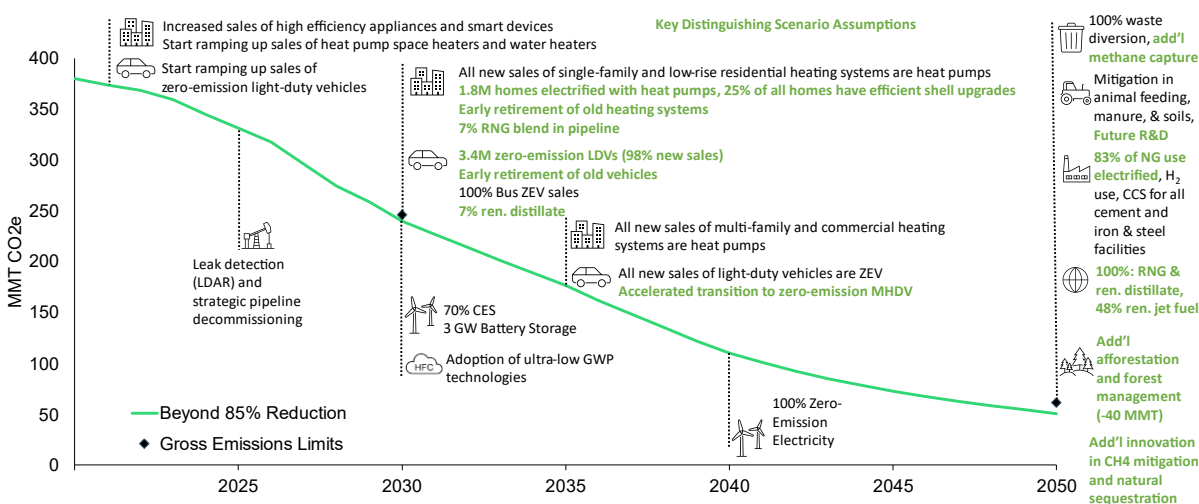


Figure 9. Key Assumptions in Scenario 4: Beyond 85% Reduction



9.3 Key Findings

The integration analysis presented multiple pathways to achieving the GHG emission limits and led to several key findings:

- Achieving deep decarbonization is feasible by mid-century.** Achieving the GHG emission limits **requires action in all sectors**, especially considering the Climate Act’s emissions accounting, as described in *Chapter 4. Current Emissions*. Every sector will see high levels of transformation over the next decade and beyond, requiring critical investments in New York’s economy.

- **Energy efficiency and end-use electrification are essential parts of any pathway that achieves New York State emission limits.** Approximately 1 to 2 million efficient homes will need to be electrified with heat pumps by 2030. Approximately 3 million zero-emission vehicles (predominantly battery electric) will need to be sold by 2030.
- **A transition to low global warming potential (GWP) refrigerants and enhanced refrigerant management will be required** to electrify while reducing and ultimately eliminating GHG emissions from hydrofluorocarbon (HFC)-based refrigerants used in today’s heat pumps.
- **Consumer and community decision-making is key, and especially important for the purchase of new passenger vehicles and heating systems for homes and businesses through the next decade.** In all modeled scenarios, zero-emission vehicles and heat pumps will need to become the majority of new purchases by the late 2020s, and fossil fuel-emitting cars and appliances will no longer be sold after 2035. This represents an unprecedented rate of adoption of novel and potentially disruptive technologies and measures.
- **New York will need to substantially reduce VMT while increasing access to public transportation.** This should include expanding transit services structured around community needs, smart growth inclusive of equitable transit-oriented development (E-TOD), and transportation demand management.
- **Wind, water, and sunlight will power most of New York’s economy in 2050 in all pathways.** Even with aggressively managed load, electric consumption doubles and peak load nearly doubles by 2050, and New York becomes a winter peaking system by 2035, with offshore wind of around 15 gigawatts (GW), solar of around 60 GW, and four- and eight-hour battery storage of around 20 GW by 2050. Firm, zero-emission resources, such as green hydrogen or long-duration storage, will be important to ensuring a reliable electricity system beyond 2040.
- **Low-carbon fuels such as bioenergy or hydrogen may help to decarbonize sectors that are challenging to electrify.** By 2030, scenarios include initial market adoption of green hydrogen in several applications, including medium- and heavy-duty (MHD) vehicles and high-temperature industrial. Additional promising end-use applications include district heating and non-road transportation such as aviation and rail.
- **Large-scale carbon sequestration opportunities include lands and forests and negative emissions technologies.** Protecting and growing New York’s forests is required for carbon neutrality. Negative emissions technologies (such as the direct air capture of CO₂) may be required if the state cannot exceed 85% direct GHG emissions reductions by 2050. Strategic land use planning will be essential to balance natural carbon sequestration, agriculture activities, new renewables development, and smart urban planning (smart growth).

- **Necessary methane emissions mitigation in waste and agriculture will require transformative solutions.** Diversion of organic waste and the capture of fugitive methane emissions are key in the waste sector. Alternative manure management and animal feeding practices will be critical in reducing methane emissions in agriculture.
- **Continued research, development, and demonstration (RD&D) is key to advancing a full portfolio of options and mitigating risk.** Additional innovation will be required in areas such as carbon sequestration solutions, long-duration storage, flexible electric loads, low-GWP refrigerants, and animal feeding, in concert with federal action (such as Earthshots).
- **The largest three remaining sources** of emissions in 2050 across scenarios are landfills, aviation, and animal feeding.

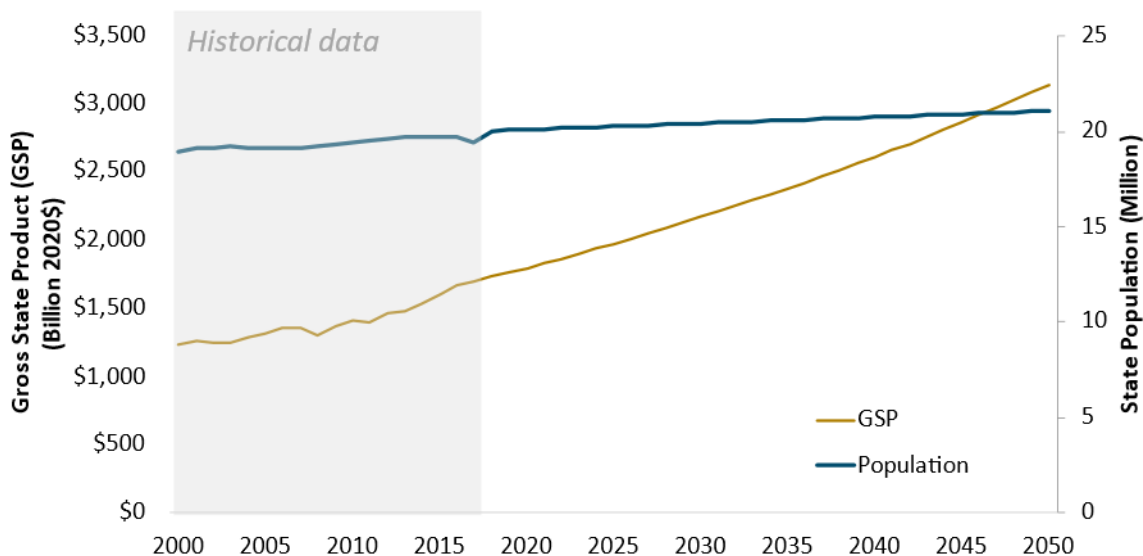
More detailed economywide and sectoral results are presented in the Integration Analysis Technical Supplement (Appendix G).

Chapter 10. Benefits of the Plan

10.1 Background

New York’s economy has been steadily growing for the last two decades and state economic output per capita has been growing even more quickly. These trends are projected to continue over time (Figure 10).

Figure 10. Historical and Projected Population and Gross State Product



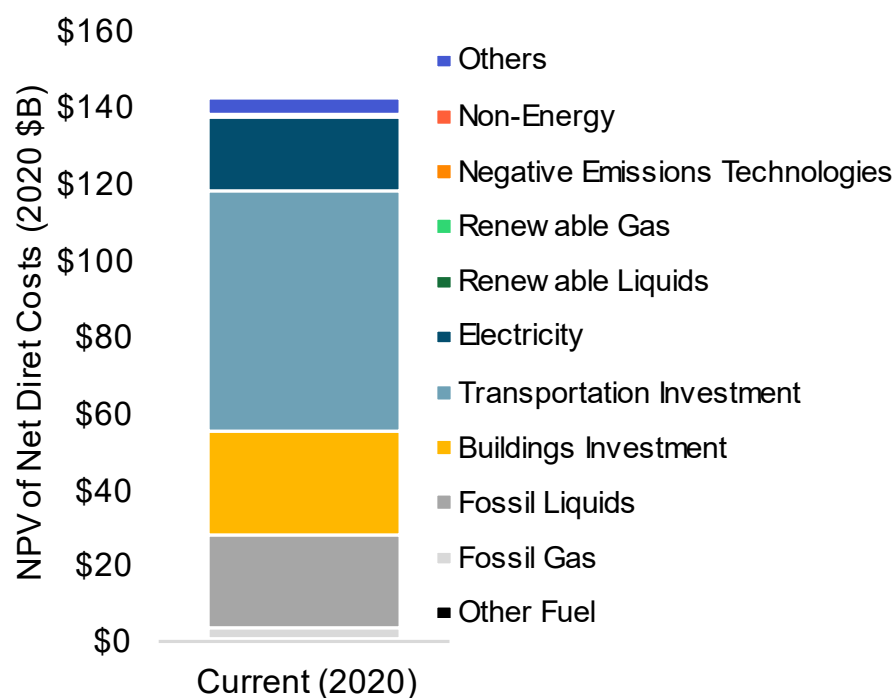
Source: NYSERDA Patterns and Trends, Federal Reserve Economic Data, Cornell Program on Applied Demographics.

Current annual system expenditure—the costs related to energy consumption in the state—to support New York’s population and economy is estimated to be over \$140 billion. This estimate includes capital investments for energy-consuming devices, liquid and gas fuel costs, and costs for in-State and imported electricity generation. While system expenditures are significant at over \$140 billion, these make up a small share of gross state product (GSP; 8.9% in 2020, see Figure 11).

Of these total system expenditures, annual energy expenditures are approximately \$50 billion, with over half of that amount (almost \$30 billion) estimated to leave New York State.¹⁹² Petroleum fuel expenditures are the largest single category at approximately \$24 billion. Current energy expenditures outline the opportunity for import substitution through electrification, where a greater share of energy services is provided by in-State resources, driving economic activity and job creation.

¹⁹² NYSERDA. “New York State Energy Profile. Patterns and Trends.” Accessed at <https://www.nyserra.ny.gov/about/publications/ea-reports-and-studies/patterns-and-trends>.

Figure 11. Estimated Current System Expenditure by Category



Note: Estimated system expenditures do not reflect direct costs in some sectors that are represented with incremental costs only. These include investments in industry, agriculture, waste, forestry, and non-road transportation.

10.2 Integration Analysis Benefit-Cost Approach

In addition to analyzing greenhouse gas (GHG) reductions, the integration analysis sought to quantify the costs and benefits of the mitigation scenarios described in *Chapter 9. Analysis of the Plan*. The quantified benefits include the value of avoided GHG emissions and avoided health impacts; cost categories include annualized capital, operations, and maintenance cost for infrastructure (such as devices, equipment, generation assets, and transmission and distribution) and annual fuel expenses by sector and fuel (conventional or low-carbon fuels, depending on scenario definitions).¹⁹³

Value of Avoided GHG Emissions

All scenarios model significant GHG emissions reductions, which avoid the economic impacts of damages caused by climate change. The value of avoided GHG emissions calculations are based on the Value of Carbon guidance, developed by New York State Department of Environmental Conservation

¹⁹³ This analysis does not natively produce detailed locational or customer class analysis, but those may be developed through subsequent implementation processes. More specificity is needed around individual proposals in order to determine the impact on specific customers. The Council recommends that as proposals are advanced with additional implementation details, a complete consumer benefit-cost impact be performed to show the impact and inform program design prior to full implementation.

(DEC) pursuant to the Climate Act.¹⁹⁴ The value of these avoided GHG emissions is measured in each scenario relative to the Reference Case. GHG emissions were measured using value of avoided carbon dioxide (CO₂), avoided methane, avoided nitrous oxide (N₂O), and avoided hydrofluorocarbons (HFCs). For other GHGs, avoided emissions were converted to carbon dioxide equivalent (CO₂e) using the Intergovernmental Panel on Climate Change's (IPCC) AR5 20-year GWP values. The avoided GHG emissions time series in each year was multiplied by the annual social cost of GHG based on the DEC Value of Carbon guidance appendix, using the central case estimate for each GHG (2% discount rate for GHG emissions). More information on the approach to estimating the value of avoided GHG emissions can be found in the Integration Analysis Technical Supplement (Appendix G).

Value of Health Co-Benefits

The integration analysis also evaluated health benefits of mitigation scenarios relative to the Reference Case. For more information on these analyses, see Health Effects below. Three categories of potential health benefits were analyzed:

- Improvements in health outcomes due to improved air quality, including reduced incidence of premature mortality, heart attacks, hospitalizations, asthma exacerbation and emergency room visits, and lost workdays¹⁹⁵
- Public health benefits from increased physical activity due to increased use of active transportation modes (such as walking and cycling) while accounting for changes in traffic collisions
- Estimated benefits of energy efficiency interventions in low- to moderate-income (LMI) homes

Integration Analysis Costs

The pathways framework produces economywide resource costs for the various mitigation scenarios relative to a reference case. The framework is focused on annual societal costs and benefits and does not track internal transfers (such as incentives). Outputs are produced on an annual time scale for the state of New York, with granularity by sector.

¹⁹⁴ The value of avoided GHG emissions calculations are based on DEC guidance, which can be accessed at <https://www.dec.ny.gov/regulations/56552.html>.

¹⁹⁵ Health benefits are calculated as “High” and “Low.” The economywide benefits applied the High case and the Low case are included in the uncertainty analysis. For more information, see Appendix G.

The integration analysis included calculations for three cost metrics: net present value (NPV) of net direct costs, annual net direct costs, and system expenditure. Cost estimates do not include estimates of federal funding available as per the Inflation Reduction Act, which is examined as a sensitivity.

- **NPV of Net Direct Costs:** This is the NPV of levelized costs in a given scenario incremental to the Reference Case from 2020 through 2050.¹⁹⁶ This metric includes incremental direct capital investment, operating expenses, and fuel expenditures.
- **Annual Net Direct Costs:** Net direct costs are levelized costs in a given scenario incremental to the Reference Case for a single year snapshot. This metric includes incremental direct capital investment, operating expenses, and fuel expenditures.
- **System Expenditure:** System expenditure is an estimate of absolute direct costs (not relative to the Reference Case). Estimates of system expenditure do not reflect direct costs in some sectors that are represented with incremental costs only. These include investments in industry, agriculture, waste, forestry, and non-road transportation.

Cost categories included in the metrics listed above are shown in Table 4. Cost outputs from the integration analysis are key inputs to the Jobs Study described *Chapter 7. Just Transition*.

Table 4. Integration Analysis Cost Categories

Cost Category	Description
Electricity System	Includes incremental capital and operating costs for electricity generation, transmission (including embedded system costs), distribution systems, and in-State hydrogen production costs.
Transportation Investment	Includes incremental capital and operating expenses in transportation (e.g., battery electric vehicles (EVs) and EV chargers)
Building Investment	Includes incremental capital and operating expenses in buildings (e.g., heat pumps and building upgrades)
Non-Energy	Includes incremental mitigation costs for all non-energy categories, including agriculture, waste, and forestry
Renewable Gas	Includes incremental fuel costs for RNG and imported green hydrogen
Renewable Liquids	Includes incremental fuel costs for renewable diesel and renewable jet kerosene

¹⁹⁶ All NPV calculations assume a discount rate of 3.6%. This discount rate was applied to all annual cost and benefit streams, including the value of avoided GHG emissions, which has an embedded, separate, and distinct perspective on discounting described in the DEC Value of Carbon guidance, which can be accessed at <https://www.dec.ny.gov/regulations/56552.html>.

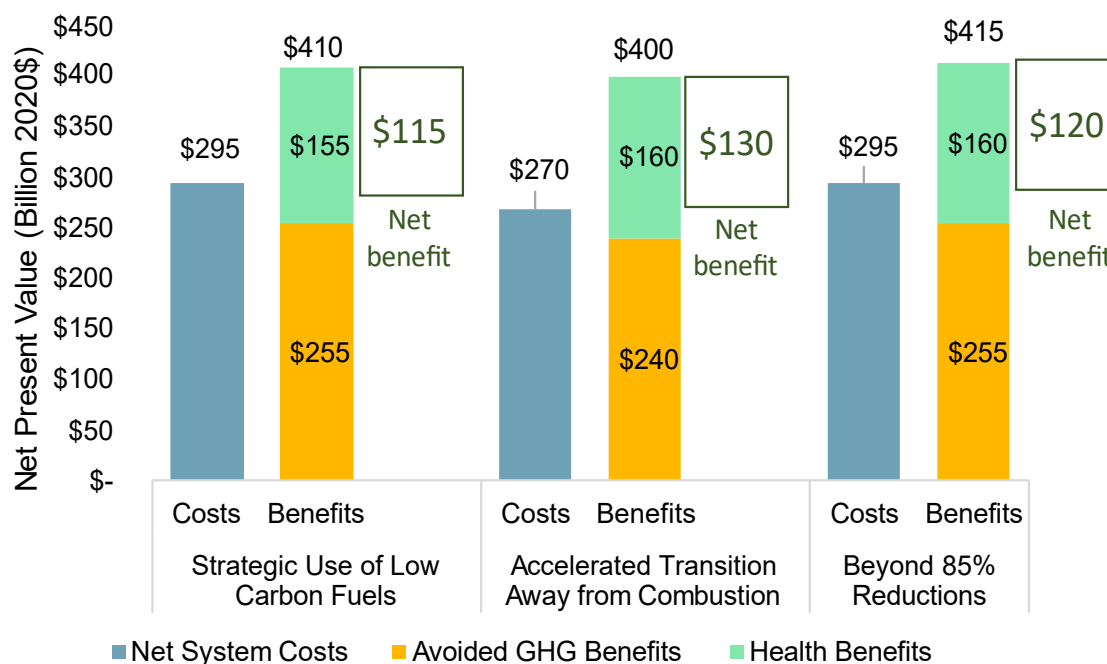
Cost Category	Description
Negative Emission Technologies	Includes incremental costs for direct air capture of CO ₂ as a proxy for Negative Emission Technologies
Other	Includes other incremental direct costs including industry sector costs, oil & gas system costs, HFC alternatives, and hydrogen storage
Fossil Gas	Includes incremental costs spent on fossil natural gas (shown as a negative for cases when gas expenditures are avoided compared with the Reference Case)
Fossil Liquids	Includes incremental costs spent on liquid petroleum products (shown as a negative for cases when liquids expenditures are avoided compared with the Reference Case)
Other Fuel	Includes incremental costs spent on all other fossil fuels

10.3 Key Benefit-Cost Assessment Findings

The integration analysis assessed the benefits of avoided GHG emissions, health co-benefits, and resource costs for Scenario 2: Strategic Use of Low-Carbon Fuels, Scenario 3: Accelerated Transition Away from Combustion, and Scenario 4: Beyond 85% Reduction (Figure 12). There are three key findings from this assessment:

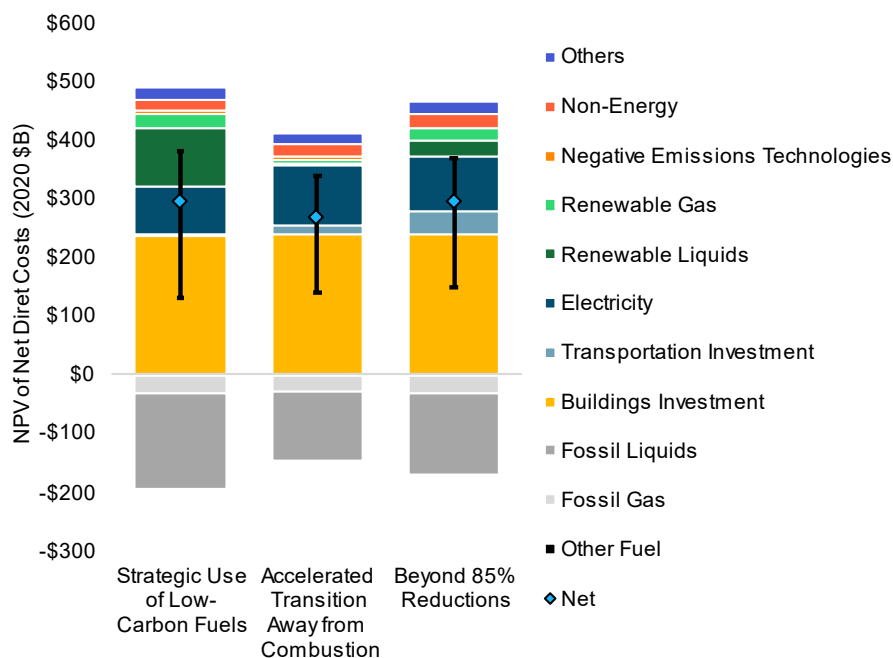
- **The cost of inaction exceeds the cost of action by more than \$115 billion.** There are significant investments required to achieve Climate Act GHG emission limits, accompanied by even greater external benefits and the opportunity to create hundreds of thousands of jobs.
- **Net benefits range from \$115 billion to \$130 billion.** Improvements in air quality, increased active transportation, and energy efficiency interventions in LMI homes generates health benefits ranging from approximately \$155 billion to \$160 billion. Reduced GHG emissions avoids the economic impacts of damages caused by climate change equaling approximately \$240 to \$255 billion. The combined benefits range from approximately \$400 billion to \$415 billion.
- **Net direct costs are small relative to the size of New York’s economy.** Net direct costs are estimated to be 0.5% to 0.6% of gross state product (GSP) in 2030, and 1.3% of GSP in 2050.
- **The Inflation Reduction Act will meaningfully reduce net direct costs.** New York could realize up to \$70 billion of federal resources in support of the Scoping Plan initiatives through 2050, which would reduce incremental costs to New Yorkers by up to 19%.

Figure 12. Summary of Benefits and Costs (NPV Relative to Reference Case)



The NPV of net direct costs in Scenario 2, Scenario 3, and Scenario 4 are in the same range (due to uncertainty) and are primarily driven by investments in buildings and the electricity system (Figure 13). All scenarios show avoided fossil fuel expenditures due to efficiency and fuel-switching relative to the Reference Case (shown in the chart as negative costs). Scenario 2: Strategic Use of Low-Carbon Fuels includes significant investment in renewable diesel, renewable jet kerosene, and renewable natural gas (RNG). Scenario 3: Accelerated Transition Away from Combustion meets emission limits with greater levels of electrification, which results in greater investments in building retrofits, zero-emission vehicles, and the electricity system. Scenario 4: Beyond 85% Reduction builds on the electrification levels in Scenario 3, includes greater investments in transportation, waste, and agriculture sector mitigation, and layers back in a limited use of low-carbon fuels to reduce gross GHG emissions beyond the 2050 limit. Scenario costs are sensitive to the price of fossil fuels and technology cost projections, as reflected in error bars. The sensitivity bars shown in Figure 13 include low and high price sensitivities for fossil and low-carbon fuels and a range of technology costs for building technologies, transportation technologies, and direct air capture. New high fuel price and high technology cost sensitivities were performed in 2022 in light of global supply chain disruptions. The Inflation Reduction Act (not included here) will further reduce net direct costs. More detail on these sensitivities is included in section 10.4 2022 Cost Sensitivity Analysis, below. The complete list of uncertainty and sensitivity analysis can be found in the Integration Analysis Technical Supplement (Appendix G).

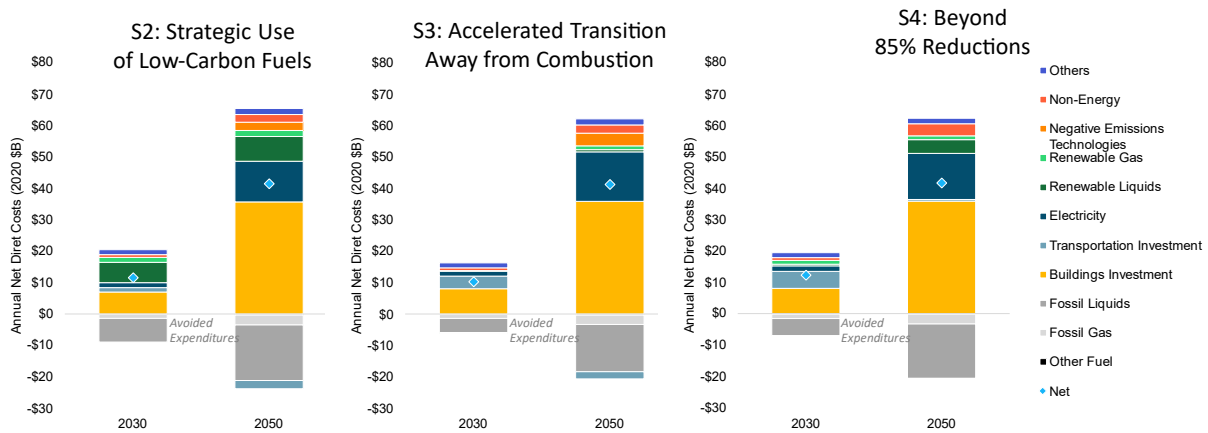
Figure 13. NPV of Net Direct Costs Relative to Reference Case (2020–2050)



Note: Uncertainty error bars include low and high fossil fuel price sensitivities and range of costs for heat pumps, EVs, wind, solar, storage, advanced renewable fuels, and direct air capture of CO₂. This figure does not include Inflation Reduction Act funding which further reduces net direct costs.

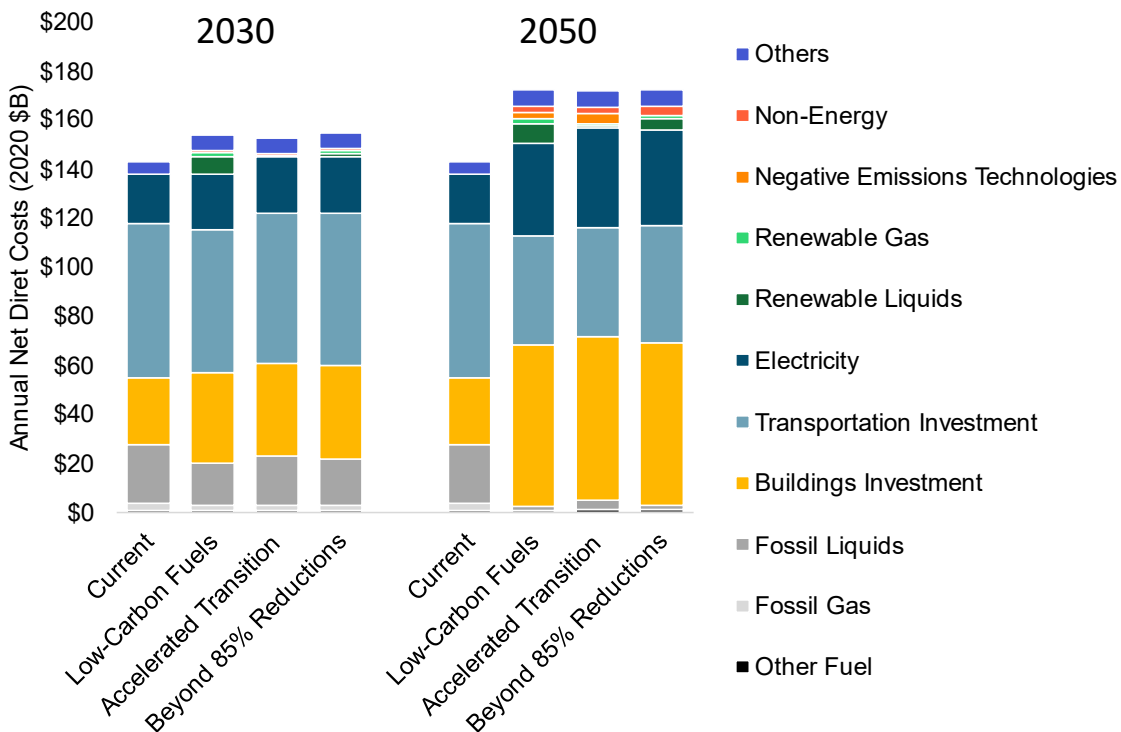
Annual net direct costs show the timing of key investments required to meet the Climate Act GHG emission limits. Scenario 2 includes significant investment in renewable diesel, renewable jet kerosene, and RNG starting in the mid-2020s. Scenario 3 includes greater levels of electrification compared with Scenario 2, which results in greater investments in building retrofits, zero-emission vehicles, and the electricity system. Scenario 4 layers on additional investments in transportation, agriculture, and waste mitigation relative to Scenario 3. Both scenarios 2 and 3 include investment in negative emissions technologies to achieve net zero emissions by 2050, whereas Scenario 4 does not require any negative emissions technologies due to the incremental investments in transportation, smart growth, agriculture, waste reductions. In 2030, annual net direct costs relative to the Reference Case are around \$11 billion per year, approximately 0.5% of GSP; in 2050, costs increase to \$41 billion per year, or 1.3% of GSP (Figure 14).

Figure 14. Annual Net Direct Costs Relative to Reference Case in Scenarios 2-4



Net direct costs were measured relative to the Reference Case, but system expenditures were evaluated on an absolute basis. System expenditures increase over time as New York invests in infrastructure and clean fuels to meet the Climate Act’s emission limits. Compared with current estimated system expenditures, cost increases are moderate: 7% to 8% in 2030 and 20% to 21% in 2050 (Figure 15).

Figure 15. Annual System Expenditures in Scenarios 2-4



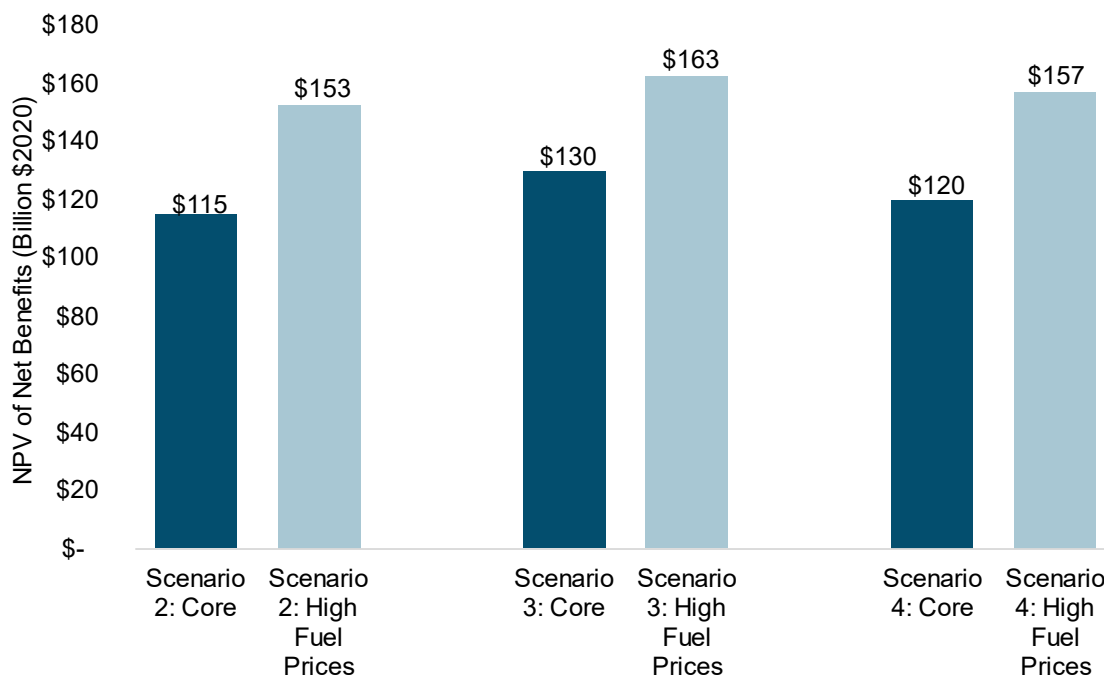
More detail on the benefit-cost assessment approach, input assumptions, results, uncertainty analysis, and sensitivity analysis is included in the Integration Analysis Technical Supplement (Appendix G).

10.4 2022 Cost Sensitivity Analysis

Since the publication of the draft Scoping Plan in 2021, the prices for several key technologies and fuels have changed due to a variety of factors such as global fuel market volatility and supply chain disruption. Additionally, the passage of the Inflation Reduction Act will lead to new incentives that can offset the cost of decarbonization. New sensitivities were performed in support of the Final Scoping Plan to consider the effects of these developments. More details are provided in Appendix G.

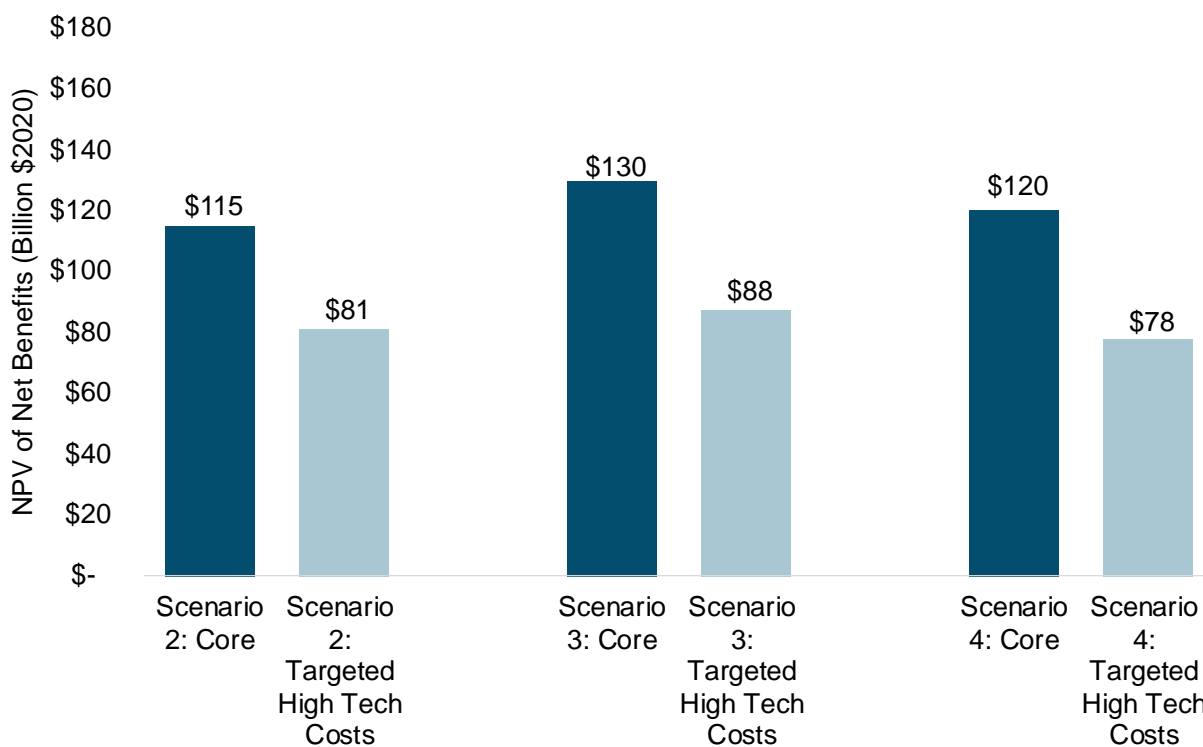
A high fuel price sensitivity evaluated the effects of the potential for persistently higher fossil fuel prices. The high fossil fuel prices increase the costs of all cases, with the largest increase in costs occurring in the Reference Case where a higher share of consumption remains fossil. This dynamic increased the net benefit of the mitigation scenarios by \$33 to \$38 billion compared with the original runs, which underscores the value of a transition to renewables to reduce exposure to higher fossil fuel prices (Figure 16).

Figure 16. Net Benefits: High Fuel Price Sensitivity



The draft Scoping Plan included a low technology cost sensitivity that explored the effects of more industry learning than what was included in the core cases. A new targeted high technology cost sensitivity was developed to explore the effects of higher prices for clean buildings and transportation technologies from near-term supply chain issues that could persist. These higher technology costs would particularly increase the costs of the mitigation scenarios, which have higher adoption of heat pumps and electric vehicles. This would reduce the net benefits of the mitigation scenarios by \$34 to \$42 billion compared with the reference case (Figure 17). Even under this targeted high technology cost sensitivity, all mitigation scenarios see significant net benefits relative to the Reference Case.

Figure 17. Net Benefits: Targeted High Technology Cost Sensitivity

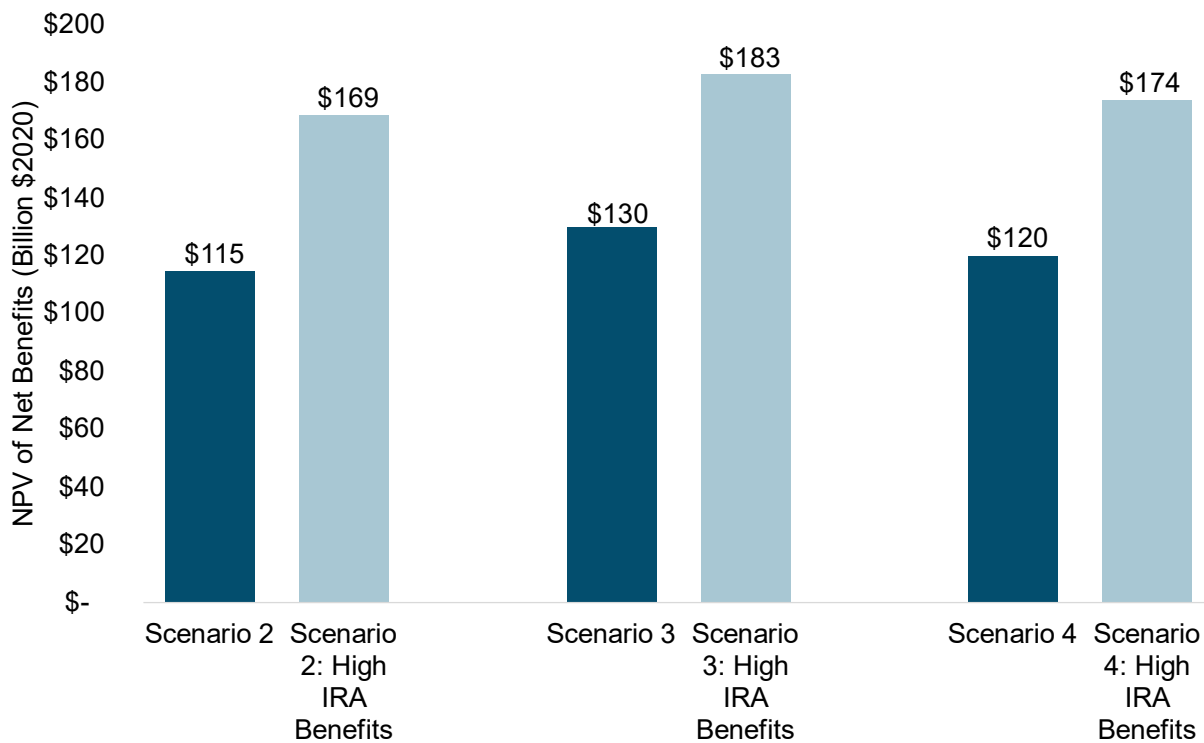


The passage of the federal Inflation Reduction Act is a major policy development that will provide important funding that can offset the costs of decarbonization economywide. The full impacts of the act will take additional time to understand in more detail. To provide an initial estimate of the impact to New York, a new sensitivity was performed to estimate the federal funding that could be available to offset the cost to achieve Climate Act requirements and goals and the impact of this federal funding on scenario benefit-cost analysis. The modeling focuses on the largest climate and energy provisions with the clearest implications and considers a range of outcomes to reflect uncertainty for the impact of key parameters (e.g., domestic content provisions, income caps, tax liability). It does not model impacts of all funding (e.g., manufacturing grants, early-stage innovation, and block grants, which will play an important role in

keeping New York on track and driving equitable outcomes but were too uncertain to model). In total, the Inflation Reduction Act could provide \$41 to \$69 billion to reduce the costs to New York to meet the requirements of the Climate Act.

The Inflation Reduction Act incentives are higher in the mitigation scenarios than in the Reference Case, due to greater adoption of clean technologies and fuels eligible for incentives (e.g., EVs, heat pumps, renewables, battery storage, and hydrogen). As a result, the Inflation Reduction Act increases net benefits of the Mitigation Scenarios by up to \$50 billion, compared with the core 2022 net benefit results (Figure 18). Federal funding associated with the Inflation Reduction Act affects all sectors of the economy, with the majority of benefits accruing to electric generation, electric vehicles, building efficiency and electrification, and hydrogen and alternative fuels production. More details are provided in Appendix G.

Figure 18. Inflation Reduction Act Sensitivity Net Benefits



10.5 Health Effects

Health Analyses Approach Overview

The analysis of potential public health benefits associated with the decarbonization policy scenarios evaluated the potential for the scenarios to affect changes in public health outcomes relative to the

Reference Case. As discussed in *Chapter 9. Analysis of the Plan*, the scenarios modeled in the integration analysis have been updated between the draft and this final Scoping Plan. The public health analysis discussed below has been updated accordingly to reflect the changes in energy consumption in the integration analysis scenarios. One exception to this is that detailed electricity sector production modeling was not undertaken again for the health analysis. Based on the changes projected in the electricity generation mix between the draft and final Scoping Plans, the potential change in health benefits is estimated to be relatively minor, approximately 0.4% of the total health benefits. Three analyses were undertaken, evaluating the potential to:

- Improve air quality and ensuing health outcomes through reduced combustion and associated pollutant emissions
- Improve public health through increased activity associated with active transportation modes such as walking and cycling
- Improve health outcomes in homes, especially LMI homes, through energy efficiency interventions

The air quality analysis applied the U.S. Environmental Protection Agency's (EPA) CO Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping Tool, customized with detailed inputs specific to New York State and the scenarios analyzed, to evaluate air quality and ensuing public health outcomes at the county level. COBRA evaluates ambient air quality based on emissions of direct fine particulate matter (PM_{2.5}) and its precursors (SO₂, VOC, and NO_x) and the ensuing changes in annual average total PM_{2.5} concentrations. The results include 12 different health outcomes, such as premature mortality, heart attacks, hospitalizations, asthma exacerbation and emergency room visits, and lost workdays. Results are calculated as "High" and "Low," reflecting two alternative methods adopted by EPA for evaluating premature mortality and non-fatal heart attacks based on two epidemiological studies of the impacts of air quality on public health. The economywide benefit results described in the sections above applied the High case, and the Low case is included in the uncertainty analysis described in Appendix G. Note that COBRA does not include additional potential benefits from reduced ozone concentrations; the value of those benefits is estimated to be a few percent of the benefits associated with PM_{2.5}. Additional benefits not included are potential benefits associated with reduced NO₂ concentrations and reduced toxics, which were not evaluated given the high uncertainty and lack of sufficient data to provide reasonable estimates.

COBRA was applied to the Reference Case and the policy scenarios described above for 2020 through 2050 in five-year increments, and the value of the improved health outcomes was interpolated to estimate

benefits for the entire period. The analysis includes emissions in all sectors and all states, and the effect of the scenarios on emissions in New York as well as any potential effect of changes in New York's electricity consumption on electricity generation in other states.

Potential public health benefits from increased physical activity due to increased use of active transportation modes, while accounting for potential increases in traffic collisions, were estimated using the Integrated Transport Health Impacts Model, customized to represent New York State.

Values from published literature on the health and safety benefits of energy system changes and weatherization programs in homes were used to estimate the potential benefits of energy efficiency interventions. These applied only to LMI homes expected to have upgraded systems and weatherization. While additional benefits may result from building changes in higher-income homes, those benefits would likely be less, and no data are available to estimate those details. For a detailed description of the health analyses methods, see Appendix G.

Key Health Findings

Decarbonizing New York can result in a substantial health benefits from improved air quality, on the order of \$50 billion to \$110 billion from 2020 through 2050 (based on reduced mortality and other health outcomes) relative to the Reference Case.

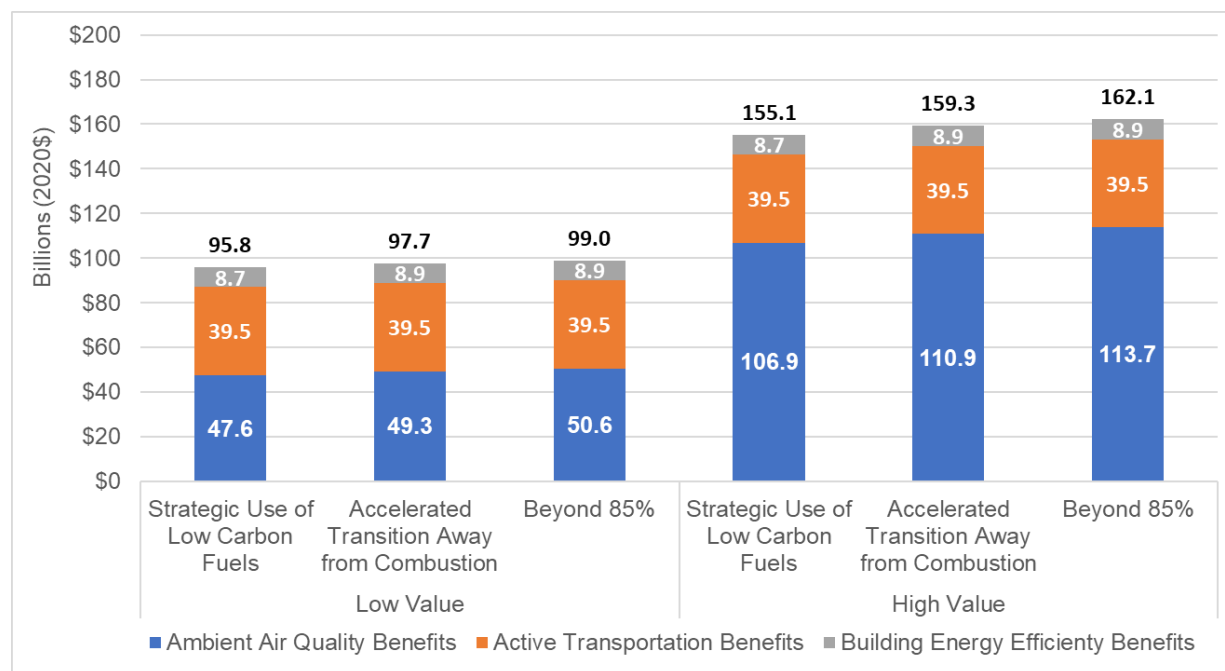
- Benefits would be experienced throughout the State and downwind in neighboring states.
- Benefits of reduced fossil fuel combustion would be higher in urban areas due to both higher emissions and larger impacted populations.
- Benefits of potentially reduced wood combustion would be higher in upstate areas.
- Annual benefits would grow over time as pollution rates decrease.

Two additional potential health benefit categories were estimated:

- \$40 billion associated with the health benefits of increased active transportation (such as walking and cycling)
- \$9 billion associated with energy efficiency interventions in LMI homes (additional benefits, not quantified, may occur in other buildings as well)

The total projected potential health benefits associated with the scenarios analyzed are presented in Figure 19. Results are presented for the High Value and Low Value cases.

Figure 19. Total Projected Health Benefits (NPV, 2020–2050)



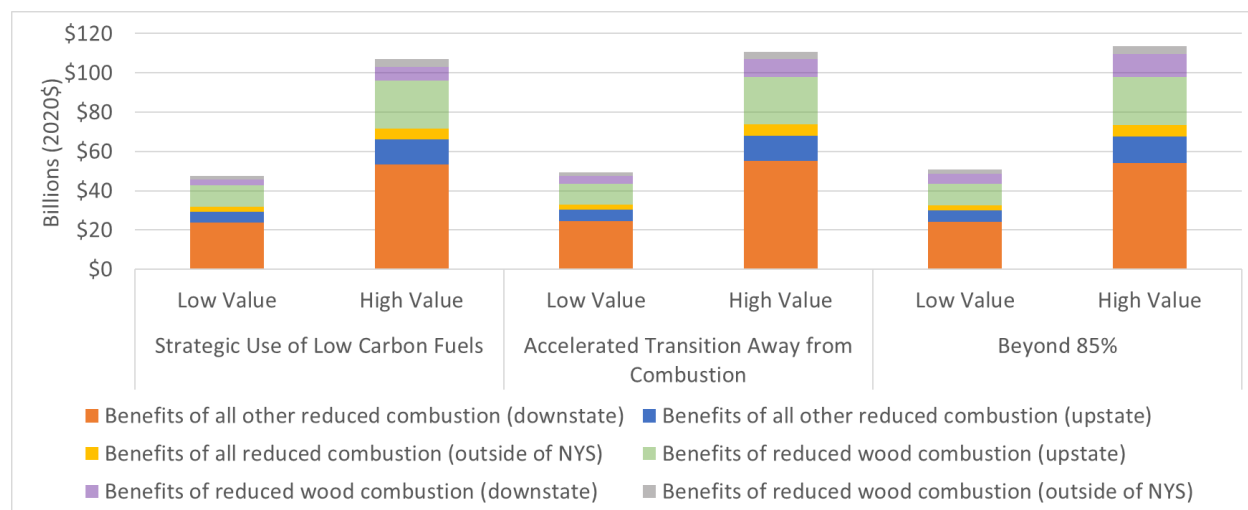
Ambient Air Quality Benefits

In all scenarios, air quality improvements can avoid tens of thousands of premature deaths, thousands of non-fatal heart attacks, thousands of other hospitalizations, thousands of asthma-related emergency room visits, and hundreds of thousands of lost workdays.

The value of the benefits by scenario are presented in Figure 20. While a small amount of benefits would occur downwind of New York in neighboring states, the vast majority of benefits would occur within New York. A large portion of the projected benefits would result from potential reductions in wood combustion. Benefits from reduced fuel combustion (excluding wood) would be larger downstate, and benefits from reduced wood combustion would be larger upstate. While the reduced wood combustion represents a small amount of the total reduced fuel combustion, it has an outsized impact on particulate matter emissions, resulting in substantially high health benefits.

Benefits would increase over time as policies affecting emission reductions take effect, gradually increasing up to approximately \$6 billion in the Low case and under \$14 billion in the High case by 2050.

Figure 20. Total Projected Ambient Air Quality Health Benefits (NPV, 2020–2050)



As presented in Figure 21, approximately 38% of the projected benefits are associated with reduced wood combustion in industrial, commercial, and residential uses. The remaining benefits are associated with relatively equal amounts from transportation (on-road and non-road) and building fuel combustion, and additional small fractions of the benefits are associated with reduced combustion in the electricity generation sector. While buildings and electricity generation have substantial emissions and ensuing health impacts locally, much of the building energy and power in New York is based on natural gas, which burns much cleaner and therefore has a substantially lower impact on particulate matter emissions and public health than oil. Oil combustion can have a much larger health impact locally, but the quantities of oil used statewide are much smaller. However, despite having lower particulate matter emissions than wood combustion overall, those oil and natural gas emissions from buildings do have a large impact on public health because they are in more populated urban areas, while wood combustion is more heavily weighted to rural areas with less dense population, resulting in similar health benefits from reducing wood and oil/gas (this is true also for renewable oil and gas). The benefits from substantially reducing or eliminating combustion in the electricity sector are on the order of 4%, and do not change materially in cases where limited hydrogen is combusted relative to non-combustion scenarios. For a sensitivity analysis of fuel options see Appendix G.

Figure 22 presents the annual health benefits (high value) by sector from the Strategic Use of Low-Carbon Fuels scenario, demonstrating the increasing benefits over time in all sectors. These sectoral results show that the majority of the benefits over time are due to emission reductions in the commercial

and residential sector. In addition, these results show that the benefits from emission reductions in the electricity generation sector largely begin in 2040.

Figure 21. Health Benefits by Sector (2020–2050)

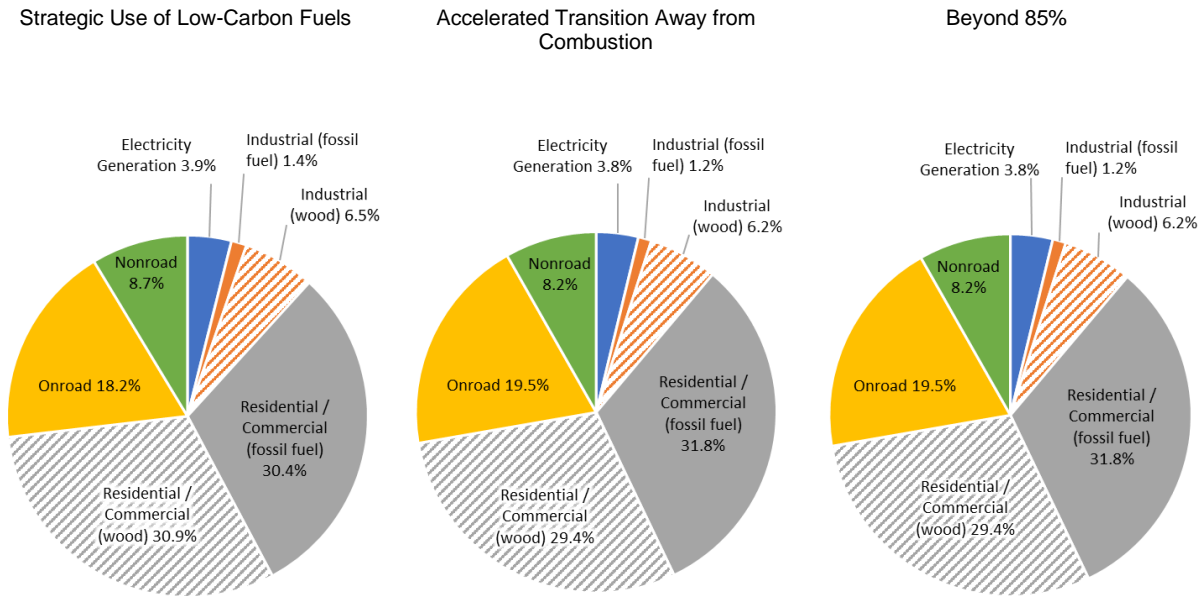
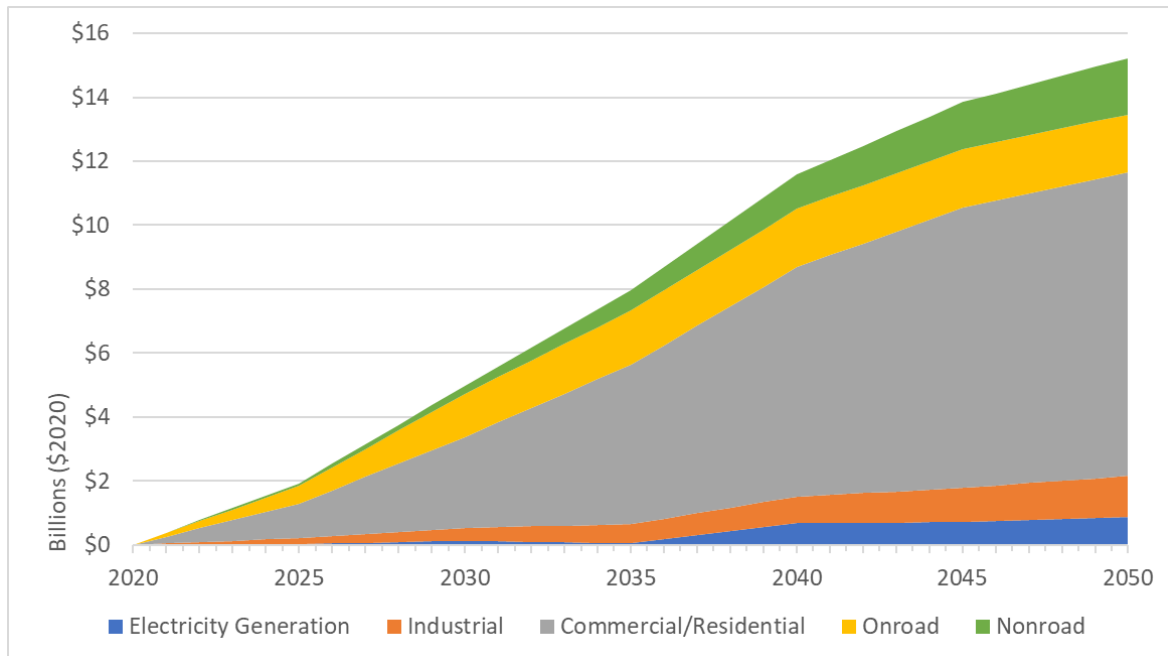


Figure 22. Annual Health Benefits by Sector (high value) for the Strategic Use of Low-Carbon Fuels Scenario



The maximum annual average PM_{2.5} concentration reductions by county projected to be achieved by 2050 are presented in Figure 23. Note that the concentration reductions in all three scenarios are very similar. The distribution of benefits per capita are presented in Figure 24, both with and without the benefits of wood combustion. While much higher benefits overall would accrue in urban areas due to the higher population, per-capita benefits are also higher in urban areas due to higher baseline health incidence and larger reductions in emissions (due to larger sources available to be reduced). The distribution of benefits is very similar in all three scenarios.

Figure 23. Reduction in PM_{2.5} Annual Average Concentrations, Strategic Use of Low-Carbon Fuels

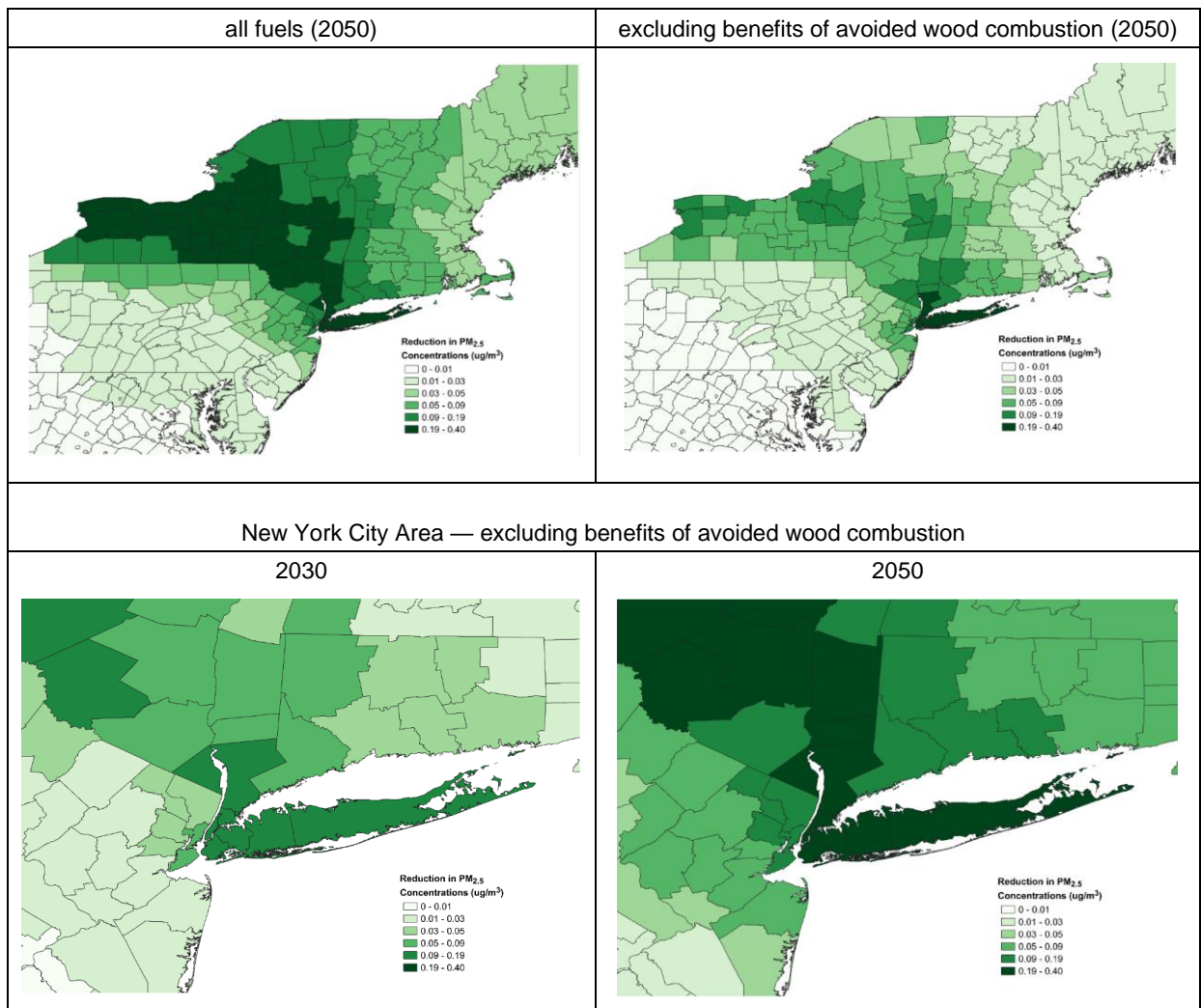
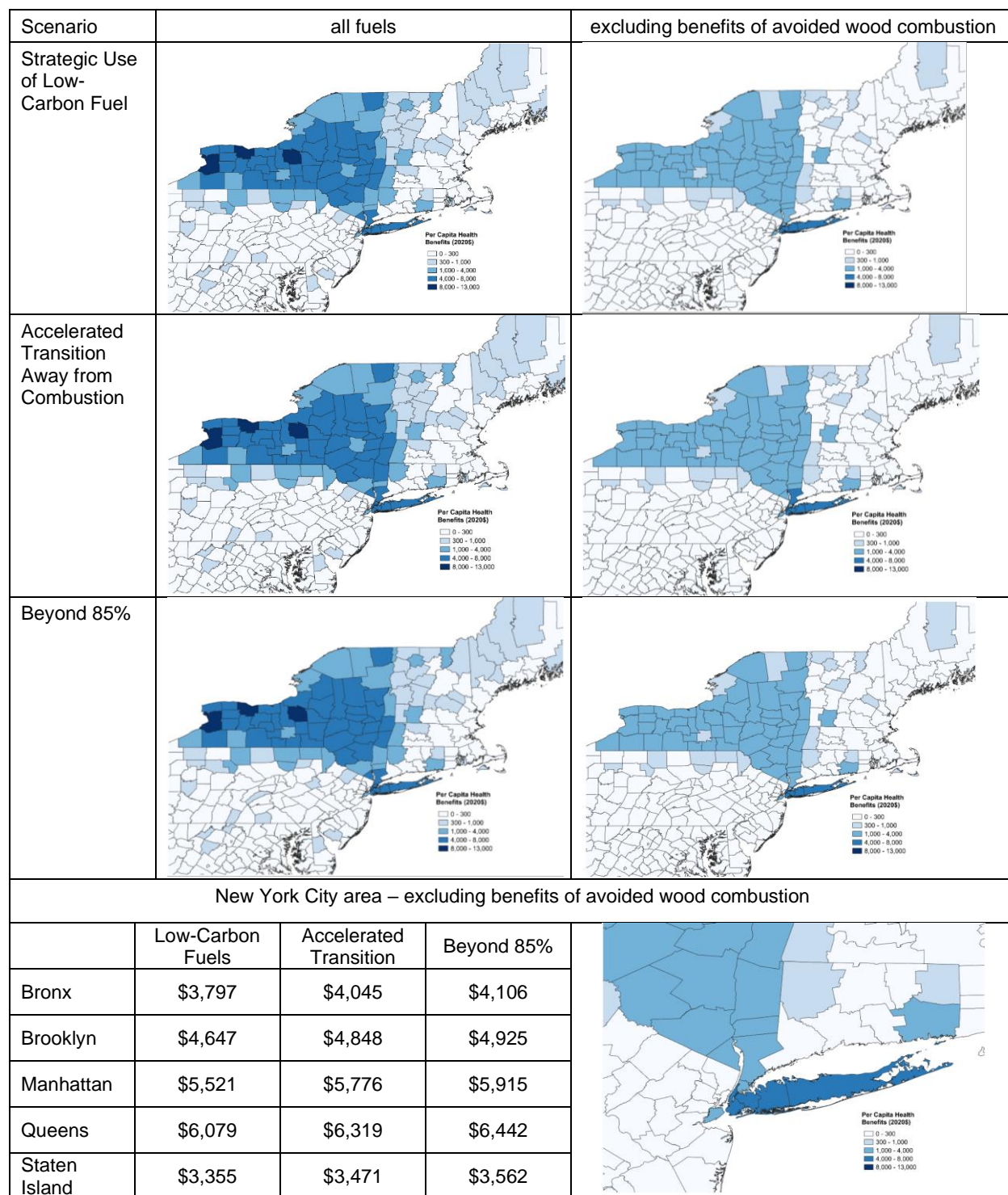


Figure 24. Per Capita Health Benefits (2020–2050)

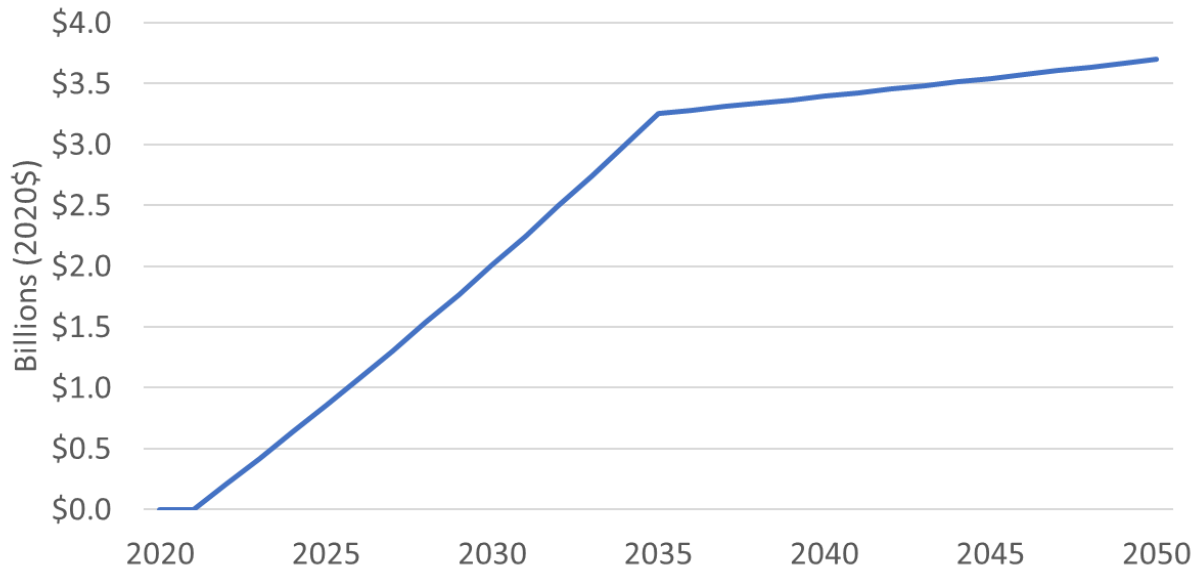


Health Benefits of Increased Active Transportation

The potential value of the net reduction in the number of deaths, including the decrease in deaths from increased physical activity and the increase in deaths from traffic collisions, is estimated to be a NPV of

\$39.5 billion (2020 to 2050). As presented in Figure 25, the values increase over the years as walking and cycling increases with the introduction of infrastructure and other measures to encourage the use of these modes. Note that the projected decrease in premature deaths from physical activity far outweighs the potential increase in deaths from traffic collisions. Active transportation benefits are the same for the Low-Carbon Fuels and Accelerated Transition scenarios.

Figure 25. Potential Annual Value of Public Health Benefits from Increased Active Transportation



Health Benefits of Residential Energy Efficiency Interventions

Health benefits in residential energy efficiency interventions are expected to result from several factors listed in Table 5. These do not include all the potential benefits, but rather only those for which sufficient study of benefits per intervention was available to apply to the New York scenarios. Not included, for example, are the benefits of indoor air quality associated with reduced indoor combustion of gas for cooking. Indoor air quality improvements can be achieved by ensuring appropriate ventilation (often in cases where ventilation and existing conditions were not appropriate prior to the intervention) combined with heat recovery where needed. Crucial to this benefit is ensuring appropriate ventilation when tightening building envelopes.

Table 5. Health Benefits Included in the Analysis of Residential Energy Efficiency Interventions

Health-Related Measure	Causes for Each Benefit	Low-Income Single Family	Low-Income Multifamily
Reduced thermal stress – heat and cold	Building envelope tightening, appliance replacements	☑	☑
Reduced asthma-related incidents or reduced asthma symptoms	Improved ventilation	☑	*
Reduced trip or fall injuries	Removal of trip hazards, roofing improvements, lighting improvements	☑	☑
Reduced carbon monoxide poisonings	Appliance replacements, carbon monoxide monitors	☑	Not available

**This was studied but no significant difference was detected.*

In many cases, benefits occur due to programs ensuring that associated measures are taken at the same time, such as ensuring that carbon monoxide monitors are available where needed and that weatherization does not happen prior to fixing existing conditions such as mold.

The analysis was undertaken at high-level, applying the number of homes to average benefits from the existing studies. Benefits were estimated only for LMI homes. There are likely also benefits for higher income homes, but data to estimate those benefits is not available.

Benefits would be highly dependent on the structure of the interventions. Energy efficiency programs differ based on whether they include appliance replacement, building shell retrofits, or other non-energy interventions (such as installing carbon monoxide detectors).

Following the current practice in New York State Energy Research and Development Authority’s (NYSERDA) energy efficiency programs, the analysis assumes that a range of non-energy measures would be included as appropriate in each case.

The projected benefits by health measure and building type are detailed in Table 6 and Table 7 for the Strategic Use of Low-Carbon Fuels and the Accelerated Transition Away from Combustion, respectively.

Table 6. Potential Public Health Benefits of Energy Efficiency Intervention (2020–2050) — Strategic Use of Low-Carbon Fuels

Health-Related Measure	LMI Single-Family (billion \$)	LMI Multifamily (billion \$)	Total (billion \$)
Reduced asthma-related incidents or reduced asthma symptoms	\$3.0	Not available	\$3.0
Reduced trip or fall injuries	\$1.4	\$0.5	\$1.9
Reduced thermal stress – cold	\$0.4	\$0.9	\$1.2
Reduced thermal stress – heat	\$0.6	\$1.5	\$2.2
Reduced carbon monoxide poisonings	\$0.5	Not available	\$0.5
Total	\$5.8	\$2.9	\$8.7

Table 7. Potential Public Health Benefits of Energy Efficiency Intervention (2020–2050) — Accelerated Transition Away from Combustion

Health-Related Measure	LMI Single Family (billion \$)	LMI Multifamily (billion \$)	Total (billion \$)
Reduced asthma-related incidents or reduced asthma symptoms	\$3.0	Not available	\$3.1
Reduced trip or fall injuries	\$1.4	\$0.5	\$1.9
Reduced thermal stress – cold	\$0.4	\$0.9	\$1.3
Reduced thermal stress – heat	\$0.6	\$1.6	\$2.2
Reduced carbon monoxide poisonings	\$0.5	Not available	\$0.5
Total	\$5.9	\$3.0	\$8.9

Sector Strategies

Chapter 11. Transportation

11.1 State of the Sector

Overview

Historically, the evolution of transportation systems has served as a catalyst for economic growth, productivity, and land use and development patterns. Transportation investments significantly influence where economic growth ensues, at what rate that growth occurs, and the design and density of the built environment. The challenge is how to balance growth, facilitated by transportation, while mitigating harmful greenhouse gas (GHG) emissions and promoting climate justice. Compounding this challenge are a multitude of factors. Individual consumers have a preference for large, less fuel-efficient vehicles. Short trips are often accomplished by single-occupancy vehicles. Innovations in commerce, such as just-in-time delivery and dispersion of production facilities, have made delivery of goods more inefficient. Local residential land use and commercial-development policies have driven unconstrained sprawl, thereby increasing vehicle miles traveled (VMT) and congestion. These challenges present an opportunity for adopting mobility-oriented development (MOD) strategies through targeted transportation investments.

The challenge of achieving the Climate Act requirements should be approached strategically and with an eye toward recognizing the opportunity and delicate balance of facilitating transportation's role in economic growth with the need to address adverse community, environmental, and human health impacts. To fully implement the requirements of the Climate Act while maintaining economic competitiveness, the State needs the full support of complementary national, regional, and local strategies.

When considering how to reduce transportation GHG emissions, it is important to note that measures for reducing emissions from transportation are interconnected. Actions to achieve the Climate Act goals and requirements transcend the transition to zero-emission vehicles (ZEVs) and include diversified mobility alternatives; promotion of denser, more diverse, better designed, and more transit-oriented land use and development policies; and implementation of market-based policies to influence travel decisions.

As of November 2022, one half of one percent of the over 10 million registered light-duty vehicles (LDVs) in New York were ZEVs.¹⁹⁷ To facilitate the level of transformation required by the Climate Act

¹⁹⁷ Atlas Public Policy. "EvaluateNY Vehicle Deep Dive." Accessed November 2022 at <https://atlaspolicy.com/evaluateny/>.

and accounting for growth in vehicle registrations, there will need to be approximately 3 million zero-emission LDVs in use by 2030 and approximately 10 million zero-emission LDVs in use by 2050. In addition, enhancing the availability, accessibility, reliability, and affordability of public transportation services, with an emphasis on unserved and underserved communities, as well as reimagining residential and commercial development utilizing MOD principles, will be integral to mitigating single-occupant discretionary vehicle trips, associated vehicle congestion, and harmful GHG emissions.

Vision for 2030

An aggressive and implementable mix of policies will be required to accelerate GHG emission reductions to the level needed by 2030. By 2030 nearly 100% of LDV sales and 40% or more of medium- and heavy-duty (MHD) vehicle sales must be zero-emission and a substantial portion of personal transportation in urbanized areas would be required to shift to public transportation and other low-carbon modes.¹⁹⁸ New York can achieve these goals through ZEV sales requirements and accompanying incentives, investments to help achieve these mandates, historic investments in expanded public transportation and micro-mobility, enhanced bicycle and pedestrian infrastructure, smart growth development, market-based policies that support lower-carbon transportation choices, and potentially a clean transportation standard that reduces the average carbon intensity of fuels as the transition to ZEVs proceeds.

Emissions Overview

The transportation sector was responsible for approximately 28% of the New York’s greenhouse gas emissions in 2019, which includes road transportation (59%), non-road such as aviation (12%), emissions from imported fuels (26%), and hydrofluorocarbons used in vehicle air-conditioning and refrigeration (3%). Transportation sector emissions are about 16% higher today than they were in 1990. The transportation sector today is largely dependent on petroleum-based fuels such as gasoline, diesel, and jet fuel, but the State has made strong progress in transitioning from petroleum-based fuels to zero-emission technologies.

The recommended policies are expected to result in as many as three million ZEVs (about 30% of LDVs and 10% of MHD vehicles) on the road by 2030.¹⁹⁹ Electric non-road equipment, such as those used in lawncare, construction, and farming, are expected to gain market share, especially in subsectors that are most conducive to electrification. Hydrogen fuel cell vehicles are expected to begin to emerge into the market by 2030, primarily for some trucking and non-road applications less suited to electrification, and

¹⁹⁸ For more information, refer to Appendix G: Integration Analysis Technical Supplement.

¹⁹⁹ For more information, refer to Appendix G: Integration Analysis Technical Supplement.

the State should begin investing prudently in the required supporting infrastructure to enable these vehicles to play a larger role in transportation emission reductions beyond 2030. Regional collaboration among states and coordination with the federal government will be needed to ensure that ZEV technologies can achieve the hoped-for growth trajectory. Supporting the development of companies in the ZEV supply chain can help create additional economic benefits and ensure a sufficient supply of these vehicles for New Yorkers.

At present, a large portion of vehicles on the road are expected to still use internal combustion engines in 2030, particularly in the MHD vehicle classes. One path to achieving 2030 emissions reduction requirements includes strategies to make limited use of renewable diesel and other lower-carbon fuels to replace diesel in existing internal combustion engine vehicles until the transition to ZEVs is complete. Policies like a clean transportation standard could be designed to support decarbonization by displacing fossil fuels with low-carbon electricity and other fuels with lower GHG emissions and co-pollutant emissions, including green hydrogen and alternative fuels. Development of these policies should be mindful of the Climate Justice Working Group's (CJWG) admonition to avoid fuel policies that extend reliance on fossil fuel infrastructure or allow emissions from fuel combustion to continue to disproportionately impact Disadvantaged Communities. Another path to achieving 2030 emissions reductions requires accelerated ZEV adoption and early retirement of internal combustion vehicles. Additional incentives would be required to achieve these outcomes.

Significant increases in the availability of public transportation services and other zero-emission mobility alternatives in the State's urbanized areas should help reduce VMT by 2030. While mobility-on-demand strategies are expected to be adopted between now and 2030, this is primarily a longer-term emission reduction strategy. System efficiency improvements, such as traffic management systems and other congestion mitigation activities, can curb emissions through reduced idling and can be deployed immediately. Land use policies that shift travel to cleaner shared mobility alternatives or reduce discretionary single occupant VMT provide significant community benefits such as air quality improvements and reduce the number of ZEVs needed to meet GHG emission reduction requirements.

Vision for 2050

By 2050, the transportation sector will need to shift nearly completely to ZEVs while substantially increasing the use of low-carbon transportation modes like public transportation, walking, and biking that reduce the number of personal vehicle trips. LDVs and a large majority of MHD vehicles will be ZEVs. Marine operations and port facilities are envisioned to be zero-emission by 2050. Some segments of hard-

to-electrify subsectors, such as aviation, freight rail, and potentially some MHD vehicles are expected to rely on green hydrogen and renewable biofuels (e.g., renewable jet fuel) to fully replace fossil fuel combustion if zero-emission applications are not feasible. A large-scale investment in expanded public transportation and complementary modes of transportation like shared mobility, biking and walking infrastructure, and smart growth (higher density, mixed use development centered around low-carbon transportation options) will help make it easier for New Yorkers to travel without using a personal car. Trips are expected to be shorter, on average, because people will have easier access to jobs, schools, and services. Transportation system investments will reflect community needs and be appropriate for the people they serve.

Table 8. Sector Spotlight: Timelines for a Just Transition in the Transportation Sector

- Majority of jobs created by 2030 expected to focus on electric vehicle charging station and hydrogen fuel station installation, along with steady levels of employment in vehicle manufacturing and wholesale trade parts.
- Emissions projected to decline 30% in this sector by 2030; fossil fuel consumption projected to decline 38% by 2030.
- Levels of job growth and loss through 2030 are roughly equivalent (~11,000 to 15,000 gained and lost), suggesting opportunity for retention and matching within the sector.
- Analysis indicates job losses are likely in the most at-risk subsector (conventional fueling stations), but these businesses may be able to adopt new business models (such as becoming hubs for electric vehicle charging equipment at convenience stores), enabling these stations to avoid employment losses associated with declining fossil and biofuel consumption.

Existing clean energy jobs:	61,500	Potential job growth by 2030:	+11,300
		2040:	+21,600
Existing conventional/legacy and fuels jobs:	125,000	Potential job loss by 2030:	-14,900
		2040:	-37,800
		Potential net job creation by 2030:	-3,600
		2040:	-16,200

Note: Job impact data from Jobs Study (Scenario 2 Initial Employment Outputs, rounded to nearest hundred). Jobs figures here may be partial due to differences in sectoral breakdown between Scoping Plan Chapters and Jobs Study; additional analysis found in Jobs Study.

Achieving this 2050 vision will require a mix of regulatory action and investment to achieve widespread ZEV adoption and additional incentives may be required to retire older internal combustion vehicles. The expansion of transportation options and smart growth development practices will rely on extensive investments at the State and local level alongside collaborations between State and local authorities to revise land use rules and coordinate on plans that create an integrated system for travelers choosing low-carbon transportation modes. Public-private collaboration and broad industry action are critical to bring the level of investment needed and to ensure New Yorkers have climate-friendly transportation options available. Market-based policies can help fund the transition and send appropriate price signals.

Importantly, to achieve the 2050 vision, early action and investment will be needed in the early 2020s to ensure the availability and affordability of the future fuels and technologies, including but not limited to green hydrogen production, delivery, and applications; renewable jet fuel or other zero-emission aviation solutions; MHD ZEV engines; and infrastructure to support large-scale electrification including heavy freight solutions.

Existing Sectoral Mitigation Strategies

New York uses less energy per capita for transportation purposes than any state in the nation due in large part to the extensive investment and utilization of public transportation services and compact land use patterns in the State’s larger urbanized areas.²⁰⁰ These services help the State reduce its transportation emissions by more than 17 million metric tons (MMT) per year, but much more needs to be done to meet the Climate Act’s GHG emission reduction requirements. There are currently over 120,000 electric vehicles (EVs) on the road in the State and the number is rapidly growing, with sales in both 2021 and 2022 shattering previous year highs.²⁰¹

New York has several ongoing strategies to promote transportation emissions reductions:

- In 1990, New York State Department of Environmental Conservation (DEC) adopted California’s Low Emission Vehicle program, requiring all new vehicles sold in the State to meet California emissions standards, which are more stringent than federal standards. The goal of the Low Emission Vehicle program is to reduce emissions of air pollutants including particulate matter, nitrogen oxides (NO_x), carbon monoxide, and volatile organic compounds (VOCs). Reducing engine pollution protects the environment and the health of the State’s residents.
- In 2013, the State initiated two major actions in transportation decarbonization programs. First, the State signed the light-duty ZEV Memorandum of Understanding, which formed the Multi-State ZEV Taskforce, a coalition of states working together to advance the deployment of ZEVs through policy research and marketing campaigns. Second, the State launched Charge NY, a series of initiatives that, over time, grew to include the Drive Clean Rebate program, offering up to \$2,000 for electric vehicle (EV) purchases or leases; the New York State Truck Voucher Incentive program, offering incentives of up to \$385,000 for the purchase or lease of electric

²⁰⁰ U.S. Energy Information Administration. August 31, 2020. “More energy is used per person for transportation in states with low population density.” *Today in Energy*. Accessed November 2021 at <https://www.eia.gov/todayinenergy/detail.php?id=44956>.

²⁰¹ Atlas Public Policy. “EValuateNY” Accessed November 2022 at <https://atlaspolicy.com/evaluateny/>.

trucks and buses; the Charge Ready NY program, offering \$4,000 per Level 2 charging port; and awareness and educational campaigns.²⁰²

- In addition to State-level initiatives, many local jurisdictions and organizations, including counties, cities, utilities, and ports, are aggressively pursuing climate action and transportation GHG emissions reductions. For example, New York City is a member of the C40 Cities Climate Leadership Group that implemented a 2050 carbon neutrality goal (OneNYC 2050) and has already purchased more than 2,000 EVs for its fleet.²⁰³
- To advance light-duty EV adoption, the State launched the Clean Fleets NY program in 2015, which supports deployments of EVs in State government fleets. In 2018, New York Power Authority (NYPA) launched the Evolve NY program, which complements Charge NY 2.0 with an additional \$250 million investment in EV charging infrastructure, services, and consumer awareness efforts. In 2019, the Public Service Commission authorized a \$31 million program to address demand charges for direct current (DC) fast charging devices, and investor-owned utilities began offering a per-plug incentive that tapers down over seven years.
- Through the New York Truck Voucher Incentive Program, administered by the New York State Energy Research and Development Authority (NYSERDA), the State aims to accelerate the deployment of all-electric and alternative fuel trucks and buses in MHD vehicle classes. The program currently includes \$53.9 million in funding and uses funds from the Volkswagen settlement overseen by DEC, as well as the Congestion Mitigation and Air Quality Improvement program overseen by the New York State Department of Transportation (DOT). New York also directed Volkswagen settlement funds (\$9.9 million) to the New York City Clean Trucks Program, which replaced diesel trucks in New York City industrial business zones that are within defined environmental justice areas.
- In July 2020, New York announced two new sweeping programs. First, New York was one of 15 states to sign a MHD ZEV Memorandum of Understanding, with the goal of having 30% of MHD vehicle sales be ZEVs by 2030 and 100% by 2050. Second, New York announced a \$701 million Make-Ready program, through which investor-owned utilities pay up to 100% of the costs of electric facilities necessary to make sites ready for EV charging of 850,000 LDVs by 2025. NYSERDA and the electric utilities are required by Make-Ready to undertake feasibility

²⁰² The PSC made a declaratory Ruling that it did not have jurisdiction over charging stations; the owners or operators of charging stations, so long as the owners or operators do not otherwise fall within the Public Service Law’s definition of “electric corporation;” or the transaction between such owners or operators of Charging Stations and members of the public.

²⁰³ New York City Sustainability Office. 2020.

studies for MHD fleets, including for school districts and transit agencies, to identify benefits, costs, logistical challenges, financing options, other barriers to electrification. By bearing these soft costs, the State is providing fleet managers with the financial information necessary to make the case for investment in zero-emission fleets. The Make-Ready program also included \$85 million for the New York Clean Transportation Prizes, three competitions to identify innovative, replicable approaches to transportation electrification that address climate justice in disadvantaged communities.

- Clean Air NY is a marketing and outreach program in the New York City metro area sponsored by DOT to educate travelers about the small changes they can make every day in their transportation choices. The goal is to reduce VMT and improve air quality. The year-round program, formerly called Ozone NY, includes Air Quality Action Day notifications, indicating unhealthy levels of particulate matter and/or ozone as forecasted by DEC.
- The 2011 New York State Complete Streets Act requires agencies to consider the convenience and mobility of all users, including pedestrians and bicyclists, when developing transportation projects that receive State and federal funding. This initiative presents an opportunity to expand upon existing programs and collaborate with bicyclists, pedestrians, people with disabilities, and others to identify best practices and designs for transportation facilities.
- The State uses federal funding through the Transportation Alternatives Program and the Congestion Mitigation and Air Quality Improvement Program. This is available to State and local governments for zero-emission transportation-related projects/programs (active transportation) and projects/programs to help address the requirements of the Clean Air Act.
- Active transportation safety is promoted through projects developed under the State's Pedestrian Safety Action Plan. This five-year, multi-agency initiative provides \$110 million to improve safety for pedestrians through infrastructure improvements, public education efforts, and enforcement across upstate and Long Island. This Scoping Plan calls for a systemic approach to proactively address widespread safety issues and minimize the potential for crashes by implementing low-cost improvements throughout the roadway network.
- New York State already leads the nation, consuming less fossil fuel per capita than any other state due in large part to a commitment to transit. New York State provides \$7 billion in support to transit operators annually.²⁰⁴ New York State's transit support is more than that of 45 other states

²⁰⁴ New York State Division of the Budget. *New York State Executive Budget FY2023*, p. 152. Accessed November 2022 at <https://www.budget.ny.gov/pubs/archive/fy23/ex/book/briefingbook.pdf>.

combined.²⁰⁵ This support is intended to maintain and enhance service levels, ensure passenger fares are reasonable and equitable, and support environmental/climate and economic goals.

- New York supports municipally sponsored public transportation services' transition to ZEVs through a multi-year funding commitment to provide the incremental cost of procuring all-electric buses.
- In 2022, New York required that by 2027 all new school bus purchases must be ZEVs and by 2035 all school buses operating in the state must be ZEVs. NYSERDA has begun developing a School Bus Electrification Roadmap to help guide future state efforts supporting this work.

These ongoing GHG emission mitigation and air quality improvement strategies contributed to New York's transportation sector progress over the last decade. The variety of these current strategies underscores the need to consider a wide range of new and enhanced strategies to further improve air quality and reduce GHG emissions. These strategies should work in concert to limit the negative effects of climate change and create a sustainable transportation system in New York that serves all its users.

Key Stakeholders

Key stakeholders responsible for the successful implementation of proposed transportation sector strategies include:

- **Transitioning to ZEVs and equipment:** DEC, NYSERDA, DOT, New York State Department of Public Service (DPS), New York City Department of Buildings, New York State Department of Motor Vehicles, New York State Office of General Services (OGS), New York State Department of State (DOS), New York State Education Department, NYPA, Dormitory Authority of the State of New York (DASNY), NY Green Bank, Port Authority of New York and New Jersey (PANYNJ), Metropolitan Transportation Authority (MTA), New York City, utility companies, automotive original equipment manufacturers, EV charging station providers, car and truck dealers, affected workers and unions, port operators, transit agencies/authorities/municipal sponsors, and the New York State Legislature
- **Enhancing public transportation and mobility alternatives:** NYSERDA, DOT, DPS, OGS, DOS, NYPA, MTA, utility companies, vehicle manufacturers, affected workers and unions, and transit agencies/authorities/municipal sponsors

²⁰⁵ Federal Transit Administration. "2021 Funding Sources." Accessed November 2022 at <https://www.transit.dot.gov/ntd/data-product/2021-funding-sources>.

- **Reduce VMT:** DEC, NYSERDA, DOT, DPS, DOS, NYSTA, NYPA, Empire State Development (ESD), MTA, New York City, New York State Council on the Arts, transit agencies/authorities/municipal sponsors, local governments, companies providing mobility services, major New York employers, affected workers and unions, and the New York State Legislature
- **Market-Based Solutions and Financing:** DEC, NYSERDA, DOT, DPS, New York State Department of Motor Vehicles, New York State Education Department, New York State Department of Taxation and Finance, NY Green Bank, and local governments

11.2 Key Sector Strategies

The key strategies within this sector are organized into four themes, as shown in Table 9. As described there in greater detail, the labor standards discussed in *Chapter 7. Just Transition* are intended to apply throughout this Scoping Plan, including for the transportation sector, as a means of promoting good, family-sustaining, union jobs accessible to all New Yorkers and achieving a true just transition.

Table 9. Transportation Sector Key Strategies by Theme

Theme	Strategies
Transition to ZEVs and Equipment	T1. Light-Duty ZEV Adoption T2. Adoption of Zero-Emission Trucks, Buses, and Non-Road Equipment
Enhance Public Transportation and Mobility Alternatives	T3. Community-Based Service Enhancements T4. Customer Convenience and Service Connectivity T5. Fleet Modernization and Electrification
Promote Smart Growth and Mobility-Oriented Development	T6. Mobility-Oriented Development T7. Smart Growth Public Education and Awareness T8. Expanding the Availability of Low-Carbon Active Transportation Alternatives T9. New Technology Integration
Facilitate Market-Based Solutions and Financing	T10. Transportation Sector Market-Based Policies T11. Unlock Private Financing T12. Market-Based Fuel Policy

Recognizing that there is no one-size-fits-all statewide strategy for effectively reducing emissions from the transportation sector and transitioning to zero-emission technologies, the Climate Action Council (Council) expects many of the strategies necessary to achieve the Climate Act’s ambitious requirements and goals will be informed through extensive engagement and outreach with affected communities, with an emphasis on overburdened and low- to moderate-income (LMI) areas.

Transition to Zero-Emission Vehicles and Equipment

Transitioning the transportation sector to zero-emission technologies is central to achieving the State’s GHG emission reduction requirements. In most cases, this means replacing existing vehicles that run on gasoline or diesel fuel with either battery electric, hydrogen fuel cell, or future zero-emission propulsion technologies. ZEVs and their related infrastructure present an economic development opportunity as well, offering a chance to build on New York’s robust historical involvement in manufacturing and supplying vehicles and vehicle components. Other alternative fuels will play a role in decarbonizing hard-to-electrify segments of the transportation sector.

On September 8, 2021, Governor Hochul signed legislation establishing a goal that all new LDVs and non-road vehicles sold in the State be zero-emission by 2035 and all new MHD vehicles be zero-emission by 2045.²⁰⁶ To help meet the State’s Climate Act requirements and goals, New York should take additional regulatory and programmatic actions to achieve these goals. The strategies proposed below aim for an even more rapid transition to ZEVs, achieving close to 100% ZEV sales for LDVs by 2030, 50% ZEV sales of medium-duty vehicles by 2030, and 80% ZEV sales of heavy-duty vehicles by 2035, which the integration analysis indicates will position the State to meeting the Climate Act requirements. The strategies to achieve these goals involve expanding light-duty ZEV adoption and converting trucks, buses, and other MHD vehicles to ZEVs.

T1. Light-Duty Zero-Emission Vehicle Adoption

There are approximately 9 million LDVs in New York, making the emissions from LDVs the largest component of transportation emissions.²⁰⁷ Since 2010, sales of light-duty ZEVs have increased and accounted for more than 3% of all LDV sales and about 1% of all LDVs on the road in 2021. Light-duty ZEVs have come down in price compared with their petroleum-fueled counterparts but are still comparatively more expensive; they are expected to reach price parity from a total cost of ownership perspective in the next two to four years and from a purchase price perspective later in the 2020s. Most light-duty ZEVs are expected to be battery electric, but hydrogen fuel cell vehicles are emerging into this market, primarily in California. A key challenge is that most of these vehicles are owned by individuals, who will each have to make their own purchase decisions if the State is to meet its Climate Act requirements. Achieving the aggressive transition in this market will require a mix of regulations, incentives (which will require identifying new sources of funding), and removal of market barriers. It will

²⁰⁶ Chapter 423 of the Laws of 2021.

²⁰⁷ Atlas Public Policy. “EValuateNY.” Accessed October 2021 at <https://atlaspolicy.com/evaluateny/>.

also depend on industry greatly accelerating the expansion of production capacity for these vehicles. Incentives for EVs and charging stations are expected to be needed primarily over the next five to 10 years, as the market for ZEVs reaches maturity. Enhanced incentives for LMI consumers will advance climate justice and achieve the air quality benefits in Disadvantaged Communities these vehicles can provide. Incentives for hydrogen fuel cell vehicles may be needed for a longer period of time, as they are expected to take longer to enter the market in significant quantities.

The CJWG enthusiastically encourages a rapid transition to ZEVs, although it cautioned that focusing on providing access to transit and lower-cost options for transportation, rather than just personal vehicles, is critical for LMI New Yorkers. The CJWG also expressed concern about investment in EVs leaving the State. Of course, most of the billions of dollars that New Yorkers spend on petroleum-based fuels each year leaves New York; accordingly, the State should continue supporting the development of businesses in the ZEV supply chain to ensure that the ZEV transition benefits the State's residents economically.

Components of the Strategy

- **Adopt California's Advanced Clean Cars 2 Regulation:** Chapter 423 of the Laws of 2021 commits 100% of all new, light-duty on-road vehicle sales in New York to be ZEVs by 2035, and directs DEC to develop and propose regulations, to the extent consistent with federal law, such as Advanced Clean Cars 2.²⁰⁸ DEC should adopt the Advanced Clean Cars 2 regulation that requires 100% light-duty ZEV sales by 2035, now that it has been finalized by California. California is also pushing to electrify for-hire vehicles through a clean-miles standard, which the State could also adopt or take other approaches to electrifying these vehicles, such as providing targeted incentives for fleet ZEV purchases and charging/fueling stations.
- **Provide enhanced ZEV purchase incentives:** ZEVs are approaching price parity with petroleum-fueled vehicles and the price of battery EVs is expected to eventually fall below that of their petroleum equivalents. Offering strategic incentives will accelerate ZEV production, price parity, and purchases. New York should enact legislation to establish a "feebate" program that would offer direct rebates for ZEV purchases supported by imposing a fee on purchases of fossil fuel vehicles. The fee and rebate levels should be dynamic in response to market conditions and ambition levels. Such a program can be designed to be revenue-neutral and can incorporate other policy goals, such as higher rebates for LMI customers and exemptions from the fee for lower-

²⁰⁸ ECL § 19-0306(b).

priced vehicles purchased largely by LMI consumers. Feebates should be applied to new car sales, but there should be an additional rebate for used ZEVs targeted toward LMI customers, which could be paired with affordable financing options. Although each integration analysis scenario under consideration relies heavily on LDV electrification, the scenario that relies more heavily on expedited electrification will require the establishment of additional incentives to retire internal combustion vehicles early.

- **Enhance ZEV awareness and reduce sales barriers:** New York should enact legislation to expand direct-to-consumer sales of ZEVs by manufacturers, which can serve to increase the availability and sales of ZEVs in the State; the State should provide dealer incentives for franchise car dealers to sell ZEVs; and NYSERDA should partner with industry participants and stakeholders to fund consumer engagement activities to increase consumer interest in ZEVs.
- **Invest in and remove barriers for ZEV charging and fueling infrastructure:** To support the level of ZEV adoption anticipated by 2030, New York must quickly increase the number of EV charging stations and hydrogen filling stations in the State. New York should fund rebates or investment in EV charging stations and hydrogen filling stations, either directly through programs run by NYSERDA and/or NYPA or through market-based mechanisms like the clean transportation standard discussed below that would generate resources for ZEV infrastructure. All financing and ownership models should be considered. As part of the State's focus on investments in Disadvantaged Communities, programs in this area should focus on charging at multi-unit dwellings, on-street charging, and convenient urban fast charging, especially in areas with less access to home charging. Strategies should also prioritize fast charging along travel corridors, especially in rural areas, and support market segments that have been slow to attract private investment, including hydrogen fueling stations for appropriate applications. Through the National Electric Vehicle Infrastructure formula program, DOT will identify opportunities to support the creation of a safe, reliable, convenient, and equitable EV fast charging infrastructure network to allow EV drivers to reach interstate, regional, and long-distance destinations. DOS should incorporate EV charging into building codes to ensure new construction is EV-ready.
- **Enact utility rate design changes:** The New York State Public Service Commission (PSC) should direct utilities, as appropriate, to implement programs that offer lower rates for or otherwise encourage off-peak charging and/or controlled, managed charging. The PSC should further examine the effectiveness of its per-plug incentive program to determine if it offers sufficient opportunities to reduce operating costs that support the near-term buildout of public and fleet charging infrastructure. It is important to make this type of charging more cost-effective when utilization is low, and the PSC should determine whether a change is necessary in the

structure of demand chargers that is cost-based and nondiscriminatory. The PSC and NYSERDA should also consider how to maximize the value of ZEVs as grid-interactive assets and storage devices, which could potentially lower electric grid upgrade costs and generate revenue for ZEV owners. They should also consider whether any policy changes are required to enable these use cases. These changes will be relevant to both LDVs and MHD vehicles.

- **ZEV workforce and economic development:** State University of New York (SUNY), New York State Department of Labor (DOL), ESD, NYSERDA, and other relevant agencies should expand the availability of ZEV-focused workforce development curricula related to ZEV maintenance and EV charging station installation and maintenance. These curricula should target both retraining the current workforce and preparing new entrants into the workforce to operate and maintain ZEVs and their associated infrastructure. Additionally, ESD, NYPA, and NYSERDA should seek opportunities to attract businesses to New York that develop and/or manufacture ZEVs, ZEV components, and ZEV-supportive products. Economic development opportunities can leverage New York’s leadership on ZEVs to attract companies to locate in the largest committed market for ZEVs on the East Coast.
- **State fleet:** In accordance with Executive Order 22, each state agency/authority shall adopt and periodically revise procurement targets, with appropriate funding allocated, to operationalize the State’s announced November 2021 commitment to a fully zero-emission State fleet of passenger vehicles by 2035. DEC should continue supporting municipal ZEV acquisition by providing rebates under the Climate Smart Communities program.

T2. Adoption of Zero-Emission Trucks, Buses, and Non-Road Equipment

Converting New York’s trucks, buses, and non-road equipment (including construction, farm, and forestry equipment) to zero-emissions technologies plays a dual role of both reducing GHG emissions from a major source and reducing local air pollution from one of the most significant sources of poor air quality and adverse health impacts. Trucks, buses, and non-road equipment are just starting to transition from diesel fuel to electricity as more options become available, but electric trucks, buses, and equipment are still much more expensive than their diesel counterparts. The transition to ZEVs for this subsector will entail a mix of battery electric and hydrogen fuel cell vehicles, which are just beginning to emerge into the market. Achieving the aggressive transition in this market will require a mix of regulations, incentives (which will require identifying new sources of funding), and the removal of market barriers and depends on industry greatly accelerating the expansion of production capacity for these vehicles. Incentives for EVs and charging stations are expected to be needed primarily over the next 10 to 15 years, as the market

for ZEVs reaches maturity. Incentives for hydrogen fuel cell vehicles may be needed for a longer period of time, as they are expected to take longer to enter the market in significant quantities.

Diesel trucks and port equipment are one of the largest sources of local air pollution in Disadvantaged Communities. Although they comprise only a small portion of total vehicles in the State, diesel trucks and buses are responsible for 30% of total particulate matter and NO_x emissions from mobile sources. Replacing diesel trucks and port equipment with ZEV trucks and equipment is a critical component of climate justice and would have a substantial impact on improving air quality statewide, especially in Disadvantaged Communities.

Replacing diesel trucks and port equipment with ZEV equivalents also provides an opportunity to generate economic development opportunities in New York. As New York is a major market for diesel vehicles, especially transit buses and school buses, its early leadership can provide a strong market signal for companies looking to locate near their end users. For instance, New York's nation-leading mandate that all school buses be zero-emission by 2035 provides a strong incentive for ZEV school bus manufacturers to locate in New York, especially considering that New York has more school buses than any other state in the country.

The CJWG enthusiastically encourages a rapid transition to ZEVs, especially for MHD vehicles. Consistent with CJWG input, this Scoping Plan prioritizes MHD ZEV incentives for vehicles such as port equipment, refuse trucks, local delivery vehicles, construction equipment, and both transit and school buses in communities overburdened with air pollution, and includes an accelerated transition of the State's fleet vehicles to ZEVs.

Components of the Strategy

- **Adopt additional Clean Fleets regulations:** In 2020 California promulgated the Advanced Clean Trucks regulations that require an increasing percentage of new zero-emission MHD truck sales annually through 2035. In December 2021, DEC finalized the adoption of these regulations.²⁰⁹ DEC should also adopt certain components of California's proposed Advanced Clean Fleets regulations, or equivalent measures. Specifically, DEC should adopt (1) the drayage truck regulation that would require the transition of predominantly diesel-powered drayage fleets

²⁰⁹ 6 NYCRR Part 218; 6 NYCRR Section 200.9.

to ZEV trucks with any NY-specific adjustments; (2) the regulation requiring federal and "high priority" fleets to transition to ZEVs; and (3) the requirement for 100% MHD ZEV sales by 2040. These regulations could be targeted to the type of fleets operating in overburdened communities and, like California, exclude smaller fleets largely operated by small businesses. In accordance with the legislation signed by Governor Hochul cited above, DEC should consider regulatory options, consistent with federal law, for requiring 100% ZEV sales for non-road vehicles by 2035.

- **Provide enhanced ZEV purchase incentives:** Zero-emission trucks, buses, and non-road vehicles are significantly more expensive than diesel equivalents today. While the cost of ownership is becoming more cost-competitive, targeted incentives will be needed to facilitate the transition to emerging ZEV technologies. The State should fund direct incentives supporting the purchase of zero-emission trucks and buses, with a focus on fleets operating in LMI and overburdened communities, small fleets, and school buses, as well as non-road vehicles and equipment such as airport ground support equipment, port cargo handling equipment, construction, farm, and forestry equipment. The State should also provide incentives or offer buybacks for equipment with small engines, including yard and garden equipment and small marine vessels, and encourage local electrification requirements.
- **State fleet:** In accordance with Executive Order 22, each state agency/authority shall adopt and periodically revise procurement targets, with appropriate funding allocated, to operationalize the State's November 2021 commitment to a zero-emission State fleet of MHD vehicles, where technically feasible, by 2040.
- **Require use of ZEV equipment by State contractors and at targeted facilities:** To further encourage ZEV adoption, New York should enact legislation that establishes procurement and contracting rules to increase the percentage of zero-emission equipment and vehicles used for State-funded projects, including contractors and subcontractors, based on production and availability, to again align with the State's November 2021 commitment. DEC should also adopt regulations similar to California's Advanced Clean Fleets proposal that require MHD trucks in use at, or accessing, certain types of facilities such as ports or intermodal railyards to be ZEVs by a set date. DEC should evaluate the date based on factors that may include truck vocation, product, and related infrastructure availability.
- **Invest in ZEV charging or fueling infrastructure:** Similar to LDV infrastructure, the State should provide rebates or direct investment in EV charging stations and hydrogen filling stations, where market support is needed. Preference for investments should be provided to fleets that operate in communities that have been disproportionately burdened by the impacts of air

pollution. DPS should continue to work with utilities to plan for expected service levels needed to support the electrification of MHD fleets, especially in Disadvantaged Communities where such depots tend to cluster.

Enhance Public Transportation and Mobility Alternatives

One of the more impactful supporting strategies for achieving the Climate Act’s energy efficiency, housing, and land use GHG emission reduction requirements is through enhancing the availability, accessibility, reliability, and affordability of public transportation services with an emphasis on unserved and underserved communities. The strategies to achieve these goals involve service enhancements, MOD, convenience and connectivity, and fleet modernization. These strategies, along with others discussed under *Smart Growth and Mobility-Oriented Development*, will reduce VMT compared with business-as-usual by providing alternatives to driving personal vehicles. For the purposes of this Scoping Plan, public transportation includes but is not limited to transit, micro-transit, shared mobility, and longer-distance passenger rail services.

T3. Community-Based Service Enhancements

MTA enhancements should focus on policies and programs that support system reliability, resilience, and network expansion projects identified in its current five-year capital plan and 20-year needs study.

Recognizing that the service needs of communities will vary throughout the State, enhancements are intended to be locally derived and tailored to achieve the maximum utilization and GHG emission reductions. This may include but not be limited to increasing the number of routes, increasing service frequency, increasing the number of scheduled stops to facilitate last mile connectivity, introducing demand response services, partnering with mobility providers, providing direct connectivity to longer-distance bus and passenger rail services, incorporating shared mobility and micro-mobility into transit offerings, or a combination of these and other service modifications. Providing and expanding access to public transportation in the context of business location and economic development will help provide access to jobs and reduce the time and expense to commute to places of employment.

CJWG feedback included the need to provide more detail on what specific public transportation enhancements were proposed and how enhancements would be identified and accomplished. As detailed below, these issues are intended to be addressed

Downstate services provided by municipalities other than the MTA is defined as services provided, directly or under contract by, municipalities in the Metropolitan Commuter Transportation District as designated in Public Authorities Law § 1262.

through context appropriate community-based discussions. The CJWG also emphasized the need to think beyond traditional urban public transit and enhance inter-regional rail transportation.

Components of the Strategy

- **Identify, plan, and implement service enhancements and offer additional shared mobility and micro-transit services:** The State should work with communities and service providers to design strategies that increase utilization of existing and new public transportation options and alternatives. Strategies should be context-specific and will differ between urban, suburban, and rural communities. Public transportation service enhancements are intended to be further informed through community-based discussions. For example, availability/accessibility may refer to an increase of service hours/frequency, an increase in routes, and/or an increase in the number of stops along a route. It is anticipated that a combination of approaches will be required in most communities.
- **Strengthen New York’s rail network:** The State should work with federal partners to improve the reliability of intercity passenger rail service and strengthen the freight rail system. These improvements will provide New Yorkers with additional low-carbon options for longer-distance travel and improve the environmental sustainability of the goods movement system.

In addition to State agencies identified as key stakeholders for the transportation sector, others responsible for the implementation of these strategies include the federal departments of Transportation, Housing and Urban Development, and Energy, and the U.S. Environmental Protection Agency (EPA).

T4. Customer Convenience and Service Connectivity

In addition to providing high-quality amenities at public transportation facilities, including sidewalks, seating, lighting, electronic customer information (next-bus), the State should assess ways to implement strategies for making public transportation easier to use and more competitive on a travel time basis. This includes simplified and integrated fare media, dedicated bus lanes and intelligent transportation/bus signal prioritization, and deploying new phone-based application technologies that make public transportation more logical/easier to understand. These enhancements will facilitate increased use of public transportation in support of reducing VMT. Current efforts underway in the State to enhance convenience and connectivity include the implementation of micro-mobility services in the Capital Region, the realignment of services to support jobs and job training in the Finger Lakes Region, and the deployment of new integrated service, trip planning, and fare payment apps in the Southern Tier Region.

The CJWG supports increased investments in enhanced public transportation alternatives and noted that doing so creates jobs in local communities, offering employment opportunities for workers in Disadvantaged Communities. In addition, the CJWG suggests offering incentives to companies in transit manufacturing for designating that a certain proportion of their workforce be hired from Disadvantaged Communities.

Components of the Strategy

- **Improve public transportation ease of use:** The State should facilitate the development and implementation of strategies for making public transportation easier to use. This includes working with the public and private sector on simplified and integrated statewide fare media and deploying new phone-based application technologies that makes public transportation more logical and easier to navigate.

T5. Fleet Modernization and Electrification

Recognizing that bus maintenance/service facilities are historically more likely to have been located near or within LMI communities, the State is committed to accelerating the deployment of zero-emission buses, which will mitigate GHG emissions and noise pollution. As part of this transition, the State should continue to support electrification of buses and other service vehicles appropriate for the communities being served.

The CJWG requested more detail to confirm what “make ready costs” include. As described below, the term “make ready costs” in this context describes the utility infrastructure costs associated with bringing the power needed and the building modifications needed to support facilities to facilitate electric bus charging.

Components of the Strategy

- **Transition to zero-emission public transportation fleets:** The State should work with municipally sponsored public transportation systems on a plan to transition to all-electric, zero-emission public transportation vehicles at defined replacement schedules appropriate for the transit provider. The State has already taken action to implement this strategy by:
 - Committing more than \$100 million toward the electrification of 25% of the five largest fleets, outside the MTA, by 2025 and 100% by 2035 (MTA has committed to purchase only electric buses after 2029 and to fully electrify its fleet by 2040)

- Directing a significant portion of the \$45 million in funding available through the Volkswagen settlement funds to assist public transportation providers with the replacement of existing diesel buses with more than 100 all-electric transit buses
- Expanding Charge Ready NY incentives for Disadvantaged Communities and enhancing options for electric transit bus procurements
- Supporting the deployment of all electric transit buses through the New York Truck Voucher Incentive Program
- Improving electric fleet economics for developers by supporting the Make-Ready program, which promotes EV charging station deployment

Barriers to implementation include funding as well as federal “payback” if vehicles financed with federal funds are replaced prior to the end of the Federal Transit Administration–rated service life.

In addition to State agencies identified as key stakeholders in this chapter, others involved in the implementation of these strategies include the U.S. Department of Transportation and the municipal owners of the vehicles and infrastructure.

Smart Growth and Mobility-Oriented Development

Smart growth land use patterns facilitate reductions in GHG emissions in the transportation sector by reducing VMT, increasing the viability and practicality of low-carbon transportation modes, and decreasing the travel distance between locations through a denser concentration and mix of residential and commercial development. Personal travel is often enhanced by the increased availability of mobility alternatives, including walking, biking, and public transportation. Taking a holistic approach to community development and MOD can help expand transportation options and economic opportunity in urban, suburban, and rural communities, although it will look different in different contexts. Strategies like MOD and expanded mobility options reduce the environmental footprint of transportation on communities and provide increased access to existing services such as healthcare, retail, hospitality, and entertainment while attracting new services, and can be designed to encourage mobility-rich affordable neighborhoods.

Smart growth strategies to reduce transportation GHG emissions fall within four categories: MOD, public education and awareness, expanding the availability of low-carbon transportation alternatives, and new technology integration. A broader set of smart growth strategies and recommendations are contained within *Chapter 19. Land Use*.

T6. Mobility-Oriented Development

To reach GHG emissions reduction requirements, the State should place greater emphasis on programs and projects that enable greater use of public transportation and other low-carbon mobility alternatives and investments that are informed by criteria that maximize sustainable land use/development patterns and climate outcomes. Because smart growth and new development happens over decades, starting as early as possible is important. Strong collaboration between the State and local governments is critical for these strategies to be effective, as most land use decisions fall under the purview of local governments. These strategies may not be applicable in every community, but many different variations on MOD are possible in communities of different sizes and densities. The CJWG expressed support for the expansion of low-cost transportation options accessible to underserved communities, a key element of MOD.

While the State currently incorporates public transportation needs into efforts to attract and retain businesses, New York should implement incentives and policies for businesses and localities for development located adjacent to and integrated into public transportation services.

Examples of integrated supportive policies and incentives to facilitate mobility-oriented development include:

- **Capital District Transportation Authority:** Recognizing that there is no one size fits all mobility solution, working with the communities that make up the multi-county transportation district, Capital District Transportation Authority has implemented an innovative and diversified range of mobility alternatives, including several high frequency/high quality bus rapid transit lines; regional ride-matching; bicycle and electric scooter sharing; and micro-transit services. The goal is to support rezoning and development that is occurring within the central business districts of Albany and Troy and to promote sustainability and environmental stewardship.
- **MTA/Developer Collaboration on One Vanderbilt Development Project (adjacent to Penn Station):** MTA worked with City Zoning and the developer early to secure transit access improvements (such as easements, stairways, and elevators) at the developer's expense in exchange for added density.
- **Niagara Frontier Transportation Authority Metro Amherst Extension:** The Niagara Frontier Transportation Authority and Town of Amherst planners are developing proposed plans and zoning to promote both transit-oriented development and mobility-oriented development along the proposed extension of Buffalo's Metro light rail system into the town.

Components of the Strategy

- **Coordinate investments in MOD:** New York should establish an interagency, multi-stakeholder, multi-disciplinary strategy to coordinate investments in and around mobility centers, which should include DOS, DOT, ESD, DASNY, DEC, NYSERDA, DOL, the Office of Just Transition, and other relevant agencies.
- **Tie incentives for business development to mobility access:** ESD should expand and institutionalize its initiatives to incorporate public transportation needs into efforts to attract and retain businesses. This includes implementing incentives and policies for developments that are located adjacent to and integrated into public transportation services, including incentives for businesses to accommodate non-vehicular commuting, such as employee-based trip reduction programs, low-/no-cost transit passes for employees, micro-transit options for employees, ride-sharing programs, bike-sharing and scooter-sharing, and cycling accommodations.
- **Revise design manuals:** To further guide MOD, DOS should facilitate, in cooperation with municipalities, the reimagining of the design manual used by local governments and developers for the construction of buildings, roadways, parking, and bicycle and pedestrian amenities. This updated manual should address both public infrastructure and buildings and how they can be designed to support clean transportation options in urban, suburban, and rural contexts. DOS should support municipalities in eliminating or reducing parking minimums and maximizing access to other mobility alternatives.
- **Designate priority development areas:** DOS and ESD should designate priority development areas to concentrate development and make it easier to build in areas that facilitate low-carbon transportation modes. All types of communities can benefit from this type of focused development area, regardless of size and density. Development incentives should focus on building transportation-related infrastructure in these areas. Such an initiative would provide the greatest climate and public health benefits when combined with other Climate Act strategies,

Examples of such incentives currently in place include:

- **Onondaga Industrial Development Authority:** Developers seeking tax credits receive preference for proposals that incorporate transit-accessibility into their proposals. If a development requires transit service, they must address the issue in their proposal before submitting a request for a tax incentive.
- **Buffalo Green Code's Transit-Supportive Development Incentives:** Buffalo's form-based code will grant a "zero-parking" waiver to projects that meet the criteria for being "transit-supportive," developers must also submit transportation demand management plans to qualify.

including housing and power generation. Additionally, such an effort should consider and not conflict with New York State Homes and Community Renewal (HCR) Well-Resourced areas.

T7. Smart Growth Public Education and Awareness

Public perception is critical to understanding and expanding smart growth. There are common misperceptions about the principles of smart growth and their effects on municipalities, particularly density, mixed-uses, mixed income/affordable housing, and sometimes transit itself. Helping the public understand the benefits of smart growth and public transportation to the climate, energy, socioeconomic equity, fiscal, economic, and public health removes some of the many barriers to successfully completing these projects. Emphasizing the links between transportation investments (particularly public transportation) and land use and development outcomes, particularly as it relates to socioeconomic equity, will help generate support for these measures.

The CJWG is supportive of smart growth and the many benefits that flow from this strategy. The CJWG, along with the Council, recognizes that these types of projects require community buy-in, which only comes through greater public education and awareness.

Components of the Strategy

- **Define benefits of smart growth:** DOS and DOT should produce research and materials that demonstrate the links between planning and transportation in New York, including impacts on local finances and equity. This should include fiscal impact analyses of smart growth compared with sprawl, regarding both public infrastructure investments for each and tax revenues generated. The agencies should also conduct additional analysis on the equity impacts of smart growth and ways to increase affordability of smart growth developments.
- **Conduct public education campaign:** Led by DOS, the State should develop and launch an expansive, multi-dimensional, grass-roots public education campaign on the links between smart growth, transportation, transit, and housing; their roles in reversing climate change; best practices for sustainable smart growth actions at the local level; and the many benefits of smart growth. These materials should be developed in concert with an online, iterative, interactive Sustainable Development Handbook.

T8. Expanding the Availability of Low-Carbon Transportation Alternatives

MOD and priority development areas are highly dependent upon the availability of low- and zero-emission transportation alternatives to complete the first mile/last mile of trips. This includes prioritizing

the availability of safe and accessible pedestrian and bicycle amenities, high quality and frequent transit, and mobility-on-demand services. As part of future investments, agencies and authorities should be required to prioritize low- and zero-emission transportation infrastructure in all activities, where feasible, and link these investments to supportive land use policies that enable greater use of low-carbon mobility options. DOT will prioritize opportunities to invest in Scoping Plan strategies including low- and zero-carbon transportation alternatives utilizing appropriate federal funding such as the Carbon Reduction Program, the Transportation Alternatives Program, and the Congestion Mitigation and Air Quality Improvement Program.

The technology surrounding low- and zero-emission first-mile/last-mile mobility will help guide individual choice. As such, the State should facilitate the development and deployment of applications (apps) to make mobility alternatives and multi-modal trips more attractive, accessible, and user-friendly.

The CJWG is supportive of the expansion of low-cost transportation options accessible to underserved communities, a key element of this strategy.

Components of the Strategy

- **Update the Smart Growth Public Infrastructure Policy Act:** The State should enact legislation to amend and strengthen the State’s Smart Growth Public Infrastructure Policy Act (ECL Article 6) to more effectively avoid new State infrastructure spending that would promote sprawl and define and prioritize priority development areas, such as TOD. This is discussed further in *Chapter 19. Land Use*.
- **Fund low-emission zones and car-free streets:** The State should prioritize investments in local projects that establish low-emission transportation zones, car-free streets, and similar concepts that encourage travelers to take alternative transportation modes and support the infrastructure required to shift freight to lower-emission modes, like rail, cargo bikes, and electric trucks.
- **Fund mobility options:** The State and metropolitan planning organizations (MPOs) should prioritize, incentivize, and expand access to funding for bike, pedestrian, transit, and complete streets projects that serve employment and population centers. These expansions in mobility options should be complemented by supportive land use policies that enhance the viability of these low-carbon transportation modes.
- **Expand partnerships with businesses:** ESD should encourage businesses seeking economic development incentives (local or State) to consult transit agencies early when seeking to locate or expand in areas with existing multi-modal options and to provide services for employees

(employee-based trip reduction programs, transit/micro-transit services, ridesharing, bike-sharing, cycling accommodations, free/reduced transit passes). DOS and DOT should provide technical assistance to these businesses and New York should offer local and State tax credits for businesses that accommodate employee public transportation and transportation demand management alternatives and for employees who use alternative mobility options.

T9. New Technology Integration

New mobility solutions also require a rethinking of the technology people use to travel and access transportation services. Emerging technologies like automated vehicles (aVs), shared mobility services, and Internet-of-Things-enabled infrastructure could be used to reduce energy use and emissions from transportation if used in a coordinated and constructive manner. Setting the right rules for technology and data use and investing in demonstrating technologies that enable low-carbon modes of transportation can help enable equitable, clean transportation solutions.

Components of the Strategy

- **Support intelligent transportation systems and aVs that save energy:** NYSERDA should invest in research, development, and demonstration (RD&D) and demonstrations of emerging intelligent transportation systems, connected vehicles and aVs, and fund the broader adoption of technologies that prove effective in improving transportation system efficiency, such as smart parking systems, adaptive traffic lights, and Internet-of-Things-enabled streetlights. New York should enact policies discouraging “empty” AV miles traveled and requiring aVs used as for-hire vehicles to be ZEVs.
- **Make data accessible and secure:** DOT, New York State Thruway, and the New York State Office of Technology Services (ITS) should support the adoption of open-source technologies and standard data collection protocols for transportation data and connected infrastructure. ITS should convene an interagency group to develop strategies to combat cybersecurity risks associated with new transportation technologies, such as aVs and EV charging.
- **Enable user-friendly apps through data sharing with transit operators:** MTA and other transit operators should facilitate the development of electronic mobility platforms offering seamless multi-modal trip planning and payment options to make public transportation more attractive, accessible, and user-friendly.

Facilitate Market-Based Solutions and Financing

The strategies and policies referenced in this chapter for decarbonizing the transportation sector will require substantial private and public investment. These investments should be facilitated, in part, through market-based and other supportive policies that generate resources necessary to implement investments required to achieve the Climate Act requirements and goals. Some of the recommended policies animate the flow of private capital while others provide a source of public funding. These policies can also provide a market signal, encouraging private action that reduces emissions, from an increased use of public transportation to the purchase of lower-emitting vehicles. The strategies to achieve these goals include transportation sector market-based policies, unlocking private financing, and developing a clean transportation standard.

T10. Transportation Sector Market-Based Policies

Market-based policies focused solely on the transportation sector can provide the dual benefits of discouraging more costly carbon-intensive behavior and providing a revenue source for investment in other strategies. One such policy in the development process is the implementation of congestion pricing in the Manhattan Central Business District. Congestion pricing, which reduces emissions by pricing driving and, through a system of variable tolling, provides a funding source for enhancements in the region's low-carbon public transportation system. Other market-based policies recommended for adoption are described below.

Components of the Strategy

- **Variable pricing/parking policies:** Similar to congestion pricing, these policies discourage driving into and parking in central cities through a system of fees, the collection of which can be used to support alternatives to driving such as public transportation and cycling infrastructure. Pricing policies could include variable fees that discourage parking at peak times or demand parking policies, which limit parking to certain users or vehicles, including ZEVs. Generally, these policies would be adopted by municipalities, but the State can play a supportive role through, for example, development of model code language.
- **Vehicle registration fees:** The State should enact legislation establishing a system of registration fees that would discourage the purchase and continued use of more carbon intensive vehicles. These fees would vary based on emissions or attributes related to emissions such as a vehicle's weight and/or drive train. If accompanied by incentives for lower-emitting vehicles, this approach would resemble the feebate program discussed above under the ZEV strategies (T1. Light-Duty Vehicle Adoption).

- **Mileage-based user fees:** The State should enact legislation to establish a per-mile fee system to fund investment in transportation infrastructure. This system would reduce emissions by discouraging driving, although consumers are generally quite price insensitive to such systems. Thus, although mileage-based users fees could effectively replace declining gas tax revenues, they may not have a significant impact on incentivizing ZEVs or lowering emissions.
- **Tax increment financing/Special assessment districts:** Municipally adopted special assessment districts provide a mechanism to finance public transportation investments. For example, New York City funded investment in the extension of the 7-Line with assessments on properties in the Hudson Yards redevelopment project.

T11. Unlock Private Financing

The use of EVs yields substantial savings in fuel consumption and reduced maintenance over the life of the vehicle. Analyses indicate that the total cost of ownership of ZEVs, both LDVs and MHD vehicles, is nearing parity, and is expected to be achieved across all vehicle classifications by the end of this decade. However, the higher initial cost of ZEVs presents an obstacle to purchasers unable or unwilling to bear the upfront cost to reap savings in the longer term.

The CJWG is supportive of measures to accelerate truck and bus electrification and provide financing opportunities to those who generally lack access to affordable capital, which is the focus of this strategy.

Components of the Strategy

Several financial strategies can be utilized to reduce the obstacles posed by the higher initial cost:

- **Establish a First Loss Protection product based on existing financial market instruments and practice:** The purchase of ZEVs can be facilitated by increasing the availability of low-cost capital/bank loans to fund the higher upfront costs of commercial ZEVs. One area of uncertainty that inhibits banks and other financial institutions from financing the purchase of ZEVs, however, is uncertainty about the residual value of the vehicles being purchased. New York should identify a State agency or authority to guarantee at least a portion of the residual value of the ZEVs being financed at the end of the loan term (such as First Loss Protection). Providing that certainty will help unlock the lowest-cost private financing needed, further reducing upfront costs to enable the purchase of ZEVs in place of fossil fuel-powered vehicles.
- **Offer fleet feasibility studies:** NYSERDA and the electric utilities should undertake feasibility studies for MHD fleets, including school districts and transit agencies, to identify benefits, costs,

logistical challenges, financing options, other barriers to electrification. By bearing these soft costs, the State should provide fleet managers with the financial information necessary to make the case for investment in zero-emission fleets.

- **Expand NY Green Bank’s mission:** The State should enable the NY Green Bank to take on different types of investment opportunities in defined categories of electrification financing, potentially including EV charging infrastructure as well as fleets.

T12. Market-Based Fuel Policy

The strategies described above will reduce the State’s reliance on fossil fuels for transportation as expeditiously as possible. Right now, the transportation fuels market is built principally around cost considerations and does not incorporate the Climate Act’s requirement for emission reductions for GHGs and dangerous co-pollutants. Aligning market incentives with the pressing need to decarbonize New York’s economy can unlock accelerated deployment of electric and zero-emission vehicles, as well as support alternative fuels in important and challenging-to-electrify use cases. A strategy that prioritizes electrification but enables existing vehicles to contribute to emission reductions via alternative fuel substitution offers a pathway for maximum reductions. Given the service life of current vehicles and equipment, liquid fuels are expected to constitute most of the fuel mix until the mid- or late-2030s under the most aggressive integration analysis scenarios identified for transitioning to zero-emission technologies. Substituting sustainable renewable fuels for a portion of the remaining fossil fuel combustion will reduce GHGs and other emissions.

For harder-to-electrify vehicles and equipment, the integration analysis scenarios identified for meeting the Climate Act GHG emission reduction requirements rely, in part, on the increased use of alternative fuels, including renewable diesel, renewable jet fuel, and/or green hydrogen. The CJWG opposes policies supporting renewable fuels on the grounds that they still release harmful air pollutants, particularly in areas overburdened with diesel emissions, and contends that the State should focus instead on expeditiously electrifying vehicles and the use of hydrogen fuel cells. Because this Scoping Plan expedites electrification as much as reasonably feasible, any GHG emission reductions from the use of renewable fuels would be in addition to the emission reductions from accelerated electrification and would not serve to slow the pace of electrification.

Components of the Strategy

- **Clean Transportation Standard:** DEC and NYSERDA should evaluate and consider adopting a variation on a clean fuel standard that would, as described in more detail below, support the

transition to electrification, expanded transit, and clean transportation alternatives, particularly in Disadvantaged Communities. A traditional clean fuel standard is a policy mechanism to facilitate decarbonization of transportation fuels by requiring fossil fuel providers to reduce the carbon content of the fuels they provide by either acquiring credits from providers of electricity for transportation use or other zero-carbon or lower-carbon fuels into the stream of commerce or by blending lower-carbon fuels into their fuel mixes. In New York, a variant of this policy, a “clean transportation standard,” would support transportation electrification as petroleum fuel providers finance the use of electricity for transportation use. **Other fuels may be eligible to generate credits through the program subject to screening based on co-pollutant emissions, as described below.** Electricity in New York is an increasingly low-carbon fuel as the State moves toward zero-emission electricity by 2040, as required by the Climate Act. A clean transportation standard should include consideration of how it might interact with other policy measures, especially economywide measures identified in this Scoping Plan. Based on benefit-cost analyses and interaction with other policies, DEC and NYSERDA should assess the viability, need for, and efficacy of the proposed clean transportation standard prior to commencing a regulatory process. This clean transportation standard design would improve on existing models via program design choices that align a standard with Climate Act goals and requirements. Any proposed standard should include the following elements:

- The program should be designed to ensure long-term electrification by instituting a long-term trajectory for carbon intensity reductions out through 2050, which would send clear price signals that indicate when combustion fuels would cease generating credits.
- The proposed clean transportation standard would also reward public transportation providers statewide for emission reductions from electrified transit, providing them with resources to accelerate zero-emission rolling stock and infrastructure, as well as improve service, particularly to underserved communities.
- The program could also offer public and nonprofit fleets “advance credits” upon purchase of ZEVs, reducing the upfront cost of these vehicles.
- To prioritize co-pollutant emission reductions in Disadvantaged Communities and benefit LMI households, the clean transportation standard should ensure that revenue generated from credits associated with home-charging of EVs is largely or wholly directed to electrification, improved transit, and other mobility alternatives to benefit Disadvantaged Communities and LMI households, with input from community representatives. One way to achieve this is by having the State generate these credits directly.

- To address the CJWG’s concerns, the clean transportation standard should also screen fuels based on their co-pollutant emissions, limiting credit generation to those fuels that, based on a rigorous analysis, including an analysis of peer-reviewed scientific research, and subject to public comment, have lower overall co-pollutant emissions than petroleum fuels.
 - Program design could consider ways to support electrification of offroad fuel uses, often a disproportionately impactful source of air pollutants, particularly in Disadvantaged Communities.
 - The policy could also be structured to allow aviation fuels to voluntarily opt into the program, reducing emissions in this challenging-to-electrify subsector.
 - Decisions regarding the carbon intensity of alternative fuels would provide market signals that promote the use of those fuels that have a lower fuel cycle carbon intensity on a life cycle basis.
- **Clean fuel infrastructure:** The State should fund incentives for infrastructure for cleaner fuels, such as green hydrogen, where additional market support is needed.

Chapter 12. Buildings

12.1 State of the Sector

Overview

New York’s residential and commercial buildings sector encompasses over 6 million buildings, which are home to 7.4 million households and include over 5 billion square feet of commercial and institutional space where New Yorkers work, learn, gather, and access essential services. The State’s large geography, varied climate, and vibrant economy drives a diverse buildings mix, as discussed further below.

Statewide, New York’s residential and commercial buildings are older than the national average, pointing to opportunities for upgrading buildings in ways that improve both quality of life and energy performance. In addition, nearly half (48%) of households statewide are low- to moderate-income (LMI) households, underscoring the importance of careful attention to housing and energy affordability.

Residential and commercial buildings use energy for heating, ventilation, and air conditioning (HVAC), water heating, lighting, refrigeration, cooking, computer and office equipment, and other small appliances. Direct greenhouse gas (GHG) emissions from the buildings sector come from burning fossil fuels onsite in residential and commercial buildings, primarily for space and water heating, and associated upstream emissions. This chapter addresses strategies for reducing GHG emissions attributable to residential and commercial buildings, whereas strategies for mitigating emissions attributable to industrial facilities are addressed in *Chapter 14. Industry*.

Emissions Overview

The buildings sector was the largest source of emissions in 2019, responsible for 32% of emissions statewide, which includes the combustion of fossil fuels in residential (34%) and commercial buildings (19%), emissions from imported fuels (33%), and hydrofluorocarbons released from building equipment and foam insulation (14%). The fuels used in buildings today include fossil natural gas, distillate fuel (e.g., heating fuel oil #2), wood, propane, kerosene, and residual fuel.

Decarbonizing building operations describes the reduction or elimination of GHG emissions from building end uses through energy efficiency improvements to reduce energy demand and through switching from equipment and systems powered by burning gas, oil, or other fossil fuels to highly efficient equipment and systems powered by zero-emission energy sources. In addition, embodied carbon associated with building construction can be reduced through building reuse and through using lower-carbon materials or carbon-sequestering products.

The integration analysis indicates that energy efficiency and managed electrification in buildings will be critical to meet New York State’s GHG emissions limits under the Climate Act. All scenarios modeled in the integration analysis include rapid adoption of high-efficiency heat pumps so that one to two million energy-efficient homes use heat pumps by 2030, and by 2050, the large majority of buildings statewide use electric heat pumps for heating, cooling, and hot water. Switching from fossil fuels to heat pumps for heating and hot water will immediately and significantly reduce GHG emissions and criteria pollutants from buildings (as powered by the State’s electric grid today). As the State advances toward a zero-emission electricity sector by 2040, electrification will enable buildings to operate with virtually zero emissions. To manage the impacts of widespread electrification on the State’s electric grid, it also will be essential that buildings make significant investments in energy efficiency, install a diverse mix of heat pump technologies, and adopt smart controls, energy storage, and other load flexibility measures. As modeled in the integration analysis scenarios, widespread improvements to building envelopes (air sealing, insulation, and replacing poorly performing windows) will reduce energy demand from the buildings sector by 30% to 50% by 2050. The adoption of ground-source (or geothermal) heat pumps (GSHPs) and installation of heat pumps with fuel backup further reduce the amount of electricity needed on the coldest days of the year, relative to air-source heat pumps (ASHPs) with electric resistance backup. The integration analysis finds that rapid and widespread building efficiency and electrification is needed and supported by the strategic utilization of alternative fuels.²¹⁰

Electrification of space and water heating with high-efficiency heat pumps is a viable approach to decarbonizing operations for nearly all types of buildings in New York. Modern heat pumps that work in very cold weather are commercially available and able to keep homes and businesses safe and comfortable year-round, as long as they are properly chosen, sized, installed by appropriately trained workers, and paired with an energy-efficient building envelope and HVAC system design. Electrically powered heat pumps circulate refrigerant to move heat from one place to another – typically between indoors and the air, ground, or water outside. GSHPs perform well in extreme temperatures without the need for electric resistance or fuel backup since heat is exchanged between the building and stable ground temperatures via an underground piping system. Cold climate ASHPs also work efficiently in New

²¹⁰ See Appendix G: Integration Analysis Technical Supplement. Scenario 2 (called “Strategic Use of Low-Carbon Fuels”) modeled in the integration analysis projects that 20% of installed heat pumps are GSHP and 80% are cold climate ASHP, of which one in 10 air source heat pumps (ASHPs) are modeled to use fuel backup to meet heating demands during the coldest 5% of hours. In this scenario, renewable natural gas (RNG) is used in the buildings sector, assuming a 9% RNG blend in gas pipelines by 2030 and 100% RNG to meet dramatically reduced gas demand in buildings by 2050. Green hydrogen use is limited mostly to transportation, industrial purposes, and electricity reliability in this scenario, though a small amount of hydrogen is used to power the Con Ed district system by 2050, with steam demand reduced by about 66% as many existing customers electrify in whole or in part.

York's climate, but in very cold outdoor conditions both their heating capacity (output) and efficiency (coefficient of performance) are reduced, and supplemental heat may be used. At a district or community-scale, underground pipes can be installed alongside other infrastructure to distribute thermal energy among multiple buildings; these thermal energy networks can recycle waste heat among diverse building types, provide load smoothing, and drive economies of scale. Compared with fossil fuel or electric resistance heating systems, ASHPs are two to three times more efficient, and GSHPs are three to five times more efficient on a seasonal basis; even higher efficiencies are possible through heat recovery and thermal energy networks.

Cold climate ASHP systems, GSHP systems, and thermal energy networks have different upfront costs, operational costs, seasonal efficiency performance, and impacts on electric peak load during the coldest hours. The integration analysis modeled a high ground source/district loop heat pump system sensitivity to examine how more widespread use of ground source heat pumps and district geothermal thermal energy networks could help reduce electric grid system impacts from electrified space heating, while reducing GHG emissions by substituting clean thermal energy sources for fossil fuel heating systems. It showed that if energy efficiency upgrades lag and ASHP installations perform poorly during very cold hours, then energy use and electric system costs would increase; or alternatively in this scenario, more GSHPs/thermal energy networks could be installed at a higher cost that is approximately balanced out by electric system savings.²¹¹ Lower demand from the buildings sector with more GSHPs and thermal energy networks would lead to lower electric system investments in firm capacity, battery storage, renewables, and the distribution grid. Ongoing analysis is warranted to monitor the relative cost trajectories of GSHP and district thermal energy networks versus electric peak costs.

Regional differences in New York also warrant ongoing consideration as technologies, markets, and policies evolve to enable the transition to an efficient, electrified building stock. New York's downstate region (Long Island, New York City, and Westchester County) is characterized by dense urban areas and a mixed climate (Climate Zone 4A, mixed humid). These cities and towns often have higher costs for construction and real estate, more multifamily housing and leased space, and taller buildings with denser occupancy. Median household incomes are typically higher in downstate counties than in upstate New York; however, Bronx County has the lowest median household income and the highest poverty rate of any county in the state (U.S. Census Bureau, American Community Survey 5-Year Estimate, 2016-2020).

²¹¹ See Appendix G: Integration Analysis Technical Supplement.

Inequality is high in New York City, where nearly one in five residents lives in poverty and over 40% of the population lives in poverty or near poverty.²¹²

Challenges to installing heat pumps in downstate New York are high installation costs, high electricity costs, the provision of gas service lines and extensions of gas mains at no or low cost to individual new customers, and uncertainty on how to design systems for existing high-rise buildings. This milder climate downstate allows for smaller heating systems, and single-family homes can use heat pumps as a whole-home solution without supplemental heat. Larger multifamily, mixed-use, or complex commercial buildings may have logistical constraints (e.g., limited roof area) that result in heat pump systems needing supplemental heat (e.g., electric resistance or pre-existing gas-fired system) on the coldest days. However, it is anticipated that supplemental heat will be phased out as envelopes are improved and heat pump technology advances to meet the needs of existing high-rises. Large buildings in New York City that purchase Con Edison's district steam for heating and hot water may prioritize system optimization, energy recovery, and partial electrification to minimize steam consumption in advance of the potential decarbonization of the district steam system.

The upstate region is characterized by suburban and rural communities, as well as small and moderate-sized cities, with cooler climates (Climate Zones 5, cool-humid and Zone 6, cold-humid). These smaller cities, towns, and villages have lower cost real estate and more single-family homes and low-rise buildings. Median incomes are typically lower than in downstate New York, with those in the Southern Tier being among the lowest in the state. In the Southern Tier and in the mostly rural and suburban counties in the Mohawk Valley and the North Country regions, low-income households are more likely to live outside census tracts that are geographically designated as Disadvantaged Communities.²¹³

Challenges to installing heat pumps in upstate New York are high installation costs, the provision of gas service lines and extensions of gas mains at no or low cost to individual new customers, limited availability of equipment and trained installers and contractors, and uncertainty on how to design efficient systems that can handle sub-zero temperatures without supplemental heat. In addition, rural areas with above-ground electric wires are more vulnerable to prolonged power outages in winter storms; while

²¹² The Mayor's Office for Economic Opportunity. 2021. New York City Government Poverty Measure 2019. Available at <https://www1.nyc.gov/site/opportunity/poverty-in-nyc/poverty-measure.page>

²¹³ Based on New York State's Draft Disadvantaged Communities Criteria. December 2021. See the "Draft Disadvantaged Communities Criteria Overview Fact Sheet" available at <https://climate.ny.gov/disadvantaged-communities-criteria/>.

furnaces and boilers also require electricity to operate, a heat pump system requires significantly more power (watts) to run, pointing to the need for resilience solutions that go beyond a portable generator. However, the upstate region also has certain advantages that may help transition these homes and businesses to heat pumps. First, homes and buildings upstate are likely to have ample outdoor space for ASHP outdoor units or GSHP ground loops. Second, where gas infrastructure is less developed, as in many rural areas and on Long Island, New Yorkers heating with delivered fuel oil or propane can benefit from significant energy bill savings by switching to an energy-efficient heat pump. Third, New York's upstate region has the cleanest electricity in the country.²¹⁴

In New York's coldest northern and mountainous regions, some homes that install cold climate ASHPs may need supplemental heat (wood, home heating oil, propane, or gas) for the coldest days to maintain comfort, avoid oversized heat pumps that lead to inefficient operation, and offer a backup source of heat during a power outage (paired with a generator as needed). Counties in the North Country, Mohawk Valley, and Capital regions are the coldest in New York.²¹⁵ Heating systems there need to keep buildings warm in winter temperatures that fall below zero (0°F), a design temperature at which available cold climate ASHP products tend to be installed with supplemental heat. The U.S. Department of Energy's ongoing Residential Cold Climate Heat Pump Technology Challenge is working in partnership with the U.S. Environmental Protection Agency, Natural Resources Canada, heat pump manufacturers, and other stakeholders to accelerate the development and commercialization of next-generation cold climate ASHPs, including products that are optimized for -15°F (-26°C) operation, which like GSHPs would meet consumer comfort, safety, and efficiency needs in even the coldest New York regions.

Vision for 2030

By 2030, one to two million energy-efficient homes should be electrified with heat pumps, and heat pumps should provide space heating and cooling for 10% to 20% of commercial space statewide. Heat pumps should become the majority of new purchases for space and water heating by the late 2020s. From 2030 onward, more than 250,000 New York homes and thousands more commercial buildings each year are expected to be retrofitted or constructed to be energy-efficient and to install heat pumps for primary

²¹⁴ Carbon dioxide equivalent emissions on a 100-year basis in the eGrid region NPCC Upstate New York (NYUP) were 234.5 pounds of CO₂e per megawatt hour of electricity produced in 2020. Emissions from the next cleanest eGrid region California (CAMX) were 515.5 pounds of CO₂e per megawatt hour that year. U.S. Environmental Protection Agency. https://www.epa.gov/system/files/documents/2022-01/egrid2020_summary_tables.pdf

²¹⁵ Based on the 99% Heating Design Temperature (°F) by county in the ASHRAE 2013 Manual J Design Conditions 8th Edition.

heating, cooling, and hot water, which is more than a tenfold increase from annual adoption today. This rapid market growth is projected to generate more than 100,000 new jobs in energy-efficient construction and clean heating and cooling. Public support for job growth and training in electrification and energy efficiency services will provide both new and incumbent workers with opportunities in the clean energy economy (see Table 10 and Strategy B8), while in-state engineering companies and manufacturers expand innovation and capacity to serve the growing New York and regional markets.

To achieve this dramatic growth, New York should invest in a significant scale-up of financial support for energy-efficient building envelope upgrades and electric heat pump systems, with priorities afforded to Disadvantaged Communities. State codes should require new construction to be highly efficient, zero-emission, and resilient to the effects of climate change. State regulations should be in place to phase out fossil fuel use in existing buildings by requiring zero-emission equipment and appliances at the time of replacement and by setting energy efficiency performance standards for large existing buildings. These regulations will send a clear policy signal, with compliance dates that allow regulated entities to plan and build capacity while regulators protect households from cost burdens. Utility price signals and technological innovation also should support expansion of grid-interactive buildings, energy storage, and other demand-side solutions for load shifting, reducing the need to operate peaker power plants and to build additional grid capacity. Throughout this transformation and through the strategies in this Scoping Plan, LMI households and frontline communities will need to be protected from displacement and threats to affordability.

Vision for 2050

By 2050, 85% of homes and commercial building space statewide should be electrified with energy-efficient heat pumps and thermal energy networks. New York should have advanced a managed, phased, and just transition from reliance on fossil natural gas in buildings to a clean energy system (see *Chapter 18. Gas System Transition*). Embedded subsidies for fossil fuels will have been eliminated, and energy-efficient, zero-emission buildings will have become the most cost-effective option in a clean energy economy that supports secure jobs and demonstrates leadership in innovation. Investments in research and development will have brought affordable batteries and thermal storage, grid-interactivity, ultra-low global warming potential (GWP) refrigerants, and advanced technical solutions for the hardest-to-electrify building types to market. All New Yorkers will benefit from a just transition that supports vibrant, healthy communities and repairs structural inequalities in access to housing, credit, employment, economic opportunities, environmental resources, and a clean and healthy environment.

Table 10. Sector Spotlight: Timelines for a Just Transition in the Buildings Sector

- The JTWG Jobs Study found that residential HVAC, residential shell, commercial HVAC, and commercial shell subsectors will experience the most growth in clean energy jobs, with installation and repair jobs comprising almost two-thirds of all jobs added by 2030. Activities like heat pump installation and weatherization work will employ construction laborers, HVAC workers, electricians, plumbers, pipefitters, and insulation workers in local communities statewide.
- In scenarios modeled in the integration analysis, fuel consumption in the buildings sector is modeled to decline by roughly 33% by 2030 and 58% by 2035. Electric heat pumps are modeled to grow rapidly from a niche market to comprise the majority share of heating and hot water system sales from 2028 onward, and nearly all heating and hot water system sales by 2035. As compared with business-as-usual, energy-efficient building shell installations are modeled to more than triple by 2025 and to be six times higher by 2030.
- The 2020s thus represents a key period for job growth and training for workers who are doing energy efficiency and electrification work in the buildings sector. Gas distribution jobs are modeled to roughly stay flat through 2030, before declining in the 2030s, whereas heating oil jobs will decrease sooner.
- With legislation passed and a new regulatory regime under development, gas distribution workers will have the remainder of the decade to learn about and get trained on community and utility thermal energy network systems at-scale before gas distribution employment is projected to drop-off – as one pathway to utilize transferrable skills.
- As described in *Chapter 7. Just Transition*, the State should conduct prospective market assessments and analyses on the detailed occupations that will support job growth across the residential and commercial buildings sectors. Market analysis on these occupations should include an assessment of wraparound service needs, career pathways, and skills transferability for new and existing buildings workers, and should inform the scale-up of workforce development and training.
- Coordination across the New York State Energy Research and Development Authority (NYSERDA), New York State Department of Labor (DOL), and the Office of Just Transition, as well as direct engagement with labor unions and Registered Apprentice programs, is a vital part of understanding and responding to these market needs and to ensuring trained installers.

Existing clean energy jobs:	165,200	Potential job growth by 2030:	+135,700
		2040:	+197,600
Existing fuels jobs:	13,600	Potential job loss by 2030:	-2,600
		2040:	-8,000
		Potential net job creation by 2030:	+133,100
		2040:	+189,600

Note: Job impact data from JTWG Jobs Study (Scenario 2 Initial Employment Outputs), rounded to the nearest hundred. Jobs figures here may be partial due to differences in sectoral breakdown between Scoping Plan Chapters and Jobs Study; additional analysis found in the Jobs Study.

Existing Sectoral Mitigation Strategies

Catalyzing energy efficiency and electrification of space and water heating in buildings is a pillar of New York’s climate and equity agenda. The New Efficiency: New York strategy demonstrates the State’s commitment to reducing energy waste, fossil fuel use, and GHG emissions in the buildings sector, and doing so in a manner that advances equity, creates, and transitions to clean energy jobs in communities statewide, supports energy affordability, prioritizes benefits to Disadvantaged Communities, and expands access to comfortable, healthy, and energy-efficient homes and businesses. New York invests over \$1 billion in public funds annually for State- and utility-administered grant and market development programs focused on energy-efficient buildings. This includes a coordinated, statewide framework to

benefit LMI New Yorkers and the launch of the NYS Clean Heat initiative. The State’s clean energy workforce training initiative helps to equip the current and future workforce while increasing industry diversity and job opportunities in line with a just transition. Another long-standing priority is catalyzing innovation and bringing leading technologies and companies to New York, for example, through public-private partnerships that spur scalable demonstration projects for visionary, low-carbon buildings.

New York’s 2022–2023 State Budget includes a \$25 billion, five-year housing plan that will create or preserve 100,000 affordable homes across New York with a focus on economic recovery, social justice, improved digital connectivity, and climate action. The plan also provides for electrification and energy efficiency work to be ready for electrification in an additional 50,000 homes. Under the plan and its Sustainability Guidelines issued in 2022, New York State Homes and Community Renewal (HCR) is working to produce high quality affordable housing with improved building envelope performance and significantly lower or zero on-site GHG emissions from fossil fuel burning appliances. As noted in the Barriers and Opportunities Report, addressing the climate and housing crises in tandem will be more effective than addressing them separately.

The Advanced Building Codes, Appliance and Equipment Efficiency Standards Act of 2022 bolsters New York’s regulatory and policy environment to support energy efficiency and GHG reduction strategies in buildings along with expanded appliance standards. Additionally, the Utility Thermal Energy Network and Jobs Act requires the Public Service Commission (PSC) to develop a regulatory structure for utility thermal energy networks for heating and cooling homes, and utilities to launch pilot projects. The New York State Department of Environmental Conservation (DEC) also has adopted regulations that prohibit certain hydrofluorocarbons (HFCs) in specified uses (such as commercial refrigeration and large air-conditioning equipment) (6 NYCRR Part 494). Executive Order Number 22 builds upon progress and sets new goals for the State’s lead-by-example sustainability and climate directives for State agencies.

Even as New York demonstrates leadership, the speed and scale of action to decarbonize buildings must accelerate dramatically. Meeting New York’s ambitious climate requirements and goals in the residential and commercial buildings sector requires multi-pronged policy action, including new regulations and a major scale-up of public investments, to break through thorny market barriers and to manage significant risks to achieving the necessary equity and emissions reduction outcomes. The strategies recommended for the buildings sector work to achieve the Climate Act’s energy efficiency requirement for 2025, and critically, to spur more rapid and widespread end-use efficiency and electrification in buildings.

Key Stakeholders

Collaboration is critical among multiple State agencies, local governments, the federal government, consumers, nongovernmental organizations (NGOs), New York’s electric and gas utilities, affected workers and unions, and industry actors including the construction and building improvement industry, real estate actors, and clean energy businesses. Stakeholder engagement must include meaningful involvement of households, businesses, and community-based organizations from frontline communities, LMI households, public housing authorities and residents, environmental justice organizations, and affordable housing groups.

12.2 Key Sector Strategies

The key strategies within this sector are organized into four themes, as shown in Table 11. As described there in greater detail, the labor standards discussed in *Chapter 7. Just Transition* are intended to apply throughout this Scoping Plan, including for the buildings sector, as a means of promoting good, family-sustaining, union jobs accessible to all New Yorkers and achieving a true just transition.

Table 11. Buildings Sector Key Strategies by Theme

Theme	Strategies
Adopt Zero-Emission Codes and Standards and Require Energy Benchmarking for Buildings	<ul style="list-style-type: none"> B1. Adopt Advanced Codes for Highly Efficient, Zero-Emission, and Resilient New Construction B2. Adopt Standards for Zero-Emission Equipment and the Energy Performance of Existing Buildings B3. Require Energy Benchmarking and Disclosure
Scale Up Public Financial Incentives and Expand Access to Public and Private Low-Cost Financing for Building Decarbonization	<ul style="list-style-type: none"> B4. Scale Up Public Financial Incentives B5. Expand Access to Public and Private Low-Cost Financing B6. Support Development of Thermal Energy Networks B7. Align Energy Price Signals with Policy Goals
Expand New York’s Commitment to Market Development, Innovation, and Leading-by-Example in State Projects	<ul style="list-style-type: none"> B8. Invest in Workforce Development B9. Scale Up Public Awareness and Consumer Education B10. Support Innovation B11. Reduce Embodied Carbon from Building Construction
Transition from Hydrofluorocarbons	<ul style="list-style-type: none"> B12. Advance a Managed and Just Transition from Reliance on Hydrofluorocarbon Use

As a cross-cutting strategy, New York should establish a 2030 target for the buildings sector that is commensurate with the level of electrification and efficiency needed to achieve the State’s climate goals and should then monitor progress to ensure that policies and programs are in place to achieve this target.

Adopt Zero-Emission Codes and Standards and Require Energy Benchmarking for Buildings

When new buildings are constructed, clear and cost-effective opportunities exist for decarbonizing building operations and reducing embodied carbon emissions. Fulfilling these opportunities will have long-term impacts throughout the construction market. Advanced codes will minimize the near-term installation of additional fossil fuel equipment and ensure that new buildings going forward are resilient to the impacts of climate change. State entities will lead by example in this regard pursuant to Executive Order 22, which requires sustainable procurement specifications and that from 2024 onward all new construction submitted for permitting by affected State entities shall avoid building systems or equipment that can be used for the combustion of fossil fuels (to the fullest extent feasible with allowance for necessary use for backup emergency generation and process loads).

In existing buildings, the best opportunity for energy improvements is during routine home and capital improvements and when HVAC equipment is retired from service. Since the useful life of HVAC equipment ranges from 15 to 30 years, seizing the opportunities to electrify New York's over 6 million buildings by 2050 requires near-term action.

Electrification and efficiency improvements in existing buildings present a larger challenge of sheer scale. The New York State Energy Research and Development Authority (NYSERDA), DEC, and New York State Department of State (DOS) should work together to adopt regulatory requirements that will bring about the end of fossil fuel combustion in buildings by prohibiting replacement of fossil fuel equipment at end of useful life, coordinated with action taken by the PSC and New York State Department of Public Service (DPS) to regulate gas utilities and with New York State Department of Labor (DOL) and the Office of Just Transition to promote workforce development. Building performance standards also will compel efficient operation of buildings and capital investments in high-performance building envelopes and efficient HVAC systems.

These regulations and complementary market support must be thoughtfully designed to drive adoption of highly efficient heat pump systems that are coupled with measures that reduce thermal energy demand, rather than uptake of inefficient alternatives such as electric furnaces or boilers. If not managed, there is a risk that consumers could install inefficient electric equipment in inefficient buildings; this would result in higher ongoing electric bills for building occupants and, if widespread, excessive system peak electricity demands that would be extremely costly to meet. Put simply, policy action to decarbonize buildings must address both energy efficiency and electrification.

Advancing equitable outcomes for lower-income households and Disadvantaged Communities also demands careful design of regulatory actions and complementary strategies. The Climate Justice Working Group (CJWG) expressed support for regulatory sunset dates for combustion equipment in buildings provided that these regulatory actions are coupled with additional goals and public investments to benefit Disadvantaged Communities. This Scoping Plan endorses this condition for regulatory action and proposes complementary strategies to minimize the risk of negative impacts on lower-income and vulnerable households while prioritizing investments that benefit affordable housing and Disadvantaged Communities.

For buildings, resilience is the ability of the building systems to be prepared for, withstand, adapt, and quickly recover from disruptions such as severe weather, power outages, and chronic changes to the climate. Given the increased frequency of extreme weather events, which also increase the probability and scale of electric grid outages, it is critical to consider and manage risks to resilience when electrifying the heating systems of buildings. Flexible technologies and grid-interactive appliances that actively manage building energy consumption can contribute to improved grid reliability and resilience. At the building level, high-performance building envelope features prolong passive survivability. Additional resilience strategies include on-site renewable energy that is able to operate independent of the grid, energy storage, and electric vehicle (EV) battery-interactive capabilities. The resilience of building and energy systems is a priority area for public investment in research, solution development, and demonstration projects.

B1. Adopt Advanced Codes for Highly Efficient, Zero-Emission, and Resilient New Construction

This Scoping Plan recommends adopting zero-emission State codes as an important policy lever that can contribute to the rapid transformation presented in the integration analysis. New York City's Local Law 154 of 2021 sets carbon dioxide (CO₂) emission limits that effectively prohibit fossil fuel combustion equipment for heating, hot water, and most appliances in new construction, beginning in 2024 for lower-rise residential, and by 2027 for commercial and large multifamily. The State should adopt comparable codes, applicable to all municipalities, to prohibit fossil fuel combustion systems and fossil fuel combustion equipment in new construction.

Components of the Strategy

The Advanced Building Codes, Appliance and Equipment Efficiency Standards Act of 2022 requires the New York State Energy Conservation Construction Code (Energy Code) to be updated to achieve energy efficiency and GHG emission reductions in support of the Climate Act. DOS and the New York State Fire

Prevention and Building Code Council (Code Council) – in consultation with DEC, NYSERDA, other State entities including the Office of Just Transition and other Climate Action Council (Council) agencies, local governments, and interested stakeholders – should adopt codes and standards for new construction (and additions and alterations as applicable) of residential and commercial buildings to be built to a highly efficient, zero-emission standard, and incorporate requirements for building resilience. In coordination, the PSC and DPS should work with New York’s electric and gas utilities to account for updates to building codes and standards in their distribution system planning and infrastructure investments and with regard to relevant occupational licensing requirements, while continuing to enhance the associated tools and data available to customers and stakeholders.

- **Update regulations to improve energy efficiency and building resilience:**
 - 2025: Adopt highly efficient State Energy Code for new construction (and additions and alterations as applicable) of residential and commercial buildings to require highly insulated thermal performance and air tightness; electric readiness for space conditioning, hot water, cooking, and dryers; EV readiness where parking is provided; and solar wherever the opportunity exists and is feasible (with allowances for green roofs and other uses of rooftop space).²¹⁶ These requirements should apply to construction of buildings that file for a building permit starting in 2025.
 - 2025: Adopt additional building resilience features into State codes for new construction (and additions and alterations as applicable) to require energy storage or on-site renewable generation that is able to operate independent of the grid, with specifications for sizing to meet resilience demands.²¹⁷ Also require grid-interactive electrical appliances as feasible (such as batteries and hot water heaters) to support grid reliability and eliminate barriers to residential adoption of GSHPs. These requirements should apply to construction of buildings that file for a building permit starting in 2025.
- **Adopt regulations to end on-site emissions:** DOS, NYSERDA, and the Code Council should advance code provisions that prohibit fossil fuel combustion equipment for space conditioning,

²¹⁶ In the context of building energy codes and standards, residential buildings include one- and two-family attached or detached dwellings, and multifamily buildings three or fewer stories above grade. Commercial buildings are all buildings other than low-rise residential buildings, including multifamily high-rise residential buildings over three stories in height above grade. Buildings containing both residential and commercial spaces are generally considered separately with respect to compliance with model energy codes.

²¹⁷ NYSERDA is conducting research to understand building load profiles for thermal comfort/safety in order to recommend standards for battery or thermal storage in instances of power outages.

hot water, cooking, and appliances. Until such codes are adopted statewide, NYSERDA should encourage local governments to adopt NYStretch Energy Code.

- 2025: Adopt State codes that prohibit building systems or equipment used for the combustion of fossil fuels in new construction statewide of single-family and low-rise multifamily residential buildings having three stories or less (and additions and alterations as applicable). These requirements should apply to construction of buildings subject to residential codes and standards that file for a building permit starting in 2025.
- 2028: Adopt State codes that prohibit building systems or equipment used for the combustion of fossil fuels in new construction statewide of multifamily residential buildings having four stories or more and commercial buildings (and additions and alterations as applicable). These requirements should apply to construction of buildings subject to commercial codes and standards that file for a building permit starting in 2028.
- **Support local code enforcement and facilitate clear permitting processes for building decarbonization technologies:** The State also should provide additional funding for local code enforcement (staff, training, materials) and a credentialing program for Energy Code inspectors. NYSERDA should continue to offer training and resources to help local Authorities Having Jurisdiction and the building industry, including frontline installers, understand and meet energy code requirements. For battery energy storage systems, geothermal wells for GSHP and thermal energy networks, and other building decarbonization technologies that may experience permitting processes and challenges that vary by locality, NYSERDA, other relevant State agencies, and partners should work to facilitate clear permitting processes, for example by providing resources and tools, facilitating peer-to-peer sharing of good practices, and helping to reduce the learning curve for Authorities Having Jurisdiction and the building industry.

B2. Adopt Standards for Zero-Emission Equipment and the Energy Performance of Existing Buildings

Among the 6.1 million existing buildings in New York, single-family homes and other low-rise residential buildings (up to three stories) are relatively straightforward to upgrade and convert to zero-emission heating and hot water systems using residential-sized GSHPs or ASHPs that are suited to heat efficiently in cold climates. Larger, complex building typologies may necessitate more flexibility in both timing and technological solutions, and affordable housing will need compliance paths that protect tenants.

Technical solutions to retrofit high-rise multifamily and commercial buildings are advancing rapidly. New York is supporting research, development, and demonstration (RD&D) activity that ranges from demonstrating heat pump solutions to maintain centralized heating and hot water systems in large buildings (transferring technology now in use in Northern Europe and Canada) to fostering the development of small, cold climate packaged/window heat pumps that will be affordable for high-rise multifamily buildings. In large and complex commercial and institutional buildings, phased electrification retrofits also offer a feasible, resource-efficient path. Steps include integrating electrification with near- and long-term capital planning (including tenant lease turnover), reducing space conditioning loads and recovering waste heat, and converting steam to hydronic distribution to accommodate the lower temperature hot water produced by heat pumps. For central plant equipment, feasible heat pump installations may meet the large majority of the building's heating load while maintaining a supplemental fuel heat source for peak conditions, with a plan to phase it out over time if possible.

For existing buildings, New York should require the sale and installation of energy-efficient and zero-emission new equipment for space heating and hot water, when replaced at the equipment's end of useful life in residential and commercial buildings.²¹⁸ The State should further require efficiency upgrades for large buildings through a building performance standard. The development of codes, standards, and regulations should include further analysis of societal and consumer benefits and costs, as well as provide for compliance pathways for existing buildings to account for extenuating circumstances (including, but not limited to, housing affordability-related matters and health and safety/emergency needs).

Components of the Strategy

NYSERDA, DEC, and DOS should work together to implement standards for building performance, appliances, and equipment. These regulations should be coordinated with action taken by the PSC and DPS to regulate gas utilities and in consultation with DOL and the Office of Just Transition to support workforce development actions in a manner that is responsive to industry needs and consistent with *Chapter 7. Just Transition*. As identified below, the State should enact legislation to enable these regulatory actions.

- **Regulations to improve energy efficiency in existing buildings:** New York's Advanced Building Codes, Appliance and Equipment Efficiency Standards Act of 2022 enables

²¹⁸ The Integration Analysis assumes that the average useful life for hot water and space heating equipment in residential and commercial buildings ranges from 15 to 18 years. In practice, equipment may be kept in service for significantly longer timeframes.

NYSERDA, with DOS, to establish and enforce efficiency standards for appliances and equipment that are sold, leased, or installed in New York in order to promote energy reduction, water conservation, GHG reduction, and/or increased demand flexibility. As soon as possible, the State should further enact legislation that enables the establishment and enforcement of energy efficiency standards for buildings, in coordination with NYSERDA, DOS, and local code officials for development and enforcement.

- As soon as possible: Adopt energy efficiency standards for appliances that are exempt from federal preemption (such as computers, monitors, fluorescent and LED light bulbs, and air purifiers).
 - 2027: Require existing properties larger than 25,000 square feet (sq. ft.) to upgrade to energy-efficient lighting in all commercial spaces and common areas.
 - 2030: Adopt an energy efficiency performance standard for existing commercial and multifamily properties larger than 25,000 sq. ft. (with distinct accounting for the electrification of heating and other end uses). Compliance standards should be informed by statewide benchmarking data and align with New York City's Local Law 97 and across State and local government requirements where appropriate. A phased-in building performance standard could become effective starting in 2027.
- **Zero-emission standards to phase out fossil fuel combustion equipment:** NYSERDA and DEC should collaborate on developing and setting zero-emission standards for building equipment, in coordination with DOS for enforcement. DEC should set and enforce zero-emission standards tied to the operation of large fuel burning equipment. In addition to the considerations required by the Climate Act and the State Administrative Procedures Act (SAPA), for a full public engagement and comment process that considers consumer costs and benefits as well as technical and industry readiness and the ability of the electric system (generation, transmission, and distribution) to meet electricity demand with widespread electrification, building-level resilience and potential for future connection to a clean thermal energy network will also be considered in the development of these emission standards. Relevant considerations are also outlined in the Gas System Transition Plan Framework (Table 18). Such standards shall ensure that compliance will not disproportionately burden Disadvantaged Communities. These zero-emission standards across a range of equipment types should apply starting in the years noted below.
 - 2025: The State should review and consider modifications to existing statutory provisions that relate to utilities providing new gas service to existing buildings as part of a

comprehensive plan to end investments in new gas infrastructure in coordination with municipalities.

- 2030: Adopt zero-emission standards that prohibit replacements (at end of useful life) of residential-sized equipment used for the combustion of fossil fuels for heating and cooling and hot water. The standards beginning in 2030 should regulate equipment sized to typically serve single-family homes and low-rise residential buildings with up to 49 housing units.
- 2035: Adopt zero-emission standards that prohibit replacements (at end of useful life) of large and commercial-sized equipment used for the combustion of fossil fuels for heating, cooling, and hot water. The standards beginning in 2035 should regulate equipment sized to typically serve larger multifamily buildings (having four stories or more or 50 or more housing units) and commercial buildings.
- 2035: Adopt zero-emission standards that prohibit replacements (at end of useful life) of fossil fuel appliances for cooking and clothes drying.
- 2035: DEC should adopt zero-emission standards that prohibit fossil fuel use in large fuel burning equipment for heating and domestic hot water. The standards should be enforced under a new emissions enforcement regime of large combustion equipment sized to typically heat buildings 50,000 sq. ft. or more in floor area, thereby requiring early retirement.

B3. Require Energy Benchmarking and Disclosure

Energy consumption benchmarking provides building decision-makers with information to improve building operations and investment decisions, and the data collected statewide will inform building performance standards. Lack of awareness in the market may limit the effective use of benchmarking data. Education will be needed for consumers, brokers, and building owners on how to use the energy usage and benchmarking information.

The State must also mitigate against and monitor for potential harm to Disadvantaged Communities. Disinvestment could occur if disclosure or labeling of energy performance makes properties less attractive to potential renters and buyers, or conversely, demand for efficient buildings could price people out of the market for healthy housing in their community. Adequate technical and financial assistance for LMI homeowners and building owners will be needed in Disadvantaged Communities to scope and finance energy upgrades. As was emphasized by the CJWG, energy affordability is a challenge for many LMI households and required energy disclosure provides important information when buying or renting a home, including ongoing energy costs, which informs decision-making and budgeting. The State should

ensure consistency and alignment across State and local government requirements (such as New York City local laws), including in reporting templates and timeframes.

Components of the Strategy

NYSERDA, DOS, the New York State Department of Taxation and Finance, and the New York State Office of the Attorney General should work together to implement and enforce energy benchmarking and disclosure requirements, in coordination with PSC direction to utilities under its jurisdiction. The State should enact legislation to enable these regulatory actions.

- **Require energy consumption information and disclosures:**
 - 2024: Commence a statewide energy benchmarking and disclosure program that requires owners of multifamily and commercial properties larger than 10,000 sq. ft. to annually report whole-building energy and water consumption data to NYSERDA for public disclosure. NYSERDA should lead implementation, with support from the Department of Taxation and Finance and the Attorney General’s office. Also, the PSC should require electric, gas, and water utilities to provide automatic aggregated whole-building uploads of utility customer data directly to the U.S. Environmental Protection Agency’s (EPA) ENERGY STAR Portfolio Manager.
 - 2025: Require multifamily and commercial properties larger than 25,000 sq. ft. to undertake a comprehensive building energy assessment (audit), to be conducted by appropriately trained workers, at least once every 10 years that evaluates the building’s systems and identifies opportunities to invest in energy efficiency upgrades, electrification or electrification-readiness for building systems, and climate risk with resilience measures. Filing an assessment report with NYSERDA would be required on a cycle established by the State or at the time that a building permit is needed for specified work that must conform to Code, whichever comes first. NYSERDA should lead implementation, in close coordination with DOS and local code officials for development and enforcement.
 - 2025: Require owners of all single-family and multifamily residential and commercial buildings to obtain and publicly disclose, as part of sale or lease listing of a building, housing unit, or commercial space, the prior-year energy consumption of the building, unit, or space (at least 12 consecutive months of energy bill data).
 - 2027: Require owners of single-family buildings to obtain and disclose an energy performance rating (such as a Home Energy Rating System index) as part of sale listing.

Scale Up Public Financial Incentives and Expand Access to Public and Private Low-Cost Financing for Building Decarbonization

A substantial infusion of both public resources and private capital will be needed to pay for the building upgrades necessary to decarbonize buildings, while also expanding access to safe and healthy housing and bolstering resilience to climate impacts. The integration analysis indicates that to meet the Climate Act’s GHG emission reduction requirements, more than 250,000 housing units each year will need to adopt electric heat pumps and energy efficiency measures from around 2030 onward – more than a tenfold increase from current market activity – with a comparable pace of transformation in the commercial sector. Across the residential and commercial buildings sectors, annual investment costs for these upgrades are projected to grow over time from roughly \$5 billion in 2030 to \$30 billion in 2050, based on the incremental cost of building electrification and shell improvements made in each year. This investment will expand jobs in energy efficiency and building electrification in communities statewide and is projected to add 100,000 new clean energy jobs by 2030. This investment remains a fraction of other building-related expenditures in New York, which annually include approximately \$60 billion in buildings investments and over \$30 billion on energy costs across the residential and commercial buildings sectors. Significant opportunity exists to redirect existing spending toward a more sustainable buildings sector.

B4. Scale Up Public Financial Incentives

Financial incentive programs will need to scale up dramatically to motivate millions of homeowners and building owners to install high-efficiency electric heat pumps and make energy efficiency improvements such as sealing air leaks, adding insulation, and using building controls. Building envelope sealing and weatherization measures improve comfort (reducing drafts, cold surfaces, and noise pollution) and reduce risk of pests and mold; moreover, to promote healthy homes, weatherization needs to include appropriate ventilation systems and must take place after any pre-existing safety and health issues (such as mold, mustiness, or high levels of formaldehyde and other air pollutants) are addressed. Replacing an existing heating system with a high-efficiency electric heat pump system that also provides air conditioning and filtration can meet formerly unaddressed or inadequate cooling needs. Although many energy efficiency upgrades improve housing quality and are cost-effective, these projects can be disruptive for occupants or simply not a priority for owners. For most existing homes and buildings, moreover, the current upfront costs of building electrification and related energy efficiency upgrades such as air sealing, insulation, and building controls can be significantly higher than costs for replacing fossil fuel equipment.

For example, for an older single-family home that is otherwise in good condition, the average installed cost for a heat pump for whole-home space heating and cooling paired with an air sealing and insulation upgrade is estimated to be about \$21,000 for a cold climate ASHP and \$40,000 for a GSHP system (before available rebates and tax credits), as compared with roughly \$10,000 or less to replace a fossil fuel boiler/furnace and air conditioner (with no envelope work).²¹⁹ A homeowner who switches from home heating oil to an electric heat pump will see substantial energy bill savings, so that with currently available incentives through NYS Clean Heat and the federal geothermal tax credit, the project payback could be between five to eight years. For many customers now heating with low-cost gas, however, bill savings do not currently offer a clear economic return on investment for adopting a whole-home heat pump. Because of the diversity of stock and pre-existing conditions in multifamily buildings, potential costs vary widely to convert existing apartments to heating and cooling with efficient heat pumps. The average cost of investing in an efficient heat pump is estimated to range from about \$14,000 per apartment unit for an ASHP retrofit in a small multifamily building to \$50,000 per apartment unit for an ASHP paired with a moderate shell efficiency package (including air sealing, roof insulation and double pane windows) in a large multifamily building (before available rebates and tax credits); corresponding incremental costs range from roughly \$10,000 to \$40,000 per unit.²²⁰ In considering consumer benefit-cost and equity impacts, it is further important to recognize that some housing is unsafe and unhealthy due to years of underinvestment, such that costly repairs are needed before making energy improvements.

Given the scale of the challenge, public funding must be used strategically to accelerate market adoption, help LMI consumers, promote transitioning the existing workforce and workforce development that expands skills and job placement, and advance equity. Expansion of financial incentive programs to motivate early adoption in market-rate housing and commercial buildings will be needed for at least the coming decade. This support should target existing buildings more so than new construction and eventually phase out (once efficient, zero-emission codes and standards go into effect), with a longer

²¹⁹ Installed equipment costs reflect weighted average statewide costs sourced from Appendix G: Integration Analysis Technical Supplement Annex 1: Inputs and Assumptions (updated November 18, 2021). Energy cost savings modeled separately, finding that a modest single-family home that switches from oil heating to a heat pump (paired with basic air sealing/insulation) annually saves \$1,200 (NYC) to \$1,700 (upstate) with a ccASHP, or \$1,700 (NYC) to \$2,100 (upstate) with a GSHP. The same home that switches from gas heating (but maintains gas service) sees only a modest annual cost decrease (NYC) or cost increase (upstate) with a ccASHP, or \$700 (NYC) to zero (upstate) annual cost savings with a GSHP.

²²⁰ Installed equipment costs reflect weighted average statewide costs sourced from the Integration Analysis – Inputs and Assumptions Workbook, comparing an air source heat pump to gas heating equipment and room air conditioner (AC); the moderate shell efficiency package is referenced as “basic shell” in the source data and is compared to the “reference shell” cost estimate. The source data also includes installed costs for ground source heat pumps which if paired with a moderate or deep shell efficiency package would sum to a higher range of costs than that provided in the text for air source heat pumps.

timeframe for support for low-income households and, as appropriate, for next-generation technologies as they emerge.

Dedicated financial support programs for LMI households, affordable and public housing, and Disadvantaged Communities are essential to enable these households to make and benefit from energy upgrades that improve housing quality and comfort, with careful attention to impacts on housing and energy affordability. For these households and buildings, grant funding will need to cover most or all the near-term cost premium for building electrification and efficiency upgrades, considering economic realities and to remedy unjust patterns of redlining and underinvestment in Disadvantaged Communities. A major investment of public funding, at a scale and along a timeframe that aligns with the adoption of zero-emission codes and standards, will be needed to decarbonize and improve the quality of housing for LMI households, affordable and public housing, and in Disadvantaged Communities.

It also is critical to ensure that the phase out of fossil fuel equipment in buildings does not increase low-income residents' cost of housing, nor create undue energy burden. In New York, the Home Energy Fair Practices Act and PSC regulations provide comprehensive consumer protections for both residential and non-residential utility customers, including applications for service, service terminations, customer billing, and payment and complaint procedures.²²¹ New York has also established an Energy Affordability Policy that sets the goal of limiting energy costs for low-income households to no more than 6% of their income. The existing low-income energy bill discount programs administered by the major electric and gas utilities should be expanded, and current or future public utility bill assistance programs will need to recognize and adjust for both increased cooling needs as the climate warms and the shift from traditional forms of heating to efficient electrification (using heat pumps that provide both heating and air conditioning). Electrifying rental housing can lead to changes in how energy services such as heating, cooling, and cooking are metered, resulting in transfers of utility costs between building owners and occupants. Over the longer term, regulatory requirements must be coupled with ongoing public financial support for poor and working-class households. Thoughtful policy and programmatic design and coordination of funding sources will be essential to support affordability, safe and healthy housing, consumer protections, and economic opportunities that benefit Disadvantaged Communities.

A salient challenge is marshalling additional public funding, across State, ratepayer, and federal funding and tax credits, at the needed scale, alongside animating the flow of private capital to low-carbon building

²²¹ 16 NYCRR Part 11 (HEFPA) governs residential service and Part 13 governs non-residential service.

construction and improvements. At present, charges levied on electric and gas ratepayers provide the largest source of funding for New York’s energy efficiency incentive programs, with heat pump incentives funded by electric ratepayers specifically. This funding source has the benefit of established precedent and regulatory oversight, which as major new policy initiatives are considered, includes public process and assessment of ratepayer impacts. While there is scope for strategic re-direction and some potential expansion of ratepayer-funded programs, the scale of investment will require a leveraging of multiple sources of funding including other State, federal, and private funding sources. Moreover, the PSC should direct utilities to continue to assess and place priority on investments in clean, distributed energy resources (DERs) (including weatherization and energy efficiency, storage, and electrification of heating) that are comparatively cost-effective ways to reduce peak electric or peak gas demand. Even as these avenues are explored, though, new funding sources beyond ratepayer charges will need to be identified.

In 2022, New York enacted a State Geothermal Income Tax Credit equal to 25% of geothermal system expenditures up to \$5,000 for owner-occupied homes, which helps position New York to take advantage of federal geothermal tax credits. State tax credits could be expanded to further encourage GSHP systems and building decarbonization in multifamily and rental housing, commercial buildings, and thermal energy networks. Two potential economywide State policy mechanisms, cap-and-invest and carbon tax/fee, are discussed in *Chapter 17. Economywide Strategies*. If either policy is implemented and provides a new source of funding for policy actions identified in this Scoping Plan, the housing sector should be a priority area for investing that funding to support both equity and emissions reductions.

Critical opportunities exist to leverage federal funding made available under the federal Inflation Reduction Act of 2022. Long-term tax credits will provide market certainty and make it more affordable for New Yorkers to install decarbonization technologies including energy efficiency upgrades, high-efficiency electric appliances, solar panels, and battery storage systems. Notably, federal tax credits for geothermal heat pump system installations extend through 2032 at rates of 30% of the installed cost, with an additional 10% domestic content bonus credit, stepping down in 2033 and 2034. Additional grants for LMI households for home energy performance-based whole-house rebates (the HOMES Rebate) and for High-Efficiency Electric Home Rebates will support broader adoption and further increase benefits. In the integration analysis work, modeling of these tax credits and LMI formula grants specifically for energy efficiency and heat pumps found that this federal funding could reduce New York’s cost of the transition to an efficient, electrified building stock by \$7 billion or more.

The recommendations below also identify specific opportunities to leverage existing and potentially expanded federal funding, in particular for affordable housing and low-income households. For example, the EmPower New York program and the federal Weatherization Assistance Program both provide no-cost energy efficiency solutions to income-eligible New Yorkers; these programs can help improve the conditions in existing homes, make homes electrification-ready in some instances, and provide a network of contractors and nonprofit community-based organizations to support low-income communities. Scaling up funding and revising the Weatherization Assistance Program guidelines to allow for electrification could better serve Disadvantaged Communities through existing program infrastructure. In addition, around 10,000 multifamily units are built or preserved each year with a combination of federal tax credits and subsidy programs provided by HCR, which has a goal to increase subsidies for the full electrification of that unit production over time.

The CJWG emphasized that regulatory action to phase out fossil fuel equipment in buildings is inadequate without added policy goals and public investments to benefit low-income households and Disadvantaged Communities. The strategies proposed here are consistent with the CJWG’s call to front-load and prioritize public investments in efficient appliances and zero-emission heating, cooling, and cooking equipment in Disadvantaged Communities so that poor and working-class households are not left behind, while safeguarding that building electrification does not increase the housing or energy cost burden on low-income residents. Informed by input from the CJWG, the proposed strategy components include attention to New York’s existing energy affordability goal, the needs of public housing, and the health benefits associated with building decarbonization. The CJWG further called for “clawback provisions” as part of public subsidies to private landlords to defend against rate increases, gentrification, and displacement. This specific recommendation is not reflected in the proposed strategy because such provisions merit careful consideration in program design.

Components of the Strategy

Significant coordination will be needed among State and local agencies and utilities, notably to support low-income households and Disadvantaged Communities, with State leadership from the PSC and DPS, NYSERDA, HCR, New York Power Authority (NYPA), and New York State Office of Temporary and Disability Assistance (OTDA).

- **Scale up incentives for building decarbonization:** The State should scale up direct incentives for weatherization (including sealing of cracks and holes, insulation of attics and walls, replacement or repair of windows and outside doors, and mitigation of energy-related health and

safety issues), additional energy efficiency upgrades, electrification-readiness, and electrification with highly efficient heat pumps and resiliency measures in residential and commercial buildings. In incentive program design, it is important to place emphasis on ease of access to available and relevant resources for consumers and installers, particularly for LMI households and buildings in Disadvantaged Communities that may access resources from multiple programs. Electrification incentives need to be structured and marketed in a manner that motivates replacement of fossil fuel combustion heating systems before equipment failure in order to allow time for good-practice sizing and specification of a heat pump system paired with weatherization and other thermal efficiency measures as appropriate and needed to keep operating costs affordable. Where incentives are offered through utility companies, the State should develop a coordinated statewide program to provide a consistent experience and incentive structure that helps installers reach more customers, with a priority to LMI households and Disadvantaged Communities. Incentives also could include expanded State tax credits, such as the recently enacted Geothermal Income Tax Credit.

- **Align regulatory frameworks:** The State should identify and pursue modifications to regulatory frameworks for energy efficiency, building electrification, and resiliency programs to further align the programs with Climate Act goals and requirements. This includes, but is not limited to, attention to accounting holistically for the societal costs and benefits of building energy upgrades, including health impacts associated with outdoor and indoor air quality and thermal comfort. Additionally, as discussed in *Chapter 18. Gas System Transition*, the State should review and as appropriate bring into alignment with the Climate Act statutory provisions regarding gas service, such as reviewing the provision of gas service lines and extensions of gas mains at no cost to new customers (known as the “100-foot rule”).
- **Design incentive levels and programs to align with value to the energy system and consumers:** While the upfront cost to install GSHP systems and thermal energy networks is higher, geothermal heating and cooling systems are less expensive to operate (lower annual energy bills and maintenance costs), have a longer lifespan compared other types of HVAC equipment, and require less electricity to operate during the coldest peak times compared with ASHP systems. Zero-emission new construction and comprehensive building decarbonization retrofits that include on-site renewable generation plus energy storage likewise will minimize electric grid impact and increase energy bill savings, and will improve building resilience. The value provided to both the energy system and consumers, in particular to low-income and vulnerable households, should be considered in setting incentives. Substantially higher adoption of GSHP systems, thermal energy networks, and on-site energy storage solutions will require

both appropriate State incentives that leverage generous federal tax credits and novel financing and coordination solutions.

- **Prioritize LMI households, affordable housing, and Disadvantaged Communities:** The State should expand dedicated direct incentives and financial support mechanisms for weatherization, energy efficiency, and electrification for LMI households, affordable housing, public housing, and Disadvantaged Communities. This includes developing new partnerships to effectively deliver programs (such as through housing agencies, community development financial institutions, and local community-based organizations), streamlining program enrollment models, and establishing people-centered policies, programs, and funding across local, State, and federal governments, consistent with recommendations and opportunities described in the Barriers and Opportunities Report. It likewise involves adopting inclusive engagement processes that incorporate Disadvantaged Communities and LMI households in program co-design processes, including co-design with and for the most vulnerable New Yorkers. These strategies should account for New York’s existing Energy Affordability Policy, which seeks to limit energy costs for low-income households to no more than 6% of their income, as well as a household’s cumulative cost burden related to housing, energy, transportation, and healthcare when assessing affordability impacts. Pursuant to Executive Order 22, State entities should prioritize State facilities located in Disadvantaged Communities for energy efficiency and electrification upgrades, which will lower environmental impacts on these communities.
- **Prioritize energy upgrades and pilot new resilience strategies in public housing:** The State should support and accelerate efficiency, electrification, and resilience in public housing, particularly in New York City Housing Authority buildings and in other Public Housing Authority developments statewide, with attention to the special needs of and jurisdictional issues that affect the State’s public housing stock. The State should pilot a range of resilience solutions in public housing and housing for vulnerable populations, with learnings shared to inform broader community- and building-level resilience strategies. In doing this, the State should leverage federal and other available funding sources to support community resilience, deeper retrofits, and electrification. Specifically, the State should support resilience centers (or resilience hubs) in public housing developments that meet community needs and gathering space in non-emergencies (childcare and after school programming space) and provide safety and comfort in acute situations, including during power outages. Such centers should include backup power (including solar-storage pilots) for multi-day outages, a basic livable space that is thermally safe while also providing access to sufficient electricity to meet critical needs (e.g., refrigeration for

medications, power for in-home medical processes/equipment, air filters for critical conditions), and community space to coordinate disaster relief.

- **Expand access to community solar:** Under the State’s Solar Energy Equity Framework, NYSERDA will implement a strategy for community solar projects that provide electric bill savings to income-eligible households and/or that benefit affordable housing or public buildings in Disadvantaged Communities, with program rules that direct benefits to low-income residents.
- **Fund non-energy improvements when necessary:** As described in the Barriers and Opportunities Report, building stock that is old and in disrepair can limit the reach of building decarbonization and resiliency programs, due to challenges such as increased cost to make upgrades, the need to address more critical priorities (e.g., roof repair), or structural deficiencies or health and safety issues that lead to homes being deferred from energy efficiency and weatherization program participation until such issues are addressed. For example, moisture and mold-creating conditions in a home need to be addressed before weatherization in order to protect the health of occupants; but severe mold issues require deferral from the federally funded Weatherization Assistance Program since mold testing and remediation is not an allowable cost. Lack of maintenance and upgrades can also negatively impact occupant health (via indoor air quality and temperature comfort), economic security, and increased stress and anxiety. The State should create a new Retrofit and Electrification Readiness Fund for LMI households, affordable housing, rent regulated housing, public housing, and residential buildings in Disadvantaged Communities to cover costs of non-energy building improvements that are necessary to install energy measures and broadband installation costs when funding energy projects.
- **Leverage funding for healthy homes and community development:** The State should leverage services, resources, and funding across housing, health, community/economic development, and energy improvements for low-income households to fund decarbonized, resilient, and healthy housing retrofits. Near-term actions can expand use and coordination of both State and federal funding (such as use of Weatherization Assistance Program funds for health and safety improvements), build on the ongoing pilot to leverage New York Medicaid’s Value-Based Payment program for Managed Care Organizations to contribute to healthy housing services and home energy efficiency improvements, and engage with nonprofit hospitals in community health needs assessments. Expanding relationships with local housing agencies offers further opportunities to leverage federal resources such as through Community Development Block Grant and U.S. Department of Agriculture (USDA) Home Repair funds.
- **Support community-scale solutions and community thermal systems:** The State should develop, pilot, and, where successful, scale up financial support for portfolio- and community-

scale solutions, where hundreds of homes and businesses are contracted for energy upgrades to boost project delivery efficiency, reduce unit costs, incorporate place-based strategies, and drive scale and momentum (as compared with one-off projects). A strategy to support development of clean thermal energy networks is discussed in this chapter. Another opportunity is for State, federal, and local government entities that support disaster and flood recovery needs to integrate resources both for long-term resilience and to equip damaged homes, businesses, and community facilities to make highly efficient repairs with electrified equipment (for example, replacing a damaged water heater with a heat pump water heater).

- **Increase market transparency on project costs:** For projects that receive State or utility incentives for heat pumps and other building decarbonization upgrades, the State should routinely collect and publish (in an anonymized and aggregated format) data on the installed project cost to increase market transparency on cost.

B5. Expand Access to Public and Private Low-Cost Financing

Mobilizing and focusing private capital at scale will be essential to construct, upgrade, and operate highly efficient, electrified buildings. Modernizing codes and standards to require electrification and efficient construction will drive such investment via existing market activity and the cycle of routine building improvements. Low-cost financing products for energy efficiency, electrification, electrification readiness, solar photovoltaics (PV), energy/thermal storage, resiliency measures, and related improvements are also needed so that single-family, multifamily, and commercial and institutional building owners can access low-cost capital at the scale needed to pay for the building upgrades necessary for decarbonization.

At present, there is a general lack of lender interest and awareness around financing building electrification and energy efficiency projects, as well as perceptions of risk in underwriting based on energy performance. New York should help to address this barrier through lender education and outreach, and by making available case studies and modeling tools so that lenders can appropriately underwrite to energy performance standards and applicable regulatory requirements. The largest sources of capital for building investments are in the mortgage industry. NYSERDA and HCR plan to continue to convene the financial industry to explore ways to bring capital to building decarbonization in compliance with the Climate Act. This will build upon roundtables that the Federal Reserve Bank of New York, NYSERDA, and the Community Preservation Corporation held in 2022 with housing developers and lenders to explore climate adaptation risks to their portfolios and to identify public and private public financing options for decarbonizing New York's affordable housing; the resulting white paper included

recommendations for property tax abatements for electrified buildings and longer amortization for loans used to decarbonize buildings.²²²

Another important role for the State is to provide for consumer protection in connection with financial products and services, particularly for products that target LMI consumers. In addition, the NY Green Bank, HCR, State and local revolving loan funds, and possibly electric/gas utilities offer important mechanisms to strategically deploy public financial resources in ways that can leverage private capital and accelerate the transition to a decarbonized, resilient building stock.

Reflecting on input from the CJWG, the proposed strategy places priority on consumer financing made available by community development financial institutions and credit unions.

Components of the Strategy

Action and coordination across a range of State agencies and stakeholders is likewise important to expand access to low-cost financing for building electrification and efficiency upgrades, with leadership from HCR, the NY Green Bank and NYSERDA, the New York State Department of Financial Services (DFS), Dormitory Authority of the State of New York (DASNY), and NYPA.

- **Integrate energy requirements and resources into affordable housing deals:** The State should continue to scale up energy and green requirements in affordable housing deals while ensuring that sufficient resources are available to maintain, preserve and produce housing that is clean, safe, and affordable. For example, by no later than 2023, all new construction projects that receive Tax Credit funding through HCR will be required to be high-performance and all-electric buildings, as required in HCR’s Sustainability Guidelines for New Construction. The State should also continue to streamline access to all incentives and resources for regulated affordable housing building decarbonization to go through the housing agencies that are making projects affordable, to also make these projects energy-efficient, electrified or electric-ready, and resilient.
- **Integrate energy performance into underwriting:** The State should provide support for lenders to underwrite to energy performance standards and applicable regulatory requirements. HCR should consider updating its underwriting standards, consistent with federal regulations and requirements, to take into account potential reduced operational costs stemming from the new

²²² Federal Reserve Bank of New York. October 2022. “Sustainable Affordable Housing: Strategies for Financing an Inclusive Energy Transition.” Available at <https://www.newyorkfed.org/outreach-and-education/climate/fed-affordable-housing-and-energy-transition>

high performance buildings standards. Data collected from existing projects in operation of similar construction type will inform the new underwriting standards.

- **Expand access to financing:** The State should provide greater access to low-cost financing products for upgrades, including for low-income homeowners and buildings located in Disadvantaged Communities. This financing also should be available for non-energy improvements needed for code compliance and to enable electrification of heating and hot water systems. The State should also explore new mechanisms to deploy public financial resources to enable low-interest financing products coupled with credit enhancement or insurance. The State should prioritize support for financing products made available by community development financial institutions and credit unions as part of the Community Reinvestment Act regulatory compact.
- **Expand energy savings performance contracting for public sector buildings:** The State should enact enabling legislation to expand the use of energy savings performance contracting to support implementation of emissions reduction upgrades in State and municipal buildings, P-12 schools, and other public facilities. Performance contracting is a financing mechanism in which efficiency upgrades are paid for through savings from reduced utility costs. Changes to existing statute should expand the eligible list of measures for energy savings performance contracting, expand the allowable payback term for deep decarbonization performance contracts, allow some fast payback measures to help fund deferred maintenance needs, and allow a State agency or authority to request to keep a portion of cost savings that result from performance contracts.
- **Create a revolving loan fund:** The State should create a revolving loan fund for building decarbonization and the reuse of buildings and building materials. For example, Environmental Facilities Corporation's (EFC) Clean Water State Revolving Fund provides a model for enabling public mandates to be coupled with access to low-cost capital. This would be implemented through a bond-issuing government authority.

B6. Support Development of Thermal Energy Networks

Thermal energy networks offer an important pathway to both scale up zero-emission heating and cooling in buildings and to transition highly skilled gas workers into a similar sector, utilizing the existing skills of utility workers and the building trades workforce. Thermal energy networks leverage shared infrastructure to provide space heating and cooling to connected buildings, using distribution pipes and heat pumps to move thermal energy from an initial source and sink (such as a geothermal borehole or waste heat from local facilities) to connected buildings. This allows thermal energy networks to be highly efficient, to mitigate electric grid impact by smoothing loads across connected buildings, and to be

powered from renewable, zero-emission resources. Shared infrastructure and thermal resources also help achieve economies of scale, presenting the opportunity to lower costs per customer.

The Utility Thermal Energy Networks and Jobs Act allows gas and combined gas and electric utilities to become holistic thermal energy providers. Specifically, the statute directs the PSC to adopt rules and regulations to create fair market access requirements for utility-owned thermal energy networks; exempt small-scale thermal energy networks not owned by utilities from PSC regulation; promote the training and transition of utility workers impacted by the Climate Act; and encourage third-party participation and competition where it will maximize benefits to customers. The statute also requires that the State's largest gas and electric utilities propose thermal energy network pilot projects for PSC review and approval, with an emphasis on serving Disadvantaged Communities. For the operations and maintenance of thermal energy networks, the statute prioritizes hiring transitioning gas utility workers and requires that the utility enter into a labor peace agreement with a labor organization that represents gas and electric utility workers. The PSC initiated a proceeding in September 2022 and is actively working to implement this new statute and assess utility pilot proposals. To support the identification of strong projects, NYSERDA has provided information on feasibility studies conducted through its Community Heat Pumps Pilot Program, a competitive solicitation to support development and demonstration of thermal energy networks.

Components of the Strategy

The highly efficient performance and economies of scale presented by thermal energy networks offer a promising opportunity for the State to support building decarbonization through centralized investments that are equitable for Disadvantaged Communities and preserve family-sustaining jobs in the heating and cooling sector. The PSC and DPS, NYSERDA, DEC, DOL, and the Office of Just Transition should work together with utilities, affected workers and unions, local governments, and private-sector partners to support clean thermal energy networks that supply thermal energy via piped non-combustible fluids used to transfer heat into and out of buildings and eliminate onsite GHG emissions from heating and cooling end uses, in alignment with the Climate Act's requirements to promote climate justice and reduce GHG emissions. Support for this nascent industry is anticipated to include pilot programs, regulatory support, potential studies and analysis, and workforce development.

- **Workforce training for gas sector workers to operate thermal energy networks:** The piped infrastructure of thermal energy networks makes gas sector and pipeline workers a strong fit to install the clean heating and cooling infrastructure of the future. Labor unions for these sectors

were vital partners in passing the Utility Thermal Energy Networks and Jobs Act. The PSC and DPS, DOL, the Office of Just Transition, and other State agencies should work together with utilities and unions, including unions for operations and maintenance workers, to help connect trained gas workers with new thermal energy network projects, on training and skills development, and on efforts to bring new workers into the sector.

- **Develop appropriate regulations and permit fees for geothermal wells greater than 500 feet deep:** DEC regulations developed for oil and gas wells also apply to geothermal wells greater than 500 feet, despite differences in environmental risks. These regulations further apply on a per-well basis, whereas large GSHP and thermal energy network projects benefit from drilling multiple boreholes to distribute heat, adding a regulatory burden and permitting costs to geothermal projects. Currently, financial security requirements for regulated well types are set in statute, including the specific dollar amounts. The following actions should be taken to make regulations more appropriate for geothermal wells:
 - DEC should develop regulations for geothermal and stratigraphic wells to relieve some of the economic and time burden while still protecting the environment and public health from the risks associated with these well types.
 - Remove the dollar amounts from ECL §§ 23-0305(8)(k) (FS for oil and gas) and 23-0305(14)(f) (FS for geothermal wells) and allow DEC to establish financial security requirements in regulation as it does for mines.
 - Remove the fixed dollar amount in ECL § 23-1903, which sets permit fees for regulated wells on a variable depth, per-well basis, and allow DEC to develop an appropriate permit fee schedule in regulation.
- **Streamline access to public and utility rights of way as well as heat sources/sinks:** The State, in partnership with local governments, should develop clear processes and rules for thermal energy network projects to access already established public and utility rights of way. In addition, the State should establish appropriate default compensation levels intended to compensate property owners in these rights of way. In high density areas, thermal energy network infrastructure should be evaluated and pursued simultaneously with other planned infrastructure projects to minimize incremental cost and disruption. State and local governments also should provide simple and transparent access to heat sources and sinks for potential use by thermal energy network developers. Any rules promoting thermal energy networks should be carefully designed to avoid undermining private property rights or diminishing private property values.
- **Support public-private partnerships for geothermal and thermal energy network financing and development:** The PSC is working to advance a regulatory framework that encourages both

utility development of thermal energy networks and third-party participation and competition where it will maximize benefits to customers. The passage of the federal Inflation Reduction Act may provide opportunities to develop new approaches for financing geothermal investments, due to the combination of generous long-term tax credits and accelerated depreciation. Ongoing analysis of legal, tax, and regulatory issues, institutional investor scale investment structures, and funding approaches is needed to determine the feasibility of and consumer benefit from potential third-party ownership financing structures that would leverage private-sector investment to finance GSHP systems and thermal energy networks.

- **Prioritize public sector support for thermal energy networks that serve LMI housing and buildings in Disadvantaged Communities:** The State should place emphasis on leveraging the economies of scale presented by thermal energy networks to support a transition to clean heating and cooling in LMI, affordable, and public housing and historically underserved or Disadvantaged Communities. The Utility Thermal Energy Networks and Jobs Act and subsequent direction from the PSC support this goal by requiring that at least one thermal energy network pilot project per utility service territory must be located in a Disadvantaged Community.
- **Explore thermal energy networks as part of the gas system transition:** The State should further explore opportunities to convert buildings to heat pumps or thermal energy networks on a street-by-street or neighborhood-by-neighborhood basis, which could allow for strategic decommissioning of gas infrastructure as part of the managed transition of the gas system.

B7. Align Energy Price Signals with Policy Goals

The low relative cost of gas compared with electricity is a major barrier to building electrification. Over time, the costs of operating high-efficiency electric heat pumps will need to become more attractive compared with heating with fossil natural gas. *Chapter 17. Economywide Strategies* discusses a potential economywide policy that would price carbon emissions, and *Chapter 18. Gas System Transition* addresses a managed transition of the gas system. Such policy actions are expected to increase consumer energy prices for fossil fuels. Moreover, electric rate structures will need to evolve to be supportive of and appropriate for higher levels of electrification of buildings and vehicles, with attention to equitable rate design.

The CJWG called for a more expansive set of actions related to consumer protection that would include a safety net style guarantee of renewable energy to every household. Expanding access to community solar (as discussed above) and aligning energy bill discount programs (discussed below) are related strategy components.

Components of the Strategy

- **Price GHG emissions from fossil fuels:** *Chapter 17. Economywide Strategies* of this Scoping Plan discusses a potential economywide program that would effectively price GHG emissions.
- **Align electric rates:** The PSC and DPS should lead consideration of dynamic underlying electric rate structures and programs (such as dynamic load management) that provide appropriate price signals to customers to incentivize deployment and usage of DERs, including heat pump systems, EV charging, battery and thermal storage, and other load flexibility measures that promote more efficient utilization of the electric delivery system and help to mitigate summer and winter system peaks. In March 2022, the PSC adopted an alternative cost of service approach that will result in Standby Service and Buyback Service rates that more accurately align individual customers' contribution to system costs with the rates such customers pay, thereby sending improved price signals to those customers. Customers opting into the voluntary Standby Service rates will have an increased ability to manage their bills, and those bills will more accurately reflect the effects of those customers' usage, specifically when combined with the installation of DERs and electrification technologies.²²³
- **Align bill discount programs:** For low-income households, the State should expand existing low-income energy bill discount programs administered by the major electric and gas utilities and ensure that current or future public utility bill assistance programs recognize and adjust for both increased cooling needs and the shift from traditional forms of heating to efficient electrification.

Expand New York's Commitment to Market Development, Innovation, and Leading-by-Example in State Projects

In coordination with financial incentives and regulations, State support for market development and innovation is important for ensuring the delivery of building decarbonization solutions that perform well and make our lives better. Areas of focus should include workforce skills and broad public awareness and engagement that motivates behavioral change. State RD&D investment in building decarbonization solutions should be structured to help attract and expand economic development and support products that are manufactured in New York, to serve the growing New York and regional markets.

The CJWG expressed broad support for market development and innovation investments as proposed in the following strategies. The group called for attention to growing local supply chains and creating jobs in

²²³ New York State Department of Public Service. "Case 15-E-0751, Allocated Cost of Service Methodology for Standby and Buyback Service Rates and Energy Storage Demand Charge Exemptions Order." Issued March 16, 2022.

clean energy businesses that serve Disadvantaged Communities, as well as providing dedicated support to minority- and women-owned business enterprises (MWBE) to innovate and actively participate in the transformation of the buildings sector.

B8. Invest in Workforce Development

Chapter 7. Just Transition discusses critical actions to scale up workforce education, training, job placement, and development initiatives that equip New York’s current and future workforce for the clean energy economy and ensure the application of appropriate labor standards. Equally important, the chapter describes strategies to increase industry diversity and clean energy job placements for residents of Disadvantaged Communities, low-income residents, veterans, workers in fossil fuel industries, and other priority populations.

Consistent with the just transition framework and implementation partners described in *Chapter 7. Just Transition*, equipping a workforce to design, install, inspect, maintain, and operate healthy, comfortable, zero-emission buildings needs to include expanded or new training. For example, many heat pump installers today have knowledge or skill gaps around best practices for sizing, selecting, and installing ASHPs in New York’s cold climate, underscoring the importance of workforce development to support quality installations and build market confidence. Overall, workforce development investments are critical to close skill gaps and address the shortage of qualified, skilled workers who are ready to deliver the unprecedented speed and scale of adoption of heat pumps and energy efficiency measures that is needed over this decade to meet New York’s climate requirements.

Components of the Strategy

NYSERDA, DOL, the Office of Just Transition, and Empire State Development (ESD) should work together to support workforce development actions, in a manner that is responsive to industry needs and job placement opportunities and is supportive of applicable labor standards and the promotion of equitable access to family-sustaining jobs, including union jobs, consistent with the discussion in *Chapter 7. Just Transition*. State agencies should work in coordination with educational institutions, training organizations, unions, industry actors, local governments and community-based organizations, workforce one-stops, and foundations.

- **Expand training:** Training for incumbent and new clean energy workers and adjacent industries needs to be increased dramatically, through investments in training infrastructure/delivery, career pathways, direct-entry Pre-apprenticeship and Registered Apprenticeship programs, on-the-job-

training, and industry partnerships. The State should support expanded or new training and resources across targeted workforce segments in the following priority areas listed in Table 12.

Table 12. Priority Training and Resource Areas and Target Workforce Segment

Priority Training and Resource Area	Target Workforce Segment
Building and energy code education, requirements, and enforcement	<ul style="list-style-type: none"> • Local government code officials • Building inspectors • Contractors • Labor unions and Registered Apprenticeships
Sizing, selection, and installation of heat pumps and supporting measures	<ul style="list-style-type: none"> • Contractors • Technicians • Designers
Addressing leak reduction and proper disposal of HFCs already in use in building equipment, and transitioning to low-GWP alternatives for building equipment and spray foam insulation to reduce HFC emissions	<ul style="list-style-type: none"> • Contractors • Technicians • Designers
Continuing education on building decarbonization as part of existing or new licensing and/or registration requirements	<ul style="list-style-type: none"> • Contractors • Architects • Engineers • Building operators • Labor unions and Registered Apprenticeships • Real estate professionals, such as brokers and inspectors
Retention of experienced building service workers	<ul style="list-style-type: none"> • Building and facility operators • Maintenance workers • Service workers • Labor unions and Registered Apprenticeships
Building management systems training	<ul style="list-style-type: none"> • Building and facility operators • Labor unions and Registered Apprenticeships
Understanding and engagement in planning processes that will support the clean energy transition	<ul style="list-style-type: none"> • Planners • Designers • Planning boards
Identifying and addressing health and safety issues during audits and home visits with cross-training on healthy homes	<ul style="list-style-type: none"> • Contractors • Energy auditors • Health and social workers
Partnering with industry to increase the number of qualified geothermal drillers	<ul style="list-style-type: none"> • Drilling contractors • Labor unions and Registered Apprenticeships
Just Transition of workers in fossil fuel industries to transfer their skills to clean energy opportunities	<ul style="list-style-type: none"> • Existing fossil fuel workers, including utility workers equipped to build and maintain thermal energy networks • Technicians • Labor unions and Registered Apprenticeships

- **Curricula and career services:** The State should encourage building decarbonization curricula and career services in State-funded and private education including P-12, technical schools, apprenticeships, and engineering and architecture programs at universities.
- **Prioritize Disadvantaged Communities and other priority populations:** The State should prioritize Disadvantaged Communities and low-income residents for training and job placement by creating community-to-employment pipelines and career pathways that are informed by an analysis of the effectiveness of current on-the-job training investments, led by the skills and hiring needs of employers to maximize job placement, and paired with wrap-around services to support job retention. Family sustaining wages, comprehensive benefits, and local and targeted training and hiring should be ensured through direct-entry Pre-apprenticeships and Registered Apprenticeships, project labor and Community Benefits/Workforce Agreements, and On the Job Training Funding as described in *Chapter 7. Just Transition*. The State should increase ranks of MWBEs, service-disabled veteran-owned businesses (SDVOBs), and worker cooperatives through increased funding for workforce training, business development support, and certification assistance, so as to provide increased opportunities for MWBE and SDVOB utilization on State contracts, in accordance with Executive Law Articles 15-A and 17-B.

B9. Scale Up Public Awareness and Consumer Education

With competing demands on our attention, there is low public awareness about New York’s Climate Act in general, and more specifically, low awareness about steps to take to decarbonize buildings. Similarly, most people are not aware that using combustion appliances in their home such as heating systems and gas stoves may increase indoor air pollutant concentrations (see *Chapter 8. Public Health* for a description of associated health risks), while also contributing to outdoor air pollution and climate change. New York should expand its support for broad public awareness and consumer education, create strategic partnerships with trusted community leaders, and scale up targeted outreach and decision-making support to increase market demand and accelerate the transition to low-carbon, energy-efficient, and electrified buildings.

Components of the Strategy

NYSERDA, the PSC and DPS, and utilities should lead these efforts, in coordination with local governments and community-based organizations and leaders.

- **Scale up campaigns:** The State should support and scale up multilingual, culturally appropriate public and consumer education efforts through large-scale, coordinated awareness, inspiration,

and education campaigns. This would include traditional and broad reaching media, digital communication, “influencer” style campaigns, user-generated campaigns, virtual tours, and mailers. Campaigns would provide specific resources and tools for installers, distributors, the home-visiting workforce, and other supply chain actors to educate consumers on building decarbonization options that will decrease GHG emissions and improve resilience. Topics for informational campaigns targeting building owners and residents would emphasize available incentives to replace equipment before failure, available low-cost financing products, and information on upcoming applicable codes and standards requirements. Broad education would further communicate the benefits of healthy, efficient, and low-/zero-emission building systems and building materials for occupants and property values.

- **Create strategic partnerships:** The State should create strategic partnerships that can have broad impact, including with trusted community leaders, religious leaders, and community-based organizations. The State should also partner with utilities to promote decarbonization and sunset messaging that promotes fossil natural gas as a “cleaner” choice. Other partners should include the State University of New York (SUNY), cooperative extensions, business councils, industry organizations and leading companies, unions, schools and teachers, film and public venues, and State and local elected officials. This work can build on experience from NYSERDA’s HeatSmart programs.
- **Prioritize Disadvantaged Communities:** The State should ensure messages, messengers, and media reflect Disadvantaged Communities in marketing efforts, and prioritize education and technical assistance for Disadvantaged Communities. NYSERDA should build on its development of regional Clean Energy Hubs and on NYSERDA’s and the State’s electric and gas utilities’ commitment to maintain the New York Energy Advisor website as a “one-stop shop” source of information for clean energy, electrification, and energy efficiency programs for LMI households. The State should fund and expand community hubs to offer education, resources, local contractors, technical assistance, and program navigator support.
- **Publicize leaders:** The State should publicize best practices for efficient building operations and recognize leaders and innovators in efficient operations that support building occupants. The State should create an incentive program or challenge to attract or encourage others to sign a pledge to commit to neutrality.
- **Provide technical resources:** The State should provide technical assistance and resource toolkits for building decision-makers and residents including playbooks for low-carbon solutions in common building types, free in-home or virtual audits to homeowners, and capital planning support for large buildings. This includes resources and tools to support tenant engagement and

demonstrating low-carbon solutions through challenges and case studies. The State should develop case studies showing the feasibility, performance, and costs for three paths to transition to highly efficient and electrified buildings: full electrification, phased electrification, and electrification readiness. The State should support new public-private partnerships or local government entities (such as the NYC Accelerator) to work with building owners and assist with access to useful resources and guidance, where appropriate in coordination with the State's regional Clean Energy Hubs.

B10. Support Innovation

For nearly all buildings in New York, technologies exist today that can dramatically reduce the building's energy use and, with zero-emission electricity, decarbonize the building. However, ongoing innovation with respect to technology, design and planning, and business models is needed to reduce the cost and increase the value of such upgrades in order to make their value proposition competitive with conventional building systems. RD&D also should be pursued to develop and deploy specific technologies, such as long-duration energy storage and ultra-low GWP alternatives to HFCs, including natural refrigerants, spray foam insulation, HVAC, water heating, and refrigeration technologies. In these areas, federal government RD&D funding and leadership is critical.

Complementary RD&D investment by New York in building decarbonization solutions offers multiple benefits. These include a strong multiplier for jobs and economic development, in-state demonstration projects and case studies for emerging technologies in prevalent building types, increased resilience of New York's buildings stock, and demonstration projects that are located in and benefit Disadvantaged Communities. The State should continue to support RD&D and help to bring new companies and manufacturers to New York that offer innovative solutions for highly efficient, electrified, and resilient buildings; for grid-interactive buildings; and for reducing embodied carbon in buildings.

Components of the Strategy

NYSERDA and ESD should lead the State's RD&D investments in coordination with Regional Economic Development Councils (REDCs) and local economic development agencies (as critical partners to assess innovation opportunities), SUNY, DEC, DPS, and the utilities.

- **Leverage federal resources:** The State should advocate for, and leverage, federal and national laboratory resources focused on identifying and commercializing advancements in technologies for building decarbonization and building resilience.

- **Scale up tech transfer:** The State should scale up resources to identify and promote technology transfer for innovative building decarbonization technologies and design approaches that are in use internationally and could be transferred to the New York market. For example, key areas for tech-transfer support include adapting technologies for U.S. and New York standards, in-state demonstrations, market research, partnering with New York entities, and manufacturing assistance.
- **Attract and expand in-state businesses, manufacturing, and economic development:** As discussed in *Chapter 14. Industry*, the State should continue to develop an in-state supply chain of green economy businesses and manufactures by offering economic incentives such as loans, grants, tax credits, technical assistance programs, and access to venture capital investments. These incentives should attract, expand, and retain green economy businesses as well as identify and advance in-state economic opportunities, for example to take advantage of production line re-purposing or attract green manufacturing to legacy/rust belt cities and Disadvantaged Communities.
- **Support minority- and women-owned and socially responsible business enterprises:** The State should provide support and outreach for MWBEs, cooperatives, and B Corps, including dedicated access to expert advisory services, internships, fellowships, board placement in innovative companies, and access to venture capital for underrepresented women and minority entrepreneurs, via New York Ventures.
- **Support NextGen building decarbonization solutions:** The State should continue to support RD&D, demonstrations, and technology transfer and commercialization for next generation HVAC systems, building envelopes, and design approaches that meet technical needs, deliver high performance, and lower costs. This includes continued improvement in cold climate performance across a range of heat pump products and sizes; improved domestic hot water heat pump technologies; solutions for harder-to-electrify buildings, including those on the Con Ed steam system; community thermal loops; advanced heat recovery and ventilation; improved thermal storage for HVAC applications; innovative materials, construction approaches, and manufacturing methods that improve building envelopes; and other technologies.
- **Support NextGen grid-interactive buildings solutions:** The State should support RD&D, demonstrations, technology transfer and commercialization, and development of standards across manufacturers and equipment for Grid-Interactive Efficient Buildings to deliver energy efficiency, load flexibility, and modulation capabilities that contribute to efficient grid management and grid reliability. The State should support the development of market signals, including revenue streams for Grid-Interactive Efficient Buildings, via analysis of opportunities

to provide grid services and electric/thermal services to neighboring buildings, assessment of market mechanisms for supporting desired policy outcomes, and pilots and demonstrations to inform rulemaking and ratemaking.

- **Support RD&D for alternative fuels:** The State should assess and then support RD&D needs with respect to the potential for some use of alternative fuels in buildings (such as renewable natural gas [RNG], green hydrogen, wood, and/or high-percentage biodiesel blends) and bioenergy with carbon capture and storage for harder-to-electrify building end uses or systems, which may include campuses with district energy systems. This research should account for impacts on not only the buildings sector, but the industrial, transportation, agriculture, waste, and power sectors, which could benefit from advancement of these solutions. The research agenda should include:
 - Rigorous energy, GHG, and environmental sustainability guidelines and metrics
 - Analysis of the potential air quality and health impacts and best practices to minimize these impacts, such as emissions control technologies, as well as mitigating localized impacts in Disadvantaged Communities
 - Life cycle GHG accounting, with strong preference given to zero- or negative-emission sources
 - The safety of green hydrogen
- **Support RD&D for building resilience:** The State should assess and then support RD&D needs with respect to building resilience as it looks toward both widespread building electrification and more frequent extreme weather and chronic changes to the climate. The State should research, develop, and pilot grid-independent, non-fossil fuel approaches for heating and cooling buildings during prolonged power outages, such as long-duration thermal storage, GSHP plus battery systems, and passive cooling approaches. Related RD&D investments (also discussed in *Chapter 13. Electricity*) include the flexibility and resilience of the electrical system and long-term energy and thermal storage solutions.

B11. Reduce Embodied Carbon from Building Construction

A specific area for RD&D and for the State to lead by example is to reduce the embodied carbon associated with building construction, which describes all GHG emissions that result from the mining, harvesting, processing, manufacturing, transportation, and installation of the products and materials that are used in buildings, as well as end-of-life emissions associated with the disposal of those materials. The most impactful way to reduce embodied carbon is to reuse existing buildings where practical, rather than demolishing and constructing anew. When new construction or renovation occurs, smart and integrated

building design processes can significantly reduce embodied carbon at little-to-no added cost of construction. Moreover, in-state manufacturing can grow to produce the low-carbon alternative products. However, there is currently a broad lack of awareness in the industry of embodied carbon impacts from products in use in buildings, including among designers, contractors, and manufacturers.

To lower the embodied carbon of products and materials used in the buildings sector, New York should establish procurement requirements and design specifications for State-funded projects, building on the framework established in Executive Order 22 directing the GreenNY Council to issue operational directives and guidance for common construction materials to be used in projects using the state procurement process. To lower emissions associated with concrete use in buildings, the State should build on the elements of the Low Embodied Carbon Concrete Leadership Act of 2021, directing the Office of General Services to establish a stakeholder group to set guidelines for state agency procurement of low-carbon concrete.

The State should further take actions to create broad carbon literacy regarding the impact of construction materials as well as support education, building reuse, building de-construction and material reuse, RD&D, and in-state manufacturing of alternative products. These efforts also will increase industry attention to carbon-sequestering products, such as hempcrete and sustainable wood products like mass timber. Some of the components in this strategy relate closely to those presented in *Chapter 14. Industry* (Strategy I2) and *Chapter 15. Agriculture and Forestry* (Strategy AF19).

Components of the Strategy

Interagency coordination through the GreenNY Council should include DASNY, DEC, New York State Office of General Services (OGS), NYPA, NYSERDA, DOS, ESD, and other agencies.

- **Lead by example in State projects:** Pursuant to the Low Embodied Carbon Concrete Leadership Act and Executive Order 22, the State should continue to drive embodied carbon reductions through design and procurement in State-funded new construction projects.
- **Make embodied carbon transparent:** In design specifications, the State should require Environmental Product Declarations for structural building materials where available and require the use of available modeling software and design tools for calculation of the project's embodied carbon budget. The State, through the GreenNY Council, should adopt methodologies for calculation of carbon reduction, including use of a standardized database of values to support analysis for calculation of carbon emissions for use in environmental product declarations. The

methodologies, database, and analyses should leverage the efforts of the federal Buy Clean Initiative and Inflation Reduction Act directives for federal agencies to establish consistency and allow for a like for like comparison across different building materials.

- **Follow lower-carbon specifications:** The State should require that State-funded projects follow lower-carbon specifications (see GreenNY) for the most carbon intensive construction materials and products (such as concrete, foam insulations, glass, and window units).
- **Set reduction targets for projects:** Subsequently, the State should set a target embodied carbon reduction level for projects that is below the established mean embodied carbon budget, as illustrated over the previous years.
- **Incorporate embodied carbon budgets into permitting:** The State should require an embodied carbon budget to be submitted as part of the permit process for all commercial and institutional new construction (and additions and alterations as applicable), immediately for State entities and no later than 2025 for local government entities. The State should provide funding for training and resources for designers and for State and local permitting entities to check carbon budgets for completeness at first and then for accuracy as the market improves in its abilities.
- **Encourage building reuse:** The State should identify and pursue financial incentives, changes to building codes, and other strategies to encourage building reuse, beginning in urban centers that are returning vacant buildings to use. Maintaining the existing building facade and architectural style can be an additional benefit to the embodied carbon reduction. Consistent with *Chapter 16. Waste*, this would include State support for local communities to establish and expand material reuse and exchange centers, as well as training for local crafts and trades people, to encourage the reuse, retrofitting, and repair of existing buildings and building systems and the deconstruction and reuse of building materials.
- **Support RD&D:** The State should support RD&D, demonstration projects, and technology transfer and commercialization for enhanced low-embodied carbon construction, including preference for reuse of existing buildings, as well as showcase low-embodied carbon designs and undertake industry outreach.
- **Expand in-state manufacturing for products:** The State should provide economic incentives and technical assistance to expand in-state manufacturing and assembly for products that are lower in embodied carbon or made of carbon sequestering materials (also known as biogenic or agriculture-based materials). ESD, the New York State Wood Products Development Council (WPDC), SUNY College of Environmental Science and Forestry (ESF), and DEC are well-positioned to provide and coordinate assistance.

- **Incorporate embodied carbon specifications into incentive programs:** In the design of energy efficiency incentive programs, the State should incorporate lower-carbon specifications for the most carbon intensive products (such as foam insulations in homes).
- **Leverage federal efforts and policy development:** The Inflation Reduction Act directs the EPA to develop a program to support the development, enhanced standardization and transparency, and reporting criteria for environmental product declarations for construction materials and products, through offering grants and technical assistance to manufacturers. New York should participate in the federal Buy Clean state government partnership effort in order to expand markets for clean manufacturing and low-carbon materials across the U.S. To assist with standardization and methodological consistency, New York should leverage tools being developed by the federal government, such as the U.S. Department of Energy’s Building Technology Office, for life cycle analysis and standard setting for specific products.

Transition from Hydrofluorocarbons

B12. Advance a Managed and Just Transition from Reliance on Hydrofluorocarbon Use

HFC use is currently widespread in refrigeration and HVAC equipment, including in heat pumps that are being recommended to electrify space conditioning and water heating and in foams that provide insulation for higher efficiency buildings. New York State agencies should continue to coordinate with U.S. Climate Alliance states on HFC reduction policies and ensuring an effective phasedown of HFCs. In 2020, DEC adopted the 6 NYCRR Part 494 regulation as a first step in reducing the use of high-GWP HFCs in New York. In 2022, DEC began stakeholder outreach on a rulemaking to expand Part 494 in response to the draft Scoping Plan.

Components of the Strategy

- **Provide education and training:** The State should provide resource toolkits, programs, and incentives that make low-GWP refrigerant technologies and low-GWP alternatives available and affordable, including a focus on natural refrigerants. NYSERDA should support design professional and workforce training and education, including in Registered Apprenticeship programs, around low-GWP refrigerants and alternatives, including natural refrigerants, in building equipment and in building/construction spray foam. DEC should promulgate regulations regarding proper disposal of HFCs already in use in existing equipment and such regulations should be supported by training installers and contractors on handling, equipment maintenance, and disposal protocols.

- **Update regulations, codes, and standards:** As soon as possible, the State should update relevant codes, including the mechanical code, to allow the use of low-GWP alternatives for HFCs in relevant building equipment. DEC should promulgate regulations requiring reclamation or destruction of refrigerants from appliances at end-of-life, with verification and reporting, and require leak detection for certain commercial refrigeration. In addition to education and training, the State should provide economic support (such as, incentives to purchase leak detection and reclamation equipment, or compensation for refrigerant reclamation) to aid local industry with this transition.
- **Support the HFC phase-out in food stores:** Supermarkets are the largest source of HFC emissions in New York. There are natural alternatives available today that not only provide significant GHG reduction benefits but are also more efficient, do not contain fluorinated chemicals, and have a lower total cost of ownership. The key barrier to wider adoption is the high cost of installation, which may be prohibitive for small businesses and for stores in Disadvantaged Communities. NYSERDA, DPS, and DEC should coordinate to develop incentives such as utility rebates and grant programs to support the adoption of natural refrigerants in food stores. Incentives are particularly needed to fund a substantial portion of the installation of new equipment in existing stores in Disadvantaged Communities or stores operated by independent companies or small chains, to enable food stores to phase out HFCs without impacting LMI consumers or negatively affecting food security.
- **Phase out high-GWP HFCs:** DEC should expand the scope of 6 NYCRR Part 494, which prohibits certain HFCs in refrigerator/freezers, chillers, commercial refrigeration, and aerosols/foams/solvents end uses, including through the establishment of a GWP threshold that decreases over time as low and ultra-low GWP options become available and addressing leakage in existing equipment during the transition. DEC should align New York policy with anticipated federal (EPA) policy measures to meet HFC reduction requirements as well as with other U.S. Climate Alliance states, to send a strong market signal to manufacturers and industry while mitigating costs of the transition.
- **Research health effects and environmental impacts:** The State should support further research into known data gaps, including an analysis of typical leak rates and charge size in heat pump technologies and research into long-term health effects of exposure to new HFC-alternative chemicals in building materials.
- **Support RD&D:** The State should continue to support demonstration projects for low and ultra-low GWP refrigerants in HVAC and hot water systems and for refrigerant leakage detection and reduction strategies. The State should develop case studies in refrigerant management and

alternatives to HFCs, including natural refrigerants, showing the safety, performance, and cost impacts.

Chapter 13. Electricity

13.1 State of the Sector

Overview

New York’s electricity sector comprises traditional fossil fuel-fired power generation facilities and nuclear generation facilities, along with clean energy generation such as wind, solar, hydropower, energy storage, and transmission infrastructure. In 2021, renewable resources accounted for approximately 27% of the State’s electricity generation. Meanwhile, nuclear resources contributed about 24% of the electricity generation in the State. Fossil fuel generation, including fossil natural gas, oil, and dual fuel generation produced more than 47% of statewide electricity.²²⁴ The reliance on coal has decreased significantly in recent years (see Figure 26) with the last remaining coal-fired power plant closing in 2020, following New York State Department of Environmental Conservation’s (DEC) adoption of revisions to 6 NYCRR Part 251 in 2019 to establish carbon dioxide (CO₂) emission limits for existing power plants.²²⁵

Emissions Overview

The electricity sector comprised 13% of statewide emissions in 2019, including electricity generation within the State (44%), imported electricity (15%), emissions from imported fuels (41%), and the SF₆ used in electricity distribution and transmission (<1%). Electricity sector emissions have declined 46% since 1990.

Vision for 2030

The Climate Act requires that 70% of statewide electricity come from renewable energy sources by 2030 (70x30). The Climate Act also requires 6,000 megawatts (MW) of distributed solar by 2025 and that 3,000 MW of energy storage be installed by 2030. The State has since set increased targets to deploy 10,000 MW of distributed solar and 6,000 MW of energy storage by 2030.²²⁶ The renewable electricity requirement can be accomplished by aggressive deployment of existing renewable energy technologies

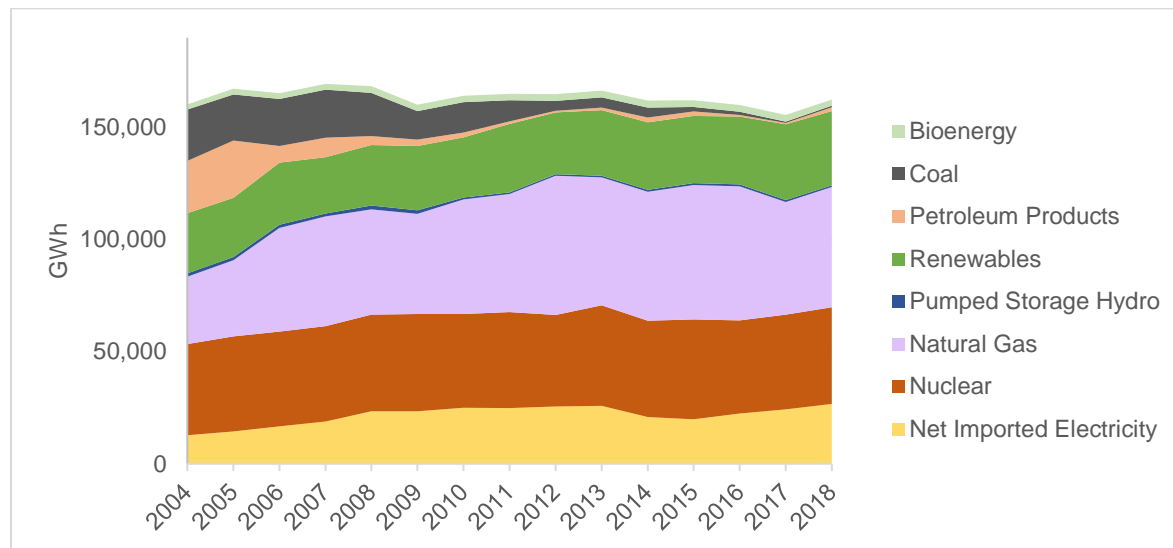
²²⁴ New York Independent System Operator. 2022. “Power Trends 2022, The Path to a Reliable, Greener Grid for New York.” Accessed at <https://www.nyiso.com/documents/20142/2223020/2022-Power-Trends-Report.pdf/d1f9eca5-b278-c445-2f3f-edd959611903>.

²²⁵ NYSEDA. 2022. “Patterns and Trends: New York State Energy Profiles, 2004–2018.” Albany. Accessed at <https://www.nyserda.ny.gov/about/publications/ea-reports-and-studies/patterns-and-trends>.

²²⁶ In September 2021, Governor Hochul called for an expansion of the State’s distributed solar program from 6,000 MW to 10,000 MW and tasked NYSEDA and DPS with developing a distributed solar roadmap to outline a framework to advance the expanded goal in a resilient, cost-effective and responsible manner. In April 2022, the PSC approved this new framework for the State to achieve at least 10,000 MW of distributed solar by 2030. In January 2022, Governor Hochul directed DPS and NYSEDA to update New York State’s Energy Storage Roadmap to double deployment, reaching at least 6 gigawatts of energy storage by 2030.

such as wind, solar, and energy storage. With the primary procurement mechanisms already established, the recommendations included here for 2030 seek to address barriers in the construction and operation of renewable energy, accelerate the pace of development, and reduce the cost of decarbonizing the electric grid. These include support for the Clean Energy Standard (CES) and storage deployment, refined electric grid modeling to improve decision-making, and improved coordination across State agencies.

Figure 26. Electric Generation by Fuel Type (2004–2018)



Source: NYSERDA Patterns and Trends – New York State Energy Profile.

Vision for 2050

By 2040, the Climate Act requires that the State achieve a zero-emission electricity system (100x40) as well as 9,000 MW of offshore wind by 2035. Achieving this will require all of the actions identified for 2030, plus further renewable energy capacity additions and a focus on developing new technology solutions. The State will also need market solutions that better align with the 100% zero-emission requirement, allow for a rapid transition away from fossil fuel generation, and maintain reliability and affordability.

As the transportation and buildings sectors transition to electric – due to zero-emission vehicle (ZEV) sales requirements and incentives and zero-emission building codes – the increased demand will impact the amount of renewable electric generating capacity needed to meet the 70x30 and 100x40 requirements. The State anticipates annual electricity demand growth of 100% to 110% by 2050, dependent on the scale and timing of electrification and whether there are other clean alternatives for the transportation and building sectors. The level of electrification needed to achieve the statewide greenhouse gas (GHG) emissions reduction requirements will increase overall electric load and shift the system peak demand

from the summer to the winter. Given the large amounts of renewable energy that must be procured and developed to reach the Climate Act requirements, the State needs to incorporate load flexibility and controllability into the electric grid as sectors electrify in order to create a more manageable system. New and upgraded transmission and distribution systems will be needed statewide, including specific transmission and distribution investments that will be necessary to deliver energy from where the generation is located to where the load demand exists.

Recommendations include advancing long-duration storage and designing market mechanisms that promote, support, and do not disadvantage those clean resources needed to meet the requirements.

Table 13. Sector Spotlight: Timelines for a Just Transition in the Electricity Sector

- The JTWG Jobs Study found that in the electricity sector, more mature subsectors like transmission, distribution, and solar will see strong growth between 2019 and 2040, while more nascent subsectors like offshore wind, storage, and hydrogen are expected to experience exponential growth. This finding indicates that parts of the growing sector will be able to build upon their current established workforce, while other parts of this sector will almost need to start from the beginning as these subsectors have little, if any, workforce development infrastructure.
- Emissions are projected to decline by roughly 67% by 2030 and 100% by 2040. By 2050, across all modeled pathways, New York will install over 60 GW of solar capacity (both utility-scale and distributed resources), between 16-17 GW of new land-based wind capacity (including imported wind from neighboring ISOs), and between 16-19 GW of offshore wind resources.
- The 2021 Jobs Study found that major occupational groups in electricity growth subsectors will experience consistent growth with the largest increase occurring within installation and repair, which occupies more than 45% of electricity. Management and professional occupations represent more than 25% of electricity occupations and will experience the second largest growth.
- As described in *Chapter 7. Just Transition*, in cases when continued operation of a power plant or other facility or system is needed, even as it winds down, the State should focus efforts on retaining workers while retraining them for new, clean energy jobs. In other cases, when facility closures and system transitions are known ahead of time, training and supportive services should be implemented while individuals are still working to prepare workers for the transition to clean energy.
- Coordination across the New York State Energy Research and Development Authority (NYSERDA), New York State Department of Labor (DOL), other State entities including the Office of Just Transition and other Climate Action Council agencies will be critical to coordinate all funding and financial incentives for workforce development, community support, existing worker support, and new worker support related to the transition away from fossil fuel electric generation sources.

Growing Subsector (solar, offshore wind, onshore wind, hydropower, hydrogen, biomass, distribution, transmission, and storage) jobs:	113,200	Potential job growth by 2030: 2040:	+57,200 +88,700
Displaced Subsector (fossil fuel and nuclear generation) jobs:	17,800	Potential job loss by 2030: 2040:	-4,000 -12,400
		Potential net job creation by 2030: 2040:	+53,200 +76,300

Note: Job impact data from JTWG Jobs Study (Scenario 2 Initial Employment Outputs), rounded to the nearest hundred. Jobs figures here may be partial due to differences in sectoral breakdown between Scoping Plan Chapters and Jobs Study; additional analysis found in the Jobs Study.

Existing Sectoral Mitigation Strategies

Prior to the adoption of the Climate Act, the State had existing policy mechanisms and programs in place to achieve electricity system decarbonization, including the New York State Energy Research and Development Authority's (NYSERDA) extensive procurement programs for land-based and offshore renewable energy resources. These efforts continue and have been expanded where necessary to meet the 2030 requirements in the Climate Act. For instance, in the fall of 2020, the New York State Public Service Commission (PSC) implemented key provisions to align the CES and Offshore Wind Standard with the Climate Act and provide NYSEDA with the authorization to procure the renewable energy needed. These provisions included increased annual Tier 1 renewables procurement targets under the CES for NYSEDA to align with the 70x30 mandate, the adoption of the 9,000 MW offshore wind procurement directive, and the creation of Tier 4 to deliver renewable energy to New York City.²²⁷ NYSEDA's procurement for Tier 1 will need to average almost 4,500 gigawatt hours annually over the 2021 to 2026 period to meet the Climate Act's 2030 directive (which includes calculation for load growth). The CES also includes the Tier 2 Maintenance Resource program, which is an important mechanism to keep existing renewable facilities operational. These policies will be updated and adjusted over the course of the next decade by the PSC through the required biennial review of the CES Program, so that the PSC and NYSEDA can adjust program requirements and procurement targets as necessary to meet both the 2030 and 2040 directives and to protect the future of our existing renewable energy base.

The New York State Department of Environmental Conservation (DEC) also has environmental policies in place to address GHG emissions from the electricity sector. While 6 NYCRR Part 242, the CO₂ Budget Trading Program (RGGI), implementing regulations have been in place for this sector-specific cap-and-invest program since 2009, the most recent revisions extended the cap reductions out to 2030. In addition to reducing the RGGI cap by 30%, New York expanded the compliance obligation under these revisions to cover peaking units 15 MW and larger. DEC also regulates new, modified, and non-modified existing major electric generating facilities under 6 NYCRR Part 251, CO₂ Performance Standards for Major Electric Generating Facilities. The most recent revisions to 6 NYCRR Part 251 were critical to ensuring the State met its commitment to eliminating coal from the electric generating sector by 2020. The regulations also ensure that any new and/or modified sources meet stringent CO₂ emissions standards.

²²⁷ New York State Department of Public Service. "Case 15-E-0302, Implementation of a Large-Scale Renewable Program and Clean Energy Standard, Order Adopting Modifications to the Clean Energy Standard." Issued October 15, 2020.

Under the Clean Air Act, DEC has also been permitting and regulating emissions of co-pollutants from power plants for over 50 years to address the local and regional impacts from the emissions of particulate matter, nitrous oxides (NO_x), and sulfur dioxide (SO₂). Current DEC regulations that target emissions of fossil fuel-fired facilities include:

- Ozone Season Oxides of Nitrogen (NO_x) Emission Limits for Simple Cycle and Regenerative Combustion Turbines (6 NYCRR Subpart 227-3 – The “Peaker Rule”): Adopted in early 2020, this regulation contains ozone season NO_x emission limits for affected sources for calendar years 2023 and 2025. It also contains provision to extend the compliance dates if the New York Independent System Operator (NYISO) or Local Distribution Owner determine there is a reliability need. For Subpart 227-3, the primary pollutant of concern is NO_x because the peakers regulated are an order of magnitude dirtier than clean combined cycle units. From a climate perspective the targeted peakers represent less than 3% of the CO₂ from all regulated electric generating units.
- CO₂ Budget Trading Program (6 NYCRR Part 242): Part 242 is New York’s regulation for implementing the RGGI program. The regulation was recently revised in December 2020 to further reduce the CO₂ emissions budget or cap by 30% through 2030 and expand applicability to peaking units. Another regional program review is scheduled to begin toward the end of this year. Due to the recent expansion, Part 242 now covers more peaking units of 15 MW and above (previously 25 MW and above).
- CO₂ Performance Standards for Major Electric Generating Facilities (6 NYCRR Part 251): DEC adopted revisions to Part 251 to establish CO₂ emission rate limits for non-modified existing electric generating facilities. The current emission limits are 1,800 lbs/megawatt hour or 180 lbs/million British thermal unit (Btu). The regulations were adopted in 2019. Part 251 created CO₂ emission rate limits. Though this regulation helped to retire the last of New York’s coal plants, currently all peaking units meet those rate limits.

DEC’s emissions regulatory programs combined with the PSC’s significant investments in utility ratepayer-funded programs, which includes NYSERDA’s procurement programs, as well as Long Island Power Authority (LIPA) and New York Power Authority (NYPA) procurement activities are the purposeful combination of incentives and regulations that are designed to safely phase out the use of fossil fuel for electricity and gradually replace it with renewable technologies. Under Section 7(2) of the Climate Act, all decisions, including permitting decisions, pertaining to electric generation facilities, State entities will need to ensure that the proposed actions are not inconsistent with and will not interfere with the attainment of the statewide GHG emission limits. Additionally, under Section 7(3) of the Climate Act,

State entities must ensure such decisions do not disproportionately burden Disadvantaged Communities and prioritize reductions of GHG emissions and co-pollutants in Disadvantaged Communities. Until the regulations required under the Climate Act to ensure compliance with the statewide emission limits are promulgated by DEC, agencies will ensure compliance with Section 7(2) by reviewing a decision's consistency with the statewide GHG emission limits established under the Climate Act.²²⁸

Key Stakeholders

Key stakeholders include NYSERDA, New York State Department of Public Service (DPS) and the New York State Public Service Commission (PSC), DEC, NYPA, LIPA, Empire State Development (ESD), other State entities including the Office of Just Transition and Climate Action Council (Council) agencies, the NYISO, utility owners and operators, affected workers and unions, host communities (community-based organizations, school districts, local governments), and both fossil and clean energy generation owners and operators. These groups will have to work together to ensure an effective and efficient transition to a zero-emission electricity grid, while maintaining reliability and cost-effective implementation.

13.2 Key Sector Strategies

The key strategies within this sector are organized into three themes, as shown in Table 14. As described there in greater detail, the labor standards discussed in *Chapter 7. Just Transition* are intended to apply throughout this Scoping Plan, including for the electricity sector, as a means of promoting good, family-sustaining, union jobs accessible to all New Yorkers and achieving a true just transition.

²²⁸ 6 NYCRR § 496.4.

Table 14. Electricity Sector Key Strategies by Theme

Theme	Strategies
Transform Power Generation	E1. Retirement and/or Repurposing of Fossil Fuel Fired Facilities E2. Accelerate Growth of Large-Scale Renewable Energy Generation E3. Facilitate Distributed Energy Resources E4. Support Clean Energy Siting and Community Acceptance E5. Promote Community Choice Aggregation
Enhance the Grid	E6. Deploy Existing Storage Technologies E7. Invest in Transmission and Distribution Infrastructure Upgrades E8. Improve Reliability Planning and Markets E9. Advance Demand Side Solutions
Invest in New Technology	E10. Explore Technology Solutions

Transform Power Generation

With fossil natural gas currently being the principal fossil fuel source for electricity generation in the State, a significant transformation of the power sector is necessary to meet the Climate Act’s 70x30 and 100x40 requirements. To decrease the use of emitting fuels in the electricity sector, New York must deploy clean energy resources such as land-based wind and solar, offshore wind, hydropower, fuel cells that use renewable fuels, and energy storage. While many programs are already in place to support and encourage these types of resources and significant progress has been made, aggressive deployment of clean resources must continue, and the effectiveness of programs and policies should be continually evaluated and changed if renewable energy is not being deployed at the pace necessary to achieve the requirements on time. This will require investment in training and retraining of the existing workforce as well as supporting workforce development actions, in a manner that is responsive to industry needs and job placement opportunities and is supportive of applicable labor standards and the promotion of equitable access to family-sustaining jobs, including union jobs, consistent with the discussion in *Chapter 7. Just Transition*.

E1. Retirement and/or Repurposing of Fossil Fuel Fired Facilities

Achieving a 100% zero-emission power grid will require phasing out the use of fossil fuel for power generation over time. During the same period, New York will also need to maintain a completely safe and reliable power grid.

Currently, to meet daily electricity demand, a combination of generation assets (i.e., power plants) is reserved and then dispatched to meet electricity demand at the lowest achievable cost. This combination of resources is called the “supply stack.” Typically, renewable generators run whenever they

have supply available from their fuel sources, such as wind and sunlight. “Baseload” generators are those generators with low per-unit running cost and serve as the bottom of the supply stack (chosen to run first and most often); typically these are large nuclear, hydroelectric, and some of the more economic fossil fuel power plants. Other generation is used to meet energy demand beyond that served by baseload plants, which fluctuates throughout the day. When demand increases beyond minimum and average daily load, or baseload supply resources are interrupted, other “peaking” generators are used to provide the remaining amount of power requirements. While these peak generators are typically the most expensive and polluting units on the system (on an emission rate basis), they run infrequently and are able to respond to demand in real time.²²⁹ Peaking generators may also be used in certain locations (load pockets) where energy delivery into the load pocket may become congested, requiring electricity to be produced and delivered locally (e.g., within the load pocket itself, including areas within sub-transmission and distribution networks).

Transitioning to zero-emission electricity will require addressing emissions from both baseload and peaking facilities and balancing the electricity system with integration of dispatchable and zero-emission resources as intermittent renewable energy generation penetration increases. To facilitate and enable retirement and/or repurposing (meaning use of this space for siting clean energy transition activities such as energy storage, operations and maintenance activities, training facilities, etc.) of fossil fuel-fired facilities, New York needs to continue and accelerate its deployment of new renewable generators (e.g., wind, solar, hydro), maintain the fleet of renewable generators it has now, upgrade its transmission and distribution system to allow for the maximum use of the renewable generators (i.e., get the power where it needs to go), improve management on the demand side of electricity use, and invest in energy storage technologies. Pursuant to existing policies and procedures, any retirement and/or repurposing of existing fossil fuel generation must be done in coordination with the PSC, the NYISO planning process, the required reviews under Section 7(2) and 7(3) of the Climate Act, and consistent with New York State Reliability Council criteria. These significant climate investments will assist with meeting the requirements of the Climate Act, while also supporting increasing New York’s renewable energy supply, reducing its reliance on fossil fuels, reducing energy price volatility, increasing system resiliency, and improving power quality.

²²⁹ A majority of these units are traditional peaking units that operate less than 10% of the time on an annual basis. See Case 18-E-0130, In the Matter of Energy Storage Deployment Program, “*The Potential for Energy Storage to Repower or Replace Peaking Units in New York State.*” July 2, 2019.

As described in more detail below as the components of Strategy E2, New York should also have a detailed process in place to ensure that the fossil fuel generators are gradually and safely retired while still maintaining reliability. Studies such as the NYISO Reliability Needs Assessment and overall Comprehensive Reliability Plan will inform this process to ensure consumer energy reliability while transitioning away from fossil fuel electricity generation. If a reliability need or risk is identified, zero-emission solutions should be fully explored, such as storage, transmission upgrades or construction, energy efficiency, demand response, or another zero-emission, dispatchable resource. Evaluation of alternative fuels such as green hydrogen and renewable natural gas (RNG) for this strategic use should include an analysis of the air quality impacts, health impacts, and full life cycle GHG emissions impacts, in addition to avoiding localized pollution in Disadvantaged Communities.

Only after these zero-emission and alternative fuel resources are fully analyzed and determined to not be able to reasonably solve the identified grid reliability need shall retention of existing or construction of new or repowered fossil fuel-fired generation facilities be considered. These should only be considered if the NYISO and local transmission operators confirm that the fossil fuel-fired facility is required to maintain system reliability and that need cannot reasonably be met with the alternatives listed above. Even in those cases, the fossil-fueled generation facility should assist in meeting the goals of the Climate Act, including the need to ensure safe and reliable electric service. That is, its deployment should result in one or more of the following: a greater integration of zero-emission resources, a reduction in fossil fuel generation, a significant reduction of GHG and co-pollutant emissions, a benefit to an environmental justice community, or a benefit to the electric system that addresses the identified reliability need or risk.

In addition, public and stakeholder input must be incorporated into the decision-making process and a thorough analysis of compliance with Section 7(2) and 7(3) of the Climate Act including equity considerations, as mandated by the Climate Act, should be completed by DEC and/or other relevant State agencies. The Climate Justice Working Group (CJWG) is supportive of strategies to facilitate retirement of fossil fuel-fired generation facilities and recommends the Council take the additional step of placing a moratorium on the permitting of new fossil fuel plants until there is a demonstrated system reliability need that can only be addressed with fossil fuel generation. To address this recommendation, the State should leverage the use of regulations and transparent resource planning processes to properly phase out the use of fossil fuel generation facilities while maintaining electric system reliability.

Components of the Strategy

- **Assessment and determination of emissions reduction targets:** The PSC, DEC, NYSERDA, and the New York State Energy Planning Board should work in coordination to determine the potential for GHG emission and co-pollutant reductions from fossil fuel generation by 2030 and set a corresponding timeline for interim emissions reduction targets in alignment with the 70x30 and 100x40 requirements. The timeline from present to 2030 for possible emission reductions should be determined in conjunction with the renewable energy procurement and interconnection schedule and should represent a continual decline in emissions from present to 2040 while ensuring the reliability of the energy system is maintained. The process should include effective mechanisms for input and comments by stakeholders (including but not limited to generators, utilities, and environmental, environmental justice, public health, labor, and electricity consumer advocates and organizations, as well as local communities) and the public. When setting interim emission reduction targets, consideration should be given to the location and emissions profile from fossil generating units across the State, as well as relevant planning studies from involved organizations (the Power Grid Study, NYISO reliability analyses and other planning processes, New York State Reliability Council, etc.) to inform decisions to address these emissions in the most efficient and effective manner possible. Disadvantaged Communities shall be considered when determining the interim emissions reduction targets, as required by the Climate Act. The effectiveness of the interim emissions reduction targets and progress toward achieving the 2030 goals shall be evaluated every two years starting in 2024 and adjusted accordingly to ensure the subsequent 2040 zero-emission target is achieved. Reviews should coincide with the requirements in the Climate Act, State Administrative Procedures Act (SAPA) three-year review requirement, and resource planning review (see below).
- **Promulgation of emissions regulations:** DEC should assess regulatory options to reduce emissions from fossil fuel-fired generating units to the maximum extent practicable to achieve the requirements of the Climate Act while maintaining system reliability. Consistent with the above analysis, and in coordination with PSC, NYSERDA and other interested stakeholders, DEC should examine all potential regulatory options, including new regulations and/or permit requirements or amendment of current regulations and/or permitting requirements, to determine the most efficient, effective, and enforceable format to achieve the determined interim emissions reduction targets described above and the Climate Act directives. The process should consider other regulatory programs, including a potential economywide program as discussed in *Chapter 17. Economywide Strategies*, as well as RGGI, and include effective mechanisms for input and comments from stakeholders prior to a formal proposal under SAPA, similar to the

process used in promulgating the DEC “Peaker Rule,” 6 NYCRR Subpart 227-3. Once completed, DEC should follow SAPA in promulgating the identified regulation(s).

- Consistent with SAPA, the effectiveness of the regulations should be evaluated every three years. This evaluation should coincide with the resource planning review (see below on planning).
 - Coordination of closures and the necessary reliability assessments should take place between State Agencies (e.g., DEC, PSC, NYSERDA, ESD) and other key stakeholders (e.g., the NYISO, utilities and fossil fuel facility owners and operators; see below on planning).
 - Evaluation of GHG emissions and co-pollutants, benefits, reliability needs, cost, and available replacements (and their subsequent impacts) must be executed (see below on planning).
 - Specific focus should also be given to emissions of co-pollutants in disadvantaged and environmental justice communities, as required by the Climate Act.
- **Regular and transparent resource planning:** The PSC will conduct biannual reviews of the renewable energy program and electric system resource mix starting in 2024 as required by the Climate Act in order to support and ensure the achievement of the emissions reduction targets and compliance with the promulgated regulations by DEC, as well as achievement of the 70x30 and 100x40 requirements. As part of this review process, the PSC should evaluate options to retire and/or repurpose existing fossil fuel electric generation facilities. In 2022, the State initiated the development of a blueprint to guide the retirement and redevelopment of New York City’s oldest and most-polluting fossil fuel facilities and their sites by 2030. This blueprint is being developed by DPS, NYSERDA, and DEC and will be completed in 2023 to serve as a critical input into future CES, State Energy Plan, and/or Scoping Plan updates and to coincide with the review of any related regulations or Climate Act requirements, including the biannual review described above. These State agencies will also coordinate the development of this blueprint with the NYISO and utilities, including consideration of relevant studies by these organizations and requirements of the Climate Act. Although this blueprint is focused on New York City, the recommendations and considerations in this blueprint will be useful in evaluating options for retirement and/or repurposing of fossil fuel facilities located throughout the State.

In developing this blueprint and as part of regular and transparent resource planning processes, the State will examine options to reduce or eliminate emissions from fossil fuel-fired generation facilities, including behind-the-meter fossil resources as expeditiously as practicable but not later

than 2040, identifying the nature, feasibility, cost and avoided costs, risks and risk mitigants, and impacts on emissions and health as well as reliability. These options may include efficiency, storage, load flexibility, distributed energy resources (DERs), and transmission and distribution upgrades, among others. The blueprint will also describe the existing policies and procedures for the retirement and/or repurposing of existing fossil fuel generation including PSC rules and regulations, the NYISO planning process, and with New York State Reliability Council criteria.

The blueprint will also include detailed analysis and planning to address the impacts on communities and workers. Specifically, the blueprint will:

- Assess the revenue impacts on school districts and municipalities of fossil fuel plant closures and ensure adequate funding of the Electric Generation Facility Cessation Mitigation Program as plants are retired²³⁰
- Ensure the retirement and/or repurposing of these facilities is done in coordination with the transition of the gas system, as described in *Chapter 18. Gas System Transition*, to ensure electric grid reliability needs are met
- Ensure that plant owners are responsible for costs of site remediation
- Focus on repurposing these facilities as necessary to take advantage of their location and infrastructure to ensure reliability while meeting the Climate Act requirements, including consideration of these facilities for zero-emission alternative uses such as energy storage
- Support a process involving local stakeholders to determine redevelopment of sites as plants are retired, including those workers at sites and their collective bargaining representatives
- Examine options to reduce emissions impacts in environmental justice and Disadvantaged Communities, including prioritizing facilities located in Disadvantaged Communities for retirement and/or repurposing (see Appendix B for details)
- Investigate and implement options to develop market mechanisms to assist in the removal of fossil fuel-fired generating facilities from the system. These options include, but are not limited to, the valuing of environmental attributes either within or external to NYISO markets. Specifically, the State should consider a clean dispatch program that creates Clean Dispatch Credits. Zero-emission, fully dispatchable assets that can dispatch to fulfill the role of peaking units would generate Clean Dispatch Credits. Consideration should be given to both capacity and per-megawatt hour payment structures. Load-serving entities would be required to purchase increasing amounts of Clean Dispatch Credits annually to ensure

²³⁰ As of April 2021, New York State has appropriated a cumulative total of \$140 million for the program.

progress is being made. In developing any such market mechanisms, per the requirements of Section 7(3) of the Climate Act in agency decision-making, New York must ensure Disadvantaged Communities are not disproportionately burdened and prioritize reductions of GHG emissions and co-pollutants in Disadvantaged Communities.

- Assess workforce impact through existing data collection processes such as information collected in the New York State Worker Adjustment and Retraining Notification (WARN) Act processes, and any other data not already collected through existing closure response efforts.
- Identify and suggest measures to limit negative impact on current workforce, consistent with the discussion in *Chapter 7. Just Transition*.

E2. Accelerate Growth of Large-Scale Renewable Energy Generation

New York needs to get new renewable energy projects built. This points to the need for efficient processes to deploy large-scale renewable generation and improved transmission and distribution systems. To achieve this, the PSC and NYSERDA have administered successful CES procurement programs such as Tier 1, Offshore Wind, and Tier 4 which looks to increase renewables penetration in Zone J, and the Build Ready program that prioritizes the pre-construction development of existing but less desirable, abandoned, or underutilized sites for auction, to provide a de-risked project for developers to construct and operate at these locations. New York will continue to rely on the CES to reach the 70x30 and 100x40 requirements.

As previously discussed, the October 2020 CES Order increased the annual targets of renewable energy to be procured in order to meet the Climate Act requirements. NYSERDA's current procurement programs, including Tier 1, Offshore Wind, and Tier 4, will expand and continue to procure the renewable energy needed to reach these requirements and a zero-emission grid. The State also recently created a dedicated office, Office of Renewable Energy Siting (ORES), to streamline and expedite the siting of major renewable energy projects. As noted, the PSC also created a comprehensive grid planning process pursuant to which local system upgrades are being proposed by utilities and approved. The PSC continues to participate in existing planning processes related to bulk transmission projects and recently identified the need for several public policy transmission needs through the NYISO Public Policy Transmission Planning Process. One of these projects (Empire State Line) completed construction in 2022, a second project (A/C Transmission) is currently under construction, and a third project (Long Island-to-New York City Intertie) is being solicited by the NYISO. The PSC has also created a process to authorize NYPA

priority transmission projects. The recently approved Smart Path Connect is going through permitting under Public Service Law Article VII.

The CJWG is generally supportive of accelerating the deployment of large-scale renewable energy systems; however, it also stresses the need to balance this approach to large-scale renewables with significant investment and technical support for Disadvantaged Communities to develop zero-emission, behind-the-meter microgrids to reduce grid strain, increase resiliency and affordability, and diversify the State's energy portfolio. The strategies included in this Scoping Plan are aimed at doing just that and emphasize the need for support for underserved, low- to moderate-income (LMI), and environmental justice communities in the strategies related to DERs and Community Choice Aggregation (CCA), including development of zero-emission microgrids and district clean energy systems.

Components of the Strategy

- **Evaluate and adjust:** The PSC should continue to evaluate and adjust policies and procurement targets as necessary in order to achieve the Climate Act requirements and goals to deploy and maintain existing renewable energy systems including solar, land-based wind, hydropower, and offshore wind. The evaluation should include a review of the cost and benefits of these renewable energy investments. In addition, it is recommended that PSC assess, through its transparent processes, mechanisms to minimize rate impacts in the context of other related policies, such as its Energy Affordability Policy program.
- **Support successful programs:** The State should continue to support successful programs and regulatory changes, such as Build Ready and the Accelerated Renewable Energy Growth and Community Benefit Act through funding and hiring adequate staff in ORES and other relevant State agencies (including NYSERDA, DPS, New York State Department of State [DOS], and DEC) to ensure a rigorous but efficient and timely procurement and permitting process.
- **Identify facilitating transmission and distribution needs:** The PSC should continue to identify the key transmission and distribution upgrades, improvements, and new line construction needed to deliver renewable energy from where it is built to where it is needed to complement other transmission and distribution activities described later.
- **Establish permitting goals:** ORES should establish a non-binding metric or goal with respect to MWs of renewable energy that should be permitted each year in such an amount that complements the Tier 1 request for proposals procurements.

- **Explore:** The State should explore additional areas of openness and engagement with the NYISO and other stakeholders to improve the interconnection/Class Year process.²³¹
- **Labor and workforce development:** As part of clean energy infrastructure development and as new technologies and solutions emerge, workforce development actions should include local and targeted hiring provisions, particularly to incentivize the hiring of workers from Disadvantaged Communities, as well as to support displaced and transitioning workers.

E3. Facilitate Distributed Energy Resources

Clean DERs will continue to be pursued alongside the expansion of large-scale renewables. These resources generate electricity closer to end users, thereby increasing the efficiency and reducing carbon pollution compared with other generation facilities as well as improving grid resiliency and potentially curtailing the need for costly transmission investments.

DER is also a primary way (alongside energy efficiency) to meet the social equity requirements of the Climate Act. In some areas, clean energy from DERs can help to provide some of the reliability attributes that would otherwise be met by running existing fossil fuel generation, thereby improving local air quality. When properly developed, clean DER projects can also allow communities to participate in the process, providing economic development and workforce development opportunities, and bolstering resiliency. Increases in distribution system hosting capacity and the pace of interconnection will be important factors in facilitating deployment of DERs.

The CJWG is supportive of this strategy. It suggests that there needs to be a process in place to assure that LMI community solar savings do not conflict, interfere, or in any way prevent access to the other LMI energy savings programs such as the Home Energy Assistance Program. The CJWG highlighted that when designing incentives, use of grants over tax credits is preferred as tax credits may not be beneficial for LMI consumers. These concepts have been included below.

²³¹ The NYISO interconnection/Class Year Process is part of the NYISO's Comprehensive System Planning Process that focuses on the NYISO's responsibility to prepare for the impact of expected changes in supply and demand of power on the reliable operation of the New York transmission system over a ten-year period. The NYISO's Interconnection processes enable parties to pursue construction and interconnection of generation, transmission, and load facilities to the New York State Transmission System and Distribution System.

Components of the Strategy

Physical Needs

- **Hosting Capacity:** The PSC should work with the utilities and the NYISO to make proactive and timely investments in local transmission and distribution infrastructure and evaluate the associated cost-sharing/allocation borne by the utility ratepayers in these upgrades, including an evaluation of potential non-infrastructure or non-wire alternatives that could potentially delay or eliminate the need for conventional infrastructure investments.²³² The Regional Economic Development Councils (REDCs) should participate in utility and NYISO planning processes to identify sites in Disadvantaged Communities and legacy/rust belt cities that present economic development opportunities for consideration in these infrastructure investments, with particular emphasis on fulfilling supply chain needs to meet the Climate Act emissions reductions requirements. The PSC should also accelerate adoption of innovative technologies and programs that increase hosting capacity, such as flexible interconnection, hybrid systems, and coupling with energy storage or controlled load, smart inverters, and solutions that enable maximum back-feeding at the substation level from distribution to transmission as part of the local transmission and distribution planning process.
- **Interconnection:** The PSC should work with the utilities to speed up the pace of processing interconnection applications and need for right-sizing human resources at utilities, State agencies, and other relevant organizations to mitigate delays in application processing. This includes enhanced coordination among state agencies having jurisdiction for permitting to streamline the siting, permitting, and interconnection processes.

Financial Support

- **Rate Design:** The PSC should consider improvements to electric rate structures and programs (such as the Value of DER Value Stack²³³ compensation or the Standby and Buy-back service

²³² The PSC directed the electric IOUs to develop a set of suitability criteria against which each traditional capital infrastructure project would be compared to determine the suitability for such project to be delayed or eliminated through successful implementation of a NWA project. See New York State Department of Public Service. “Case 16-M-0411, Distributed System Implementation Plans, Order on Distributed System Implementation Plan Filings.” Issued March 9, 2017.

²³³ Value Stack compensation provides policy resources with utility bill credits that reflect the following grid values: energy, installed capacity, environmental value, and avoided distribution costs (local and system-wide). Value Stack was created through reforms to net energy metering in New York State Department of Public Service. “Case 15-E-0751.” <https://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=15-E-0751>.

rates²³⁴) that provide appropriate cost-based price signals to customers to encourage DER deployment and usage, as well as building heating and hot water system electrification technologies.

- **Compensation:** The PSC should consider improvements to the Value of DER Value Stack to more accurately reflect value provided by DERs, such as a more granular (time and location) environmental value and avoided transmission costs, and include a review of the cost and benefits of these renewable energy investments.
- **Incentives:** The PSC and NYSEDA should target incentives to stimulate high-benefit DER projects (dual-use solar/agriculture, multifamily housing, heat pumps/geothermal, collective solar projects) paired with electrification serving LMI and Disadvantaged Communities. NYSEDA should expand the Solar Energy Equity Framework programs, Low Income Community Solar concept, and adder for Inclusive Community Solar Projects. The State should ensure that participation in incentive programs is effective for the target audiences (e.g., tax credits may not be as effective for LMI consumers) and does not preclude participation in other programs. The State should eliminate barriers to enrollment for the target populations by streamlining and automating the processes where possible.²³⁵
- **Ground-mounted siting:** The State should address resistance and concerns to siting of ground-mounted solar projects, particularly in upstate and western New York.
- **Rooftop, parking lot, and carport solar permitting:** The State should address the need for a streamlined permitting process across authorities having jurisdiction that reduces processing times and soft costs.
- **Zoning:** DOS and NYSEDA should provide model zoning laws to municipalities for residential/commercial properties to require new construction be designed as “solar-ready.”
- **Resources & education:** The State should create or expand on regional discussion forums between itself, local communities, and projects to connect communities with resources, information, and address local concerns.
- **Aggregations:** Encouraging aggregations of DERs will provide additional value for grid management.

²³⁴ New York State Department of Public Service. “Case 15-E-0751, Allocated Cost of Service Methodology for Standby and Buyback Service Rates and Energy Storage Demand Charge Exemptions Order.” Issued March 16, 2022.

²³⁵ The Expanded Solar For All program authorized by the PSC in National Grid’s service territory applies bill credits from participating Community Solar projects to all customers enrolled in the utility Energy Affordability Program on an opt-out basis.

E4. Support Clean Energy Siting and Community Acceptance

New York will need to accelerate the deployment of renewable energy projects (both large-scale renewables and DERs) in order to achieve the Climate Act's mandates. While NYSERDA's procurement programs and improved permitting processes are critical to deployment of new renewable facilities, other actions are needed to get projects successfully sited and accepted by host communities. New York needs a multi-pronged approach with communities to support the siting and acceptance of renewable energy facilities, including wind, solar, storage, and transmission upgrades. This multi-pronged approach should include strong communication, engagement, and public outreach to communities. It should also include promotion of the benefits that renewable energy projects will provide, while working with communities to maximize these local benefits and minimize impact on lands identified by communities with other competing uses such as farming and agricultural soils, forest preservation, or other cultural resources.

This approach to fostering community acceptance will differ for smaller, distributed projects in more densely populated locations to larger utility-scale wind and solar projects in more rural areas or offshore. The community concerns and the community benefits for these two types of projects are somewhat different, but both can provide energy cost savings for residents and businesses in the community, local infrastructure improvement, local tax revenue and economic benefits, local job creation, and cleaner air for New Yorkers.

The CJWG supports finding compromise around local control while achieving State targets and emphasizes the need for community education and engagement to inform New Yorkers about the climate crisis and the benefits of shifting to a clean energy economy.

Components of the Strategy

Clean Energy Development

- **Agrivoltaics:** NYSERDA and New York State Department of Agriculture and Markets (AGM) should commence a study on developing a comprehensive agrivoltaics program to research and incentivize the viability of agrivoltaics to integrate solar into agricultural communities and provide habitat improvement for threatened and endangered species.²³⁶

²³⁶ Agrivoltaics is the co-location of solar energy projects and agriculture.

- **Development Mapping:** The State should develop a Clean Energy Development Mapping tool to help municipal representatives and local communities make informed land use decisions and communicate local priorities to developers.
- **Fund planning:** The State should offer State support and funding for Regional Planning Associations to assist municipalities in planning for renewable energy development.
- **Refine NYSERDA processes:** NYSERDA should continually refine processes, evaluation, and incentives for determining buildable projects and selecting projects for procurement request for proposals.
- **Decommissioning:** The State should study and advise communities on how to best implement options for decommissioning of community-owned projects at the end of their production life.

Public Education and Outreach

- **Public education:** The State should launch a statewide public education campaign to inform New Yorkers about the climate crisis and the benefits of shifting to a clean energy economy. The campaign should focus on community-based outreach and education on climate science and solutions and could include a P-12 climate change curricula in schools, supporting nonprofits, increasing public awareness about the benefits of renewable energy, connecting people with clean energy programs job training and educational opportunities, providing support to local governments and indigenous populations to actively participate in the clean energy transition, and encouraging local and regional land use and decarbonization planning.
- **Nonprofit outreach:** Based on availability, the State should provide funding for nonprofits and community-based organizations to carry out education and outreach about clean energy benefits.

Equity & Local Benefits

- **Measure and publish benefits:** The State should ensure community benefits, including employment numbers and job quality information, and avoided costs are tracked and that this information is accessible through a platform such as Open NY.
- **Cooperative structures:** The PSC and NYSERDA should evaluate the role of municipal/cooperative structures in Disadvantaged Communities in providing benefits to these host communities, examine laws regarding cooperatively owned enterprises, and establish consumer protections in this new market.
- **Host benefits:** NYSERDA should make host community benefits more robust and targeted (such as NYSERDA's Host Community Billing Program).

- **Local government:** NYSERDA, DEC, and DOS should empower local governments to take a leadership role in educating the community in clean energy.
- **Streamline incentives:** Based on available funding, NYSERDA should expand and streamline incentives for energy efficiency, including funding for customers based on utility payment history instead of credit scores. This should include enhanced coordination on the various State or federal bill payment assistance and energy efficiency programs.
- **Weatherization:** Based on available funding and consistent with recommendations in *Chapter 12. Buildings*, NYSERDA should invest in weatherization assistance and energy efficiency programs, and leverage funding from existing federal programs.
- **Broadband:** The State should enable host towns to speed up rural broadband expansion and leverage utility and clean energy investments to support broadband rollout.
- **Climate Resilience Hubs:** The State should consider support for incentivize local “climate resilience hubs,” a central location that has solar and storage and becomes a location the community can gather during power outages.
- **DCAS:** The State should work with the New York City Department of Citywide Administrative Services to assist with building more renewable energy projects and in the implementation of other strategies including energy efficiency and building decarbonization.
- **Loan Loss program:** The State should leverage loan loss reserve programs as a tool to reduce the risk of lending to low-income households and to residents in Disadvantaged Communities, such as NYSERDA’s Loan Loss Reserve Program.²³⁷
- **Subscriber benefits:** The PSC and NYSERDA should support benefits programs for LMI community subscribers, including the recent targets established in the NY-Sun initiative for 1,600 MW of the incremental 4,000 MW target to benefit Disadvantaged Communities and LMI subscribers, with an estimated \$600 million in investments serving these communities.²³⁸

Commercial Rooftop & Parking Lot Solar

- **Rooftop / Parking lot solar:** The State should conduct further analysis to identify and implement effective ways to build economic or incentive structures to increase the development of

²³⁷ NYSERDA. 2022. “Loan Loss Reserve Program.” Albany. Accessed at <https://www.nysesda.ny.gov/All-Programs/Loan-Loss-Reserve-Program#:~:text=The%20Loan%20Loss%20Reserve%20fund,the%20event%20of%20a%20default>.

²³⁸ New York State Department of Public Service. “Case 15-02703, In the Matter of the Value of Distributed Energy Resources, Order Expanding NY-Sun Program.” Issued April 14, 2022.

commercial rooftop and parking lot solar installations paired with storage to take advantage of the available space, especially in urban areas.

E5. Promote Community Choice Aggregation

Community choice aggregation (CCA) programs allow local governments to make bulk power purchases on behalf of participating homes and businesses in their jurisdiction, making it easier for residents and employers to benefit from local clean energy projects, while also improving project economics and advancing the Climate Act requirements. Connecting homes, businesses, and community institutions with clean energy products and services through CCA programs, zero-emission microgrids, district systems, and community-scale campaigns encourages adoption of new, innovative technologies to generate value and savings for consumers in an equitable manner.

Most communities in New York that have implemented a CCA program procure 100% renewable energy as their default supply. When CCAs integrate opt-out community solar, participating homes and small businesses are enrolled in one or more community solar projects from which they receive credits on their electric bill. These credits directly reduce the charges on the bill. Customers who are enrolled in community solar typically receive guaranteed savings of 5% to 10%. Opt-out community solar allows CCAs to enroll hundreds, or even thousands, of people at once. This significantly reduces soft costs associated with solar and makes the economics of solar all the more attractive. This arrangement has potential to continue the downward trend in solar prices and incentives, while the total amount of solar dramatically increases. Many CCA programs are working to capture the economic benefits of clean energy more broadly. For example, some CCAs have developed opportunities around opt-out community solar, energy efficiency, heat pumps, electric vehicles (EVs), demand response, and energy storage.

The CJWG is generally supportive of encouraging local climate action, and more specifically sees CCAs as tools for transformative change in the way consumers connect to and purchase their energy. This strategy includes the CJWG recommendations to remove of barriers to entry, particularly for lower income households, and include safeguards for energy burdened households that may have been the target of previous predatory practices related to their energy bills and services.

Components of the Strategy

- **Support CCA and community distributed initiatives:** NYSERDA should continue to encourage development of CCA programs where communities choose 100% renewable energy as

the default supply and where participants are automatically enrolled in Community Solar. Prioritization of these efforts should be focused on Disadvantaged Communities.

- **Expand CCA eligibility:** The PSC should enable county governments to authorize and form CCA programs with local opt-out in addition to the cities, towns, and villages that are currently eligible to participate.
- **Enable zero-emission microgrids and district systems:** Over the next 10 years, NYSERDA should work with utilities and campuses to enable the development of zero-emission microgrids (municipal, schools, and private) and district clean energy systems. Microgrids can serve as a community asset by enhancing resiliency and local system reliability, reducing grid congestion, and increasing electric system efficiency.
- **Ensure strong consumer protections:** PSC should continue refining its CCA policies to ensure proper safeguards are in place to protect consumers and should consider the most efficient way to deliver maximum benefits from renewable energy, particularly to LMI households.

Enhance the Grid

While transformation of the power sector is critical to achieving the State’s goals and requirements, it also presents the opportunity to make enhancements to the electric grid. Enhancements can improve the efficiency, delivery, and reliability of electricity, facilitate the integration of renewable energy, and prioritize clean resources consistent with the Climate Act.

E6. Deploy Existing Storage Technologies

A portfolio of energy storage technologies will be needed as intermittent renewable energy generation penetration increases. Existing and newer, long-duration storage will be needed to maintain reliability as the State approaches 2040; however, these technologies will need to be deployed well before 2040 to reach the State’s goals and requirements.²³⁹

In 2018, the PSC issued a landmark energy storage order based on the Energy Storage Roadmap. The order established a 3,000 MW energy storage goal by 2030 and included deployment mechanisms to achieve the target. However, the goal was established based on a 50% renewable target for 2030. The new Climate Act targets will require significantly higher levels of energy storage as exemplified in the recent

²³⁹ NYSERDA. 2020. “Pathways to Deep Decarbonization in New York State.”

Power Grid Study,²⁴⁰ which identified a need for more than 15 gigawatts (GW) of energy storage. The order also included \$350 million in bridge incentives to accelerate the energy storage market, including solar-plus-storage projects with NY-Sun and another \$53 million in RGGI funds. As of December 2022, these funds have been almost fully allocated. Though the order was a significant step forward for the energy storage market in New York, deployment needs are most certainly greater than initially envisioned and these existing programs will be insufficient to meet the expanding need. NYSERDA and DPS are currently in the process of updating the State’s Energy Storage Roadmap to update and revise the storage deployment goal to achieve 6,000 MW of energy storage by 2030 in recognition of the substantially higher requirements identified in the Power Grid Study.

The CJWG was generally supportive of this strategy and suggested prioritization of energy storage to protect Disadvantaged Communities where the resilience need is greatest including at both the local distribution and transmission levels, which is contained in the components below.

Components of the Strategy

- **Provide increased funding for energy storage deployment:** The PSC should consider methods to create a market for retail and wholesale storage, such as establishing Clean Dispatch Credits or expanding the CES to better integrate storage or to initiate a new docket that sets new binding targets and creates a dedicated funding mechanism that is similar to the CES for storage as soon as practicable and no later than the end of 2023. Funding should be prioritized to projects that benefit frontline communities where the resilience needs are often the greatest.
- **Incorporate energy storage into energy delivery and transmission planning:** Further refined modeling of the future electrical grid is needed to evaluate the potential system reliability needs that are anticipated for that future grid. The modeling should identify the need for storage resources with longer durations that may develop with technology innovation to show the true breakdown of potential storage versus fully dispatchable generation needs and that includes modeling for better demand-side management of electricity such as thermal energy storage, electric vehicle-to-grid technology, etc.

²⁴⁰ New York State Department of Public Service and NYSERDA. 2021. “New York Power Grid Study.” Albany. Accessed at <https://www.nyserdan.ny.gov/About/Publications/New-York-Power-Grid-Study>.

- **Work with the NYISO:** The State should continue to work with NYISO on market enhancements that facilitate the resource transition, support investment, minimize costs to consumers, and meet reliability.

E7. Invest in Transmission and Distribution Infrastructure Upgrades

As New York State moves forward in meeting the Climate Act requirements, there will be a need for significant investments in New York’s electricity transmission and distribution system to allow for the utilization of new renewable and energy storage resources and to meet growing electric load due to electrification. The scope and nature of these investments are expected to vary depending upon the location and type of energy storage and zero-emission generation resources that are added to the system. The REDCs should participate in utility and NYISO planning processes to identify sites in Disadvantaged Communities and legacy/rust belt cities that present economic development opportunities for consideration in these infrastructure investments, with particular emphasis on fulfilling supply chain needs to meet the Climate Act emissions reductions requirements. The PSC should continue to evaluate through its utility planning processes any changes to utility rates, tariff structures, or other rules to achieve the objectives of the Climate Act, including in support of economic development. The high-voltage transmission system, or bulk electric system, is operated by the NYISO, whereas the lower voltage, local transmission and distribution systems are owned by electric utilities.

The most potent of the GHGs identified in the Climate Act is sulfur hexafluoride (SF₆), which is 17,500 times more potent than CO₂ based on a 20-year global warming potential (GWP), and persists in the atmosphere for thousands of years. SF₆ is most commonly used as an insulator in electricity transmission and distribution equipment and its use continues to grow. New York utilities were historically one of the largest emitters of SF₆ but are now among the leaders nationwide in reducing leakage rates through voluntary reduction programs. These significant future investments in new transmission infrastructure should include a plan for fully phasing-out reliance on SF₆, including measures for existing equipment, to minimize leaks as the State transitions to environmentally friendly and cost-effective alternatives.

The Public Policy Transmission Planning Process is the primary mechanism that ensures the bulk transmission grid can enable New York State’s climate policies, which includes transmission upgrades that connect and transport renewable generation and energy storage resources to load centers. The PSC has issued multiple orders to initiate a statewide transmission planning process, which the utilities now refer to as the Coordinated Grid Planning Process, and is a requirement of the Accelerated Renewable Energy Growth and Community Benefit Act. The Coordinated Grid Planning Process will identify Phase

One transmission upgrades, which are local transmission projects that would address existing reliability needs but also have Climate Act benefits such as increased hosting capacity for renewable generation. Phase Two projects include local transmission upgrades that are needed to address Climate Act goals and requirements and would not otherwise be identified in the routine capital planning process of the utility. Finally, the utilities will need to coordinate with the NYISO to identify the most efficient mix of local and bulk transmission upgrades needed to meet the long-term Climate Act goals and requirements. In addition, the State approved contracts in April 2022 under a competitive procurement through Tier 4 of the CES to deliver renewable energy into New York City, which is particularly dependent on polluting fossil fuel-fired generation.

The CJWG is supportive of this strategy, seeing it as key to building out renewable energy resources. It suggests the inclusion of additional actions, including proactively identifying key transmission and distribution upgrades, improvements, and new line construction needed to deliver renewable energy across the State and maximize the retirement of fossil fuel-fired resources. As recommended by the CJWG, this Scoping Plan recommends that state agencies and utilities approach interconnection through a justice-oriented lens where community-led and community-supported clean energy projects are facilitated and recognize that high interconnection costs for projects in Disadvantaged Communities are a barrier that needs to be addressed.

Components of Strategy

- **Transmission and distribution expansion:** The State should expand electricity transmission and distribution systems to support energy delivery and, building on the Power Grid Study, continue research, development, and demonstration (RD&D) and rapid deployment of advanced grid technology to:
 - Alleviate transmission system bottlenecks to allow for better deliverability of renewable energy throughout the State
 - Unbottle constrained resources to allow more hydro and/or wind imports and the ability to reduce system congestion
 - Optimize the utilization of existing transmission capacity and right of ways
 - Increase circuit load factor through dynamic ratings
 - Encourage utilities to accelerate cost-effective investments in their local systems that will facilitate renewable energy development and support electrification of other sectors, such as buildings and transportation, but also increase safety and resiliency

- Evaluate opportunities for energy storage to function and be compensated as a transmission and distribution system asset
 - Encourage agencies with roles in the Article VII siting process to prioritize transmission projects that are identified in the Coordinated Grid Planning Process or that provide Climate Act benefits
- **Strategic investment:** NYPA, LIPA, and utility companies should continue with strategic long-term transmission and distribution investments for expedited projects needed in the short-term (within approximately five years). Utilities should continue investments for local transmission and distribution investments within a utility’s footprint, and public policy needs should be declared in the current NYISO Public Policy Transmission Planning Process through Federal Energy Regulatory Commission (FERC) Order 1000.
 - **SF₆ emissions:** DEC should adopt regulations to reduce SF₆ emissions and establish a timeline for phasing out new SF₆ equipment. New York should also collaborate with other U.S. Climate Alliance states to align policies across the country to drive a market shift toward SF₆ alternative technologies nationwide. This will help New York’s power grid remain one of the cleanest, lowest emission grids in the country.
 - **Hosting capacity:** The State should focus on increasing hosting capacity with a holistic/top-down approach in order to accelerate adoption, while also being mindful of the tradeoffs between siting resources in high-cost areas and investments in transmission and distribution infrastructure to reach the most equitable cost option, support the integration of large-scale renewables and DERs, meet forecasted electricity demand growth with widespread electrification, and support economic development efforts.
 - **Renewable Energy Zones:** The State should create a database to identify Renewable Energy Zones and track renewable energy development and availability capacity in these zones. The database should inform recommendations for a process to establish Renewable Energy Zones where construction and interconnection of large-scale renewable generation is cost-effective, determine quantity of renewable energy targeted within each zone, and develop a plan for each Renewable Energy Zone to build sufficient transmission to ensure energy delivery within and out of the zone.
 - **Upgrades for offshore wind:** The State should conduct further planning and pursue system upgrades on Long Island and in New York City to facilitate 9,000 MW of offshore wind.
 - **Multi-port infrastructure:** The State should promote multi-port infrastructure investment to support and facilitate the growth of the offshore wind industry in New York. Future offshore

wind solicitations should continue to include a multi-port strategy and a requirement for offshore wind generators to partner with any of the prequalified New York ports to stage, construct, manufacture key components, or coordinate operations and maintenance activities.

- **Education:** The State should continue engagement, outreach, education, and support for local municipalities, communities, and residents to improve acceptance of energy delivery projects.

E8. Improve Reliability Planning and Markets

Generation resources combined with the transmission and distribution systems, control centers, and wholesale markets provide a continuously operating, reliable system to service New York's electric needs. All of these elements will need to make the transition and come together effectively to provide continuity of a reliable power system, while implementing the goals and requirements of the Climate Act. A flexible grid also necessitates an interconnected digital system passing data back and forth, which increases cybersecurity vulnerabilities and risks. These vulnerabilities and risks must be identified and mitigated.

During the grid transition, several reliability challenges must be successfully managed; these challenges include the variety of resource and resource attributes and the anticipation of changing load needs and patterns. Continual study of needs through the NYISO's Comprehensive System Planning Process and expansion of the transmission system to relieve constrained generation pockets will be needed to help increase electric grid reliability during the transition.

With a supply mix increasingly composed of intermittent generation resources, the grid will face unprecedented challenges to remain resilient to weather events regardless of the location of supply resources. The current system is heavily dependent on existing fossil fueled resources to maintain reliability. To ensure reliability and that generation is available when needed, fossil fuel plants have dual fuel capability utilizing oil as a backup fuel during periods of high gas and electric demand. To replace these units, dispatchable and zero-emission resources will be needed to balance the system and must be significant in capacity, be able to come online quickly, and be flexible enough to meet rapid, steep ramping needs.

The importance of developing large amounts of dispatchable generation is echoed in the Power Grid Study, Pathways Study, and NYISO Grid in Transition and Climate Change Study. Energy storage is one such resource that can provide benefits on the supply side at the generation level by providing dispatchable, flexible capacity, which results in lower generation costs and increased system reliability.

Energy storage can also provide benefits on the demand side at the customer level by providing flexibility and resiliency benefits for consumers through demand response and backup power supply. In addition, markets that incentivize resources with the desired attributes, provide optimal reliable grid management, and are sufficiently flexible to allow for technology innovation will help achieve the Climate Act requirements, while ensuring benefits for, and reduced impacts on, Disadvantaged Communities. This requires several forward-looking market designs that send the correct price signal at the appropriate time. Effective markets can help to actively facilitate the clean energy transition while supporting reliability and removing barriers to clean energy deployment.

The CJWG generally supports the call for continued efforts to ensure reliability and improve resiliency to extreme weather events and climate change but suggests that the NYISO and its processes should be more transparent and information better disseminated with local energy advocates. It also suggests that there is a need to address extreme heat vulnerabilities beyond overcapacity to the grid, such as water demand for cooling of power plant systems, the declining efficiency and reduced output from combustion turbines and combined-cycle plants during high temperatures, and the expansion of metal in power lines as a result of extreme heat that results in sagging power lines and an increased risk of tree strike-related fires. Furthermore, the CJWG posits that investments in storm hardening infrastructure must be first implemented in historically overburdened Black and brown communities, since these communities have less access to cooling for summer storms, heating for winter storms, transportation, or savings.

Components of the Strategy

Planning and Analysis of Needs

- **Continual evaluation:** The State should conduct established biennial evaluations to assess the state of bulk power system reliability in consultation with the federally designated electric bulk system operator (NYISO) and the New York State Reliability Council. These evaluations should ascertain if any program adjustments are needed to ensure continued safe and adequate electric service. They should be informed by the review of the State's power system performance in conformance with established operations requirements and by relevant studies including the NYISO's Reliability Needs Assessment and the NYISO 2021-2040 System & Resource Outlook.
- **Assessing climate change impacts:** Power system studies and planning should consider analyses to integrate climate change impacts as needed for reliability and resiliency. Studies should reflect that risks and reliability challenges will change over time due to the impacts of climate change and the changes to the power system.

Resiliency

- **Infrastructure investment:** The State should continue efforts to ensure reliability and resiliency of the electric grid to be able to withstand the effects of extreme weather events, which will be exacerbated by climate change. This work should include continued infrastructure investment such as storm hardening, elevating equipment and substations, and moving lines underground. In addition, design criteria must change over time and must reflect the impacts of climate change as needed. Given the impacts of storms on communities, investment in community outreach to provide effective communication, and support from the time of storm preparation through restoration must be made.

Improving Grid Reliability through Markets

- **Market flexibility:** The State should work with the NYISO to update the market products, requirements, and technology standards needed to maintain reliability over time so that all resources can participate in the market, based on their attributes, to provide the products and services needed for reliability. Undue costs, including creating barriers to renewables, should not be imposed that would impair meeting the Climate Act requirements. Reliability needs and risks will change over time, and the markets should reflect these changes as well.
- **Market participation:** The State should work with the NYISO to expand wholesale market eligibility participation rules for new policy resources. The NYISO implemented the Co-Located Storage Resource Market Design, the first phase of a Hybrid Storage Model, where hybrid resources are allowed to participate as two separate resources located at the same site in December 2021. The NYISO is in the process of developing the next phase of the Hybrid Storage Model, which would allow for a more versatile “Aggregated” market design in to be completed in 2022. The NYISO should also make changes consistent with FERC Order 2222 requirements.
- **Wholesale market improvements:** The State should work with the NYISO to continue assessing opportunities to improve accuracy and granularity of wholesale market energy price signals, including shortage pricing, congestion relief, and peak/off-peak pricing. This should include the evaluation of the inclusion and valuation of ancillary market services in the context of integrating increasing quantities of renewable resources and other products.
- **Support flexible resources:** The State should work with the NYISO to adapt current ancillary service market designs and look to add products that are needed to incent flexibility as needed to efficiently integrate renewables. The NYISO supports markets for energy, ancillary services, and capacity. The fundamental relationship among these markets will likely need to evolve. For

example, more revenue will likely shift to ancillary service markets over time as system needs are reevaluated in the context of integrating increasing quantities of renewable resources. This should include proactive development of new products needed; however, these new products should be structured properly to reflect only current system needs so as to not cause unnecessary costs. A balancing act is needed between developing the products and services of the future while not implementing changes before they are needed.

- **Resource adequacy:** The State and the NYISO should examine all resource adequacy options and continue to improve resource adequacy contribution compensation, including the consideration of alternative market structures of procuring resource adequacy. In May 2022, the State and the NYISO were successful in advocating to FERC to ensure that buyer-side mitigation will not be applied to Climate Act resources and for alternatives that maximize access to the capacity market for public policy resources.²⁴¹ The State and the NYISO should investigate how best to include all resources in the capacity markets, with the goal of reflecting dynamic smart loads in resource adequacy. The State and the NYISO should continue to evaluate the capacity market value of all resource types so that resources are paid for capacity consistent with the value they provide to the grid as well as allow fair access to the capacity market for energy limited resources and accurately reflect the value of such resources especially as the need for grid flexibility grows over time.
- **Value environmental attributes:** The State should determine the most effective approach to incorporate environmental values in market pricing and/or in policy and investment benefit-cost analysis. There should also be consideration of improvements to current State programs to incentivize Climate Act resources through mechanisms such as Renewable Energy Certificates, Offshore Wind Renewable Energy Certificates, and storage solicitations. The State should consider changes and/or augmentation to the RGGI program to more fully reflect the cost and impact of emissions as represented in New York policy and consider if other changes are necessary in pricing in the wholesale markets to help achieve the Climate Act mandates, including a more rapid increase in renewable and storage build out and a transition of the fossil fleet. This assessment should consider the need for, and impact of such changes given the potential economywide program, as discussed in *Chapter 17. Economywide Strategies*. Finally,

²⁴¹ Buyer-side mitigation is a mechanism used in the capacity market that is intended to prevent bidders from artificially suppressing capacity prices. However, in practice, this can unintentionally favor fossil generators over clean resources. FERC Order is available here: https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20220510-3099.

the State should consider a Clean Dispatch Credit for zero-emission, fully dispatchable assets that dispatch during peak load times.

- **Earnings adjustment mechanisms:** The PSC should initiate a generic proceeding for earnings adjustment mechanisms to review and evaluate how the existing mechanisms are working, lay the groundwork and create consistency across the utilities where it makes sense to do so, and consider additional earnings adjustment mechanisms related to the decarbonization and social equity goals of the Climate Act. This review should be done on a periodic basis, and earnings adjustment mechanisms should be adjusted as necessary to encourage the needed outcomes.

Support of Distributed Energy Resources and Demand-Side Opportunities

- **Demand-side opportunities:** The State should expand demand-side opportunities and opportunities for flexible resources. It is anticipated that demand response resources will play a more critical reliability role in the future as the grid becomes more electrified and the load shape shifts. Demand response can also supply some amount of needed system flexibility without emitting carbon which is consistent with the 100x40 Climate Act requirement. There should be a holistic evaluation of both wholesale and retail demand response programs to identify gaps and opportunities for new programs or program changes to meet the needs of a changing grid. As the grid evolves with State policy, it will become more important that incentives are adequate for the participation of flexible resources in the real-time energy market. An efficient real-time market can create opportunities for resources to compete and meet rapidly changing system needs. The NYISO is evaluating prospective changes to the energy market in the context of its Grid in Transition efforts.
- **Market access for Distributed Energy Resources:** The State should improve access for DERs and continue improvements to cost causation retail rate price signals through:
 - Continued promotion and improvement of the Value Stack compensation mechanism in the Value of Distributed Energy Resources proceeding
 - Continued innovation in demand-side management and DER programs, with a focus on expanding utility customer enrollment and performance
 - Continued promotion and improvement of Standby and Buy-back service rates
 - Increased deployment and efficient use of DER
 - Continued design and implementation of Distributed System Platforms and markets for DER products and services

- **Availability of information:** The State should enhance and augment the availability of public information to assist developers in making informed project development decisions.
- **Proactive advocacy:** Based on available resources, the State should fund expansion of the existing office and team within DPS that systematically focuses on proactive advocacy at NYISO and FERC to provide DPS with the necessary resources to ensure that wholesale markets and planning processes align with Climate Act requirements and support environmental justice concerns while also maintaining reliability. The expanded DPS office should focus on improved coordination with other essential State agencies including NYSERDA and DEC. The DPS office should also monitor the developments of FERC’s recently created Office of Public Participation and work with both that office and its Environmental Justice senior advisor to assist and support increased participation by low-income New Yorkers at FERC.

E9. Advance Demand Side Solutions

Responsive demand presents an opportunity to optimize for the lowest system cost and most expeditious deployment of both clean supply and demand solutions by reducing the need for electricity, especially during peak hours. Peak demand hours occur when electrical power is provided for a sustained period at a rate significantly higher than the average supply level. Evaluating energy consumption on building load duration curves is a way to evaluate how consistently a building is using the energy it consumes and to provide a method to determine if there is an opportunity to implement peak demand saving strategies and reduce inefficient energy usage. As such, responsive demand should be analyzed and appropriately modeled as part of future generation and energy supply to allow for consideration of those modeled impacts on costs and timelines of power generation by decade and incorporation into system planning.

Reducing demand and creating demand flexibility can significantly reduce scope and costs of infrastructure buildout and will yield GHG reductions, criteria pollutant reductions, and health benefits in the near term by reducing reliance on high-polluting peaker facilities. Continuing to focus efforts on reducing the peak demand now will ensure that as we build out a clean electric grid, we do not build extra capacity of renewable generation assets to meet a higher peak demand and run the risk of those assets being underutilized. Energy efficiency improvements and load management can also help businesses reduce costs to all electric customers and help avoid dual-fueled peaking units from switching to oil during gas demand peaks.

Components of the Strategy

Planning and Analysis

- **Cost study:** DPS and NYSERDA, in consultation with utilities, should complete a study on avoiding or reducing grid upgrade costs through the use of demand response and geothermal, including district thermal systems, with a focus on LMI individuals and Disadvantaged Communities.
- **Data availability:** DPS, NYSERDA, and the NYISO should identify and make available key pieces of data needed for markets to facilitate the clean energy transition in real-time marginal, average emissions and/or zonal resource/fuel mix data, as needed from the NYISO and as defined by New York City and pertinent State agencies to facilitate cost-effective implementation of the Climate Act, Local Law 97, and to improve value of DER and demand response programs.²⁴²

Development of Standards and Tests

- **Appliance standards:** New York’s Advanced Building Codes, Appliance and Equipment Efficiency Standards Act of 2022 enables NYSERDA, with DOS, to establish and enforce efficiency standards for appliances and equipment that are sold, leased, or installed in New York in order to promote energy reduction, water conservation, GHG reduction, and/or increased demand flexibility. NYSERDA should prioritize State and federal appliance standards and adopt State equipment standards (or advocate for the federal government to adopt standards) that require a universal, standardized communication protocol in electric and heat pump water heaters, space heating heat pumps, EVs, and in-home batteries.
- **Program participation:** The PSC and DPS should develop standards to enable “opt-out” programs rather than “opt-in.” Demand flexibility programs that are designed as opt-out instead of opt-in should include standards to ensure customers will see savings on their bills.
- **Benefit-cost analyses:** The PSC should reopen the generic benefit-cost analysis proceeding to update costs and benefits, including Climate Act compliance costs (carbon and other environmental impacts), important non-energy benefits (such as localized health impacts and equity), and inclusion (or lack thereof) of customer cost contributions in order to accurately assess the true value of energy efficiency and demand response while complying with the Climate Act. This analysis should also consider the scenarios modeled in the integration analysis and

²⁴² A number of assumptions including for imports and exports from other regional transmission organizations and independent system operators must be determined.

discussed in *Chapter 12. Buildings* that describe the building improvements needed for widespread building efficiency and electrification and areas where backup sources of heat may be needed.

- **Equity of rules:** The PSC and DPS should ensure that energy storage does not face double rules and unfair charges. The State should consolidate its permitting rules for energy storage so they can be evaluated in one process. Utility commissions should reexamine their tariffs on energy storage resources and ensure they are applied fairly. In March 2022, the PSC issued an order adopting new Standby Service and Buyback Service rates that included the adoption of a limited exemption from Buyback rates for standalone energy storage systems. This order will help to further develop and grow the energy storage market in New York that will be necessary to enable the State’s clean energy goals.²⁴³ The PSC also issued an order directing the utilities to file revised Buyback and Standby Service Tariffs,²⁴⁴ and those tariffs have been filed by the utilities.

Prioritize Under-Resourced Communities

- **Engagement:** Utilities should engage the community and partner with community-based organizations to learn about communities and identify needs and shared objectives.
- **Funding:** New funding should be directed toward low-income and Disadvantaged Communities and existing funds should be made more accessible.
- **Metrics:** In planning for a sustainable future, New York should work with communities to ensure appropriate metrics to track program success and partner with local governments to establish appropriate consumer protections.

Invest in New Technology

To achieve the 70x30 requirement, the focus should be on energy delivery, energy efficiency, and aggressive deployment of existing renewable energy and energy storage technologies. However, the 100x40 requirement presents significant challenges that cannot currently be met by the deployment of these existing technologies. Current studies identify that, even after full deployment of available clean energy technologies, there is a remaining need for 15 GW to 45 GW of zero-emission, dispatchable electricity generation capacity in 2040 to meet demand and maintain reliability, although that gap may

²⁴³ Case 15-E-0751, *Order Establishing an Allocated Cost of Service Methodology for Standby and Buyback Service Rates and Energy Storage Contract Demand Charge Exemptions* (March 16, 2022).

²⁴⁴ Case 15-E-0751, *Order Directing Standby and Buyback Service Tariff Filings* (March 16, 2022).

change over time depending on forecasted demand.^{245,246} This calls for a focus on identifying and developing solutions for dispatchable technologies that can be called on as needed to balance supply and demand. In addition, these studies show a forecasted need of 111 GW to 124 GW in total generation capacity in 2040 as compared with the current electric system capacity of 37 GW in 2022. This equates to a three-fold increase in generating capacity between now and 2040.

E10. Explore Technology Solutions

Whether the answer is new long-duration storage technology or other new zero-emission, dispatchable technologies that may emerge due to RD&D efforts over the next two decades, the costs are likely to be high and aggressive action and smart planning will be necessary to make these fundamental shifts in our energy systems in the next two decades. While these actions will be costly, the health, societal, and economic benefits of the transition to clean zero-emitting technologies will be significant and the cost of inaction or insufficient action will far outweigh the costs of action. The utilization of technology solutions must be consistent with the requirements of Section 7(2) and 7(3) of the Climate Act in agency decision-making.

Moving forward, one technology focus is long duration energy storage. Achieving the Climate Act’s high renewable energy, zero-emission electricity system will require substantial amounts of energy storage operating over various time scales – spanning from minutes to hours, days, weeks, and even longer – to maintain grid flexibility, reliability, and resiliency. When it comes to alternative fuels, while some have potential to serve as flexible and dispatchable resources, many are unproven at commercial scale. Of particular interest is to ensure historically overburdened communities do not see an increase in co-pollutants or reduction in air quality as a result of these alternative fuels. Therefore, further analysis, technical development, and research is needed in order to determine the feasibility and climate and health impacts of alternative fuels to ensure they provide net benefits.

Nuclear power generation is a complex technology with potential impacts on host communities as well as questions relating to the impacts of nuclear waste on health and the environment. Yet at the same time, nuclear generation provides a significant amount of baseload resources and is zero-emission, providing a

²⁴⁵ NYSERDA. 2021. “New York Power Grid Study.” Albany. Accessed at <https://www.nyserda.ny.gov/About/Publications/New-York-Power-Grid-Study>.

²⁴⁶ New York Independent System Operator. 2022. “2021-2040 System & Resource Outlook (The Outlook).” Albany. Accessed at https://www.nyiso.com/documents/20142/32663964/2021-2040_System_Resource_Outlook_Report_DRAFT_v15_ESPWG_Clean.pdf/99fb4cbf-ed93-f32e-9acf-ecb6a0cf4841.

complement to the increasing amount of variable generation renewables being added to the grid. Analysis should occur prior to the end of the Zero Emissions Credit program in 2029 to determine whether subsidizing any of the State's remaining nuclear reactors will be necessary for meeting the 100x40 requirement and/or whether more cost-effective and environmentally friendly alternatives are available. The analysis should consider the ability of nuclear to contribute to baseload and to meet reliability requirements, as well as cost, health, safety, community impact, and environmental concerns of nuclear power generation.

The CJWG supports the near-term focus on achievement of 70x30 via deployment of currently available solutions. However, it expresses strong concern about the promotion of some emerging technologies, including green hydrogen, RNG, biofuels, biomass, and waste-to-energy, which it contends can add more GHGs to the environment rather than less and can also lead to more localized pollution concentrated in environmental justice communities. The CJWG highlights the need for further research and consideration of life cycle GHG accounting and potential air quality and health impacts of these technologies prior to supporting demonstration projects. The CJWG also recommends a life cycle analysis of the environmental, health, safety, emissions, and environmental justice impacts of nuclear fuel be conducted and the State proactively plan for the scheduled shutdown of the four reactors upstate.

Components of the Strategy

Solutions for Dispatchable Technologies

- **Determine technologies and define zero-emission:** The PSC, in coordination with NYSERDA, DEC, and other agencies should identify, explore, evaluate, and support the development of dispatchable technologies and solutions as they emerge in support of the Climate Act's requirements for a zero-emission electricity system by 2040 and for consistency with Section 7(2) and 7(3) of the Climate Act. This should include a comprehensive analysis of the life cycle of GHG emissions, benefits (health, environmental, and economic), safety considerations, and costs of these technologies.
- **Modeling:** NYSERDA should conduct detailed, holistic, modeling within a zero-emission world. Modeling should include holistic integration of load, generation, and energy delivery and be flexible in the solutions chosen. While modeling is being completed, the State should move forward with known needs.
- **Support innovation and demonstration projects:** NYSERDA should act as a hub for technological innovation and convene stakeholders and conduct strategic research on new

renewable and storage project technologies. NYSERDA should work with a consortium including but not limited to the NYISO, utilities, developers, and solution providers to bring technologies to large-scale deployment faster and more cost-effectively. This includes support for utility-scale demonstration projects for new technologies, including storage and transmission and distribution.

- **Federal resources:** The State should advocate for and leverage federal and National Laboratory resources focused on identifying and commercializing advancements in transmission and zero-emission dispatchable long-duration storage solutions.
- **Market enhancements:** The State should continue market enhancements, such as adjusting capacity market valuation, market rules, and market incentives that better align the markets with the Climate Act to encourage the innovation that will support achievement of the 100x40 requirement. Market solutions for these dispatchable technologies, such as long-duration storage, are important to support investment, minimize the cost to consumers, and support reliability.
- **Long-duration energy storage:** NYSERDA should focus programs and funding on research and demonstration projects for the development of large-scale and longer-duration storage. The State should develop and expand a Storage Center of Excellence so that new technologies can be matured and deployed on the grid for large-scale testing as well as attract and engage relevant parties in collaborative efforts to address the challenges unique to long-duration storage.

Alternative Fuels

- **Prioritization:** During planning, the State should prioritize zero-emission resources (such as storage, energy efficiency, and renewable energy) where feasible when considering the need to meet demand for end uses, technology limitations, GHG emission impacts, and costs. Green hydrogen and RNG should be targeted to strategic uses or when needed for safety, reliability, resilience or affordability and should demonstrate air quality, health and life cycle GHG benefits including avoiding localized pollution in Disadvantaged Communities before implementation.
- **Analysis of impact:** Further analysis, technical development, and research is needed in order to determine the feasibility, climate impact, and health impacts of alternative fuels prior to infrastructure investment. Technological innovation, development, and scaled deployment is needed in order to prove the effectiveness and economics of the technologies. Specifically, RD&D strategies should include:
 - Rigorous energy, GHG, and environmental sustainability guidelines and metrics for RNG and green hydrogen. Priority utilization should be provided for feedstocks with the lowest GHG emissions, with strong preference given to zero- or negative-emission sources

- Analysis of the potential air quality and health impacts of producing and using these fuels and best practices or end uses to minimize these impacts, including research into mitigating localized impacts in Disadvantaged Communities
- Evaluation of the safety of green hydrogen storage and pipeline operation
- Research on emissions controls that reduce/eliminate emissions (e.g., NO_x from hydrogen combustion) and research on emissions (leaks) of hydrogen and associated climate impacts
- The potential for negative or positive impacts on other economic sectors, such as waste management or agriculture

Nuclear Generation

- **Evaluate the future role of nuclear generation:** The State should evaluate the role of existing nuclear reactors within the 100x40 requirements as part of policy actions needed prior to the cessation of the State’s Zero Emissions Credit program in 2029, and also include the time needed for potential federal and State relicensing of these facilities and the time to determine refueling options for the different reactors.²⁴⁷ In addition, the State should consider the potential contribution of advanced nuclear technologies in achieving 100% zero-emission electricity by 2040. Advanced nuclear reactors may provide a way to develop and deploy new nuclear resources faster, at lower cost, with improved safety mechanisms and with lower residual nuclear waste,²⁴⁸ but this potential has not been demonstrated and must be carefully and rigorously evaluated. Within this evaluation, the State should analyze the expense, health, safety, security, opportunity costs, community impact and environmental impacts of nuclear power generation, including but not limited to, fuel mining and production, nuclear waste disposal and site remediation.
- **Public input:** If public policy mechanisms are proposed for the continuation of nuclear power generation, effective mechanisms for input and comments by stakeholders and the public should be implemented to include but not be limited to representation from customers, environmental interests, environmental justice communities, labor, local communities, and indigenous communities.

²⁴⁷ U.S. Nuclear Regulatory Commission. 2022. “Reactor License Renewal Process.” Accessed at <https://www.nrc.gov/reactors/operating/licensing/renewal/process.html>.

²⁴⁸ 42 U.S. Code § 16271

Chapter 14. Industry

14.1 State of the Sector

Overview

This chapter contains incentive-based strategies for mitigating the direct greenhouse gas (GHG) emissions attributable to certain industrial activities within the State. In general, the sector strategies in this chapter target the direct, on-site emissions that originate from stationary sources in sectors including manufacturing, mining, and quarrying,²⁴⁹ where such emissions are not already addressed separately in this Scoping Plan.²⁵⁰ Strategies for addressing emissions from the oil and gas sector are discussed in *Chapter 18. Gas System Transition*. Each sector is described in additional detail below.

Emissions Overview

Industrial emissions made up 9% of statewide emissions in 2019, including emissions from methane leaks and combustion from the oil and gas system in New York (45%), the direct combustion of on-site fuel (27%), emissions from imported fuels (20%), and non-combustion industrial processes (6%).

Manufacturing

Manufacturing-based GHG emissions addressed by the strategies in this chapter are those associated with the combustion of fossil fuels and non-combustion industrial processes in the production of goods. The largest share of GHG emissions is created by the production of food, paper, bulk chemicals, glass, cement, metals, semiconductors, wood products, and plastics.

As described in *Chapter 4. Current Emissions*, most emissions in the manufacturing sector come from a small subset of energy- or emission-intensive and trade-exposed industries,²⁵¹ causing emission mitigation strategies in this chapter to emphasize approaches that are less likely to result in emissions and economic

²⁴⁹ Manufacturing, mining, and quarrying are identified as Industrial Sectors by the North American Industry Classification System (NAICS) utilized by the U.S. Census Bureau. More specific production activities, including food, paper, and chemical manufacturing, are considered subsectors within manufacturing.

²⁵⁰ As an example, the sectoral strategies in the Industry chapter do not address the indirect emissions associated by industry's use of electricity or transportation vehicles.

²⁵¹ Energy-intensive industries consume a high amount of energy as a share of their economic output. In general, energy intensity is measured by comparing an industry's energy expenditures as a percentage of its revenue (Appendix C, pg. C-4). Emissions-intensive industries are those that emit a high amount of GHG emissions relative to the value of their economic output. They include emissions produced directly or indirectly, such as through the use of electricity (Appendix C pg. C-5). Trade-exposed industries are producers in highly competitive markets where consumers are sensitive to price. Trade exposure is often measured by the extent to which products are bought and sold across jurisdictional boundaries (Appendix C pg. C-5).

leakage. Appendix C sets out a method by which the State could identify energy- or emissions-intensive and trade-exposed industries.

Traditionally, energy-intensive and trade-exposed (EITE) industries have been defined as those industries that exceed thresholds set for both energy intensity and trade exposure. With the increase in non-emitting energy supply, however, EITE industries are now more frequently defined as those that exceed thresholds for emissions intensity and trade exposure.

Mining and Quarrying

Mining and quarrying activities produce stationary-source GHG emissions primarily from grinding equipment and diesel-powered material handling and moving equipment. Only a small share of the State’s GHG emissions are produced by mining and quarrying activities, some of which also occur within energy- or emission-intensive and trade-exposed industries and are thus addressed in these strategies similar to manufacturing activities.

Other Energy- and Emission-Intensive Industries

Given the 30-year time horizon of this Scoping Plan, it is possible that new potential industrial GHG emission sources may emerge or grow to become significant sources of GHG emissions. For example, energy-intensive operations such as data centers and cryptocurrency mining operations have the potential to consume significant amounts of electricity and, in some cases, have sought to generate their own electricity from fossil fuel combustion. While many grid-based electricity-intensive activities will be automatically decarbonized by 2040 in concert with the elimination of GHG emissions from the electricity sector (100x40), as covered in *Chapter 13. Electricity*, the additional electricity load could make it more difficult to meet the Climate Act’s 100x40 requirement. In addition, it is possible that new sources of fuel combustion and non-combustion process emissions will also emerge. Accordingly, the State should monitor and evaluate emerging industries and develop policy responses needed to ensure that those industries do not interfere with meeting the statewide emission limits or other Climate Act requirements.

Industrial Sector Considerations

In formulating sectoral strategies for industry, this Scoping Plan reflects several considerations specific to industrial emissions. The heterogeneous nature of industry, and the resulting need for customized solutions on an industry-specific and even factory-specific basis, may result in higher cost per ton of emissions reduced than from larger-scale measures in other economic sectors such as power generation or transportation. In addition, energy- or emission-intensive and trade-exposed industries are likely to represent a high share of industry sector emissions. These industries are both highly sensitive to increases

in the cost of energy or emissions, as well as limited in their ability to pass along higher costs to consumers due to trade competition. As a result, non-incentive-oriented approaches are likely to cause leakage, whereby businesses leave or avoid the State and locate in other jurisdictions where they can emit higher levels of GHGs than they could have had they remained in the State. This results in less economic activity in the State but may achieve no progress on reducing global emissions; in fact, it may increase emissions overall. The Climate Act requires that the Scoping Plan include mechanisms to limit emissions leakage, some of which were developed by the Just Transition Working Group (JTWG) and are described in *Chapter 7. Just Transition*.

Near-term emission reduction opportunities in industry are likely to come primarily from energy efficiencies and some limited electrification for lower temperature processes. Greater emissions reductions (via the use of carbon capture, alternative fuels, or other) will likely occur in the longer term as innovation takes place and technologies scale, mature, and become more viable. However, significant opportunities for emission reductions currently do exist in industry and can be achieved primarily through increased organizational focus on energy management and efficiencies.

Vision for 2030

Industry's contribution to meeting the 2030 GHG emission reduction requirement would be met primarily with continued investment in energy efficiency and some limited electrification within the sector.

The Climate Act requires 40% GHG emissions reductions economywide from 1990 levels by 2030 and statewide energy efficiency of 185 trillion British thermal units (Btu) energy reduction from the forecasted 2025 energy demand. Industry's contribution to meeting these targets would be primarily with continued investment in energy efficiency and some limited electrification within the sector. Energy efficiency has been embraced by the manufacturing sector because it is one of the most cost-effective methods for reducing its GHG emissions. Due to the potential to reduce the amount of energy that must be purchased, and thereby saving money, efficiency measures may at times be able to pay for themselves without government subsidy. Specific efficiency measures can include upgrading motors and drives, making operational changes to improve compressed air efficiency, and adopting smart manufacturing methods and strategic energy management principles. Due to the heterogeneity of the industrial sector, energy efficiency solutions will need to be customized to address specific needs.

Vision for 2050

To meet the Climate Act requirement of an economywide 85% reduction in GHG emissions by 2050 relative to 1990 and the goal of net zero emissions across the economy, the pillars of a decarbonized electricity supply and negative emissions will play a more significant role in the industrial sector. Most industrial facilities need high temperature heat in their manufacturing process, and solutions to reduce emissions from industrial heat could include green hydrogen and/or alternative fuels, as well as carbon capture, use, and storage. The use of alternative fuels is not a substitute for electrification, where it is reasonable and appropriate, for the sector. A few of these solutions are at the early stages of development and will require investment in research, development, and demonstration (RD&D) to prove at scale and to advance to market. In some limited instances, industrial sources might be able to qualify for the use of an alternative compliance mechanism if the New York State Department of Environmental Conservation (DEC) has established such a mechanism and if the source can meet the stringent requirements set out in the Climate Act to govern its use. To reduce emissions in the industrial sector by 2050, six key strategies have been identified.

Existing Sectoral Mitigation Strategies

Mitigation strategies are those that directly reduce emissions or sequester carbon. The State has already adopted several mitigation strategies that address industrial GHG emissions. The New York State Energy Research and Development Authority (NYSERDA), New York Power Authority (NYPA), and Empire State Development (ESD) each offer programs in this area, while DEC employs a regulatory approach.

NYSERDA offers support to industry through a variety of programs, with a goal to promote energy efficiency, reduce GHG emissions, and deploy renewable energy. Programmatic support can be broadly categorized into four areas: technical assistance and training, equipment incentives, competitive grants, and RD&D support. An example of one of NYSEDA's programs is the Strategic Energy Management Program, through which it offers training to industrial facilities to help optimize energy use through a continuous improvement approach.

NYPA's mission is to lead the transition to a carbon-free, economically vibrant New York through customer partnerships, innovative energy solutions, and the responsible supply of affordable, clean, and reliable electricity. NYPA Energy Services programs develop projects in the areas of energy efficiency, electric vehicles (EVs), distributed energy resources (DERs) such as solar and storage, smart street lighting, data-driven energy reduction, and other clean energy initiatives.

ESD offers financial assistance (loans, grants, tax credits, venture investments) to incentivize industry in exchange for investment or job commitments, as well as technical assistance to conceive and scale disruptive technologies. For example, ESD’s Division of Science, Technology, and Innovation encourages greater collaboration between private industry and universities in the development and application of new technologies, including alternative energy systems. Another ESD program is New York Ventures, the State’s innovation venture capital fund that provides seed and early-stage venture capital funding to support and attract new high-growth businesses.

DEC, as a regulatory agency, reviews air pollutant and other relevant permit applications for new industrial facilities, modifications to existing facilities, and relevant renewals of existing facility permits to ensure that the proposed actions are not inconsistent with and will not interfere with the attainment of the statewide GHG emission limits established under the Environmental Conservation Law (ECL).

Key Stakeholders

Engaging stakeholder input is critical in the implementation of the various strategies to ensure the solutions will have the intended impact and meet the needs of the market. Included in the dialogue should be entities such as, but not limited to, industrial trade associations, business associations, affected workers and unions, universities, manufacturing corporations, energy service and engineering companies, industrial equipment suppliers, New York electric and gas utilities, the U.S. Department of Energy, NYSERDA, NYPA, New York State Department of Public Service (DPS), DEC, ESD, New York State Department of Labor (DOL), the Office of Just Transition, and New York State Office of General Services (OGS).

14.2 Key Sector Strategies

There are six key strategies highlighted in this sector, as shown in Table 15. As described there in greater detail, the labor standards discussed in *Chapter 7. Just Transition* are intended to apply throughout this Scoping Plan, including for the industry sector, as a means of promoting good, family-sustaining, union jobs accessible to all New Yorkers and achieving a true just transition.

Table 15. Industry Sector Key Strategies

Strategies	
I1.	Provide Financial and Technical Assistance
I2.	Incentivize Procurement of Low-Carbon Products
I3.	Support Workforce Development
I4.	Facilitate Research, Development, and Demonstration
I5.	Establish Greenhouse Gas Registry and Reporting System
I6.	Provide Economic Incentives

11. Provide Financial and Technical Assistance

The industrial sector is confronted with many barriers and other challenges to implement emission reduction strategies, the most significant of which include risk aversion that solutions will interrupt manufacturing processes, lack of in-house expertise in new technologies, lack of time to commit to energy savings solutions, lack of trust that the solution will deliver the intended benefits, and intense competition for internal company capital. The State should help overcome these barriers by providing technical and financial assistance in implementing various solutions for decarbonization. Specific solutions could include NYSERDA's engineering study support, financial incentives to buy down project costs, and potentially NYPA's Energy Solutions programs and its Power Proceeds programs within the geographic regions they serve.

Implementation of this mitigation strategy would continue from the present until 2050. Most emissions reductions prior to 2030 will be achieved through energy efficiency and low-temperature electrification. As technology advances, support through this mitigation strategy will further enhance emission reductions by 2050 through other means.

The transition for industry to decarbonize and embrace new technological solutions will take time and require State support. Providing clear market signals of long-term commitments would bolster industry confidence in decarbonizing the sector.

The CJWG supports directing State assistance toward reducing industrial emissions in Disadvantaged Communities. Industrial facilities often disproportionately affect Disadvantaged Communities, and investments can be prioritized to target industries with the greatest impact on these communities. In addition, the CJWG noted that emissions reductions strategies for the industry sector do not mention regulation to drive down industrial emissions as close to zero as is technically possible. Additional regulation on industrial sources must be carefully considered within the Climate Act requirements to limit emissions leakage.

In consideration of the CJWG feedback, it is acknowledged that, within the Climate Act requirements to limit emissions leakage, other potential measures must be carefully considered in the event that incentive-based strategies do not achieve sufficient reductions of industrial emissions. This includes DEC's authority under the Climate Act to promulgate regulations to control industrial emissions. In assessing the appropriateness of other measures, a primary consideration shall be the impact on the workforce and industry.

Components of the Strategy

- **Efficiency and decarbonization programs:** The PSC should continue to support and approve of funding for development of programs that embrace energy efficiency, electrification, and decarbonization and to adjust its efforts to ensure alignment with the Climate Act while also focusing investments and their associated benefits in Disadvantaged Communities. State programs administered by NYSERDA and investor-owned utilities should be complementary and coordinated to maximize both market impacts and federally supported decarbonization initiatives pursuant to the Inflation Reduction Act, the CHIPS and Science Act, and other federal funding streams.
- **Low-cost power programs:** The State should continue to provide qualified industries and businesses with lower electric energy cost through allocations of NYPA power.

12. Incentivize Procurement of Low-Carbon Products

Another strategy that has been identified to reduce emissions in the industrial sector is to create State procurement incentives so that manufacturers will produce less emission-intensive goods to capitalize on the increased demand for such goods.

The initial focus for this effort should be to incentivize the manufacturing of lower-carbon building materials such as cement, steel, and aluminum. The public sector purchases a large proportion of building materials produced in the market. This enables the State to exert significant influence on the producers of building materials to develop low-carbon options across its entire range of products. At the same time, the standards for verifying what constitute a low-carbon product are relatively well-established for these types of materials.

At present, about 28% of annual emissions associated with buildings can be allocated to the use of construction materials, primarily emissions associated with the production of concrete and steel as well as aluminum, glass, and insulation material.²⁵² Demand for greener building materials from the private sector will spur manufacturers to reduce the embodied carbon in their products. However, there is an

²⁵² International Energy Agency and the United Nations Environment Programme. 2018. *2018 Global Status Report: Towards a Zero-Emission, Efficient and Resilient Buildings and Construction Sector*.

opportunity to accelerate the growth of this demand via public procurement directives, given that nearly 50% of all cement and 20% of all steel that is purchased in the U.S. is paid for with tax dollars.²⁵³

There are many available pathways to offer advantages to providers of these low-carbon materials in the public procurement process. California’s Buy Clean program, for example, created a system in which selected building materials – structural steel, concrete reinforcing steel, flat glass, and mineral wool board insulation – used in public projects would need to meet minimum global warming potential (GWP) standards.²⁵⁴ Another option to enable low-carbon material procurement is to discount bid prices submitted for public work projects if the bidders are utilizing building materials with low GWP. New York recently passed a law that instructs OGS to examine available incentives, including bid discounts, to encourage the use of low-embodied carbon concrete in State agency projects.²⁵⁵ The exact method of supporting procurement of low-carbon products should be established through coordinated efforts of expert government stakeholders, with the interagency GreenNY Council, including NYSERDA, DEC, and other State agencies, leading the effort. The development of low-carbon procurement rules should seek to consider the product’s full life cycle emissions, where feasible, and safety and engineering validations should be addressed with regard to low-carbon construction materials and methods.

Increasing demand for low-carbon building materials with public procurement directives will have a positive impact on the emissions associated with the State’s manufacturing sector. Just as the manufacturing sector is generally heterogeneous in nature, specific methods of reducing the GWP of a given building material vary by subsector (such as cement, glass, and steel). In general, interventions to reduce the GWP of a building material are identical to reducing overall emissions, and principally include, but are not limited to, more energy-efficient production, process changes, greener production inputs, and/or the sequestration or utilization of captured carbon dioxide (CO₂). Some of the components in this strategy relate closely to those presented in *Chapter 12. Buildings* (Strategy B11) and several strategies in *Chapter 15. Agriculture and Forestry*.

The cost implications of providing preferential procurement standards for low-carbon building materials are likely to be marginal given the relatively small share of overall project costs that these materials

²⁵³ Dell, Rebecca. 2020. *Build Clean: Industrial Policy for Climate and Justice*.

²⁵⁴ California Department of General Services. “Buy Clean California Act.” Accessed September 27, 2021, at <https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/Buy-Clean-California-Act>.

²⁵⁵ Chapter 724 of the Laws of 2021.

represent. Cement, for example, represents only an estimated 1.5% of public construction costs. Moreover, even today, many lower-carbon alternative products have comparable cost characteristics to legacy materials, and even more advanced methods of drastically reducing the GWP of building materials are unlikely to have a significant impact on costs.

The CJWG supports this strategy, as well as other demand-side approaches, since State procurement preferences for low-carbon building materials can encourage less energy-intensive manufacturing in some sectors. The CJWG also recommended using a “best value” procurement framework to score bids that commit to climate mitigation efforts and related workforce, training, local hire, and apprenticeship programs targeted to residents in Disadvantaged Communities.

In consideration of this CJWG feedback, it is recommended that the possibility of utilizing a “best value” procurement framework as described in the feedback be explored. Additional work is necessary to determine the legal and regulatory changes that might be required for such a “best value” procurement framework to be adopted. Development and utilization of such a “best value” procurement framework should include the application of labor standards, as discussed in *Chapter 7. Just Transition*.

Components of the Strategy

Given the public sector’s significant share of market demand for building materials and the critical need for increased supply of low-embodied carbon building materials, the State should increase purchases of low-carbon materials to provide manufacturers with an economic incentive to increase supply.

- **Identify carbon intense materials:** First, the interagency GreenNY Council should develop a list of the most carbon-intensive building materials and products eligible for incentives or preferential treatment in procurement.
- **Develop standards:** After identification of eligible products, the interagency group should work with manufacturers, trade associations, researchers, and other like-minded states or federal agencies to set standards for determining the GWP of each building material.
- **Provide policy support:** The State should implement policy mechanisms that provide advantages to projects or procurement bids utilizing products that meet or exceed GWP targets.

13. Support Workforce Development

The workforce development enabling initiative is intended to expand the State’s existing green workforce and focus on training workers on existing decarbonization technologies and on newer solutions as they

become available. As of 2019, there were nearly 164,000 clean energy jobs in New York, a 16% increase since 2015. Jobs in this area are expected to continue to grow as skills will be needed for industry to plan, operate, and maintain various clean energy technology solutions.

Industrial companies face several barriers in this area, including the need to invest the time and other resources necessary to provide the training and to maintain the dedicated in-house expertise to deliver it. However, these barriers can be mitigated by State programs designed to share in the risk of such investment by providing financial support for the training and by developing training programs geared to industry's specific needs. NYSERDA and DOL have a long history of collaborating and delivering successful clean energy workforce development and training programs and can build upon that success to meet the Climate Act requirements and goals between now and 2050.

The CJWG recommends these strategies ensure consideration of individuals in Disadvantaged Communities in business and workforce development efforts.

Components of the Strategy

The industrial sector will have both short- and long-term needs to train workers to assist in decarbonization. The State should undertake the following steps to assist in workforce development and training.

- **Expand training capacity:** NYSERDA should partner with training organizations and businesses to increase the number of individuals being provided with training, with particular attention to displaced workers and increasing the number of individuals from Disadvantaged Communities being served by these programs.
- **Update training content:** NYSERDA should work with training organization and businesses to update training content to prepare workers for jobs with both established and newly emerging clean energy technologies and strategies. This could be accomplished by issuing competitive solicitations, developing strategic partnerships with industry organizations, and supporting training activities that meet industry's specific needs.

14. Facilitate Research, Development, and Demonstration

While currently available market solutions for reducing industrial GHG emissions can help the State's manufacturers make substantial progress in achieving the State's 2030 and 2050 statewide GHG emission

limits, they will not be sufficient. Given the heterogeneity of the industrial sector, the specific solutions for subsectors will vary, but they broadly include four main categories:

- Energy efficiency
- Industrial electrification
- Alternative fuels, feedstocks, and energy sources, and utilizing more renewable electricity
- Carbon capture, utilization, and sequestration

Given current trends, many of the required technologies for deep decarbonization of the industrial sector will not be available in the timeframe necessary for the State to meet its targets. However, the State could speed the deployment of some of these solutions with a robust RD&D agenda. This includes impacts on not only the industrial sector, but the buildings, transportation, and power sectors, which are all likely to benefit from advancement of many of these solutions. Research should also determine guidelines that indicate which solutions should be incentivized and the manner in which they should be deployed. These guidelines should be set to prioritize those with lowest cost and those that will result in the greatest reduction of GHG emissions. The guidelines also should ensure that solutions are pursued only if they meet benchmarks for environmental justice and equity as well as for economic and technical scalability. After this analysis, public capital should be directed at supporting solutions via research funding as well as pilot and demonstration projects.

The CJWG has raised concerns around technology solutions such as carbon capture and storage and hydrogen. The CJWG supports reducing fossil fuel combustion for industrial heat, replacing it with electric heat whenever feasible. The CJWG inquired specifically as to the future use of green hydrogen and made the point that combusting hydrogen has the potential to produce potentially harmful levels of nitrous oxide (NO_x) emissions. The CJWG recognized, however, that some industrial high-heat processes may not be electrifiable and that in these cases green hydrogen is a potential alternative fuel. In consideration of this CJWG feedback, it is recommended that identifying, quantifying, and mitigating or avoiding potential harmful effects associated with such new technologies and approaches, such as NO_x emissions from hydrogen combustion, will be a necessary, critical concern of future research efforts.

Components of the Strategy

As mentioned above, the State can speed the deployment of industrial decarbonization solutions with a robust RD&D agenda. This agenda should be informed by an analysis of which solutions will have the greatest impact on the State's emissions.

- **Develop a scope of work for research:** NYSERDA should develop a research agenda for industrial decarbonization solutions. This research should account for impacts on not only the industrial sector but also the buildings, transportation, agriculture, waste, and power sectors, which could benefit from advancement of these solutions. The research agenda should include:
 - Rigorous energy, GHG, and environmental sustainability guidelines and metrics
 - Analysis of the potential air quality and health impacts and best practices to minimize these impacts, such as emissions control technologies, as well as mitigating localized impacts in Disadvantaged Communities
 - Life cycle GHG accounting, with strong preference given to zero- or negative-emissions sources
 - The safety of green hydrogen
- **Issue a solicitation:** NYSERDA should issue a solicitation for third-party services to conduct research and provide recommendations on the most appropriate areas for investment in emerging industrial decarbonization solutions.
- **Provide funding for research and pilot/demonstration projects:** Based on the results of the analysis, NYSERDA should work to provide funding to optimally scale identified solutions.

15. Establish Greenhouse Gas Registry and Reporting System

The ECL requires DEC to consider establishing a mandatory registry and reporting system for individual sources to obtain data on GHG emissions that exceed an established threshold.²⁵⁶ DEC should promulgate regulations to establish a new GHG registry and reporting system or expand the existing GHG reporting requirements. This could be accomplished as a component of another regulatory program, such as an economywide program of the type discussed in *Chapter 17. Economywide Strategies*. The system should include sources that currently report emissions data to DEC on an annual basis and expand the universe of facilities that are required to report by establishing a lower reporting threshold than currently exists.

²⁵⁶ ECL § 75-0105(4).

Having a more complete picture of the amount of GHGs emitted from a larger percentage of facilities would allow for a more focused effort to reduce GHG emissions from existing industrial sources, which can often be accomplished by reducing fuel combustion. Since fuel combustion also releases other contaminants, including hazardous air pollutants, the communities in which these facilities are located can be expected to experience improved air quality and health outcomes.

The registry and reporting system would allow DEC to collect, review, and make publicly available the submitted GHG emissions data. Facilities required to report GHG emissions to the new system would be responsible for the costs involved in generating and reporting the data. Reporting of GHG emissions by industry and verification of reported GHG emissions would not be expected to vary significantly from methods used by DEC for other pollutants but could result in additional administrative costs associated with the development of new or additional electronic reporting platforms and associated infrastructure. DEC would attempt to align, to the extent possible, the new reporting requirements with existing DEC and U.S. Environmental Protection Agency (EPA) GHG emissions reporting programs.

Components of the Strategy

- **Develop internal draft of GHG reporting regulation:** DEC should promulgate regulations to establish new or expand the existing GHG reporting requirements, which may be a component of another regulatory program, such as an economywide program of the type discussed in *Chapter 17. Economywide Strategies*. When developing the regulatory program, DEC should evaluate existing online reporting systems such as those established by EPA and the California Air Resources Board. DEC should work with the State's Office of Information Technology Services or other appropriate entity to develop an online electronic reporting platform for this regulatory program.
- **Provide training to regulated entities:** DEC should work with impacted facilities to ensure information exchange and to ensure that applicable reporting requirements are clearly understood.

16. Provide Economic Incentives

The State should continue to develop an in-state supply chain of green economy businesses by offering economic incentives like loans, grants, tax credits, technical assistance programs, or even venture capital investments.

One of the most prominent economic incentives that the State can use in attracting these businesses is the enhanced Excelsior Jobs Program for green economy companies that make products or develop

technologies that are primarily aimed at reducing GHG emissions or supporting the use of clean energy. This program awards refundable tax credits to green businesses that are committed to hiring workers, undertaking research and development, or making capital investments in the State, with credits provided only after the fact under a pay-for-performance model.

NYPA has several economic development programs that support industry, other businesses, and not-for-profits in the State. These programs provide either project funding or low-cost power, including hydroelectric power, primarily in exchange for commitments to retain or create jobs and invest capital in the State. An example is ReCharge New York, a program through which NYPA provides low-cost hydroelectric power to businesses and not-for-profit organizations throughout the State in exchange for investment or job commitments. In late 2020, NYPA adjusted the criteria for evaluating economic development awardees to include the applicants' support of green jobs and manufacturing in the New York.

The CJWG supports directing State assistance toward developing green economy businesses in Disadvantaged Communities.

Components of the Strategy

Green economy industries are poised for significant growth. Anchoring an in-state supply chain of growing green businesses will help the State meet its climate goals and requirements while also attracting new investments and jobs.

- **Offer economic incentives:** These incentives should operate to secure green economy attraction, expansion, and retention projects. Implementation should include engagement with green economy businesses to identify potential in-state economic opportunities, engagement with awardees and suppliers of State green procurements to discuss potential in-state economic opportunities, and coordination with State partners to identify all relevant incentives. There should be coordination with Regional Economic Development Councils (REDCs) to identify sites in Disadvantaged Communities and legacy/rust belt cities with strong potential for revitalization, utilizing incentives to attract green economy business investment to those areas.
- **Implement complementary initiatives:** These initiatives should focus on growing the workforce, supplier base, and market demand that will increase the State's attractiveness as a location for these new green businesses.

Chapter 15. Agriculture and Forestry

15.1 State of the Sector

Overview

Agriculture and forestry encompass multiple economic sectors that include livestock, crops, dairy, timber, wood products, and bioeconomy products. Greenhouse gas (GHG) emission sources include farm and forestry equipment, livestock, cropland, forest fires, decomposition of dead trees, and development of agricultural and forest areas. Emissions from farm and forestry equipment are addressed in *Chapter 11. Transportation* (Strategy T2). The agriculture and forestry sectors can also implement practices that enhance carbon sequestration, as forestland and cropland have the ability to sequester carbon dioxide (CO₂) from the atmosphere and store it in trees, plants, and soils. Practices can also reduce fossil fuel use through the adoption of best management practice systems that help farmers make more efficient use of inputs such as manure and other nutrients. In addition, these sectors have the potential to drive emission reductions outside of the State by reducing the demand for imported goods and providing substitutions for more fossil fuel-intensive products. Each strategy will include increased technical services and financial assistance to improve access to programs and reduce barriers to access for historically unrepresented farmers and forest landowners. The New York State Department of Agriculture and Markets (AGM) Diversity and Racial Equity Working Group’s report will serve as a guide for related strategies outlined in this chapter.²⁵⁷

The strategies described in this chapter address mitigation of agricultural GHG emissions,

primarily methane and nitrous oxide (N₂O) as well as carbon capture (or sequestration) primarily through the growth of trees and other plants but also through well-managed and healthy trees, plants, soils, and wood or bio-based products. Maximizing the carbon sequestration and storage potential in the agriculture

Emissions Overview

Agricultural emissions consisting of methane, nitrous oxide (N₂O) and a small amount of carbon dioxide (CO₂) represented approximately 6% of statewide emissions in 2019 from livestock (92%) and soil management practices (8%). However, agriculture and forestry also provide carbon sequestration benefits and can provide significant contributions toward achieving net zero total emissions from all sectors in the State. For example, annual carbon sequestration in forestlands (77%) and urban forests (14%) and long-term storage of carbon in harvested wood products (5%) provided 97% of the State’s greenhouse gas (GHG) emissions removals in 2019. The remaining greenhouse emissions removals are from natural and working lands. These benefits are also described in *Chapter 19. Land Use*.

²⁵⁷ New York State Department of Agriculture and Markets. 2021. *Diversity and Racial Equity Working Group Report*. 2021. Accessed at https://agriculture.ny.gov/system/files/documents/2021/08/diversityracialequityreport_1.pdf.

and forestry sectors is a key strategy for achieving the Climate Act goal of net zero emissions across all sectors of the economy by 2050.

Vision for 2030

In contributing to the statewide 2030 GHG emissions reduction requirement, the agricultural sector will execute actions to reduce methane and N₂O emissions. To reduce methane and N₂O emissions, the agricultural sector will implement recommendations for livestock operations and cropland management. In addition, both the agriculture and forestry sectors will undertake measures to facilitate broad carbon storage and sequestration. Actions to maintain and increase carbon storage and sequestration on the land base in New York and in agricultural and forestry products include protecting farm and forest lands from conversion and development, afforestation and reforestation, improved forest management practices, cropland management practices (such as soil health management practices), and the long-term storage of carbon in harvested wood products (such as mass timber). Together, these actions will achieve approximately 30 million metric tons (MMT) carbon dioxide equivalent (CO₂e) net sequestered annually. This chapter will focus on specific management practices and *Chapter 19. Land Use* will discuss strategies related to avoided conversion, afforestation, and reforestation.

Vision for 2050

The 2050 goal of the Climate Act is to achieve net zero GHG emissions statewide and a required 85% reduction in GHG emissions. Emissions reductions beyond 85% of 1990 statewide levels can be achieved through approximately 60 MMT CO₂e net annual sequestration in the forestry and agricultural sectors and related land use practices (*Chapter 19. Land Use*). In addition, in 2050, agricultural GHG emissions will need to be further reduced from 2030 levels,²⁵⁸ which will require additional development of research, technology, and market solutions where the technical potential has yet to be reached. Support for New York's bioeconomy is recommended to meet the Climate Act requirements and goals and will serve to grow the agriculture and forestry industries in New York by substituting products grown and produced in New York for imported fossil fuel-intensive products, which will contribute to reducing global GHG emissions and increasing sequestration in New York.

²⁵⁸ Wightman, Jenifer, and Woodbury, Peter. 2020. *New York Agriculture and Climate Change; Key Opportunities for Mitigation, Resilience, and Adaptation*. Cornell University. https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/2/7553/files/2020/07/CarbonFarming_NYSAGM_FINAL_May2020.pdf.

Existing Sectoral Mitigation Strategies

New York has 18.6 million acres of forests and 6.9 million acres of agricultural lands in production.^{259,260}

Over the last decade, farmers and foresters in New York have continued their efforts and investments to advance environmental sustainability and efficiency, both of which increase carbon benefits and climate resilience. There are several examples of these efforts:

- New York dairy farmers made significant strides in reducing the carbon footprint per hundredweight of milk through greater efficiencies in precision feed management, reducing enteric emissions from cow digestion.
- The New York State Methane Reduction Plan (May 2017) identified and set targets for reducing methane emissions from the agricultural sector.²⁶¹
- A suite of technical assistance and planning resources were developed through the Agricultural Environmental Management (AEM) framework on farm and forest GHG emission mitigation opportunities.
- New York's Climate Resilient Farming (CRF) grant program, which demonstrates how climate-responsive efforts can be integrated alongside existing environmental and water quality agricultural programming, has awarded over \$20 million in project funding, resulting in an estimated 370,000 MT CO₂e reduced/sequestered.
- Thousands of landowners have been assisted with forest management on more than two million acres of private lands through programs like the Forest Stewardship Program, Environmental Quality Incentives Program (EQIP), the 480-a Forest Tax Law program, Partnerships for Regional Invasive Species Management, Forest Health rapid response programs, and the Forest Health Diagnostic Lab.
- The Forest Stewardship Council® and Sustainable Forestry Initiative® has provided Green certification on 800,000 acres of State forests.

²⁵⁹ Albright, Thomas A., Brett J. Butler, Susan J. Crocker, Jason M. Drobnack, Cassandra M. Kurtz, William H. McWilliams, Randall S. Morin, Mark D. Nelson, Rachel Riemann, Lance A. Vickers, Brian F Walters, James A. Westfall, Christopher W. Woodall. 2020. "New York Forests 2017." *Resource Bulletin NRS-121*. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 118 p. <https://doi.org/10.2737/NRS-RB-121>.

²⁶⁰ U.S. Department of Agriculture. National Agriculture Statistic Service. 2019. "2017 Census of Agriculture, Volume 1, Chapter 1: Part 32 State Level Data: New York." Accessed at https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/New_York/nyv1.pdf.

²⁶¹ New York State Department of Environmental Conservation, New York State Department of Public Service, New York State Department of Agriculture & Markets, Soil and Water Conservation Committee, NYSERDA. 2017. *Methane Reduction Plan*. Albany. Accessed at https://www.dec.ny.gov/docs/administration_pdf/mrpfinal.pdf.

To continue to enable farmers to reduce GHG emissions and increase sequestration in soils through site-specific practices on lands under their management, New York should utilize the AEM framework, overseen by AGM and the New York Soil and Water Conservation Committee (SWCC) and locally led and implemented by county Soil and Water Conservation Districts (SWCD). This existing framework should be coupled with new and expanded initiatives, research, development, and demonstration (RD&D) of novel approaches to reducing emissions and increasing sequestration capacity and increasing workforce capacity to scale up programs and initiatives.

Management of New York's forests, to promote tree health, recreation, wildlife habitat, and wood products, among other reasons, also has many implications for long-term carbon storage and sequestration. The New York State Department of Environmental Conservation (DEC) should continue to provide best management practices (BMPs) and guidance to foresters, promote programs including, but not limited to Regenerate NY, 480-a, Urban and Community Forest Grants, Partnerships for Regional Invasive Species Management, and forest health rapid response programs, as well as work closely with landowners to increase carbon benefits and climate resilience.

Key Stakeholders

Key stakeholders include landowners, organizations involved in outreach, education, and landowner assistance, private sector cooperatives and companies, agricultural support groups, forest product organizations, workforce development organizations, affected workers and unions, research entities, and the Legislature. Stakeholders involved in these roles are described below; however, this should not be considered an all-inclusive list. Stakeholders involved in more than one role are only listed once.

- Stakeholders that hold forest land in New York include DEC, New York State Office of Parks, Recreation, and Historic Preservation (OPRHP), New York State Department of Transportation (DOT), New York Power Authority (NYPA), land trusts, utility companies, municipalities, municipal associations, local communities, timber investment management organizations, and private landowners.
- Stakeholders involved in outreach, education, and other forms of landowner assistance include U.S. Department of Agriculture (USDA), New York State Department of State (DOS), New York City Department of Environmental Protection, county Soil and Water Conservation Districts (SWCDs), Cornell Cooperative Extension (CCE), the Society of American Foresters, International Society of Arboriculture, New York Society of Arboriculture, New York State Urban Forestry Council, ReLeaf, Master Forest Owners, Arbor Day Foundation, Forest Connect,

the Nature Conservancy, New York Forest Owners Association, New York Tree Farm, Empire State Forest Foundation, hunting stakeholders, arborists, and foresters.

- Stakeholders involved in the creation, promotion, and use of forest products include the New York State Energy Research and Development Authority (NYSERDA), Regional Economic Development Councils (REDCs), Dormitory Authority of the State of New York (DASNY), Empire State Development (ESD), Empire State Forest Products Association, the Wood Products Development Council (WPDC), U.S. Green Building Council, American Society of Civil Engineers, American Institute of Architects, U.S. Department of Energy, Port Authority of New York and New Jersey (PANYNJ), Commercial Aviation Alternative Fuels Initiative, the Business Council of New York State, New York City Department of Buildings, pulp and paper manufacturers, lumber and veneer mills, furniture manufacturers, wood pellet plants, wood-fired power plants, and waste materials stakeholders.
- Stakeholders involved in workforce development include Paul Smith’s College, Boards of Cooperative Education Services, the Workforce Development Institute, and affected workers and unions. Stakeholders involved in research efforts include State University of New York (SUNY) College of Environmental Science and Forestry (ESF), and Cornell University College of Agriculture and Life Sciences (CALS). Stakeholders involved in incentive programs and legislation include the New York State Department of Taxation and Finance and the State Legislature.
- Farmers, State and federal agencies, the State Legislature, colleges and universities, county SWCDs, CCE, outreach and education agencies/facilitators, nonprofits, land trusts, farm organizations, private sector professional engineers and planners, financial lenders, watershed coalitions, municipalities, nongovernment organizations (NGOs), food processors and cooperatives, agricultural associations, and others may be integral to implementing strategies of the agricultural sector. Specific implementation leads and stakeholders are listed below for each strategy.

15.2 Key Sector Strategies

New York’s forests serve as a major carbon sink that hold 1,911 MMT carbon,²⁶² nearly 10 times the amount of carbon produced by all sectors each year. In addition, forests sequester approximately

²⁶² Domke, Grant M., Brian F. Walters, David J. Nowak, James E. Smith, Stephen M. Ogle, J.W. Coulston, T.C. Wirth. 2020. “Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018.” *Resource Update FS-227*. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. <https://doi.org/10.2737/FS-RU-227>.

26.6 MMT CO₂e annually.²⁶³ Recommended strategies to mitigate GHG emissions and sequester and store additional carbon from the agriculture and forestry sectors are discussed in the sections below. Although also connected to the agriculture and forestry sectors, additional strategies related to land use including avoided conversion of agricultural and forest lands, afforestation, and reforestation are included in *Chapter 19. Land Use*. The strategies contained in this chapter provide long-term, integrated approaches to achieving GHG emissions reductions while also ensuring food security, the creation of wood products, and promoting agricultural and forest adaptation in the face of a changing climate, while minimizing the potential for emissions leakage by farmers and foresters moving operations out of State. In addition, the recommendations presented below affect many other non-emission Climate Act goals. The key strategies within this sector are organized into four themes, as shown in Table 16.

Table 16. Agriculture and Forestry Sector Key Strategies by Theme

Theme	Strategies
Promote Sustainable Forest Management	AF1. Identify Where Forest Management Provides the Greatest Benefits AF2. Prevent Forest Pests, Diseases, and Invasive Species and Restore Degraded Forests AF3. Maintain and Improve Sustainable Forest Management Practices and Mitigation Strategies AF4. Assist Landowners in Implementation of Sustainable Forest Management and Mitigation Strategies AF5. Support Local Communities in Forest Protection and Management AF6. Monitor Progress and Advance Forestry Science and Technology AF7. Conduct Education and Outreach on Forest Management
Advance Livestock Management Strategies	AF8. Advance Alternative Manure Management AF9. Advance Precision Feed, Forage, and Herd Management
Improve Soil Health, Nutrient Management, and Agroforestry	AF10. Advance Agricultural Nutrient Management AF11. Adopt Soil Health Practice Systems AF12. Increase Adoption of Agroforestry AF13. Develop Agricultural Environmental Management Planning for Climate Mitigation and Adaptation AF14. Monitor and Benchmark Agricultural Greenhouse Gas Emissions AF15. Establish a Payment for Ecosystem Services Program AF16. Bolster Local Agricultural Economies

²⁶³ Domke, Grant M., Brian F. Walters, David J. Nowak, James E. Smith, Stephen M. Ogle, J.W. Coulston, T.C. Wirth. 2020. “Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018.” *Resource Update FS-227*. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. <https://doi.org/10.2737/FS-RU-227>.

Theme	Strategies
Promote a Climate-Focused Bioeconomy	AF17. Develop Forestry Training Programs to Support Expanding Workforce and Climate Knowledge AF18. Expand Markets for Sustainably Harvested Durable Wood Products AF19. Develop a Sustainable Biomass Feedstock Action Plan for Bioenergy and Low-Carbon Products AF20. Increase Market Access for New York Low-Carbon Products AF21. Provide Financial and Technical Assistance for Low-Carbon Product Development AF22. Advance Bio-Based Products Research, Development, and Demonstration AF23. Advance Deployment of Net Negative Carbon Dioxide Removal

Promote Sustainable Forest Management

New York has 18.6 million acres of forests, covering approximately 62% of New York’s total land area.²⁶⁴ Through photosynthesis, forests absorb and store CO₂ that can offset GHG emissions and reduce the impacts of climate change. New York’s forests hold an estimated 1,911 MMT of carbon,²⁶⁵ which is equivalent to the CO₂ that would be produced to power all the houses in New York for the next 100 years.²⁶⁶ However, there has been a trend in the loss of forested area in the past 10 years that has contributed to a decline in the net amount of CO₂ absorbed by forests each year, from 30.3 MMT CO₂e in 1990 to 26.6 MMT CO₂e in 2019.²⁶⁷ Further, annual carbon sequestration by forests is expected to decline slightly statewide by 2050 due to increased impacts from invasive species, forest pests, drought, flooding, storm damage, and lowered planting and regeneration success due to climate change. In addition to forest area loss as New York’s forests have aged, their annual carbon sequestration rate has slowed.

Promoting a wide diversity of site-specific forest management strategies across the landscape, including harvesting, thinning, and/or leaving mature forests intact, will best help increase New York’s carbon sequestration, storage, and climate resilience. New York’s forests are managed for a wide variety of

²⁶⁴ Albright, Thomas A., Brett J. Butler, Susan J. Crocker, Jason M. Drobnack, Cassandra M. Kurtz, William H. McWilliams, Randall S. Morin, Mark D. Nelson, Rachel Riemann, Lance A. Vickers, Brian F. Walters, James A. Westfall, Christopher W. Woodall. 2020. “New York Forests 2017.” *Resource Bulletin NRS-121*. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 118 p. <https://doi.org/10.2737/NRS-RB-121>.

²⁶⁵ Domke, Grant M., Brian F. Walters, David J. Nowak, James E. Smith, Stephen M. Ogle, J.W. Coulston, T.C. Wirth. 2020. “Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018.” *Resource Update FS-227*. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. <https://doi.org/10.2737/FS-RU-227>.

²⁶⁶ U.S. Environmental Protection Agency. 2021. “Greenhouse Gas Equivalencies Calculator. Division of Energy and Environment.” Accessed June 4, 2021, at <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>. Average emissions rates were used for this calculation.

²⁶⁷ Domke, Grant M., Brian F. Walters, David J. Nowak, James E. Smith, Stephen M. Ogle, J.W. Coulston, T.C. Wirth. 2020. “Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018.” *Resource Update FS-227*. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. <https://doi.org/10.2737/FS-RU-227>.

reasons including promotion of tree health, downstream water quality, recreation, wildlife habitat, and wood products. How a forest is managed has implications for long-term carbon storage and sequestration depend on factors like forest age, health, and tree species, as well as how the wood is utilized following harvest. Guidance is needed to promote forest management regarding carbon storage and sequestration, climate resilience, and other climate-related issues using the strategies described below. The Climate Justice Working Group (CJWG) supports the strategies under the Sustainable Forest Management theme, however, suggests there is an over-reliance on voluntary incentive-based programs.

AF1. Identify Where Forest Management Provides the Greatest Benefits

Well-managed forests provide a wide array of benefits to humans and the natural environment including wildlife habitat, flood mitigation, recreational opportunities, health benefits, reduced heating and cooling costs, protection of air and water quality, and carbon sequestration and storage. Forest management actions need to be site-specific and targeted to provide the greatest benefits to New Yorkers.

Identifying and prioritizing locations for forest management is an enabling strategy that will allow the State to target areas for forest management to maximize carbon sequestration and storage and climate resilience. DEC is currently working with SUNY ESF to develop site-specific models of aboveground forest carbon across the landscape which is expected to be complete in 2023, with updates and improvements expected to be ongoing. Barriers to this strategy include the ability to obtain and update light detection and ranging technology data, quantification of forest benefits such as forest resilience, and mapping of forest benefits.

Components of the Strategy

- **Prioritization models:** DEC should continue to work with partners such as SUNY ESF to select, implement, and develop prioritization models for forests in need of management, including those in urban areas, and small parcels owned by family forest owners.

AF2. Prevent Forest Pests, Diseases, and Invasive Species and Restore Degraded Forests

Invasive species means a species that is nonnative to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.²⁶⁸

²⁶⁸ 6 NYCRR 575.2(s), 576.2(e).

Invasive species may include plants, animals, insects, and diseases. In forests, invasive plants can rapidly change an area's hydrology, displace native species, and prevent forest regeneration. Invasive plants were found in 55% of the most recent forest inventory analysis survey plots²⁶⁹ and 56% of private landowners were concerned about invasive plants in the most recent National Woodland Owner survey.²⁷⁰ Invasive insects and diseases such as emerald ash borer and hemlock woolly adelgid can cause rapid mortality to trees or contribute to a loss in tree health due to increased stress, contributing to mortality in the long-term. In the most recent National Woodland Owner survey, 74% of private landowners were concerned about invasive insects and disease.²⁷¹ By altering the forest ecosystem, preventing regeneration, reducing the growth and vigor of trees, and causing direct mortality, invasive species negatively impact the ability of New York's forests to store and sequester carbon.

DEC enforces 6 NYCRR Parts 575 and 576, regulatory programs regarding invasive species and 6 NYCRR Part 192 for forest insect and disease control, and AGM enforces 1 NYCRR Chapter III related to insect and disease control. These programs seek to accomplish prevention, outreach, rapid response, and research on invasive forest species and diseases through its Invasive Species and Ecosystem Health program, Partnerships for Regional Invasive Species Management, the New York Invasive Species Research Institute, and the Forest Health Diagnostic Lab, as well as partners statewide. Climate change is expected to increase the competitiveness of invasive plants and increase the range and survival of native and invasive insects and diseases. Prevention, response, and restoration will be ongoing as new invasive species are introduced and the ranges and competitiveness of existing species in New York expand.

Components of the Strategy

- **Increase prevention of invasive species:** Currently, most of DEC's invasive species prevention takes place through education and outreach activities. To increase efficacy, DEC and AGM should increase resources and strengthen its partnership with the USDA Animal and Plant Health Inspection Services to increase prevention of invasive forest pests and diseases entering New

²⁶⁹ U.S. Department of Agriculture Forest Service. 2020. "Forests of New York, 2019." *Resource Update FS-250*. Madison, WI. 2p. <https://doi.org/10.2737/FS-RU-250>.

²⁷⁰ Butler, Brett J., Jaketon H. Hewes, Brenton J. Dickinson, Kyle Andrejczyk, Sarah M. Butler, Marla Markowski-Lindsay. 2016. "U.S. Department of Agriculture Forest Service National Woodland Owner Survey: national, regional, and state statistics for family forest and woodland ownerships with 10+ acres, 2011-2013." *Res. Bull. NRS-99*. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 39 p. <https://doi.org/10.2737/NRS-RB-99>.

²⁷¹ Ibid.

York and the U.S. (such as Tree-SMART Trade) through strengthened regulations, inspection, and enforcement of wood packaging material and live plant imports.

- **Expand statutory authority:** The State should enact legislation to expand the scope of ECL § 9-1709 to provide DEC with more statutory authority to strengthen and amend 6 NYCRR Parts 575 and 576 to allow more rapid listing of invasive species for regulation.
- **Support programs that combat invasive species:** DEC already has response and monitoring programs for some of the major forest pests and invasive species in New York including kudzu, hemlock woolly adelgid, oak wilt, and southern pine beetle supported through federal grant funding and New York’s Environmental Protection Fund (EPF); however, additional staff resources and funds are needed to further reduce the loss of forest carbon due to forest health issues on private and public forest. DEC should facilitate additional capacity for rapid response teams for forest pest and disease outbreaks and invasive vegetation issues that negatively impact forest carbon (such as forest regeneration) as well as continue to aggressively implement forest and other management efforts that can help prevent impacts. Priority should focus on intervening where rapid, extensive loss of forest carbon sequestration capacity could occur.

AF3. Maintain and Improve Sustainable Forest Management Practices and Mitigation Strategies

Improving and expanding the use of sustainable forest management practices and mitigation strategies is ongoing and has direct benefits for carbon storage and sequestration. Current efforts by DEC include sustainability certification on State lands, the Forest Stewardship Program, EQIP run by USDA Natural Resources Conservation Service (NRCS), the 480-a Forest Tax Law program, and the Regenerate NY cost share grant program.

Components of the Strategy

- **Invest in forest carbon research:** DEC should work with partners like SUNY ESF, Cornell CALS, and others to support research, develop BMPs, guidance documents, and decision trees to inform forest management regarding carbon storage, carbon sequestration, climate resilience, and other climate-related issues including on improving forest resilience and vigor, regeneration, forest soils, and prevention of high-intensity wildfire. DEC should also work with partners to expand funding for and conduct peer reviewed climate, forest carbon, and applied forest management research in New York such as improving forest resilience, vigor, regeneration, and forest soil carbon storage.

- **Establish a Forest Carbon and Climate Resilience working group:** DEC should lead a working group to improve communication on carbon and climate best practices and improve implementation coordination. This working group should bridge the gaps and implementation needs of science, management, outreach, and on-the-ground practices.
- **Research carbon benefits of old-growth forests:** DEC should work with partners such as the New York Natural Heritage Program to evaluate the carbon benefits associated with old-growth forests, including evaluating the carbon stocks of old-growth forest soils.
- **Develop best practices:** DEC and AGM should develop guidance on forestry management practices to maintain or increase forest carbon stocks across the landscape while producing an annual sustained yield of durable wood products.
- **Implement forest carbon certification program:** DEC should develop and implement a Forest Carbon Certification Program, where qualified forester participants with a certification credential would be able to work under State-funded forest programs and forest carbon programs.
- **Restore degraded forest assets:** DEC should work with forest landowners to implement restoration measures in degraded forests through Regenerate NY and other programs to improve carbon storage, carbon sequestration, and climate resilience such as extending harvest intervals, uneven aged harvests, rehabilitating high graded and under stocked stands, and invasive species management and prevention. Restoration should be implemented on small forests parcels in addition to larger forested blocks. With current estimates of 1.1 million acres of understocked forests in New York, immediate action and substantial funding is necessary to rehabilitate these acres to increase their carbon sequestration potential.
- **Invest in financing options for upgrades and best practices:** DEC should work with the WPDC, ESD, and NGOs to provide funding for low interest loans or grants for upgrading to new logging or manufacturing equipment to facilitate increased utilization, improved forest management, or BMPs to lower site impacts (such as machine tracks for wheeled harvesters to lower soil impacts).

AF4. Assist Landowners in Implementation of Sustainable Forest Management and Mitigation Strategies

Of New York's forests, 73%, or 13.7 million acres, are owned by private landowners.²⁷² The majority of all the carbon sequestration and storage occurs on these lands. Of these privately owned forests, only

²⁷² USDA Forest Service. 2020.

about 27% received professional advice within the past five years, only 18% had a written management plan,²⁷³ and only 9% (1.2 million acres) were under professional forest management through the 480-a Forest Tax Law Program, which provides tax incentives to landowners for forest management.²⁷⁴ In addition, the costs of maintaining a healthy forest, forest dieback due to pests and diseases, annual taxes, and shifts to smaller parcel sizes, these landowners have been facing increasing pressures to subdivide and develop their forested lands and convert forests to other uses, such as to agriculture, with more than 65,000 acres converted in 2019.²⁷⁵ New programs should focus on landowners with smaller land holdings to increase the target audience and allow for diverse management objectives beyond strictly timber management. In addition to the 480-a program, other ongoing DEC programs that assist forest landowners include the Forest Stewardship Program, Regenerate NY cost share grant program, and USDA NRCS-run EQIP. The large number of private landowners who need to be reached could present a possible barrier to this strategy; however, improving sustainable forest management and mitigation strategies will help improve carbon storage and sequestration in New York, as well as climate resilience.

Components of the Strategy

- **Expand education and outreach:** DEC should work with partners such as CCEs, SWCDs, NGOs, SUNY ESF, Cornell CALS, the NY Forest Owners Association, and other organizations and universities across the State to provide, expand, and improve outreach and technical assistance on forest carbon and forest management to landowners including information about estate planning, intergenerational transfer, and the importance and contribution of working forestlands through programs such as the Forest Stewardship Program, AEM, Partnerships for Regional Invasive Species Management, and Master Forest Owners.
- **Amend Real Property Tax Law § 480-a:** The State should enact legislation to amend Real Property Tax Law § 480-a to create tracks for forest carbon management, induce greater landowner participation and integrate stronger sustainability provisions (such as forest regeneration) with the primary goal to remain unchanged and encourage sustainable timber

²⁷³ Butler, Brett J., Jaketon H. Hewes, Brenton J. Dickinson, Kyle Andrejczyk, Sarah M. Butler, Marla Markowski-Lindsay. 2016. "U.S. Department of Agriculture Forest Service National Woodland Owner Survey: national, regional, and state statistics for family forest and woodland ownerships with 10+ acres, 2011-2013." *Res. Bull. NRS-99*. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 39 p. <https://doi.org/10.2737/NRS-RB-99>.

²⁷⁴ New York State Department of Environmental Conservation. 2020. "New York State Forest Action Plan: December 2020." Albany. Accessed at https://www.dec.ny.gov/docs/lands_forests_pdf/nysfap.pdf.

²⁷⁵ Malmsheimer, Robert, Patrick Heffernan, Steve Brink, Douglas Crandall, Fred Deneke, Christopher Galik, Edmund Gee, John Helms, Nathan McClure, Michael Mortimer, Steve Ruddell, Matthew Smith, John Stewart. 2008. "Forest management solutions for mitigating climate change in the United States." *Journal of Forestry* 106.

management. The tax abatement benefit for landowners should remain unchanged with up to 100% reimbursement to municipalities.

- **Enact new legislation:** The State should enact legislation to create a new real property tax incentive (new Real Property Tax Law § 480-b) to allow private forest landowners to manage for multiple benefits (such as wildlife habitat, water quality, wood products, carbon sequestration, and carbon resilience) and, if desired, conserve their forests in natural conditions to participate in tax programs. Tax benefit to landowners should increase as the year of commitment increase, recognizing the accumulated annual sequestration benefits over time. This program should require a forest management plan written by a certified forester if harvesting is required. To be eligible for this program, a landowner would be required to enroll at least 15-acres of contiguous forested land. Initial benefits should start at a lower level than Real Property Tax Law § 480-a and a new Real Property Tax Law § 480-c with up to 100% reimbursement to municipalities.
- **Enact new legislation:** The State should enact legislation to create a real property tax incentive (Real Property Tax Law § 480-c) to provide forest landowners a tax incentive to undertake practices that increase carbon storage, carbon sequestration, and climate resilience while addressing the need for additionality (additional carbon or climate benefits generated due to practices above the current baseline state). This program should be practice- and carbon inventory-based and require a forest management plan written by a carbon certified forester if harvesting. To be eligible for this program, a landowner would be required to enroll at least 15-acres of contiguous forested land. The tax benefit to landowners should increase as the years of commitment increase to recognize accumulated sequestration benefits over time with up to 100% reimbursement to local municipalities.
- **Support programs that provide technical assistance to private landowners:** The State should expand the funding for cost share programs, such as Regenerate NY and AEM to assist forest landowners in increasing carbon storage, carbon sequestration, and climate resilience on private forestland, including restoration of degraded forests and implementing BMPs for forest carbon. The first round of the Regenerate NY program will help restore and afforest 503 acres of land to forest; however, support for this program will need to substantially increase to have a measurable impact on forest carbon benefits. The formal addition in 2019 of Forest Conservation Planning and BMP implementation into the AEM framework now provides technical assistance and funding from SWCDs to farmers with forestland to improve management of forest resources for multiple benefits, including carbon storage and sequestration.

- **Establish equipment caches:** DEC, SWCDs, NGOs, and the WPDC should establish equipment caches across the State to allow landowners and operators to borrow forestry and logging equipment to implement low-impact forest management for approved practices.

AF5. Support Local Communities in Forest Protection and Management

Local governments including counties and municipalities own approximately 1% of forested areas large and productive enough for wood production and have jurisdiction over land use planning and restrictions for forests within their boundaries.²⁷⁶ In addition, tree canopy covers 1.3 million acres of urban and community areas, storing about 32.1 MMT of carbon (equivalent to the CO₂ that is produced to power all the houses in New York for one and a half years) and contribute to 1 million tons of gross carbon sequestration each year (equivalent to the CO₂ that is produced to power 400,000 homes for one year).²⁷⁷⁻²⁷⁸ Increasing forest protection and management in local and urban communities will increase carbon sequestration and storage as well as climate resilience. In addition, trees in urban areas reduce overall energy use (such as through the reduced use of air conditioning) and therefore reduce GHG emissions. Current efforts by DEC include the Urban and Community Forestry Program, which provides education, outreach, guidance, and a grant program to local and urban communities, and the Community Forest Conservation Program, which provides funds to municipalities to acquire local forest lands to create community forests. However, urban and community tree cover is declining by about 6,720 acres annually.²⁷⁹ In addition, many municipalities lack a comprehensive plan and/or zoning ordinance or laws for forests, and often these documents do not clearly address forest retention and/or uses. In some cases, restrictions within municipal jurisdictions on forest management drive local landowners to develop their land.²⁸⁰ In addition, similarly to private landowners, the costs of maintaining a healthy forest, forest

²⁷⁶ Daniels, Katherine H. 2005. *A Municipal Official's Guide to Forestry in New York State*. New York Planning Federation, Department of Environmental Conservation and Empire State Forest Products Association. 31p. Accessed June 9, 2021, at <http://cceanondaga.org/resources/municipal-officials-guide-to-forestry-in-new-york-state>.

²⁷⁷ U.S. Environmental Protection Agency. 2021. "Greenhouse Gas Equivalencies Calculator." Division of Energy and Environment. Accessed June 4, 2021, at <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>. Average emissions rates were used for this calculation.

²⁷⁸ Nowack, David J., Eric J. Greenfield, Robert E. Hoehn, and Elizabeth Lapoint. 2013. "Carbon storage and sequestration by trees in urban and community areas of the U.S." *Environmental Pollution* 178, 229-236.

²⁷⁹ Nowack, David J., and Greenfield, Eric J. 2018. "Declining urban and community tree cover in the United States." *Urban Forestry & Urban Greening* 32, 32-55.

²⁸⁰ Malmsheimer, Robert W., and Donald W. Floyd. 1998. "The Right to Practice Forestry: Laws Restricting Nuisance Suits and Municipal Ordinances." *Journal of Forestry* 96(8): 27-32. <https://doi.org/10.1093/jof/96.8.27>.

dieback due to pests and diseases, annual taxes, and shifts to smaller parcel sizes, municipalities have been facing increasing pressures to subdivide, develop, or allow development on their forested lands.²⁸¹

Components of the Strategy

- **Provide guidance and support:** DEC should work with partners, like SUNY ESF and Cornell CALS, to provide guidance, support, and funding to local communities to plan and implement forest maintenance projects that help communities adapt to climate change.
- **Provide BMPs:** DEC should work with partners like SUNY ESF and Cornell CALS to provide BMPs for urban forests including what trees to plant for carbon sequestration and climate resilience and ways to increase the lifespan of urban trees through improved maintenance.
- **Increase funding:** The State should increase the funding levels and scope of Urban and Community Forestry Grants to assist local municipalities and private landowners in the management of the urban forests, including planning, planting, and maintenance of trees. Round 15 of DEC’s Urban and Community Forest Grants funded 38 projects across the State; however, support for this program will need to increase to have a greater impact on urban forest carbon benefits.
- **Develop guidance and support:** DEC and SWCDs should develop guidance for and provide support to local communities to establish or expand youth and young adult conservation corps to employ, and train youth for maintaining and improving urban forest management.
- **Support research:** DEC should work with partners like Cornell CALS and SUNY ESF to increase urban forestry and forest carbon research on ways to maximize the carbon and other benefits of establishing and maintaining urban forests.

AF6. Monitor Progress and Advance Forestry Science and Technology

Tracking the carbon sequestered and stored by New York’s forests is critical to enabling and evaluating the success of carbon sequestration and storage. Monitoring forest carbon progress will help the State identify successful forest management strategies and provide further insight into what land use patterns can lead to the greatest carbon sequestration and storage. Monitoring will also help identify areas of the State that have low regeneration or stocking and areas that have been impacted by invasive species, wildfire, and other disturbances that need restoration efforts. DEC is currently working with SUNY ESF

²⁸¹ Malmshemer, Robert, Patrick Heffernan, Steve Brink, Douglas Crandall, Fred Deneke, Christopher Galik, Edmund Gee, John Helms, Nathan McClure, Michael Mortimer, Steve Ruddell, Matthew Smith, John Stewart. 2008. “Forest management solutions for mitigating climate change in the United States.” *Journal of Forestry* 106.

to monitor forest carbon on a statewide level to support the annual GHG emissions inventory and additional efforts are underway by other organizations throughout the state and the northeast. DEC will work with partners to continue to track forest carbon and improve monitoring.

Components of the Strategy

- **Monitor forest carbon:** DEC should continue to work with partners like the U.S. Forest Service Forest Inventory and Analysis program, SUNY ESF and Cornell CALS to monitor forest carbon and evaluate tactics to determine efficacy and maximize efficiency.
- **Create science-based decision tools:** DEC should work with partners like SUNY ESF and Cornell CALS to create science-based decision tools to help make the most efficient and cost-effective decisions on forest-based climate change initiatives.
- **Improve forest carbon soils knowledge:** DEC should work with partners to research carbon within forest soils and the associated belowground dynamics of this carbon pool.

AF7. Conduct Education and Outreach on Forest Management

Education and outreach to New York’s private and public landowners who can implement forest management practices and mitigation strategies is needed to ensure and enable the success of the strategies described in this chapter, which will in turn increase carbon sequestration and storage and climate resilience. In addition, the benefits forests and wood products provide should be promoted to the public to increase their use and for a better understanding of why protecting and managing forests is beneficial for carbon sequestration, wildlife, and the people of New York. DEC currently conducts education and outreach through individual programs such as the Forest Stewardship Program, EQIP, Regenerate NY, the Urban and Community Forest program, through partners like SWCC, and through efforts like #ForestryFridays on social media. Additional proactive education efforts could be beneficial for reaching new audiences.

Components of the Strategy

- **Promote forest management:** DEC should work with partners to build public acceptance for forest management and increase the adoption of climate focused forest management on all landownership types.
- **Expand outreach:** DEC should continue to provide stewardship foresters, cooperating foresters, urban foresters, city planners, and local officials with outreach training, technical assistance, resources, and toolkits to better engage landowners and other stakeholders on climate change.

- **Support urban forestry:** DEC should continue to increase the promotion of urban forestry and tree care through TreeLine USA for utilities, TreeCity USA for communities, Tree Campus for college campuses, and ReLeaf efforts in communities across the State.
- **Support education and outreach:** DEC should bolster urban forestry and natural resource education and outreach, especially in historically marginalized communities by identifying and working with local partners.
- **Promote New York wood products:** SUNY ESF and WPDC should work with DEC to engage social media influencers and wood product manufacturers to promote New York wood products, including traditional and emerging wood products and utilization, as trendy, local, and sustainable.
- **Provide education and outreach:** DEC should engage partners to provide education and outreach to the construction industry, architects, engineers, building designers, and the public about mass timber construction, harvested wood product applications, and the carbon mitigation benefits of substituting wood products instead of those that are fossil fuel-based. Education and outreach should include workforce training on the installation and use of wood in buildings and infrastructure.

Advance Livestock Management Strategies

The highest level of agricultural emissions, primarily methane and secondarily N₂O, is attributed to livestock. Enteric fermentation from dairy and other livestock farms represents approximately two-thirds of agricultural methane emissions with manure management making up the balance. Therefore, the following strategies contribute to the deepest reductions in agricultural emissions, addressing methane reduction through manure management practices and precision animal feeding. Alternative manure management strategies rely heavily on the advancement of current programs led by the AGM, SWCC, NYSERDA, and county SWCDs. Precision feed, forage, and herd management strategies rely mainly on increased training and support to the farm community by Cornell CALS, CCE, nutritionists, and feed industry professionals; expanded use of monitoring and decision tools; and continued and enhanced research and development of feed supplements and additives for further methane reductions.

AF8. Advance Alternative Manure Management

The storage of manure is an important practice to facilitate nutrient management, reducing the need for synthetic fertilizers and mitigating runoff for the improvement of water quality. However, the treatment and storage of livestock manure can produce methane through the anerobic decomposition of the manure. Manure storages have caused the single highest increase in agricultural emissions from the 1990 baseline

year to today.²⁸² Mitigation of this source of emissions ranges from technically feasible to challenging depending on the use of available strategies and technologies or through more innovative and advanced manure management system approaches. Manure methane reductions require an evaluation of new processes, technologies, and costs; overcoming storage retrofit and livestock bedding challenges; operating and maintaining systems for methane prevention or optimal capture and destruction to minimize methane loss and leakage; filling gaps in applied research as well as in-field leak monitoring processes; balancing nutrients and methane inputs with increases in imported organic waste processing; and improving quantification and verification of outcomes.

This strategy can reduce methane emissions by implementing practice systems specifically planned and designed for each farm, including but not limited to cover and methane capture systems, anaerobic digester systems, composting, and other innovative systems that collect, capture, and destroy methane from manure storages or prevent methane production through alternative manure management practice systems. This strategy can also lead to creation of a renewable, alternative fuel to self-supply farm energy needs. The on-site use of biogas captured from manure management, where feasible and practical, is preferred before refinement of biogas into renewable natural gas (RNG) for on-site use and with emphasis placed on non-combustion applications such as use in fuel cells. The limited supply of biogas or RNG should be targeted to strategic uses such as locations where it can provide electric system capacity for buildings and transportation electrification by alleviating system constraints. Infrastructure needs for biogas or RNG from manure management should be consistent with the framework outlined in *Chapter 18. Gas System Transition*.

Air quality, health, and GHG benefits should be identified before implementation, including requirements to avoid localized pollution in Disadvantaged Communities. Specific components of this strategy, which include utilizing existing State programs and planning tools through AGM and the SWCC, can begin implementation immediately and can scale with additional resources dedicated to these programs. Through six rounds of funding, the CRF program has awarded \$6.2 million for manure storage cover and methane capture systems, assisting 20 farms. While resources for this program have increased over the last seven years, increases in both public and private investment and outreach will be needed to have a greater impact on methane reductions. Longer timeframes will be required for other components relating to landowner and farmworker education, outreach, research, and market connections with NYSERDA and

²⁸² Wightman, J.L., and P.B. Woodbury. 2016. "New York Dairy Manure Management Greenhouse Gas Emissions and Mitigation Costs (1992–2022)." *Journal of Environmental Quality* 45: 266-275.

SWCDs as key partners. These strategies rely on the New York AEM Framework and strong incentives to implement alternative manure management systems.

The CJWG favors imposing regulations on dairy and other livestock farmers to reduce emissions. The strategies described below rely more heavily on long established technical assistance and cost-share programs to achieve methane reductions from manure management. Feedback from the CJWG indicates a preference for manure management strategies upstream of the manure storage or that reduce animal waste generation at its source.

Components of the Strategy

- **Expand funding for current programs:** AGM and SWCC should continue to significantly expand CRF program funding to assist farmers in implementing alternative manure management practice systems that reduce methane emissions.
- **Expand private sector and NGO partnerships:** AGM and SWCC should collaborate with NGOs and private industry partners such as the U.S. Dairy Net Zero Initiative and dairy cooperatives who are currently doing essential work to reduce emissions in the dairy sector to combine resources and expand outreach.
- **Expand farmer access:** AGM and SWCC should increase farmer access to technical and financial assistance. This should prioritize historically unrepresented farmers and beginning farmers. Specifically, continue developing outreach strategies, gathering information, and gaining understanding of the experiences of historically unrepresented and beginning farmers.
- **Strengthen program policies:** AGM and SWCC should refine current grant program policies to encourage manure management systems funded through State programs to incorporate methane prevention or mitigation strategies, including, site specific strategies that minimize methane emissions, and retrofit capacity for existing anaerobic storages.
- **Expand SWCD capacity:** The State should expand capacity of SWCDs and partners to aid on-farm implementation of GHG emissions reduction and sequestration management practices.
- **Expand technical assistance:** AGM, along with stakeholders, should increase technical assistance and engineering capacity for feasibility assessment, planning, design, operation, maintenance, and monitoring of alternative manure management systems.
- **Expand training:** AGM and SWCDs should expand training to technical service providers and farm staff to design, build, operate, and maintain alternative manure management systems.

- **Develop new funding opportunities:** AGM should develop a State-funded loan guarantee program to stimulate investment in alternative manure management systems.
- **Expand purchasing opportunities:** AGM and SWCC should explore the development of bulk buying programs to reduce core material and equipment costs (such as cover and methane capture systems, separators, standardized controls, and other components), similar to the solar industry and energy-efficient heating programs.
- **Advance energy production:** NYSERDA, along with AGM, should expand support for the advancement of energy production and methane mitigation following a full life cycle analysis, including measurement and abatement of methane leakage, consideration for avoided emissions, and future innovations based upon the recommendations from the biomass action plan. Programs that incentivize anaerobic digestion should require systems be built (or retrofit) for maximum methane mitigation to ensure development of well-managed, low emissions biogas or RNG production such as utilizing emissions minimizing technologies and techniques, minimizing fossil fuel use in biogas or RNG production, minimizing emissions from biosolids/digestate, and consideration of a regulatory framework to ensure best practices.
- **Minimize fugitive methane and co-pollutant emissions from energy production:** AGM and NYSERDA should develop and apply standards for leak detection and repair from energy production systems. These standards will also include monitoring to guide management to minimize losses and optimize GHG emissions reduction benefit. DEC should use permitting, monitoring, and enforcement to limit methane and co-pollutant emissions from energy production such as anaerobic digesters.
- **Align market opportunities:** AGM and NYSERDA should align manure management systems designed for energy production, organic waste management, and methane mitigation with markets and private-sector investments (e.g., clean transportation standard, industry net zero initiatives, and others). NYSERDA and DPS, along with utilities and energy market participants, should identify energy pricing models and conduct a market-based study for waste-generated biogas.
- **Make market connections:** AGM and NYSERDA should improve connections and markets between farms with alternative manure management systems and other businesses able to supply organic co-products or use products generated by such on-farm systems (such as electricity, heat, gas, and organic soil amendments).
- **Support research and outreach:** AGM should implement long-term funding support for alternative manure management applied research and outreach, including evaluation of new processes, technologies, and GHG quantification and verification methodology for manure

management systems, quantification of methane leakage and detection, processes for realizing additional value from manure, and analyses for strategic development/siting of methane mitigating manure and organic waste management systems. Research efforts should also seek to improve estimates of methane emissions from anaerobic digestion and methods to reduce or eliminate these emissions.

AF9. Advance Precision Feed, Forage, and Herd Management

Methane is produced as part of normal digestive process in animals, especially ruminants. During digestion, microbes present in the animal's digestive system ferment feed consumed by the animal. This microbial fermentation process, referred to as enteric fermentation, produces methane as a biproduct, which can be exhaled or eructed by the animal. Although methane from feed digestion represents the highest percentage of agricultural emissions, dairy and other livestock farms have improved feed efficiency, reducing methane emissions per unit of milk and other products since the 1990 baseline.²⁸³ Additionally, over time, New York dairy farmers have made significant strides in reducing the carbon footprint per hundred weight of milk through greater efficiencies in precision feed management, reducing enteric methane emissions from cow digestion.²⁸⁴

Deep reductions are required for New York agriculture to meet the Climate Act emission limits. Mitigation of methane emissions from enteric fermentation range from feasible to challenging from the implementation of precision feed, forage, and herd management through continued and enhanced training and support to the farm community to the expanded research and testing needs, of methane-reducing feed additives to determine long-term efficacy, safety, and scalability.

To reduce methane and N₂O emissions while achieving desired ruminant growth and lactation goals, this strategy requires the evaluation of new processes, technologies, costs, and returns; demands sustained adaptive management by farmers and advisors; flattening the learning curve by farmers, advisors, and the feed industry; filling gaps in applied research; and overcoming weather and market disruptions that can

²⁸³ Capper, J. L., and R. A. Cady. "The effects of improved performance in the United States dairy cattle industry on environmental impacts between 2007 and 2017." *Journal of Animal Science*, Volume 98, Issue 1, January 2020, skz291. <https://doi.org/10.1093/jas/skz291>;

Capper, J. L., R. A. Cady, and D. E. Bauman. 2009. The environmental impact of dairy production: 1944 compared with 2007. *J. Anim. Sci.* 87:2160–2167. doi:10.2527/jas.2009-1781;

Wightman, J.L. and P.B. Woodbury. 2016. New York Dairy Manure Management Greenhouse Gas Emissions and Mitigation Costs (1992–2022). *Journal of Environmental Quality* 45: 266-275.

²⁸⁴ Ibid.

lower performance (producing lower quality forage). This strategy acknowledges that additional methane emission reduction may be realized from feed additives developed in the future and supports research to evaluate their potential. Research in combination with incentives may lead to substantial reductions in emissions. Some components of this strategy that include utilizing existing programs and planning tools can begin implementation immediately and be scaled up with additional resources dedicated to them. Longer timeframes will be required for other components relating to applied research and market development of feed additives with Cornell CALS and CCE as key partners for implementation.

Components of the Strategy

- **Expand precision feed and forage education:** AGM should work with partners such as Cornell CALS to expand outreach and education of precision feed and forage management to more ruminant livestock farmers, nutritionists, and feed industry professionals. Other stakeholders essential to this effort include milk cooperatives and processors.
- **Expand access to monitoring tools:** AGM should work Cornell CALS to expand access to precision feed and forage management monitoring and decision tools (such as the Cornell Net Carbohydrates and Proteins System) applicable to a range of farm conditions and management. Farm use of the methane module within Cornell’s system should be increased and statewide benchmarks should be developed to gauge improvement overtime.
- **Support research and outreach:** AGM and SWCC should implement long-term funding support for precision feed, forage, and herd management basic and applied research and outreach, including research for methane mitigating feed additives and outreach, training, and other forms of assistance to nutritionists and industry professionals regarding GHG reductions through feed management.
- **Expand SWCD capacity:** The State should expand capacity of SWCDs and partners to aid on farm implementation of precision feed and forage management practices.
- **Establish co-product markets:** DEC should explore establishment of a co-product market for food “wastes” supplied from food processors, retailers, or institutions for best uses, including as livestock feed.
- **Invest in science-based herd management:** AGM should work with partners such as Cornell CALS to develop a science-based strategy focused on improving herd management decision-making, which positively impacts cow efficiency to reduce GHG emissions while optimizing milk yield and return on investment.

- **Facilitate technical assistance:** AGM should facilitate technical assistance to improve access to programs, planning and monitoring tools, and financial assistance for on-farm implementation of precision feed-forage and herd management practices.

Improve Soil Health, Nutrient Management, and Agroforestry

Healthy soils and nutrient management provide for many functions and ecosystem services including sustaining the biological activity and diversity of the soil, water quality protection, nutrient cycling, and carbon sequestration. Practices that improve soil health help to buffer many of the impacts of climate change also increasing a farm's resiliency. The following strategies focus on N₂O reduction and increasing carbon sequestration.

N₂O makes up approximately 9% of all agricultural GHG emissions in New York. Improving nitrogen fertilizer and manure management is an effective GHG emissions reduction strategy that also provides other environmental and economic benefits. Efficient use of nitrogen fertilizer and manure can reduce N₂O emissions from cropland, improve water quality, and save the farmer money.

Improving soil health can increase soil organic matter to sequester carbon as well as maintain and enhance soil structure to increase water infiltration reducing drought stress; decreased runoff after heavy storms leads to better water quality; proper uptake of nutrients by plants reduces excess nutrients entering waterbodies; and maintaining or potentially increasing crop yields promotes food security. Existing soil health and water quality initiatives can be utilized to include GHG mitigation, taking a comprehensive approach to meeting multiple State environmental management goals.

Agroforestry practices systems that add trees into areas of agricultural production have the potential to elevate local food production and resiliency; improve water and air quality; provide storm and flood mitigation increase drought resiliency; provide habitat, scenic vistas, and agritourism; and increase economic development and jobs. Some emission and sequestration strategies are long-term approaches. It can take decades to develop additional tree cover and years to build soil carbon.

Although this chapter does not address fossil fuel emissions directly, advancing nutrient management and soil health management practice systems can reduce the number of farm equipment passes thus reducing the amount of fossil fuel use and fuel cost to farmers.

These strategies rely mainly on the continuation and expansion of current State efforts with implementation beginning immediately. Leads for these strategies include AGM, SWCC, DEC, SWCDs, Cornell CALS and CCE. Other key stakeholders include but are not limited to American Farmland Trust, land trusts, the Nature Conservancy, the Farm Bureau, and the fertilizer industry.

AF10. Advance Agricultural Nutrient Management

Farmers in New York have improved nutrient management on lands while increasing crop yields. Comparatively, N₂O emissions from farms in New York are lower than in many other agricultural systems nationally and globally, making this mitigation strategy relatively easy to implement. However, continued emission reductions, including improved measurement of existing and future efforts, require comprehensive training in the use of nutrient management tools and in some cases new equipment and data collection. Further, extreme precipitation driven by climate change can aggravate nutrient loss from farm fields. As a result, implementation of this strategy requires sustained, adaptive management by farms and crop advisors.

Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments is the continual process of nutrient management. Farms across New York will continue to reduce N₂O emissions and nitrogen pollution to waterways while achieving desired yield and quality through continued and expanded nutrient management planning and implementation on crop fields, hay fields, pastures, orchards, vineyards, and other agricultural lands receiving nutrients. Agricultural productivity and food security are important drivers for climate policy. Nutrient management monitoring and tracking programs, like those led by Cornell's Nutrient Management Spear Program,²⁸⁵ have aided farms to decrease nitrogen and phosphorus imports resulting in lower losses to the environment. Dairy and crop farmers will need additional applied research and aid to deploy effective tools to reduce GHG emissions on crop lands from fertilizer use. The CJWG is supportive of efforts to reduce N₂O emissions through more efficient use of nitrogen fertilizers and has suggested consideration of a fee on such fertilizers as a potential mechanism to reduce their use. Fossil fuel prices and factors impacting global commerce drive fertilizer prices, and increases in fertilizer costs for farmers often result in expanded

²⁸⁵ Cornell University's Nutrient Management Spear Program works to conduct applied, field and laboratory-based research, facilitate technology and knowledge transfer, and aid in the on-farm implementation of beneficial strategies for field crop nutrient management, including timely application of organic and inorganic nutrient sources to improve profitability and competitiveness of New York State farms while protecting the environment. Accessed at <http://nmsp.cals.cornell.edu/NYOnFarmResearchPartnership/DairySustainabilityIndicators.html>.

utilization of manure and nutrient management.²⁸⁶ Introducing a fee on top of unstable fertilizer prices could place undue burden on farmers who are already facing thin margins.²⁸⁷ A fertilizer fee structure could reduce New York’s food security and cause emission leakage if farms struggle to remain viable or are unable to operate.

Components of the Strategy

- **Expand funding and technical assistance:** AGM and SWCC should increase support for planning, technical assistance, and soil health or nutrient management practice implementation through the AEM Framework and associated programs, including the CRF and Agricultural Nonpoint Source Abatement and Control (AgNPS) water quality program. This should include funding to quantify climate and co-benefits related to farm-level GHG emission accounting and reduction strategies.
- **Engage with and expand program participants:** AGM, SWCC, and SWCDs should seek feedback from historically unrepresented and beginning farmers who are not currently engaged in practices and programs to remove obstacles for participation (such as holding focus groups, surveys, and farm-to-farm education).
- **Expand cost-share eligibility for historically unrepresented farmers and capital-intensive equipment:** AGM and SWCC should expand cost-share eligibility for equipment needed by farms to implement more advanced soil health and nutrient management practices. Emphasis should be on improved access to technical and financial support for historically unrepresented and beginning farmers.
- **Expand SWCD capacity:** New York should expand capacity of SWCDs and partners to aid on-farm implementation of GHG emissions reduction and sequestration management practices.
- **Enhance workforce training:** AGM and SWCC should continue and enhance training for technical assistance providers, agricultural planners, farmers, and farm workers.

²⁸⁶ Schnitkey, G., N. Paulson, C. Zulauf, K. Swanson and J. Baltz. September 27, 2022. “Fertilizer Prices, Rates, and Costs for 2023.” *farmdoc daily* (12):148, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign.

²⁸⁷ Outlaw, J. L., H. L. Bryant, J. M. Raulston, G. M. Knapek, B. K. Herbst, and B. L. Fischer. “Economic Impact of Higher Fertilizer Prices on AFPC’s Representative Crop Farms.” Agricultural and Food Policy Center, Texas A&M University, College Station, Texas. *AFPC Briefing Paper 22-01*, January 2022. Available at <https://afpc.tamu.edu/research/publications/files/711/BP-22-01-Fertilizer.pdf>

- **Support implementation services:** AGM and SWCC should support expanding capacity of custom farming service providers to aid on-farm implementation of nutrient management practices.
- **Increase use of existing tools:** AGM should work with partners such as Cornell CALS, CCE, and others to increase the use of improved methods of monitoring performance via crop yield measurement, nitrogen use efficiency, and Whole Farm Nutrient Mass Balances (for farm-wide nitrogen management). These benefits of nutrient management should be documented and shared with farmers, policymakers, and the public.
- **Collaborate with industry led initiatives:** AGM and partners should collaborate with industry led nutrient management initiatives and services, such as the 4R Nutrient Stewardship Program.²⁸⁸ They should also initiate and expand nitrogen efficiency and yield crop contests for peer-to-peer competition and informational opportunities.
- **Increase funding for applied research:** AGM should implement long-term funding support for nutrient management applied research and outreach (such as management approaches and technology).
- **Increase outreach:** The State should increase outreach to all farmers with the research and technical standards used in New York. The State should also increase outreach to consumers on the benefits of nutrient management, such as water quality improvements.

AF11. Adopt Soil Health Practice Systems

This strategy focuses on reducing net GHG emissions as well as increasing carbon sequestration and other environmental benefits through adoption of soil health management practice systems (such as combinations of cover and double crops, conservation crop rotations, perennial crops, prescribed grazing, and nutrient management), also referred to as regenerative agricultural practices. Implementing soil health management practice systems can also have the added benefit of reducing nitrogen fertilizer inputs, reducing operating costs, and improving a farm's financial viability associated with the impact of extreme weather events caused by climate change. New York's CRF program, launched as a pilot in 2015 to address climate change on farms, to date has awarded \$20 million in project funding. Integrated into the AEM planning framework and modeled after the AgNPS grant program, the CRF program demonstrates

²⁸⁸ 4R Nutrient Stewardship provides a framework to achieve cropping system goals to incorporate the Right fertilizer source at the Right rate, at the Right time and in the Right place. New York State Agribusiness Association. Accessed at <https://www.nysaba.com/4r-ny>.

how climate-responsive efforts can be integrated alongside existing environmental and water quality agricultural programming.

The State's AEM framework provides cost-share funding and technical assistance for GHG emissions reduction activities for the practices described in the paragraph above, as well as other soil health management practices. Increasing funding opportunities for existing efforts such as the CRF program and enhancing technical assistance provided through County SWCDs will result in a higher rate of implementation and provide a familiar process to farmers within an infrastructure that already exists. CRF has awarded projects through six rounds of funding that are estimated to reduce emissions on farms by 370,000 metric tons of CO₂e. A significant amount of funding will be necessary to make further impacts on emission reductions.

The CJWG supports soil health and climate resiliency and emphasizes removing barriers for historically unrepresented farmers, which aligns with the components of this strategy.

Components of Strategy

- **Expand funding for current programs:** AGM and SWCC should increase financial support for currently available and implemented practices. This includes expanded funding for CRF, AEM Base, AgNPS, increased payment rates, increased access, building equity into programs, reducing barriers that limit access in applications, increased technical assistance, encouraging adoption of a system of practices, developing a soil health standard, and establishing an annual goal for common practices. This should also include increasing awareness and support for urban soils and agriculture.
- **Engage with and expand program participants:** AGM and SWCC should seek feedback from groups/communities not currently engaged in practices and programs (such as holding focus groups, surveys, farm-to-farm educational events and addressing urban soils and urban agricultural operations). Improving access reflects the need to ensure that all farmers can take part in these practices and programs.
- **Increase adoption of soil health practices on rented lands:** AGM should increase practice adoption on rented and leased land. AGM should seek feedback regarding support needed for farmers not currently engaged in practices and programs and engage, educate, and incentivize landowners to increase adoption of practices on land they rent to farmers.
- **Expand capacity of SWCDs:** The State should expand capacity of SWCDs and partners to aid on farm implementation of GHG reduction and sequestration management practices.

- **Increase perennial plant systems:** AGM and SWCC should support converting annual cropland to perennial hay land/pasture and forests where appropriate (such as steep slopes and highly erodible lands). This is a current effort supported through the State’s AgNPS and CRF programs. Research and trials should continue to determine the efficacy of perennial grains systems in New York State.
- **Increase integrated planning efforts:** AGM and SWCDs should conduct comprehensive on-farm planning to include carbon sequestration goals, GHG emission, nutrient management, water quality, and soil health.
- **Increase use of precision and digital agricultural tools:** AGM should support continued development and implementation of precision/digital agricultural tools and sustainable intensification, which is the sustainable increase in yields on current cropland to reduce stress on marginal cropland to support this mitigation strategy.
- **Develop tools for quantification of benefits:** AGM, SWCC, and partners such as Cornell CALS should develop tools for verification of benefits and invest in remote sensing to quantify adoption of practices and environmental benefits.
- **Support research for monitoring and verification:** AGM, SWCC, and partners such as Cornell CALS should establish and maintain a comprehensive RD&D strategy for monitoring and verification of soil health that address additionality and permanence to support State climate goals and enable federal and private funding of GHG emissions mitigation practices.
- **Support research for new innovative practices:** AGM and partners such as Cornell CALS should establish and maintain a comprehensive research strategy in soil health to bring new practices and approaches (such as enhanced rock weathering and biochar) that increase sequestration rates, productivity, other environmental benefits, and scale for adoption.
- **Develop a business case for practices:** The State should identify practice systems that can generate revenue and/or added value to the farm, as well as identify a variety of public and private funding sources.
- **Educate consumers:** AGM should make efforts visible to the public through outreach campaigns making information more available, expand regenerative agricultural practices in marketing programs (such as New York Grown & Certified), and improve information provided to the public to help customers understand the practices involved in products they purchase.
- **Educate farmers and farmworkers:** AGM, SWCC, and SWCDs should expand education and outreach to include all farmers and farmworkers and to support practice adoption and encourage coupling of practices into systems for maximum benefit. They should support farm-to-farm and peer-to-peer networking to elevate long-term adoption of soil health management practice

systems (such as through local farmer discussion groups). Collaboration with private industry and NGOs such as cooperatives will also be beneficial to support both farmer and consumer education.

- **Educate students:** AGM, SWCC, SWCDs, and partners such as Cornell CALS and CCE should support agricultural and soil health instruction in schools and connect students with farms and farmers and the knowledge of the ecological benefit of healthy soils.

AF12. Increase Adoption of Agroforestry

Adding trees into areas of agricultural production increases carbon sequestration and other environmental benefits. Some examples of these production and conservation practices exist in New York. Current programs, technical services, and support should be leveraged to increase agroforestry adoption while new programs, increased investment in technical support, and capacity will be necessary. Challenges and barriers to wider adoption exist and must be overcome, including addressing the upfront costs to practice adoption; addressing land access and transfer issues/opportunities; filling gaps in research field trials, pilot projects, and market analysis in agroforestry systems; and addressing long-term management and maintenance needs and availability of appropriate tree species and survivability.

Agroforestry adoption can contribute toward afforestation and reforestation goals, hence having a high GHG emissions mitigation potential. Implementation leads for this strategy include AGM, SWCC, Cornell CALS, SWCDs, and CCE. Other key stakeholders include American Farmland Trust, land trusts, The Nature Conservancy, New York Farm Bureau, and other farm-led organizations. The CJWG supports aiding historically unrepresented farmers in opportunities for securing farmland, aligning with strategies for long-term farm leases and land transfers necessary for perennial systems.

Components of Strategy

- **Increase adoption of practices:** AGM and SWCC should expand the CRF program to incentivize agroforestry and set acreage targets for priority practices.
- **Increase riparian buffers:** AGM and SWCC should continue to emphasize forested buffers through the State's AgNPS and Source Water Buffer Program, DEC's Trees for Tributaries Program, and the USDA Conservation Reserve Program/Conservation Reserve Enhancement Program.
- **Increase silvopasturing:** AGM, SWCC, DEC, SWCDs, and CCE should expand programs that plan, design, and implement silvopasture systems. Silvopasture systems integrate trees, livestock, and forage in intensively managed rotational grazing systems with a focus on proper site and

species selection for adding trees to ensure appropriate and responsible implementation of silvopasture systems.

- **Expand funding for existing programs:** DEC should expand the Trees for Tributaries Program, the Non-Agricultural NPS Program, and Division of Fish and Wildlife Programs.
- **Advance alley cropping practices:** AGM, SWCC, SWCDs, and partners such as Cornell CALS, SUNY ESF, and CCE should conduct field trials and pilot projects and expand landowner and farmworker education and technical assistance for alley cropping.
- **Increase SWCD capacity:** The State should expand capacity of SWCDs and partners to aid on-farm implementation of GHG emissions reduction and sequestration management practices.
- **Expand education and technical assistance:** AGM, along with partners such as Cornell CALS, CCE, SWCDs, should expand education and technical assistance for agroforestry practices for beginning farmers and farmers experiencing or planning for generational transfer. Long-term planning is required for perennial systems.
- **Support long-term agricultural land transfers:** AGM, American Farmland Trust, and land trusts should assist farmers in securing long-term leasing and farm transfer to historically unrepresented and beginning farmers; long-term leases are required for long-term perennial systems.
- **Support business planning and market development:** AGM and SWCC should assist farmers with business planning and modeling for value-added practices in agroforestry. They should assist to expand supply chain development for new products in agroforestry.
- **Conduct outreach to financial lenders:** AGM should work with partners such as CCE and Cornell CALS to conduct outreach on the environmental and potential economic benefits of agroforestry systems to financial lenders and insurance providers.
- **Collaborate with federal partners:** The State should collaborate with federal partners to better align federal and State policy priorities.

AF13. Develop Agricultural Environmental Management Planning for Climate Mitigation and Adaptation

New York's AEM framework, overseen by the AGM and the SWCC and locally led and implemented by county SWCDs, will continue to enable farmers to reduce GHG emissions and increase sequestration in soils and forests through site-specific practices on lands under their management. As climate change-driven extreme weather impacts both farmland and watersheds across the state, AEM planning for climate mitigation and adaptation will improve water quality downstream by prescribing BMP systems that lead to a higher level of farmland resiliency.

AEM planning for climate mitigation and adaptation or the development of “Carbon Farm” Planning has the potential when implemented to elevate local food production and resiliency, water quality, air quality, storm and flood mitigation, public infrastructure protection, drought resiliency, habitat, scenic vistas, tourism, economic development, and jobs. A suite of technical assistance and planning resources should be developed through the AEM framework on farm and forest GHG mitigation and carbon sequestration opportunities, allowing for further planning and implementation of regenerative agricultural practices. This strategy is essential to the successful planning and implementation of practice systems that are tailored farm-by-farm for the reduction of GHG emissions, increased carbon sequestration potential, and elevated adaptation and resiliency on farmland. AEM planning resources should continue to be designed and made available in ways that are accessible and applicable to all farmers.

Components of the Strategy

- **Develop carbon farm planning protocols:** AGM and SWCC should develop planning protocols for Carbon Farm Planning by identifying gaps for future development, striving for compatibility among State and federal programs, and designing methods for collection and aggregation of outcomes from planned and implemented practice systems (such as estimates for GHG emissions, sequestration, and metrics for adaptation).
- **Pilot carbon farm planning:** AGM, SWCC, and SWCDs should conduct on-farm piloting of Carbon Farm Plans.
- **Conduct outreach and education:** AGM, SWCC, and SWCDs should provide communication of AEM Planning for climate mitigation and adaptation with farmers (such as case studies, learning from pilot farmers, training on farmer developed planning protocols/tools, and others).
- **Integrate carbon farming with existing programs:** AGM should include planning protocols in AEM Base Programs and compatibility with federal programs. Priority practice systems from plans will lead to implementation of practices that reduce emissions and increase adaptation and resiliency, thereby reducing soil and nutrient losses to the watersheds. BMP systems will be implemented through direct investment by farmers, other private investors/lenders, as well as State and federal cost-share programs.

AF14. Monitor and Benchmark Agricultural Greenhouse Gas Emissions

Annual monitoring and benchmarking of GHG emissions mitigation, carbon sequestration, and adaptation performance across applicable areas of management on farms in New York is critical to determining success in meeting targets and providing further insight into what strategies lead to the greatest achievements. Information products provide useful, farm-level data for confidential benchmarking by

farmers as well as publicly available data through farm case studies (with farmer agreement) and aggregated datasets (at the State level, rather than the farm level) to support future policy, research, and implementation. Like the farm-level AEM planning strategy, this strategy is central to the success of all other agricultural mitigation efforts.

Components of the Strategy

- **Establish funding:** AGM and DEC should establish funding for an agricultural benchmarking and monitoring program for GHG emissions. This should be a partnership effort among groups such as Cornell CALS, CCE, SWCDs, farmer groups, and agricultural industry groups.
- **Monitoring and benchmarking:** AGM should develop methods for monitoring and benchmarking (including program staff and advisory committee). Benchmarking at the farm level for farmer use should be based on comparisons with the farm's historical performance as well as the performance of similar types of farms (each kept anonymous). Benchmarking should also occur at the county and State level with aggregated, anonymous data based on comparisons with our historical performance.
- **Outreach:** AGM and SWCC should introduce monitoring and benchmarking program with farmers and farm advisors.
- **Make data available:** AGM should deliver data summaries of BMP implementation and associated estimates of GHG mitigation or sequestration levels for confidential farm-scale use and aggregated summaries for public use. Additional key performance metrics would be developed by the advisory committee/expert panel.

AF15. Establish a Payment for Ecosystem Services Program

Currently, farmers and forest landowners do not capture direct financial benefits from generating ecosystem services through their existing land management techniques. Agricultural and forested lands implementing conservation BMPs provide countless environmental benefits for surrounding communities including improved water quality, climate mitigation, carbon sequestration, increased biodiversity, and pollinator services. Establishing a payment for ecosystem services mechanism to provide a new structure for establishing and maintaining practice systems that reduce GHG emissions and sequester carbon in addition to providing other environmental benefits would provide additional incentives to farmers and forest landowners. A payment for ecosystem services program can be designed through existing programs and frameworks to address multiple services and evolve with changing needs and priorities of the State. This strategy supports the implementation of other strategies in this sector that rely on increased adoption of regenerative agricultural practices.

Components of the Strategy

- **Dedicate funding:** AGM and DEC should establish funding for a payment for ecosystem services program to be developed for agricultural producers and forest landowners.
- **Develop and design program:** AGM, SWCC, and DEC should research and design a payment for ecosystem services approach that will sustain our natural capital; provide ecosystem services of water quality, flood resilience, and climate stability; and include fair compensation for program participants.
- **Conduct outreach:** AGM, SWCC, and DEC should conduct education and outreach regarding payment for ecosystem services program and benefits to local communities.
- **Pilot payment for ecosystem services program:** AGM, SWCC, and DEC should pilot a payment for ecosystem services program for agricultural producers and forest landowners to ensure continued implementation of practices or actions that lead to increased ecosystem services.

AF16. Bolster Local Agricultural Economies

This strategy supports emission reductions by enhancing existing programs, and promoting the expansion of those programs, that encourage farm viability and resilient communities through the production and consumption of local food. Climate impacts, as well as COVID-19 impacts, have shown an elevated importance in the need for food security. This strategy is designed to enhance the expansion of markets and support for New York’s farming community. This strategy will help to enhance viability of New York’s diverse agricultural enterprises. To realize the full goals of our mitigation and sequestration strategies, the economic solvency of the agricultural community must be addressed. Much of this strategy relies on bolstering existing programs and initiatives. Implementation of these strategies are ongoing and will be scaled with increasing resources made available. AGM, OGS, ESD, and CCE are implementation leads and main partners in this strategy. This strategy speaks directly to the support of diverse farm operations including historically unrepresented and beginning farmers.

Components of the Strategy

- **Expand procurement programs for New York products:** AGM, OGS, and ESD should expand existing programs in the State that support local procurement of New York agricultural products (such as the Fresh Connect Checks Program, Farmers Market Nutrition Program, Farm-to-School, and Nourish NY).

- **Increase engagement and participation in State programs:** AGM, New York State Council on Hunger and Food Policy, and ESD should engage with communities and producers to advertise these opportunities.
- **Expand education and outreach for new farmers:** AGM should work with partners such as CCE to expand education and technical assistance for beginning farmers and generational transfer. They should assist farmers with business planning and modeling.
- **Support new agricultural products:** The State, led by AGM, should help expand supply chain development for new agricultural products in New York such as agroforestry and perennial plant system products.

Promote a Climate-Focused Bioeconomy

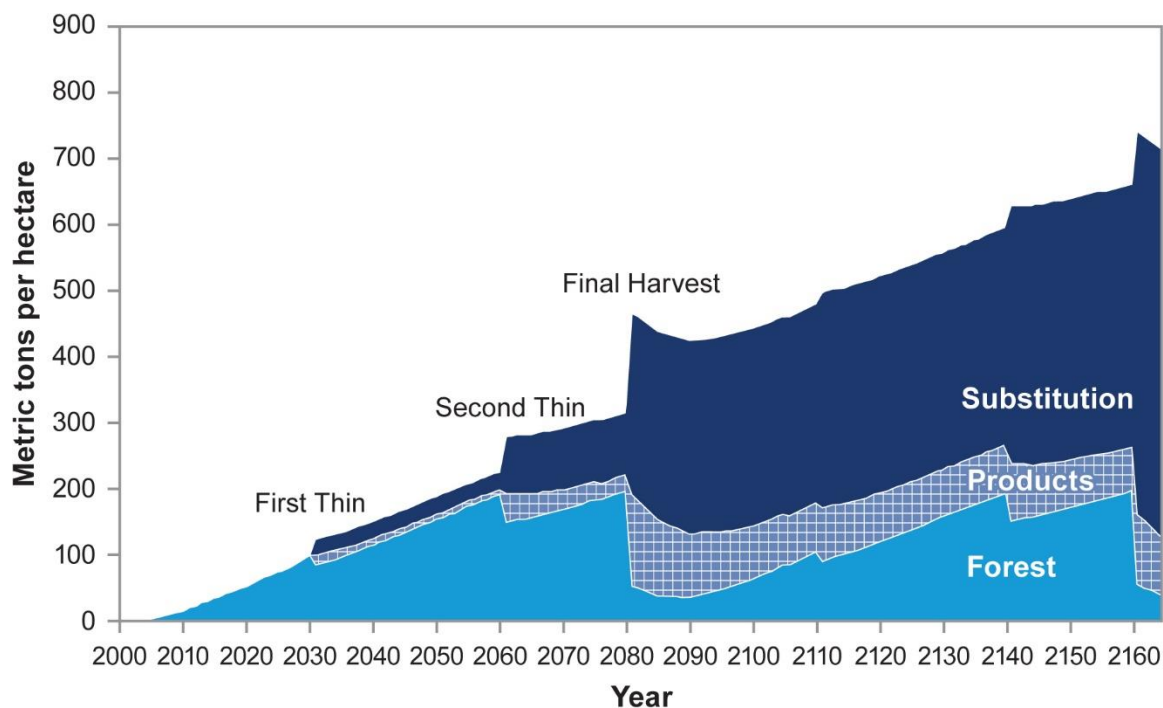
The bioeconomy produces sustainable, renewable bio-based feedstocks, rather than fossil fuel-based feedstocks, to produce products that achieve the climate and social justice requirements of the Climate Act. New York’s forest product industry produces a diverse range of products and jobs. New York’s forests and wood products industries are directly responsible for nearly 40,000 well-paying jobs and more than \$13 billion of economic output and are indirectly responsible for another 53,000 jobs and nearly \$10 billion of economic activity.²⁸⁹ In addition, there is an opportunity for enhanced carbon storage as long-term, durable wood products store carbon. Furthermore, substitution of wood products for fossil fuel-based and fossil fuel-intensive products displaces GHG emissions, such as in housing construction (see Figure 27).²⁹⁰

However, there has been a decline in the number and diversity of primary wood products manufactured in New York directly from logs such as veneer, pallets, and boards over the last two decades, which has limited management options for forest landowners. To expand the wood products industry to store more carbon and facilitate sustainable forest management, additional wood product markets, further use of wood feedstock and residues, and more training is needed in these industries.

²⁸⁹ New York State Department of Environmental Conservation. 2020. “New York State Forest Action Plan.” Albany. 144p. Accessed at https://www.dec.ny.gov/docs/lands_forests_pdf/nysfap.pdf.

²⁹⁰ Perez-Garcia, J., B. Lippke, J. Connick, and C. Manriquez. 2005. “An assessment of carbon pools, storage, and wood products market substitution using life-cycle analysis results.” *Wood and Fiber Science* 37: 140–148.

Figure 27. Carbon in Forests, Wood Products, and Concrete Substitution Benefits



Adapted from: Perez-Garcia, J., B. Lippke, J. Connick, and C. Manriquez. 2005. An assessment of carbon pools, storage, and wood products market substitution using life-cycle analysis results. Wood and Fiber Science 37: 140–148.

AF17. Develop Forestry Training Programs to Support Expanding Workforce and Climate Knowledge

As additional efforts to create additional wood product markets and the expansion of afforestation, reforestation, and other forest management efforts to enhance the long-term storage of carbon increase, an expansion in New York’s forestry workforce will be needed. There needs to be information on forest carbon management and climate resilience incorporated into existing forestry trainings and education programs to help encourage such an expansion. In addition, training programs focused on carbon sequestration, carbon storage, wood product development, and other carbon and climate-related areas need to be developed and promoted within the forestry sector to meet ongoing new demands. Information presented by existing programs will need to be aligned based on BMPs.

Components of the Strategy

- **Support workforce development and training:** DEC should work with partners such as the WPDC to develop and support workforce development and training programs for the forest sector, including incorporating forest carbon management into curriculums at the high school (such as the Boards of Cooperative Education Services) and college level and supporting existing training apprenticeship programs for careers in forestry and the forest product supply chain.

- **Integrate forest carbon into education and outreach:** DEC should integrate and support forest carbon, forest carbon management, climate change, and climate resilience into existing forestry training and continuing education programs.
 - **Enhance cooperating consulting forester policy:** DEC should add a requirement for continuing education in forest carbon or forest carbon management to Cooperating Consulting Forest Policy, CP-36, and approve rigor and accountability of the program.
 - **Integrate forest carbon management:** DEC should integrate forest carbon and forest carbon management into urban forestry and utility forestry training programs.
 - **Bolster logger training:** DEC and New York Logger Training should bolster support for the Trained Logger Certification Program and implement new training modules including forest carbon BMPs into the Trained Logger Certification program, including increasing carbon sequestration.

- **Provide outreach and education:** SUNY ESF and Cornell CALS should provide outreach and education to the construction industry, architects, engineers, and the public on mass timber construction and use of harvested wood products (fire safety, high-rise applications). Education and outreach should include workforce training on the use and installation of wood in buildings and infrastructure.

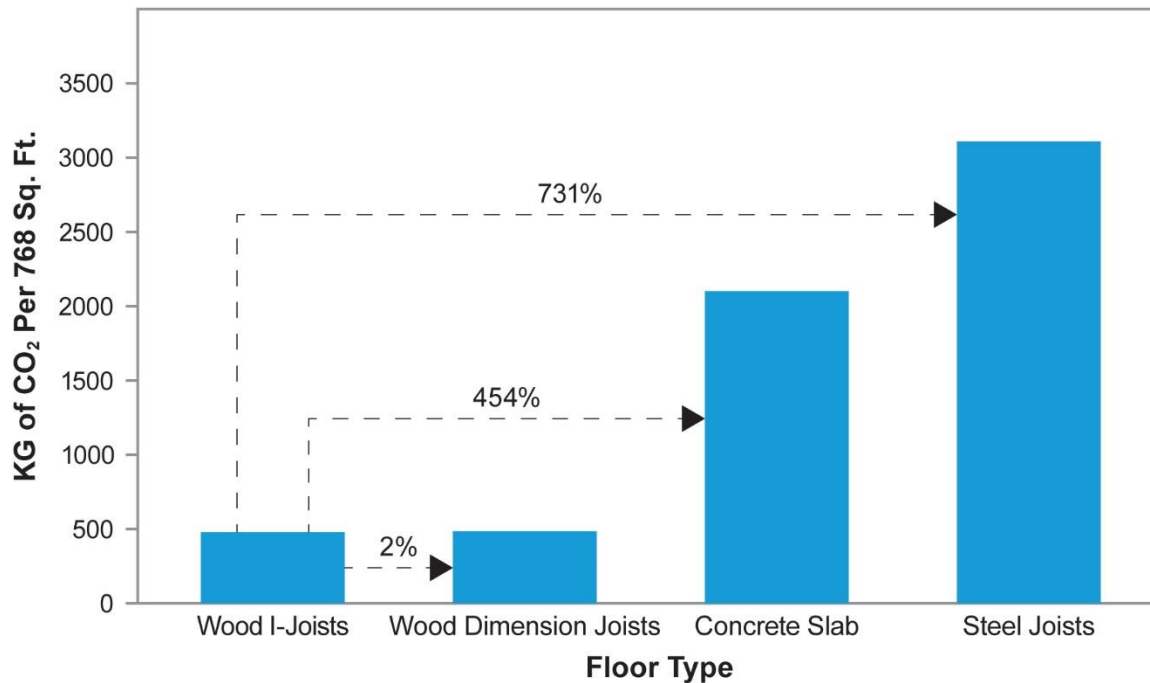
AF18. Expand Markets for Sustainably Harvested Wood Products

Use of durable, long-lasting wood products, especially as a substitute for fossil fuel-intensive products like steel, concrete, brick, or vinyl, can reduce overall emissions for construction projects. Use of long-lasting, durable wood products can reduce GHG emissions when they replace fossil fuel-based products, as illustrated in Figure 28.

These products reduce net building and infrastructure GHG emissions and provide long-duration carbon storage. Some of the components in this strategy relate closely to those presented in *Chapter 12. Buildings* (Strategy B11) and *Chapter 14. Industry* (Strategy I2).

In addition to substituting emissions for fossil fuel-intensive products, use of and markets for both high- and low-grade wood products benefits forest landowners and provides an economic driver for forest conservation, including to advance forest health and forest carbon sequestration. Execution of and carbon impacts from the strategy components listed below is expected to take five or more years, so implementation should begin as soon as possible to help reach long-term carbon sequestration goals.

Figure 28. GWP per Floor Component



Adapted from: Lippke, B., and L. Edmonds. 2006. Environmental performance improvements in residential construction: The impact of products, biofuels, and processes. Forest Products Journal 56(10):58–63.

Components of the Strategy

- **Promote carbon storing materials:** SUNY ESF, WPDC, ESD, and DEC should promote long-term, durable wood products that store carbon and are substitutes for energy efficiency materials that are fossil fuel-based (such as cellulosic fiber insulation and hemp insulation replacing foams and research potential on uses for residues from wood and hemp product creation). In general, more long-term durable products should be incentivized over production of shorter-term and shorter-lived products; however, the market for wood residues and low-grade wood should not be disincentivized to prevent the degradation of existing forests and to allow for improved forest management practices that enhance sequestration and climate resiliency.
- **Advance building code changes:** DOS and the New York City Department of Buildings should advance building code changes to adopt the International Code Council 2021 International Building Code.
- **Develop standards:** NYSERDA should work with SUNY ESF, Cornell CALS, and DEC to set standards and specifications for a minimum portion of harvested wood products, such as mass timber or wood flooring, in new construction in certain State-funded/supported buildings and infrastructure projects when New York’s supply chain can cost-effectively meet the demand.

- **Revise State procurement standards:** OGS, DEC, GreenNY, and DASNY should revise State procurement specifications that limit the eligibility of wood products that meet the technical performance standards and set minimum standards for use of wood products in new State-funded construction and infrastructure projects as feasible.
- **Remove barriers:** DOT, DEC, NYSERDA, PANYNJ, and EFC should remove barriers and create incentives for using wood for infrastructure applications, including bridges, sound barriers, transportation hubs, utility poles, marine and foundation pilings, retaining walls, solar energy infrastructure, docks, and piers.
- **Enhance supply chain:** NYSERDA, SUNY ESF, and Cornell CALS, with consultation from DEC, should enhance New York’s supply chain for harvested wood products and fund innovation to develop mass timber applications using northern hardwoods.
- **Support research:** NYSERDA, DEC, AGM, SUNY ESF, and Cornell CALS should support research and development demonstration, and technology transfer of wood utilization and wood innovations to scale the use and climate benefits of wood in the built environment.
- **Conduct research:** DEC should work with partners to conduct research on emerging forest products and markets related to bioeconomy and harvested wood product initiatives.

AF19. Develop a Sustainable Biomass Feedstock Action Plan for Bioenergy and Low-Carbon Products

As detailed in this Scoping Plan and modeled by the integration analysis, widespread and rapid electrification is necessary to achieve the emission limits. Opportunities exist to utilize bioenergy resources to meet strategic needs in order to more effectively advance this aggressive electrification trajectory. The selection of feedstock, production method and end use for bioenergy products create highly variable outcomes for GHG emissions reductions, co-pollutant emissions, and health and environmental impacts. Additional research is needed to identify bioenergy product pathways that contribute to achievement of the emissions limits by reducing GHG emissions and supporting the pace of electrification envisioned in this Scoping Plan.

A Sustainable Biomass Feedstock Action Plan will identify feedstock volumes and production methods that utilize New York biomass resources (wood and wood processing wastes, agricultural crops and waste materials, organics in municipal solid waste, animal manure, and wastewater treatment byproducts) in a sustainable, emissions-reducing and substitution-maximizing manner. The Sustainable Biomass Feedstock Action Plan will also consider other uses for these feedstocks, such as uses in low-carbon product development as described in Strategies AF20 and AF21. The Sustainable Biomass Feedstock

Action Plan should identify bioenergy and low-carbon product development pathways that demonstrate air quality and health benefits, including requirements to avoid localized pollution in Disadvantaged Communities.

The CJWG expressed concerns about the combustion of biomass and biofuels due to their release of emissions, which are presented in *Chapter 8. Public Health*. Biomass and biofuel emission concerns raised by the CJWG will be addressed through their limited application, sustainability guidelines, life cycle analyses, and standards presented in the components below. Where it applies, biomass and biofuel use should be further integrated into and detailed within the components presented in *Chapter 11. Transportation*, *Chapter 13. Electricity*, and *Chapter 16. Waste*. All research and development strategies should leverage federal resources.

Components of the Strategy

- **Develop sustainability guidelines:** NYSERDA, AGM, and DEC should establish rigorous energy, GHG, and environmental sustainability guidelines and metrics for bioenergy products using life cycle analyses. Sustainability guidelines should also include the analysis of potential air quality and health impacts of producing and utilizing bioenergy products and include best practices to minimize these impacts, especially for Disadvantaged Communities.
- **Define sustainable feedstocks:** NYSERDA should define sustainable feedstock production for bio-based processing to determine feedstock volume and practices that minimize total emissions as part of a biomass action plan. This should include an evaluation of cost-effectiveness and an assessment of activating former agricultural and underused lands (including former industrial lands) for more productive uses.
- **Incentivize residue feedstock use:** NYSERDA, AGM, and DEC should work with SUNY ESF and Cornell CALS to establish preferential pricing to prioritize use of feedstocks that are residues from existing agricultural, forest, and waste systems (e.g., low-grade wood, wood residues, waste materials, and processing wastes). Feedstocks and products with the lowest GHG emissions following life cycle GHG accounting and analysis should be prioritized for incentives. Further, the potential for negative or positive impacts on other economic sectors, such as waste management, should be considered.
- **Develop net zero energy systems:** NYSERDA and DPS should develop energy systems that can best support a net zero emissions economy in New York, including programs that leverage private capital to invest in conversion technology for bio-based feedstock into bio-based products.

- **Identify efficient bioenergy pathways:** NYSERDA should work with Cornell CALS and SUNY ESF to identify bioenergy pathways with high life cycle energy efficiency and high emissions reductions (from feedstock production, conversion, and delivery to the end user) that complement and support wide-scale electrification. NYSERDA and DEC should develop alternative fuel strategies for challenging to electrify applications.
- **Address hard to decarbonize fuel needs:** NYSERDA and DPS should work with SUNY ESF and Cornell CALS to identify 2050 hard-to-decarbonize fuel needs (such as high-quality distillate jet fuels) and potential bioenergy development (feedstock supply chain, conversion systems, and end use markets) to meet these needs. The State should continue to follow developments on the federal level and be positioned to capture opportunities related to these future needs.

AF20. Increase Market Access for New York Low-Carbon Products

In the emerging field of low-carbon products, agricultural and forest residues are converted into biochemicals and biomaterials that are replacements for the petrochemicals used to create packaging, cosmetics, binders, absorbents, concrete strengtheners, and other products. These substitutes for fossil fuel products and fossil fuel-based products can reduce overall GHG emissions. However, production capabilities for low-carbon products are lacking in the Northeast and additional defining, monitoring of markets, research, and education are needed for use and promotion of these products. These efforts are expected take many years to be fully implemented and monitoring and promotion would need to be ongoing. Some of the components in this strategy relate closely to those presented in *Chapter 14. Industry* (Strategy I2).

Components of the Strategy

- **Track low-carbon product market:** ESD and NYSERDA should begin tracking and reporting on this market to spot emerging trends, innovative applications, external market opportunities, growth opportunities to guide the development.
- **Incentivize innovation:** OGS should spur innovation through lead-by-example in low-carbon procurement requirements for State government (such as bio-based products and low-carbon concrete).
- **Identify substitutes that can be used now:** NYSERDA should commence a technology readiness level analysis of low-carbon substitutes for fossil fuel-based products and fuels and identify the high value products from bio-based processing of New York grown feedstocks and invest in production facilities.

- **Incentivize low-carbon products:** NYSERDA should provide strategic use of incentives to drive the scale-up of high-demand products when the low-carbon product alternative is not yet cost-competitive with the fossil fuel-based option.
- **Define standards for low-carbon products:** DFS, the NY Green Bank, and the GreenNY Council should develop standards and guidelines for defining a low-carbon product, including ensuring sustainable feedstock production as defined by the biomass action plan (see *AF19*).
- **Incentivize existing businesses:** NYSERDA, ESD, and DFS should expand access to low-interest loans or grants for existing New York State businesses to develop new low-carbon products lines by educating local banks on emerging biotechnologies and offering NY Green Bank loan guarantees.
- **Connect suppliers to corporations:** NYSERDA should create a low-carbon products portal to facilitate connecting New York producers to corporations and other buyers that have made GHG emissions reduction commitments. The State should expand the NY Grown program to cover more products and add a low-carbon aspect.
- **Expand agroforestry forest products:** AGM should help to expand production of high-value agroforestry products that contribute to maintaining healthy forests (sap/syrup production, nuts, mushroom cultivation, and ginseng production).
- **Provide education and outreach:** DEC and AGM along with SUNY ESF should enhance the public's understanding of the bioeconomy and its role in reducing GHG emissions.
- **Build buyer confidence:** NYSERDA should provide consumer and business-to-business education on bio-based products and low-carbon products in order to build buyer confidence.

AF21. Provide Financial and Technical Assistance for Low-Carbon Product Development

In addition to State support for increasing market access, financial and technical assistance is needed to grow bioprocessing industries for low-carbon products from low-grade wood and other biomass residuals to create bio-based substitutes for fossil fuel-based products. This assistance must also include an evaluation for any potential emissions of co-pollutants from these processes and measures to reduce or avoid those emissions. Providing this assistance will ensure this strategy mitigates GHG emissions without unintentionally emitting co-pollutants. Some of the components in this strategy relate closely to those presented in *Chapter 14. Industry* (Strategy I2).

Components of the Strategy

- **Quantify bioprocessing investments:** NYSERDA should develop criteria for qualifying near-term bioprocessing capacity investments.
- **Promote high value outputs:** NYSERDA, the Department of Taxation and Finance, and ESD should provide financial and technical initiatives to identify and promote the high value outputs from New York bioprocessing inputs.
- **Attract bioprocessing and bio-based products to the State:** ESD should create an economic development initiative focused on attracting bioprocessing/bio-based product businesses to New York.
- **Incentivize low grade feedstocks:** DEC and AGM should have preferential pricing for in-State low grade feedstocks that maximize carbon sequestration (organic waste streams, wood residues, marginal land). Creating market value for low-grade wood products can incentivize forest owners to manage their forests in a way that increases sequestration.
- **Invest in conversion technology:** NYSERDA and the NY Green Bank should develop programs that leverage private capital to invest in conversion technology for bio-based feedstock into bio-based products.

AF22. Advance Bio-Based Products Research, Development, and Demonstration

Bio-based products have the potential to replace fossil fuel and fossil fuel-based products, including for hard-to-decarbonize uses, to lower GHG emissions. Currently, incentives are required to make bio-based and low-carbon products economically competitive for use by industries. In addition, there is a potential for improved efficiency in bio-based and low-carbon products and further development of new products. To drive research and development, this strategy recommends developing a demonstration and pilot project portfolio to drive investment in the areas of alternative fuels, low-carbon products, and related sequestration that considers intersection of industrial or manufacturing, agriculture, transportation, and power generation sectors and funding innovation challenges and projects that can scale beyond business as usual to provide GHG emissions reduction benefits. These strategies are not currently underway in New York, and it is expected to take several years to develop products and complete research activities. The research agenda should include rigorous energy, GHG, and environmental sustainability guidelines and metrics, analysis of the potential air quality and health impacts and best practices to minimize these impacts, mitigation of localized impacts in Disadvantaged Communities, life cycle GHG accounting with priority utilization provided for feedstocks with the lowest GHG emissions, with strong preference given to zero- or negative-emissions sources, evaluation of emissions controls that reduce/eliminate emissions,

and the potential for negative or positive impacts on other economic sectors, such as waste management or agriculture. Research must quantify criteria pollutant emissions, ecosystem services, and bioremediation potential of deep decarbonization and net sequestration pathways analyzed under roadmap. This will enable pathways that contribute to improvements in these areas to be considered for pilot funding.

Components of Strategy

- **Determine product gaps:** NYSERDA, with partners such as SUNY ESF and Cornell CALS, should develop a research agenda scope for bio-based products by compiling a list of existing products and product efficiencies and evaluating these for gaps and potential improvements.
- **Solicit demonstration projects:** NYSERDA should develop a solicitation to perform research and identify promising pilot/demonstration projects.
- **Fund demonstration projects:** NYSERDA should fund research and pilot/demonstration projects identified in the research agenda scope as listed in the component above.

AF23. Advance Deployment of Net Negative Carbon Dioxide Removal

Carbon dioxide removal (CDR) pathways create a negative emissions profile for bioeconomy products and other economic sectors (long-duration carbon storage beyond net zero), helping to ensure that replacement of fossil fuel and fossil fuel-based products results in lower GHG emissions. Net negative CDR can provide permanent storage of atmospheric carbon.

Many CDR feedstocks (such as agricultural waste and dedicated energy crops) provide ecosystem and bioremediation services during growth. CDR technology biochar is being used in the western U.S. to remove residual waste products from forest thinning to reduce wildfire risk, and it shows promise for urban organics management or as a replacement for fly ash in concrete. However, CDR biochar has not been widely used in northeastern forests and may be the most useful in ecosystems that need to have residual wood removed due to high wildfire risk. Carbon capture directly from the atmosphere is currently extremely expensive and as such is not widely used. DEC and NYSERDA, with assistance from SUNY ESF and Cornell, would need several years to begin to set up standards, identify CDR technologies and pathways, and identify research and development priorities.

Components of Strategy

- **Set goals for CO₂ removal:** NYSERDA and DEC should set clear goals regarding the use of net negative removal technologies, evaluate solutions viable today and monitor solutions that could be viable in the future.
- **Identify CDR technologies:** NYSERDA, with SUNY ESF, should support the identification of verifiable and maintainable CDR technologies and pathways, such as direct chemical carbon capture and CDR options for biomass energy generation (biochar, capture, and storage).
- **Prioritize research needs:** NYSERDA, with SUNY ESF, DEC, and Cornell, should develop RD&D agenda and priorities with initial work to focus on nature-based CDR pathways while examining the role of technology-based pathways in the future.
- **Fund demonstration projects:** NYSERDA should fund demonstration projects of CDR technologies, such as such as direct chemical carbon capture and CDR options for biomass energy generation (biochar, capture and storage) to show the GHG benefits of these techniques over the life cycle of projects.

Chapter 16. Waste

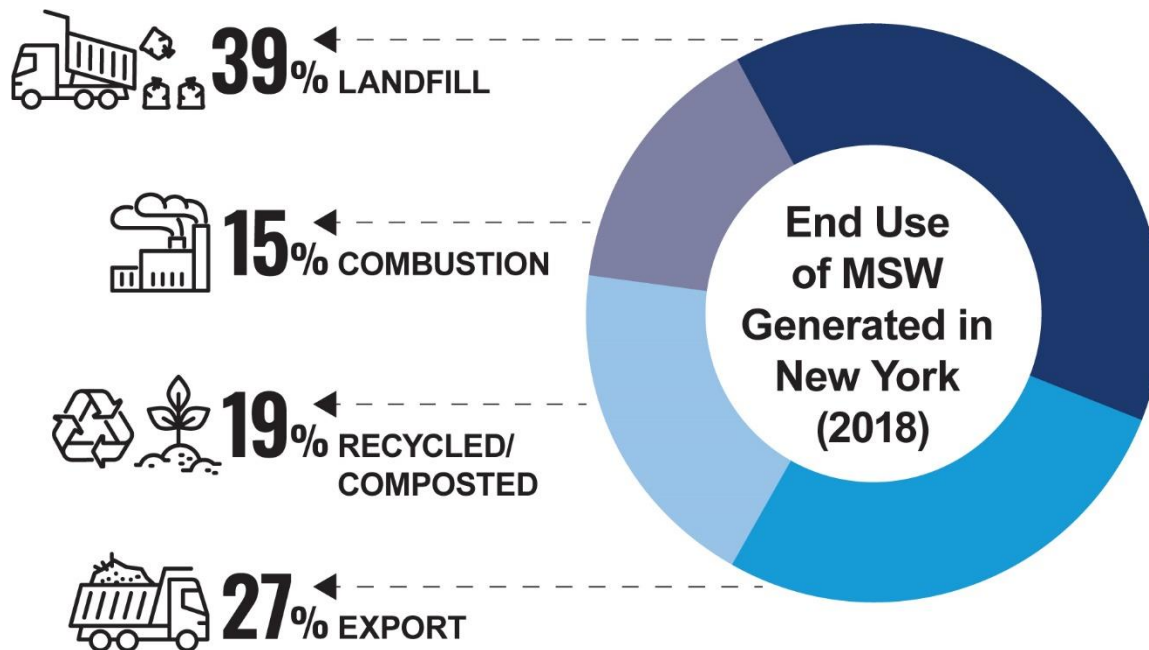
16.1 State of the Sector

Overview

The waste management sector, for the purposes of this Scoping Plan, includes all aspects of materials management and wastewater treatment. Materials management includes waste reduction, reuse, recycling (including organics recycling), combustion, and landfilling. In New York, more than 18 million tons of municipal solid waste (MSW) is generated each year, which equals 1,850 pounds for every person that lives in the State.

MSW generated in New York is managed through recycling (including composting and other organics recycling), combustion, landfilling in-State, and export for landfilling or combustion out of State. As shown in Figure 29, 19% of the MSW generated was recycled, 15% was combusted, 39% was landfilled in New York, and 27% was exported to other states for landfilling or combustion in 2018.

Figure 29. End Use of MSW Generated in New York (2018)



Source: DEC Solid Waste Annual Report.

Many facilities are needed to manage the MSW generated and handled in New York. A variety of facilities are found in the State, including MSW; combustors; recycling facilities, including organics and recyclables handling, and recovery facilities; construction and demolition debris handling and recovery

facilities; and transfer facilities. Combustors have an advantage over landfills related to their ability to recover metals that cannot be recovered through traditional materials recovery facilities.

The number of active MSW landfills in New York has dropped significantly since 1988 and has remained roughly consistent since 2000. In the past, MSW landfills were smaller, local, and less complex. Modern landfills tend to be regional and are sophisticated engineered structures. While many New York communities dispose of their waste within the State, a significant amount of waste is transported for disposal across State borders, both out of and into the State. The flow of waste is influenced by economic and market forces as well as regulatory and policy directives. However, movement of waste across State borders is considered interstate commerce and is therefore governed by federal authority under the U.S. Constitution. In the past, Congress has considered legislation that would allow states to constrain the movement of waste from other states, but no such laws have passed. In the absence of action on the federal level, the export and import of waste across State borders is expected to continue. However, some municipalities in New York have adopted local waste flow control laws that prohibit the exportation within a county, authority, etc. These local controls on the movement of waste were upheld by a Supreme Court decision.

In addition to the quantity of waste generated and how it is managed, the characteristics of the waste stream itself have a major impact on possible climate change impacts. The MSW generated in New York, broken out by material composition, is depicted in Figure 30.

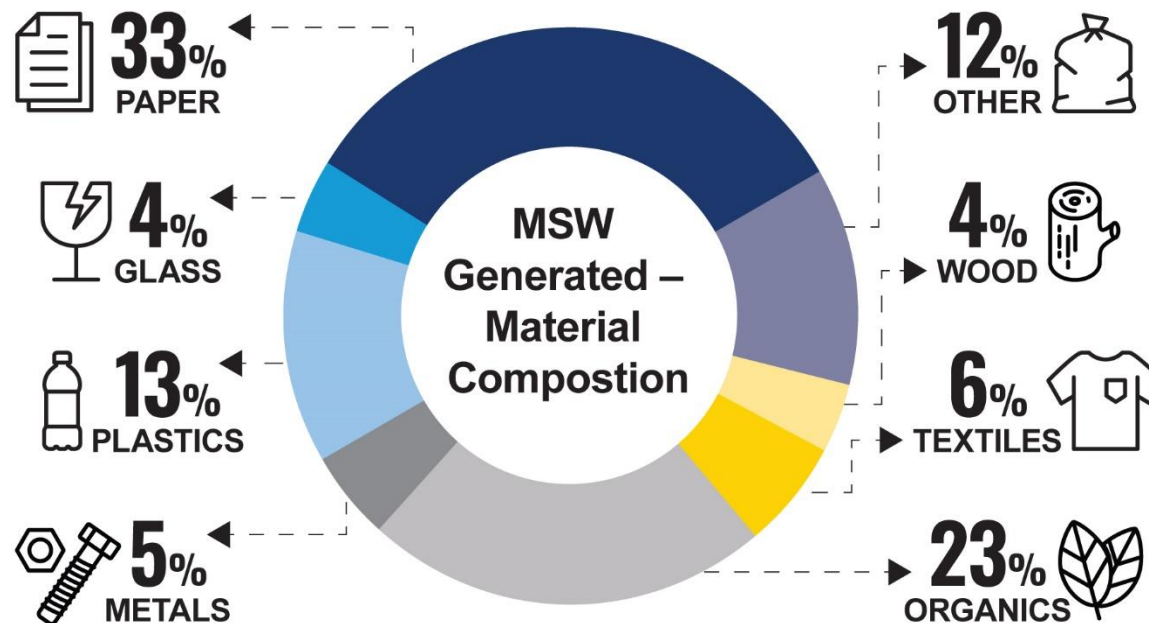
Emissions Overview

GHG emissions from the waste sector represent about 12% of statewide emissions, including landfills (78%), waste combustion (7%), and wastewater treatment (15%). Most of these emissions represent the long-term decay of organic materials buried in a landfill, which will continue to emit methane at a significant rate for more than 30 years. It also represents both waste landfilling in New York and waste export to landfills in other states.

Municipally owned wastewater treatment plants (water resource recovery facilities, or WRRFs) perform a critical function in protecting water quality. There are 612 publicly owned treatment works (also referred to as wastewater treatment facilities) that are owned by public entities in New York that serve 1,610 municipalities. The total design flow for all facilities is approximately 3,800 million gallons per day (mgd), while the reported actual flow rate is approximately 2,400 mgd. Over 70% of the facilities report actual flow rates that are less than 1 mgd. The

facilities range in size from New York City’s vast system that processes 1.3 billion gallons of wastewater per day through 14 facilities to small village systems that process less than 100,000 gallons per day.²⁹¹

Figure 30. MSW Generated – Material Composition



Source: *Beyond Waste* (DEC).

The most obvious and well-documented contribution to GHG emissions from the management of waste is from the uncaptured emissions of methane from landfills. As organic materials break down in a landfill’s anaerobic environment, they generate methane, a GHG 84 times more potent than carbon dioxide (CO₂) (20-year global warming potential [GWP] basis). MSW landfills in New York have gas collection systems in place that greatly reduce emissions, but gases still escape through the landfill cap and leak during the active placement of waste. In addition to landfills, there are other waste handling practices that produce GHG emissions, including combustion and anaerobic digestion. Although anaerobic digestion is recognized as a method for recycling organic waste, if there are leaks from the gas-handling system, methane can be lost to the atmosphere. Wastewater treatment plants have GHG emissions through wastewater processing systems and from anaerobic digesters (if present).

Greenhouse implications of waste go beyond waste handling considerations. More than 70% of municipal waste is made up of discarded products and packaging, the production, distribution, and disposition of

²⁹¹ New York State Department of Environmental Conservation. 2018. “Biosolids Management in New York State.” Albany. Accessed at https://www.dec.ny.gov/docs/materials_minerals_pdf/bsmgmt2015.pdf.

which generate emissions. Every step of the process – mining, harvesting, manufacturing, and distribution – consumes energy and generates pollution. Thus, to the extent that waste can be reduced through extended use of products and materials and through various recovery strategies, those products and materials will not have to be replaced with new materials requiring an equivalent demand on resources and the environment.

The life cycle impacts of waste are described in EPA’s report, *Solid Waste Management and Greenhouse Gases: A Life Cycle Assessment of Emissions and Sinks*. For many wastes, the materials in the waste represent what is left over after a long series of steps, including extraction and processing of raw materials, product manufacturing, transportation of materials, consumer use, and waste management.

The most significant GHG emissions impact during the life cycle of products and packaging result not from disposal, but production of the products and packaging that eventually become waste. According to the U.S. Department of Energy’s Energy Information Administration, industry worldwide uses more than 50% of the energy consumed.

Waste prevention and recycling can significantly reduce industrial energy consumption. For example, a life cycle study on the paper industry found that recycling paper and using that recycled paper in production reduces the greenhouse impacts of paper manufacturing by two to six times (depending on the paper grade) as compared with virgin manufacturing and landfilling or combustion. The potential for positive impacts of material recovery and reuse in the metals industry is even greater. When manufacturing aluminum, 95% of the GHG emissions can be avoided by substituting scrap vehicle aluminum for virgin feedstock.²⁹² The GHG emissions reductions related to manufacturing with recycled materials in place of virgin are so substantial that the GHG emissions from transportation of materials for recycling are not a significant factor in the overall carbon footprint of recycling.

There are significant opportunities to reduce or avoid GHG emissions by improving both materials themselves and our materials management practices. Strategies to do this are discussed later in this chapter.

²⁹² The International Aluminum Institute, “Sustainability,” Aluminum for Future Generations, Accessed November 2021, <https://recycling.world-aluminium.org/review/sustainability/>.

Vision for 2030

For solid waste management and WRRFs, the major contributors to emissions are associated with landfill emissions, though sources are also found at WRRFs and other facilities. To reduce emissions to achieve the required 2030 GHG emission reductions, significant increased diversion from landfills as well as emissions monitoring and leak reduction will be needed. A circular economy approach to materials management is understood and employed.

Vision for 2050

The Climate Act requires a more dramatic decrease in GHG emissions by 2050, achieving at least an 85% reduction (compared with 1990 levels). For solid waste and WRRFs, this necessitates a dramatic shift in the way waste is managed, to the point that landfills and combustors are only used sparingly for specific waste streams, and reduction and recycling are robust and ubiquitous..

In addition, methods to monitor leaks and emissions are well developed and implemented, and those emissions are significantly reduced. The circular economy approach for materials management is fully implemented and embraced.

Existing Sectoral Mitigation Strategies

In 1988, the Solid Waste Management Act (ECL § 27-0106) established in law the preferred hierarchy of solid waste management. The hierarchy established the following priorities to guide the programs and decisions of the New York State Department of Environmental Conservation (DEC) and other State agencies:

- First, to reduce the amount of solid waste generated
- Second, to reuse material for the purpose for which it was originally intended or to recycle the material that cannot be reused
- Third, to recover, in an environmentally acceptable manner, energy from solid waste that cannot be economically and technically reused or recycled
- Fourth, to dispose of solid waste that is not being reused or recycled, or from which energy is not being recovered, by land burial or other methods approved by DEC

In addition to the hierarchy, the Solid Waste Management Act established:

- Structure and expectations for regional solid waste management planning units to encourage regional cooperation

- Requirements and funding for local solid waste management plans in accordance with the hierarchy of solid waste management methods
- A mandate that municipalities adopt and implement source separation laws or ordinances for recyclables from all generating sectors by September 1, 1992 (less than five years from enactment)
- DEC's role in fulfilling these requirements

The Solid Waste Management Act's requirements were intended to ensure that both State and local governments work actively toward establishing environmentally sound solid waste management systems that integrate the hierarchy of solid waste management methods and emphasize waste reduction and recycling, using landfills only for materials that could not be managed in a more productive way.

Since the enactment of the Solid Waste Management Act, businesses, municipalities, and individuals have embraced recycling and have built infrastructure and systems to further these efforts. In recent years, many businesses have developed formal sustainability goals and programs. These efforts are encouraged and envisioned to continue, but there are limitations to their ability to succeed without dramatic changes to materials management systems. To enhance waste reduction, reuse, and recycling programs, DEC has initiated a number of actions, including but not limited to grants, product stewardship, organics recycling, and education initiatives.

Grants

The Municipal Waste Reduction and Recycling Program, funded by the Environmental Protection Fund (EPF), is the financial backbone of municipal recycling infrastructure in New York, with \$83.5 million allocated since 2010. The Municipal Waste Reduction and Recycling Program provides a recycling grant program for municipalities that covers equipment, recycling coordinator salaries, education, outreach, and planning projects, and household hazardous waste collection.

Product Stewardship

The New York State Electronic Equipment Recycling & Reuse Act (E-waste Law) was signed into law on May 28, 2010. The E-waste Law requires manufacturers who sell or offer for sale covered electronic equipment (such as computers, computer peripherals, televisions, small scale servers, and small electronic equipment) in the State to register their brands of covered electronic equipment with DEC and establish a

convenient acceptance program for the collection, handling, and recycling or reuse of electronic waste, free of charge to most consumers.

From April 2011 through December 2020, over 920 million pounds of electronic waste from New York consumers were sent for recycling or reuse, rather than being sent to landfills, waste combustion facilities, or other improper disposal methods. In addition to electronic waste, New York has programs that require manufacturers to collect and recycle rechargeable batteries, retailers to incentivize lead battery return, and manufacturers to collect and manage mercury thermostats, collect and recycle post-consumer paint, and recycle cell phones.

Green Products

The procurement of green products by government entities can drive the market for products made with recycled content and reduce waste. Executive Order 22 builds upon a decade of leadership by New York State Agencies committed to reduce the environmental footprint of their operations. Through the GreenNY Council, New York leverages tremendous purchasing power to drive markets to produce products that utilize recycled content, generate less waste, and adhere to circular economy principles. The GreenNY Council drives State procurement of more sustainable products, from office paper to vehicles.

With these State programs, purchasing green, post-consumer products are made easier and more accessible. New York State Office of General Services (OGS) Procurement Services manages about 1,500 State purchasing contracts, many of which contain environmentally friendly products and services. The GreenNY Council has established a total of 78 green procurement specifications covering commodity, service, or technology products purchased by the State.

New York State Bag Waste Reduction Act

In 2017, it was estimated that New Yorkers used 23 billion bags annually. As of March 1, 2020, all plastic carryout bags (other than an exempt bag) became banned from distribution by anyone required to collect New York sales tax. For sales that are tax exempt, plastic carryout bags are still not allowed to be distributed by anyone required to collect New York State sales tax (unless it is an exempt bag).²⁹³

²⁹³ ECL Article 27, Titles 27 and 28; 6 NYCRR Part 351.

Outreach and Education

DEC supports robust outreach and education programs to enhance recycling. These include the Recycle Right NY campaign, using social media and other means to educate the public on recycling, the DEC Delivers platform to publicize information, education for students, and market development. To research ways to increase recycling, DEC is funding multiple State colleges to look at paper, glass, plastic, waste composition, public attitudes, and other aspects of recycling.

Food Donation and Food Scraps Recycling Law

In 2019, New York passed the Food Donation and Food Scraps Recycling law. Effective January 1, 2022, large generators of food scraps (defined as generating an annual average of two tons per week or more) must donate edible food and recycle all remaining food scraps if they are within 25 miles of a viable organics recycler. In addition to the Food Scraps Law, DEC has implemented grants programs and multiple outreach efforts to increase food donation and food scraps recycling.²⁹⁴

Key Stakeholders

Key stakeholders for this sector include environmental nongovernmental organizations (NGOs), municipalities, State agencies, emergency food relief organizations, businesses, affected workers and unions, solid waste management facilities, and solid waste transporters.

16.2 Key Sector Strategies

The key strategies within this sector are organized into three themes, as shown in Table 17. As described there in greater detail, the labor standards discussed in *Chapter 7. Just Transition* are intended to apply throughout this Scoping Plan, including for the waste sector, as a means of promoting good, family-sustaining, union jobs accessible to all New Yorkers and achieving a true just transition.

²⁹⁴ ECL Article 27, Title 22; 6 NYCRR Part 351.

Table 17. Waste Sector Key Strategies by Theme

Theme	Strategies
Reduce, Reuse, and Recycle Waste	W1. Organic Waste Reduction and Recycling W2. Waste Reduction, Reuse, and Recycling W3. Extended Producer Responsibility / Product Stewardship W4. WRRF Conversion W5. Refrigerant Leak Reduction and Destruction
Monitor, Detect, and Reduce Fugitive Emissions	W6. Reduce Fugitive Emissions and Co-Pollutants from Solid Waste Management Facilities W7. Reduce Fugitive Emissions and Co-Pollutants from WRRFs
Establish Markets for Recovered Resources and Biogas Utilization	W8. Recycling Markets W9. Biogas Use

Reduce, Reuse, and Recycle Waste

Waste reduction, reuse, and recycling is critical to achieve the requirements and goals of the Climate Act. To achieve these directives, a fundamental shift in consumer habits, including purchasing practices, will be needed. The strategies described below are ambitious, fundamentally shifting the way New York currently produces, uses, and handles products and materials at end-of-life. Significant GHG impacts from this sector include the uncaptured emissions of methane from landfills, specifically from organic materials. There are also significant GHG impacts from the creation and distribution of products and packaging. Therefore, the following strategies are aimed at addressing the full life cycle of materials and products from product creation to the beneficial use of materials that would have otherwise been wasted. For waste management facilities located in Disadvantaged Communities, reducing the volume of material handled and capturing methane reduces odors that significantly impact quality of life for those communities and pose potential health impacts. Reducing waste volumes will also reduce the need for transfer facilities and will reduce truck traffic from transportation of waste that can impact Disadvantaged Communities. The strategies in this theme recognize that combustion and landfilling of some components of the waste stream will continue beyond 2050, although the amount of material disposed will be dramatically reduced, and ultimately facilities needed for disposal will be few. No new solid waste combustion facilities are envisioned, but the existing combustors, held to high environmental performance standards pursuant to 6 NYCRR Part 251’s case-specific limits, may be needed to handle waste that cannot otherwise be reused, reduced, or recycled (residual waste). Permits for solid waste combustion facilities, including renewals, will need to meet all permitting requirements, including Section 7(2) and 7(3) of the Climate Act, to ensure these actions are consistent with achievement of the emission limits and do not disproportionately burden Disadvantaged Communities and prioritize reductions of GHG emissions and co-pollutants in Disadvantaged Communities. Existing combustor capacity may be needed

to avoid the GHG impacts that would be associated with the transport and disposal of this waste to facilities located outside of New York. The applicability of the zero-emission electricity requirement and the specifics of how it will be implemented after 2040 will be addressed by the New York State Public Service Commission (PSC) in coordination with the New York State Energy Research and Development Authority (NYSERDA), DEC, and other agencies (see Strategy E10), including how electricity generation from waste management processes will be handled.

W1. Organic Waste Reduction and Recycling

Reducing the disposal of organics, including food scraps (food grown for human consumption that has not been consumed and is destined for recycling or disposal), is key to reducing the methane and CO₂ emissions at landfills and combustion facilities. Food scraps make up 18% of the total MSW stream in New York. A portion of this is wholesome, edible food that should first be source-separated and provided to people in need. This can be achieved by introducing and implementing legislation, new regulations, and financial support statewide. Proven technologies exist and successful existing systems for managing these materials can be replicated, but there are challenges related to financial limitations, behavioral change, and logistics. The relatively low cost of landfilling (particularly in Western New York) makes recycling less attractive to both the private and municipal sectors. The development of infrastructure for additional organics recycling capacity and improving food donation systems is costly. However, when implemented correctly, these costs can be partially shifted from existing waste disposal costs and may allow organic wastes to be used as feedstocks for bioenergy products (see *Chapter 15. Agriculture and Forestry*, Strategy AF20). Economically viable markets must also exist for the soil amendments and other resultant products of organics recycling to make sustainable systems.

The Climate Justice Working Group (CJWG) agrees that ending the disposal of food scraps and yard trimmings at landfills and combustors is probably the single most important action the State can take to cut emissions from this sector. The CJWG recommends stronger programs to require major food generators, farms, supermarkets, restaurants, and institutions like universities and hospitals to develop sophisticated programs that transfer excess edible foods to local food banks and other programs designed to feed the hungry.

Components of the Strategy

- **Significantly reduce the disposal of organics:** The State should enact legislation to amend and expand the existing Food Donation and Food Scraps Recycling Law (2019) to include generators of one ton per week or more beginning in 2024, one-half ton per week in 2025, and all generators

by 2028. Also, the law should be amended immediately to eliminate the 25-mile requirement and the exemptions.

- **Financial assistance for food donation:** The State should provide additional funds for emergency food relief organizations to expand food donation.
- **Reduction of food supply chain losses:** The State should provide funding to research food loss throughout the food supply chain, from farm to table, and financially support means to reduce waste at all points in the system.
- **Financial assistance for organics recycling infrastructure:** The State should expand existing financial assistance programs for organics recycling facility infrastructure, including collection and processing, for small-scale and larger-scale operations.
- **Expand food scraps collection and recycling at multi-family buildings:** DEC and appropriate housing authorities should expand and replicate successful models of organics collection and recycling programs inclusive of multifamily buildings and public housing.
- **Markets for compost, digestate, and similar products:** DEC should facilitate research and other means to increase markets for compost, digestate, and other products derived from organic waste.
- **Food waste reduction and donation for businesses:** DEC should continue to develop food waste reduction education and outreach specific to the business sector and encourage greater food donation.
- **Composting on public park land:** The State should enact legislation that will allow composting facility operation on public parks.
- **Outreach and education to promote organics recycling:** DEC should continue and expand outreach and technical assistance to expand all aspects of organics recycling (drop-off programs, household food waste reduction, school programs, facilities, etc.).
- **Engagement with the farming community:** The State should work with the farming community to increase the use of organic products, explore the potential for organics recycling facilities on farms, increase the use of food scraps for animal feed, and explore the potential for increased food donation from farms.

W2. Waste Reduction, Reuse, and Recycling

Waste reduction, reuse, and recycling initiatives significantly reduce the methane and CO₂ emissions at landfills and combustion facilities by avoiding disposing of waste in the first place. Outside of direct State agency impact, municipalities and nonprofit organizations are already implementing successful and replicable waste reduction, reuse, and recycling programs. However, having consistent and sufficient

funding, staff, and technical support to establish and operate these programs will lead to greater success. The CJWG is supportive of policies that reduce waste and encourage recycling. The CJWG recommends convenient recycling collection programs throughout the State and that these programs receive adequate funding.

Components of the Strategy

- **Fee per ton on waste:** As stated in Strategy W1, the State should enact legislation in 2023 to establish a disposal disincentive (fee per ton) on all waste generated in New York to provide financial support for reduction, reuse, and recycling.
- **Enact “By Request Only” legislation:** The State should enact legislation requiring “By Request Only” policies for single-use products and require reusable/refillable options for consumer goods in retail stores.
- **Phase out single use packaging:** The State should enact legislation that supports the reduction and eventual elimination of single-use packaged items for use in stores.
- **Container deposits:** The State should enact legislation to implement expanded deposit container programs where feasible and needed (if not covered by Extended Producer Responsibility [EPR] programs).
- **Right to Repair:** The State should enact legislation to support “Right to Repair” and other legislation that requires manufacturers of products sold in New York to provide information to consumers and third-party technicians about how to repair damaged products.
- **Materials exchanges:** The State should encourage the use of materials exchanges and sharing platforms through development of resources and facilitate the development of avenues for material reuse and product sharing opportunities for used goods.
- **Elementary school education:** DEC should partner with the State Education Department and New York State Department of Health (DOH) to develop and promote sharing table and donation guidance for P-12 schools.
- **School curriculum:** The State should educate students on the connections between waste and the environment through curriculum development and use.
- **Reusable/Refillable containers:** The State should enact legislation that incentivize reusable and refillable solutions across the full spectrum of the packaged goods sectors, such as refill at home, return from home, refill on the go, and return on the go.
- **Research on reusable packaging:** The State should support colleges and universities to research the viability of reusable shipping and packaging materials.

- **Assistance for reuse:** The State should establish a targeted grant funding program to support reuse.
- **Reuse of construction materials:** The State should support policy approaches that increase the capture and use of building deconstruction materials and recovered aggregate for a variety of applications. This may include government requirements (procurement standards, bid specifications, etc.) to include recycled or reused deconstruction materials. (See also *Chapter 12. Buildings*, Strategy B11.)
- **Support for local facilities:** The State should provide financial support from new funding provided to implement the Climate Act and other sources, for local reuse centers, material exchanges, and repair shops to move beyond volunteer-run operations.
- **Workforce development:** The State should support workforce development, job training and trade skills in repair, refurbishment, remanufacturing, recycling, and innovative materials reuse.
- **Textile recycling:** The State should implement comprehensive textile waste reduction and recycling programs.
- **Buildings solutions:** The State should expand and replicate successful models of recyclables collection and outreach programs inclusive of multifamily buildings and public housing and fund infrastructure development (such as eco-hubs) to increase access to reuse and recycling opportunities for multifamily housing and campuses.
- **Outreach:** The State should implement new and expand existing statewide campaigns for reduction, reuse, and recycling targeting New York residents and businesses and increase research collaborations and expand upon existing partnerships to improve outreach and education efforts. The State should also support peer-to-peer education and outreach campaigns in underperforming and Disadvantaged Communities around reduction, reuse, and recycling.
- **Support municipalities:** The State should support coordination between local and regional municipalities to enhance regional recycling initiatives and provide funding to hire local enforcement officers for municipal recycling programs, encouraging cross-jurisdiction and multi-planning unit collaboration.
- **State procurement standards:** The State should codify its GreenNY procurement program in statute to ensure the long-term success of the program and continued progress on issuing new green procurement standards for products that reduce GHG emissions, are energy-efficient, produce less waste and are made with recycled content, and reduce the usage of toxic chemicals in State operations.
- **Research and evaluation of current standards:** The State should evaluate the feasibility of requiring deposit-driven, universal restaurant reusables, evaluate the feasibility of requiring

reusable shipping containers and padding to replace packaging material from online retailers, support innovative zero-waste product development and business projects, and support digital demand software and technologies to monitor and reduce over-production across all sectors.

- **Tool development:** The State should develop a life cycle analysis model and solid waste management decision-making tool.
- **Enhanced local solid waste management plans:** The State should enact legislation that would require municipalities to develop and implement local solid waste management plans or to become affiliated with planning units with approved local solid waste management plans.
- **Reduce toxics in products:** The State should enact additional legislation to ban materials and chemicals that may be found in products that are of concern for human health or environmental impacts. DEC should support research and activities that will lead to less toxic alternatives.

W3. Extended Producer Responsibility/Product Stewardship

Enacting broad EPR or product stewardship requirements to cover end-of-life management of post-consumer products will allow the State to ensure their sustainable management. Successful EPR legislation and programs already exist in New York for beverage containers, electronic waste, mercury thermostats, post-consumer paint, cell phones, pharmaceuticals, and rechargeable and lead-acid batteries. Products that could benefit from new EPR legislation include packaging and printed paper, carpet, tires, textiles, solar panels, wind turbines, all batteries, appliances (especially those containing refrigerants), mattresses, and other methane-generating wastes. Paper and wood comprise more than a third of the waste stream and they will produce methane as they degrade in a landfill, so EPR and other means to recycle these materials are crucial. While it may require the development of additional infrastructure to collect and recycle additional materials, EPR strategies shift responsibility for the end-of-life management onto the producers and manufacturers of consumer goods and away from the general public. This also encourages sustainable product design and waste prevention measures higher up the product chain.

While opposed by some industries, legislation to create a framework for EPR, or individual legislation targeting products with the greatest GHG reduction impact, can significantly reduce these potent gases that are generated when consumer goods and packaging are disposed in landfills and at combustion facilities. In addition, the end-of-life management of solar panels and large-scale batteries will become more of a concern as renewable energy technologies are implemented and grow. The CJWG is strongly supportive of policies focused on waste reduction and has expressed support for EPR, indicating that passage of an EPR bill should be a priority for addressing emissions from the waste sector.

Components of the Strategy

- **EPR framework legislation:** The State should enact and implement new legislation in 2023 that creates an EPR/product stewardship framework. Alternatively, individual legislation should be enacted targeting products with the greatest GHG impact (such as packaging and printed paper, carpet, tires, textiles, solar panels, wind turbines, batteries, appliances, especially those containing refrigerants, and mattresses).
- **Electronic Equipment Recycling and Reuse Act:** The State should enact legislation to amend the Electronic Equipment Recycling and Reuse Act to improve overall program performance for e-waste by, for example, moving away from a target-based collection approach to a consumer convenience model. DEC should provide outreach to the regulated community and consumers regarding the manufacturers' requirements.
- **Rechargeable Battery Recycling Law:** The State should enact legislation to amend to the Rechargeable Battery Law to require the collection and recycling of additional consumer battery types (alkaline, electric and hybrid vehicle batteries, etc.). DEC should increase program compliance monitoring and enforcement in accordance with existing statute to improve manufacturer engagement, retailer participation and consumer convenience.
- **Mercury Thermostat Collection Act:** The State should enact legislation to amend the Mercury Thermostat Collection Act to extend the program beyond the current January 1, 2024, sunset date and to improve overall program performance.
- **Post-Consumer Paint Collection Program:** DEC should amend the 6 NYCRR Part 373 Universal Waste regulations and the 6 NYCRR Part 360 series regulation to help streamline the management of post-consumer paint in New York.

W4. Water Resource Recovery Facility Conversion

Transforming wastewater treatment plants from a waste disposal priority to WRRFs that emphasize the capture of beneficial products is a key component of the circular economy. WRRFs, which represent much of the existing capacity for organics materials management in New York, present tremendous opportunity for reducing GHG emissions. However, the funding for WRRFs is tied to municipal water and sewer rates, is generally constrained, and is largely dedicated to improving water quality, making it difficult to self-fund beneficial reuse projects. In addition, market conditions and regulations currently favor the landfilling of biosolids and digestate byproducts, which contributes to methane emissions at landfills, over beneficial reuse. Rising landfill prices may push some municipalities to beneficially reuse naturally, but others that have agreements with local landfills and will require additional incentives to

transition to recycling systems. Many municipalities are already working toward these goals and would benefit from additional State support.

Capital investments will be necessary to unlock the GHG emissions reduction potential of new resource recovery approaches and fully utilize the infrastructure as well as maintain a state-of-good-repair. Biogas and digestate products resulting from beneficial reuse can be valuable if markets are aligned with GHG emission reducing priorities, and incentivizing biogas production could reduce costly infrastructure upgrades at WRRFs. Existing treatment plants have high thermal demands to operate digesters used to stabilize sludge. Boilers and engines on site are often able to replace fossil natural gas with a WRRF's own digester gas, yet some engines are easily fouled by the impurities in the biogas. The use of biogas onsite, where feasible and practical, is preferred before refinement of biogas into RNG for on-site use with emphasis placed on non-combustion applications such as use in fuel cells. Some facilities may be well situated to provide local communities and co-located facilities with their excess biogas resource. The limited supply of the biogas resources should be targeted to strategic uses, such as locations where it can provide electric system capacity for buildings and transportation electrification by alleviating system constraints. The CJWG favors on-site use of biogas captured from waste management and that no significant new transmission infrastructure should be allowed to support additional biogas.

Components of the Strategy

- **Beneficial use:** The State should support beneficial use of biosolids and biogas that demonstrate air quality, health, and GHG benefits, including requirements to avoid localized pollution in Disadvantaged Communities, recognizing that water treatment process waste generation is unavoidable. Self-supply of energy needs at WRRFs should be incentivized, particularly when it provides electric system capacity for electrification of transportation and buildings with a focus on Disadvantaged Communities.
- **Optimize and expand anaerobic digestion:** The State should support energy production and methane mitigation following a full life cycle analysis, including measurement and abatement of methane leakage, consideration for avoided emissions, and supporting co-digestion programs at anaerobic digesters with existing capacity and include organics generated off site, such as food processing waste, food scraps and fats, oils, and grease. Programs that incentivize anaerobic digestion should require systems be built (or retrofit) for maximum methane mitigation to ensure development of well-managed, low emissions biogas or RNG production such as utilizing emissions minimizing technologies and techniques, minimizing fossil fuel use in biogas or RNG

production, minimizing emissions from biosolids/digestate, and consideration of a regulatory framework to ensure best practices.

- **Research co-pollutants:** The State should evaluate the extent and impact of co-pollutants such as emerging contaminants and advance the use of control technologies to reduce or eliminate these emissions.

W5. Refrigerant Leak Reduction and Destruction

Hydrofluorocarbons (HFCs), widely used as refrigerants in appliances, are potent GHGs with very high GWPs. HFCs contained inside well-maintained appliance systems pose minimal threat to the environment; however, 90% of fugitive emissions of these gases happen during end-of-life management of the appliance. Policies incentivizing the destruction of refrigerants at end-of-life would encourage the retirement of old, energy-inefficient equipment so that these materials are not released to the atmosphere. These policies should be coupled with continued alternative refrigerant and system efficiency research and production.

An EPR program has the potential to be cost-effective and its impact easily quantified with reporting requirements. There are a wide range of manufacturers, products, and types of refrigerants used in new and existing appliances. Enforcement may be challenging due to the large number of facilities managing these end-of-life appliances, and there is currently a lack of comprehensive disposal data.

Components of the Strategy

- **End of Life:** DEC should promulgate regulations to address leaks at end-of-life by requiring reclamation or destruction of refrigerants from appliances and institute requirements for verification and reporting. The State should enact EPR legislation for refrigerant-containing appliances.
- **Appliance Servicing:** DEC should promulgate regulations banning the sale of virgin high GWP refrigerants for servicing with an exception for reclaimed refrigerants.
- **Reporting:** DEC should create a registry and reporting requirements (to track sales, stockpiles, and leaks) for large refrigeration and heating, ventilation, and air conditioning (HVAC) systems and refrigerant wholesalers and distributors.
- **Research:** DEC should research end-of-life management for various refrigerants and their alternatives.

Monitor, Detect, and Reduce Fugitive Emissions

The quantification of GHG impacts from fugitive emissions at solid waste management facilities and WRRFs are currently under-reported and will vary based on several site-specific factors such as waste composition and facility design. Assessing these systems both during and beyond the active life of operation as well as minimizing/repairing equipment releasing fugitive emissions (leaks) can significantly reduce waste sector GHG emissions. The CJWG strongly supports controlling fugitive emissions from landfills, sewage plants, and other methane sources as a critical step in reducing emissions from the waste sector.

W6. Reduce Fugitive Emissions of Methane and Co-Pollutants from Solid Waste Management Facilities

The anaerobic decomposition of organic materials in MSW landfills and digesters generate a combination of gases, predominately methane and CO₂. Existing regulations require landfills to install gas collection systems and provide continued monitoring well beyond the active life of the facility. Fugitive GHG emissions have also been detected at anaerobic digestion facilities from operation, malfunctioning flares, or gas management systems during the downtime or maintenance on the units or from the storage of various undigested materials on site. The current GHG emissions levels from these point sources can vary significantly among individual facilities and are likely being under-reported (as shown in a study on California's methane super-emitters).²⁹⁵ While monitoring technologies continue to improve, there are significant technological and financial limitations on the facilities and municipalities. The ability to accurately measure methane leakage is currently limited.

Identifying and reducing fugitive emissions of methane from landfills and anaerobic digesters through baseline measurement, increased monitoring, and engineering and regulatory programs can reduce leaks and provide facilities with comprehensive data on their operations.

In addition to GHG emissions, actions must be taken to reduce the impact associated with co-pollutants that may be present with solid waste management facilities. Control can be exercised by siting controls, regulatory criteria, and enforcement of existing rules and standards.

²⁹⁵ Duren, R.M., A.K. Thorpe, K.T. Foster, et al. "California's methane super-emitters." *Nature* 575, 180–184 (2019). <https://doi.org/10.1038/s41586-019-1720-3>

Components of the Strategy

- **Landfill gas capture for active landfills:** DEC should enhance existing regulations, before 2025, for landfills that will lead to less methane leakage, such as a requirement to install gas collection systems sooner after waste placement, install specialty landfill gas collectors for difficult to access areas, and enhance gas dewatering systems to increase collection efficiency.
- **Control emissions from closed landfills:** The State should provide additional funding for the municipal landfill closure and landfill gas management grant program.
- **Enhanced landfill cover systems:** DEC should develop regulations for enhanced landfill covers to increase oxidation of methane.
- **Emission monitoring and emission reduction:** DEC should require improved emissions monitoring programs at all applicable solid waste management facilities, utilizing new technologies (such as drones). Also, DEC should require reductions in emissions at these facilities.
- **Funding to aid municipal landfills:** The State should provide funding for the proper closure of municipal landfills and reduce emissions.
- **Research:** DEC should research comprehensive landfill GHG emissions to evaluate monitoring techniques, quantify fugitive GHG emissions, and evaluate most appropriate uses for the gas during the transition to statewide electrification. DEC should research methods to improve estimates of methane emissions from anaerobic digestion and strategies to reduce or eliminate these emissions, including consideration of a regulatory framework to ensure best practices to minimize methane and co-pollutant emissions from anaerobic digestion and RNG production.
- **Co-pollutant control:** DEC should use regulations, monitoring, and enforcement to reduce the impact from co-pollutants associated with solid waste management facilities. The State should enact legislation to support reduction of toxic substances in consumer products, as well as EPR (see Strategy W2 and Strategy W3), since these efforts will also reduce the potential for co-pollutants present at solid waste management facilities.

W7. Reduce Fugitive Emissions of Methane and Co-Pollutants from Water Resource Recovery Facilities

Similar to solid waste management facilities, comprehensive data on existing fugitive GHG emissions from WRRFs is not available, and additional regulations and funding sources will be critical to address wastewater sector impacts. Wastewater infrastructure was not always designed to mitigate GHG emissions. Municipalities will need to measure and reduce GHG emissions from WRRFs, septic, and

sewer systems, which can be difficult without the proper equipment and training. There is very limited data currently available concerning the quantity of emissions from these facilities.

Where density and local conditions allow, septic tanks should be eliminated and converted to municipal sewer collection systems or advanced onsite treatments. Larger municipalities may be able to absorb some of these costs, but medium and smaller municipalities do not have the funding to accomplish this without State support. Total sewerage costs will vary based on the availability and proximity of a local WRRF, local soil conditions, and other factors. Fortunately, some larger municipalities are already implementing these techniques and can provide guidance for others to replicate successful programs. Some communities have high septic costs because of soil conditions and may be willing to transition. Emissions from wastewater treatment plants lead to odors and potential health impacts, which have a significant impact on neighboring communities. Prioritizing the reduction of these leaks in Disadvantaged Communities will improve air quality in these communities.

Components of the Strategy

- **Capture and beneficially reuse fugitive biogas:** DEC, EFC, and NYSERDA should work with local utilities and municipalities to repair and consistently operate WRRF flares, boilers, engines, or other equipment on-site and identify strategic beneficial uses of captured biogas before flaring excess capacity (see Strategy W9).
- **Monitoring:** DEC should require emissions monitoring and leak reduction at WRRFs.
- **Ensure proper maintenance of septic systems at the municipal level:** The State should enact legislation to establish a municipal funding mechanism to allow contractual services for routine maintenance on septic systems.
- **Encouraging transition to sewer:** The State should provide financial assistance for sewer hookups to defray high upfront costs of sewerage.
- **Operator training:** The State should provide financial support and job training to wastewater system operators.
- **Research:** DEC should support research on the emission profile of WRRFs and how they can be controlled.
- **Co-pollutant control:** The State should use regulations, monitoring, and enforcement to reduce the impact from co-pollutants associated with WRRFs. The State should enact legislation to support reduction of toxic substances in consumer products, as well as EPR (see Strategy W2 and

Strategy W3), since these efforts will also reduce the potential for co-pollutants present at WRRFs.

Establish Markets for Recovered Resources and Biogas Utilization

The recycling industry needs viable and consistent markets to continue to capture the economic value of materials and promote them for their highest and best use. Support for domestic recycling facilities and markets for the resulting recovered resources is critical in keeping the recycling strategies in this Scoping Plan financially feasible and easy to replicate.

While it is recommended that solid waste management facilities and WRRFs follow all other strategies in this Scoping Plan to achieve the maximum reduction, reuse, and recycling of waste, it is recognized that some wastes (including biosolids) are unavoidable. In addition, the organic fraction of waste already disposed of in landfills will produce methane in place for many years. Capturing these unavoidable gases for strategic and local use while the State transitions to electrification will help meet the requirements and goals of the Climate Act while avoiding future reliance on fossil fuels.

W8. Recycling Markets

Some markets may exist currently, but the prices paid for secondary materials are rarely enough to sustain the cost of the collection and processing systems. In addition, developing more local and regional opportunities for materials management can lessen the impact of global economic market fluctuations (such as China's National Sword policy).²⁹⁶ In support of this market development work, New York has entered into contracts to fund research at several State University of New York (SUNY) universities to assess overall domestic recycling markets development, plastics recycling research, and glass processing innovations. OGS implements existing green procurement rules to obtain recycled content materials at State agencies and Empire State Development (ESD) has previously assisted with funding recycling markets for materials such as glass and tires. Implementing additional funding resources for municipalities and implementing sound post-consumer content requirements across different sectors can make secondary material processing cost competitive with virgin materials, conserve resources, and reduce the GHG emissions impact from the disposal of otherwise recyclable materials. The CJWG is

²⁹⁶ China's National Sword policy, first announced in 2017, implemented bans on the import of certain recyclable materials, including mixed plastics, unsorted mixed paper, and textiles, impacting global recycling markets.

supportive of recycling programs that cut the need for virgin materials and reduce emissions from the manufacturing of consumer goods.

Components of the Strategy

- **Market development for recovered resources:** The State should support domestic recycling facilities and markets for recovered resources (including compost, digestate, and recycled aggregate/building deconstruction materials) and incentivize public-private partnerships for recycling facility development. The State should also enact legislation to require a minimum level of recycled content in certain products and packaging.
- **Reuse of building materials:** The State should provide financial assistance to research the increase of capture and reuse of building deconstruction materials and recovered aggregate. This may include government requirements (such as procurement standards and bid specifications) to include recycled or reused deconstruction materials. (See also *Chapter 12. Buildings Strategy B11.*)
- **Recyclables in green procurement:** DEC and OGS should enhance and implement new green procurement programs to require the use of recyclables (such as compost and construction aggregate) by State and local entities and those contracting with the government.
- **Production tax credit for recycled products:** The State should enact a production tax credit, similar to the credit for clean energy systems, that is applied to companies that turn recycled materials into intermediate products if they locate their facilities in New York.
- **Organics roadmap:** DEC should conduct a market study of the quantity and characteristics of organics (food waste, biosolids, other high strength waste) produced statewide, including possible end uses of such products (such as agriculture, mine reclamation, roadside soil amendments, recycled bioproducts such as bioplastics, and erosion control).
- **Research on markets:** The State should continue financial support of colleges and universities within New York in researching recycling market challenges, plastics recycling, low-grade paper recycling, and glass processing innovations for New York.
- **State purchasing:** State agencies, authorities, and local governments should support greater purchasing of products with recycled content as well as the purchase of recycled products (compost, etc.).

W9. Biogas Use

During the implementation of aggressive waste reuse, reduction, and recycling techniques, it is recognized that some amount of waste generation will be unavoidable. Biogas generation from landfills and from anaerobic digestion will continue, and a viable use for the biogas is needed. Self-supply of energy needs at landfills and WRRFs through biogas capture and use should be incentivized where it can provide electric system capacity for greater levels of buildings and transportation electrification, with particular focus on Disadvantaged Communities. Boilers and engines on site are often able to replace fossil natural gas with a facility's own digester gas, yet some engines are easily fouled by the impurities in the biogas. The use of biogas on site, where feasible and practical, is preferred before refinement of biogas into RNG for on-site use. The limited supply of biogas or RNG should be targeted to strategic uses such as locations where it can provide electric system capacity for buildings and transportation electrification by alleviating system constraints. Assessing use in the waste transportation sector, electric co-location, or cogeneration opportunities for energy and heat intensive industries and challenging to electrify users is an avenue for biogas use, and emphasis should be placed on non-combustion applications such as use in fuel cells. Infrastructure needs for biogas or RNG from waste management should be consistent with the framework outlined in *Chapter 18. Gas System Transition*. Alternative revenues at organics recycling facilities, such as energy revenue, will allow lower tip fees to attract organics at competitive levels. Stable, enhanced energy revenue will attract investment to aggressively manage methane in existing disposal facilities and existing and new organics recycling facilities. The CJWG expressed that biogas could play a role in environmentally sound waste disposal, but caution should be taken to avoid biogas use that intentionally or inadvertently leads to the extended use of fossil fuels.

Components of the Strategy

- **Strategic use of biogas:** NYSERDA and New York State Department of Public Service (DPS), along with utilities, should evaluate strategic and local uses of generated fuels, electricity, or other energy produced from biogas for essential needs during the transition to electrification and other low-emissions energy sources. This evaluation should stress the use of fuel cells for electricity in lieu of generators or pipeline use, fuel uses in the waste transportation sector, electric co-location or cogeneration opportunities for energy/heat intensive industries, challenging to electrify uses, heat for buildings, and difficult to electrify medium- and heavy-duty transportation. This evaluation should demonstrate air quality, health, and GHG benefits before implementation, including requirements to avoid localized pollution in Disadvantaged Communities.

- **Funding for organics recycling infrastructure:** NYSERDA and DPS, along with utilities, should identify energy pricing models and conduct a market-based study for waste-generated biogas. Programs that incentivize anaerobic digestion should require systems be built (or retrofit) for maximum methane mitigation to ensure development of well-managed, low emissions biogas or RNG production such as utilizing emissions minimizing technologies and techniques, minimizing fossil fuel use in biogas or RNG production, minimizing emissions from biosolids/digestate, and consideration of a regulatory framework to ensure best practices. The State should also provide a funding mechanism to support an organics recycling infrastructure.
- **Research:** DEC should complete a comprehensive landfill gas and WRRF emissions research study. The study should evaluate emissions monitoring techniques, quantify fugitive emissions, and evaluate the most appropriate uses for the gas during the transition to statewide electrification. The study should also seek to improve estimates of methane emissions from anaerobic digestion and methods to reduce or eliminate these emissions.

Statewide and Cross-Sector Policies

Chapter 17. Economywide Strategies

17.1 Overview

The Climate Action Council (Council) has identified the need for a comprehensive policy that supports the achievement of the requirements and goals of the Climate Act, including ensuring that the Climate Act’s emission limits are met.²⁹⁷ A well-designed policy would support clean technology market development and send a consistent market signal across all economic sectors that yields the necessary emission reductions as individuals and businesses make decisions that reduce their emissions. It would provide an additional source of funding, alongside federal programs and other funding sources, to implement policies identified in this Scoping Plan, particularly policies that require State investment or State funding of incentive programs, including investments to benefit Disadvantaged Communities. Equity should be integrated into the design of any economywide strategy, prioritizing air quality improvement in Disadvantaged Communities and accounting for costs realized by low- and moderate-income (LMI) New Yorkers. Pursuant to the Climate Act, a policy would be designed to mitigate emissions leakage. Finally, an economywide strategy would be implemented as a complement to, not as a replacement for, other strategies in the Scoping Plan. A well-designed economywide program will bring about change in the market and promote equity in a way that does not unduly burden New Yorkers or create disadvantages to New York’s competitive position with other states, with the nation as a whole, or with the global economy.

After initially identifying three options for consideration, the Council narrowed its consideration to two economywide GHG policies: a tax or fee establishing a carbon price and a program that caps emissions across the economy, or within particular sectors, and allocates emission allowances primarily through an auction mechanism that provide revenues for investment, known as “cap-and-invest.” The Council concluded that clean energy supply standards, which would require providers of energy across the economy to reduce the carbon intensity of fuels they introduce into commerce, can complement economywide structures as discussed in this chapter, but because such standards apply only to energy sources, they do not offer the same comprehensive coverage and opportunities for cross-sector efficiency. For this reason, the Council determined that clean energy supply standards (like the Clean Energy

²⁹⁷ ECL § 75-0109.

Standard [CES] for electricity and clean transportation standard) should be considered separately under sectoral chapters.

A carbon tax/fee would establish the price per ton of greenhouse gas (GHG) emissions that regulated entities would pay. Carbon tax/fee proposals have been considered by the New York State Legislature, and the New York Independent System Operator (NYISO) put forward a proposal for a fee on every ton of carbon dioxide (CO₂) emission from the electricity sector. A cap-and-invest program would also result in a price on emissions, but indirectly as the government entity establishes the emissions cap while the price is determined based on the available supply of and demand for emission allowances, rather than directly by the government entity. It would require regulated entities to purchase emission allowances, usually at an auction, to match their emissions. The difference from carbon tax/fee, however, is that a cap-and-invest program provides emissions certainty. A cap-and-invest program would limit the number of allowances sold, with the available amount decreasing year-by-year to ensure that overall aggregate emissions decline. Cap-and-invest programs have been implemented economywide in California and Quebec, and Washington recently passed legislation and adopted a rule to establish such a program. There are also existing sector-specific cap-and-invest programs, such as the Regional Greenhouse Gas Initiative (RGGI), that cover emissions from the electricity sector and include New York as a participant. In contrast to a carbon tax or fee, which would have to be enacted by the Legislature, the New York State Department of Environmental Conservation (DEC) could promulgate regulations establishing a cap-and-invest program using its existing authority to adopt regulations that reduce emissions.

Both carbon tax/fee and cap-and-invest programs provide a price signal stimulating lower emission choices and a source of funding for public investment and incentive programs. Both would regulate the bulk of energy, industrial, and other emissions in New York, including both fossil fuels and alternative fuels consistent with the requirements of the Climate Act. Both would be structured to comply with Environmental Conservation Law (ECL) § 75-0117, which requires that at least 35% of the overall benefits of spending be directed to Disadvantaged Communities, with a goal of 40%. But they have one fundamental difference: while both types of programs place a charge on emissions and invest the revenues, only a cap-and-invest program would implement a declining, enforceable cap on emissions overall and a mechanism for State enforcement of such limits against individual sources, thus ensuring that aggregate emissions do not exceed the statewide emission limits.

17.2 Proposed Program Design to Meet Climate Act Requirements

The Council recommends implementation of a cap-and-invest program designed to meet the Climate Act’s requirements and goals, including meeting the economywide emission limits, promoting climate justice, and mitigating leakage. Mindful of current energy price burdens on New York households, the Council recommends gradually phasing in the program with cost containment mechanisms and rebates or subsidies to offset the burden of increased energy prices on LMI households.

Structure of Program to Ensure Compliance with Statewide Emission Limits

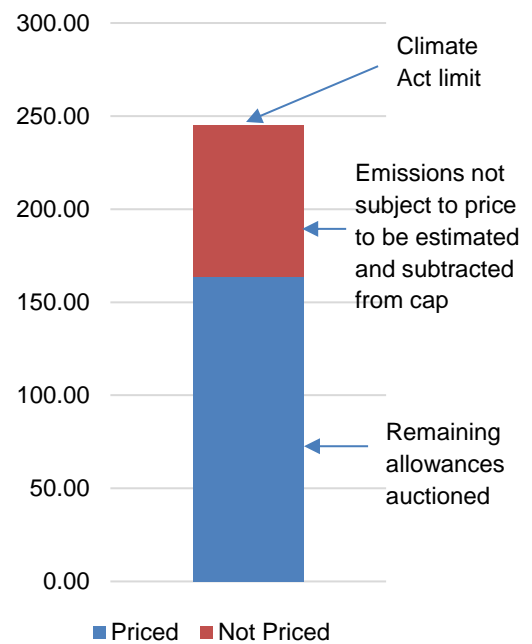
To ensure compliance with the statewide emission limits for 2030 and 2050, all emission sectors would be included under a declining, enforceable cap. A few source categories, however, would not have a compliance obligation, at least at the outset, due to federal constraints (e.g., aviation), difficulties monitoring emissions from the individual sources in the emission sector (e.g., non-fossil fuel agricultural emissions), or other considerations like consistency with RGGI. Monitoring emissions from those source categories and removing those emissions from the statewide cap (through the retirement of emission allowances) will ensure that the statewide emission limit is met.

The program would establish enforceable emission caps that decline year-by-year, including emission caps for 2030 and 2050 that correspond with the statewide emission limits established pursuant to the Climate Act and adopted by DEC in

6 NYCRR Part 496. To ensure that the Climate Act’s emission limits are met, the State would make emission allowances available at quantities that do not exceed the emissions cap for each year.

Allowances corresponding to the emissions of those sectors without a compliance obligation would be retired, with the remainder of allowances being made available to the market and sources with compliance obligations, primarily by auction. The source categories in most sectors would have a compliance obligation, as identified below:

- **Transportation:** Producers and distributors of transportation fuels would have a compliance obligation equal to the carbon content of fuels they produce or distribute.



Note: All sectors in New York would be covered by the cap. Only remaining emissions after considering difficult-to-cover sectors would be subject to allowance retirement requirements.

- Heating fuels: Utilities and other distributors of heating fuels would have a compliance obligation equal to the carbon content of the fuels they distribute.
- Industry: Industrial entities would have a compliance obligation equal to emissions from process operations and fuel combustion.
- Waste sector: Sources in this sector, including incinerators, landfills, and wastewater treatment plants, would be responsible for emissions of GHGs, including fugitive methane emissions, to the extent reasonably accurate tools for calculating such emissions are available.
- Electricity sector: Sources would be responsible for emissions from the combustion of fuels, although the program should be structured to reflect that many of these sources are also subject to RGGI. This could mean covering electricity exclusively under either the new New York system or RGGI, but not both, or covering the sector under both systems but providing credits for payments made for RGGI allowances under New York's system.

Where the Climate Act includes upstream out-of-state emissions in New York State's inventory of statewide GHG emissions, these emissions would also be covered by this program.

In general, most allowances would be made available to the regulated entities through an auction mechanism. The clearing price in such an auction would establish the price of a ton of GHG emissions in terms of carbon dioxide equivalent (CO₂e) under the Climate Act in New York. At the end of each compliance period of one year or more, each regulated entity would be required to surrender allowances equal to the emissions it is responsible for in that period. For any allowances issued but unused at the end of a compliance period, the cap-and-invest system can allow some banking, but the State should consider careful limits on this mechanism to ensure emissions do not exceed 2030 or 2050 limits and to provide for consistent progress toward those directives in intervening years.

The State could use proceeds from the auction for a variety of purposes consistent with the Climate Act, including investing in clean energy and emission reduction strategies and targeting investments to meet the Climate Act's requirements for investment in Disadvantaged Communities. As described in more detail below, at least 35%, with a goal of more than 40%, of the auction proceeds would be invested in projects and programs that benefit Disadvantaged Communities identified by the Climate Justice Working Group (CJWG). Other areas of investment include funding other emission reduction strategies identified in this Scoping Plan and funding just transition strategies that include programs for retraining and providing wage and pension support for displaced workers.

Addressing Equity and Energy Affordability

As required by the Climate Act, the implementing agencies, DEC and the New York State Energy Research and Development Authority (NYSERDA), potentially in collaboration with other agencies, would develop investment programs that ensure at least 35%, with a goal of 40%, of the benefits of investments flow to Disadvantaged Communities. Those agencies should establish a process to fully engage impacted communities in the identification and implementation of investment strategies in their communities funded with auction proceeds. Projects funded by auction proceeds in Disadvantaged Communities should incorporate a variety of workforce standards, including preferential hire for members of underrepresented communities, individuals with disability, unemployed individuals and others, and competitive advantage for businesses housed and operating in Disadvantaged Communities.

In addition, DEC should evaluate and adopt program design elements that would provide additional assurance that emissions will decline in Disadvantaged Communities. Potential mechanisms for DEC to consider, based on continued engagement with environmental justice and other stakeholders, could include limits on trading allowances that preclude sources within, proximate to, or impacting Disadvantaged Communities from purchasing allowances from outside Disadvantaged Communities; source-specific caps or other mechanisms designed to prioritize reduction of GHG or co-pollutant emissions from sources in, proximate to, or impacting Disadvantaged Communities; and targeted air quality monitoring to ensure continued air quality improvement in Disadvantaged Communities. DEC should also consider whether requiring a multiple of allowances for sources within, proximate to, or impacting Disadvantaged Communities would provide additional protection. In addition, emissions in Disadvantaged Communities would be mitigated by other Scoping Plan strategies and DEC clean air regulatory programs and can be targeted to address areas of higher pollutant levels identified by DEC's comprehensive air monitoring initiatives.

Members of the CJWG have expressed concern that market-based programs that allow emission trading can result in, or allow the continuation of, pollution hotspots in their communities. The design elements described above are intended to preclude that outcome, consistent with Section 7(3) and other requirements of the Climate Act,²⁹⁸ while ensuring that residents of Disadvantaged Communities share in the air quality, public health, and economic benefits of the clean energy transition. As it proceeds with development of the regulatory program, DEC would engage extensively with representatives of

²⁹⁸ See, e.g., ECL § 75-0109(3)(c) and (d).

Disadvantaged Communities, including the CJWG, to ensure that their input informs development of the program.

To ensure consistency with Climate Act requirements, the state could produce Disadvantaged Community investment plans intended to ensure air quality improvements every five years in consultation with representatives of Disadvantaged Communities and annual outcome reports for investments enabled with auction proceeds. Plans would identify priority program areas and pollutants, including establishing success metrics for improvements in designated geographic areas. Annual reports would evaluate progress against these metrics and can suggest amendments to plans to improve outcomes.

In addition, the agencies should develop and implement measures to mitigate any impact of higher energy prices on New York households and small business, particularly LMI households. One mechanism would be to use some portion of the auction proceeds for per-household rebates, or climate dividends, that mitigate the impact of higher energy prices. Mitigation methods benefiting LMI households should be designed in a way that does not disqualify them for other assistance, thereby canceling out the intended benefit. In designing and implementing a cap-and-invest system, the State should also evaluate affordability for non-LMI households and businesses and consider mechanisms to manage these impacts. One option would be the inclusion of a cost-containment reserve to moderate allowance prices; this mechanism is already used in RGGI. In developing the program, DEC and NYSERDA should evaluate likely costs and propose additional mitigations as needed.

Energy- or Emission-Intensive and Trade-Exposed Industries and Leakage

To implement the Climate Act's requirement to limit emission leakage, DEC should develop a mechanism to allocate allowances to energy-intensive or emission-intensive industries that are also trade-exposed. This would require the development of criteria to establish the thresholds above which industries would be deemed to be energy- or emission-intensive as well as trade-exposed. Appendix C sets out a method by which the State could identify these industries, and any final definition would be subject to public input. By identifying these energy-intensive and trade-exposed (EITE) industries, the State would be identifying which sectors are vulnerable to leakage. Sources in EITE industries could be allocated allowances based on their output. To ensure that these sources have a continuing incentive to reduce emissions, they could be allocated emissions on a benchmarking approach that is based on the emission intensity of well-performing sources within the industry. Sources with a higher emission intensity than the benchmark would need to acquire any additional allowances needed in the allowance auction. Over time, the benchmark would be reduced in accordance with the reduction trajectory of the emissions cap,

providing a further incentive for covered sources to implement technological advancements to reduce emissions. The measures align with the recommendations from the Just Transition Working Group (JTWG) on measures to minimize leakage and anti-competitive impacts of policies contained in Appendix C, as well as the discussion on leakage in *Chapter 7. Just Transition* and *Chapter 14. Industry* pertaining to impacts on jobs and industry.

17.3 Application of Evaluation Criteria

The Council's recommendation of a cap-and-invest program encompassing all source categories is supported by the application of a variety of criteria, identified in the following sections.

Certainty of Emission Reductions

A primary benefit of a cap-and-invest program is that it would cap and reduce emissions, providing legally binding emission certainty. Setting an economywide cap at a level corresponding with the Climate Act's emission limits provides certainty that those emission limits will be met, while also providing a mechanism for State enforcement of such limits against individual GHG emission sources, as required by the Climate Act.

Although a carbon tax/fee program likely would reduce emissions, it would not ensure a particular level of collective emission reductions from all affected sources. The reductions achieved through imposing a price could vary based on multiple factors including market conditions, weather, technological developments, and the effect of other policies. If the price were set too low, the program might not yield the desired or required level of emission reductions. More certainty in the level of emission reductions could be achieved by including mechanisms to adjust the price upward or downward in response to emission-reduction levels, but ultimately the initial price level and the escalation rates would be, at best, an informed guess.

The inclusion of offset programs in some cap-and-invest programs, such as RGGI, has engendered some criticism, particularly from environmental justice organizations that contend that the availability of offsets reduces the certainty of emission reductions from the regulated sources. In any cap-and-invest program adopted to meet Climate Act requirements, the role of offsets would have to be strictly limited or even prohibited in accordance with the requirements of ECL § 75-0109(4). Under that provision, DEC would have to ensure that any Alternative Compliance Mechanism that is adopted would meet various requirements specified in that provision of the Climate Act. Therefore, offsets would have little, if any, role under a cap-and-invest program designed to comply with the Climate Act.

Price Certainty

Price certainty helps businesses and investors make informed planning and investment decisions. Because renewable energy and other non-emitting energy sources would not bear any cost, potential investors in those technologies could calculate the market advantage attributable to the carbon price in making investment decisions. Likewise, an entity considering investing in emission-reducing technologies could calculate the savings that would result from those investments. Relatedly, the owner of an emitting source could use the certainty of the future price to make an informed decision about when the source would become uneconomic. The certainty of the future prices might also allow consumers to make more informed decisions.

Development of a cap-and-invest program would include measures to provide a level of price certainty. Examples include establishing a minimum allowance price and an emission containment reserve under which fewer allowances are made available if prices are below a specified level, similar to the RGGI program. Cap-and-invest programs could also include soft price ceilings to limit costs. RGGI, for example, includes a cost containment reserve mechanism that releases additional allowances at higher price levels. DEC would design such measures based on stakeholder input and to ensure they do not interfere with ensuring compliance with the Climate Act's overall statewide emission limits.

Carbon tax/fee would generally provide more price certainty because the price trajectory is established in the governing laws or regulations, rather than determined indirectly based on the government-established emissions cap. If, as indicated above, the price is adjusted over time to increase the likelihood of meeting the statewide emission limits, that would have the effect of reducing price certainty, but it would still not provide the same level of emissions reduction certainty as a cap-and-invest program.

Prioritizing Emission Reductions and Avoiding Hotspots in Disadvantaged Communities

The Climate Act requires the Scoping Plan to “identify measures to maximize reductions of both GHG emissions and co-pollutants in disadvantaged communities.”²⁹⁹ Likewise, DEC’s regulations to achieve the statewide emission limits must “prioritize measures to maximize net reductions of GHGs and co-pollutants in disadvantaged communities.”³⁰⁰ Carbon tax/fee and cap-and-invest programs would both be subject to the Climate Act’s requirement that Disadvantaged Communities receive at least 35%, with a

²⁹⁹ ECL § 75-0103(14)(d).

³⁰⁰ ECL § 75-0109(3)(d). See also Climate Act § 7(3).

goal of 40%, of the benefits of clean energy and energy efficiency spending. Either type of program could include mechanisms to ensure compliance with the Climate Act, including a process for obtaining input in investment decisions from Disadvantaged Communities.³⁰¹ In their traditional form, because both impose a uniform price for emissions across an economy, neither program offers an advantage relative to the other for local, specific air quality improvements.

As indicated above, however, the proposed design of a cap-and-invest program could also include innovative program designs to directly prevent the formation or existence of emission hotspots that occur when certain sources maintain or increase higher levels of co-pollutant emissions despite the reduction of economywide emissions. In addition, other DEC regulatory requirements limit emissions of criteria and toxic pollutants from individual facilities and vehicles.

Interaction with Other Regulatory Programs

Other policy initiatives or regulatory changes by various agencies may complement and facilitate the efficient and effective implementation of an economywide regulatory approach to reducing GHG emissions. In this regard, a cap-and-invest program has the benefit of minimizing the costs associated with ensuring any specific level of GHG emission reductions, including the level of statewide reductions required by the Climate Act. Where a government is implementing standards and other regulations, funding new investments into clean energy solutions to drive emission reductions on a sectoral basis, or making investments to support emission reductions, the declining emissions result in a lower cost to the public for the cap-and-invest program. That has happened in the RGGI program, where complementary clean energy policies have led to reduced emissions, keeping allowance prices low even with a cap that declines substantially over time. Likewise, Inflation Reduction Act funding, as well as other federal investments, would also support lower emissions that would also reduce allowance prices. In this manner, a cap-and-invest program has the benefit of automatically capturing both the cost- and emission-related benefits of other complementary policies and investments.

On the other hand, in a carbon tax/fee program, the level of a carbon price would not ordinarily vary depending on the emission reductions yielded by other programs. Instead, the emissions reduced by a direct carbon tax/fee would be in addition to the emissions reductions from the regulatory standards or other investments. Even as emissions decrease due to other policies, the level of the carbon tax/fee would remain the same – unlike in a cap-and-invest program – since the value was pre-determined through

³⁰¹ ECL § 75-0117.

government action. Of course, as those regulatory standards or other policies reduce emissions, the same carbon tax/fee would be applied to a smaller amount of emissions, potentially reducing revenues. As noted above, in the event a carbon tax/fee does not provide the required level of statewide emission reductions under the Climate Act, additional legally enforceable regulatory measures on certain source categories or sectors may be necessary to ensure the Climate Act's statewide emission limits are met.

Mitigating Risk of Leakage

The Climate Act requires programs to be designed to limit leakage. Consistent with programs implemented elsewhere, the proposed cap-and-invest program design alleviates this risk by allocating free allowances to EITE industries based on a benchmarking approach, an approach well-established in similar programs in other jurisdictions. The same goal could be accomplished in a carbon tax/fee design, by providing rebates to EITE industries, although that model has not been applied elsewhere.

Other Criteria

The other criteria considered by the Council do not favor one particular economywide model over the other.

- **Affordability and avoiding regressive impacts:** One concern often expressed about either pricing mechanism is the potential for regressive economic impacts, due to lower-income households spending a higher portion of their income on electricity, heating, and transportation fuel, which would all become more expensive if the resulting emissions bear a cost. Both carbon tax/fee and cap-and-invest policies could be designed to address those impacts, such as with rebates funded by the revenues or other investments to reduce regressive impacts.
- **Sufficiency of funding and use of proceeds:** Since a cap-and-invest program would be designed to have an economywide cap that corresponds with the Climate Act emission limits, it provides a sufficient level of proceeds by definition. Likewise, the investment of federal funding to reduce emissions has the effect of reducing the need for cap-and-invest revenues. Although a carbon tax/fee could provide more certainty regarding the amount of revenues, it provides less certainty that the revenues are adequate to ensure meeting the economywide emission limits. If the escalation rate is designed to not adequately coordinate with realized emission reductions, a carbon tax/fee program could see falling revenue even as the price does not increase sufficiently to realize Climate Act-level emission reductions.
- **Regional equity:** The Council has identified the need to ensure that an economywide program does not place a disproportionate burden on particular geographic portions of the State. This could occur, for example, in areas of the State where emission-intensive sources are concentrated,

if particular areas have less access to technologies to reduce GHG emissions, if available technologies do not meet local needs as readily (for example as a result of cold weather), or if the residents of particular areas are more reliant on higher-emission fossil fuels to meet their energy needs. Under either a cap-and-invest or carbon pricing program, investment of proceeds would be the primary mechanism to address these regional disparities. Investments could be targeted to those areas with high fossil fuel dependence to assist households and regional businesses in a swifter clean energy transition, for example through efficiency upgrades and other measures, that reduces exposure of the region and its residents to the cost impacts of the cap-and-invest system.

- **Supporting economic development and innovation:** In general, either policy mechanism would be expected to provide a competitive advantage to lower- or zero-emission industrial operations or vehicle fleets using zero-emission technologies and to stimulate private investment in lower-emission sources and technologies. In addition, auction proceeds or revenues could be invested in ways that support sustainable low-carbon economic development.
- **Incorporating multi-jurisdiction programs:** Participating in one or more multi-jurisdiction regional programs could have the benefit of assuring competitive neutrality across the region, reducing emission leakage, and, if New York's participation induces other states to participate, increasing the overall GHG emission reductions. Carbon pricing and cap-and-invest programs could be structured to accommodate regional sector-based programs like RGGI. One mechanism applicable to both types of programs would be to credit the cost of allowances under a regional program toward the payments under the State-specific program. In the alternative, compliance with a regional program could govern a particular sector in place of the State-specific program.

Chapter 18. Gas System Transition

18.1 Overview

All the information before the Climate Action Council (Council) indicates that achievement of the emission limits will entail a substantial reduction of fossil natural gas use and strategic downsizing and decarbonization of the gas system. The integration analysis scenarios and Advisory Panel recommendations also show a greatly diminished use of fossil natural gas. To achieve Climate Act targets, the integration analysis scenarios identified the vast majority of current fossil natural gas customers (residential, commercial, and industrial) will transition to electricity by 2050 and identified fossil natural gas use reductions statewide by at least 33% by 2030 and by 57% by 2035. The existing gas system was developed to meet current demand for fossil natural gas and will need to be strategically downsized as this transition proceeds. A well-planned and strategic transition of the gas system will require coordination across multiple sectors. This coordination will include integrated planning with the decarbonization of the power generation sector and buildout of local electric transmission and distribution systems to meet anticipated increases in electricity demand throughout the State. The integrated planning will ensure the transition is equitable for workers and equitable and cost-effective for consumers without compromising reliability, safety, energy affordability, and resiliency.

It is important that the strategic transition to a decarbonized gas system in New York State does not impose undue cost burdens on customers who currently rely on this fuel for home heating, especially those who can least afford cost increases. Demand reduction measures that reduce customer reliance on fossil natural gas, including energy efficiency and demand response programs, must be increased. New York State must explore whether full electrification of heating load in the near term is the most cost-effective and technically feasible solution for all customers, for instance steam heating customers in New York City, customers in areas with extreme cold climates where cold climate air source heat pumps are installed and supplemental heat may be used, or space heating customers in regions of the State where current electric capacity constraints may be more significant. These studies, combined with strategies described elsewhere in this Scoping Plan, will be used to leverage existing, emerging, and new technology to rapidly reduce and eventually eliminate the need for fossil natural gas in New York State, while taking into consideration impacts on jobs and industry as referenced in *Chapter 7. Just Transition* and *Chapter 14. Industry*.

Unlike other sectors, such as electricity generation, transportation, and energy efficiency, the gas system does not have a long history of analysis and policy development on emissions reductions to inform the

strategies in the Scoping Plan. New York State will need to implement an ongoing effort to plan for and manage the strategic downsizing and decarbonization of the gas system as the transition to greater electrification proceeds. That ongoing effort should include identification of strategic opportunities to retire existing pipelines as demand declines and exploration of the safest, most reliable, resilient, and least expensive approaches for an orderly transition. One scenario that should be considered is seeking to move whole streets or neighborhoods at a time from gas infrastructure to a community-based thermal energy network that supports heat pumps. A utility could own and run the thermal energy network, which would support heat pumps in individual buildings, with the heat pumps owned by the building owner. During the transition to the decarbonized systems, some investments in traditional infrastructure will still be necessary to maintain reliability and safety for remaining fossil natural gas customers, but greater scrutiny of such investments is warranted to minimize the level of stranded assets that make it more expensive to fully decarbonize the fossil natural gas sector. Similarly, workforce retention plans as well as efforts described in *Chapter 7. Just Transition* to support a workforce to install, inspect, maintain, and operate energy system infrastructure is necessary to ensure a safe and reliable system throughout the transition.

The Council has reviewed the potential use of alternative fuels such as renewable natural gas (RNG) and green hydrogen in the gas system for space heating or process use where electrification is not yet feasible or to decarbonize the gas system as it transitions.³⁰² While there may be a strategic role for the system to transport RNG, the potential in-state availability and resource size of RNG is currently small as compared with current levels of fossil natural gas use. As for green hydrogen, the existing gas system was not designed to handle any substantial quantity of blending of hydrogen, so the safety and durability of the system must be addressed before hydrogen is introduced into existing infrastructure. The Council notes that additional analysis is needed to determine the feasibility and the climate impact; the analysis should include an evaluation of the full life cycle greenhouse gas (GHG) and co-pollutant emissions impacts, health impacts, impacts on energy affordability, and safety and reliability considerations for the use of RNG and green hydrogen prior to investments in alternative fuels for use in gas system planning as described in the Gas System Transition Plan Framework below.

³⁰² See Appendix G: Integration Analysis Technical Supplement. Scenario 2 (called “Strategic Use of Low-Carbon Fuels”) modeled in the integration analysis. In this scenario, renewable natural gas (RNG) is used in the buildings sector, assuming a 9% RNG blend in gas pipelines by 2030 and 100% RNG to meet dramatically reduced gas demand in buildings by 2050. Green hydrogen use is limited mostly to transportation, industrial purposes, and electricity reliability in this scenario, though a small amount of hydrogen is used to power the Con Ed district system by 2050, with steam demand reduced by about 66% as many existing customers electrify in whole or in part.

While the managed transition away from fossil natural gas proceeds, it remains important to reduce methane emissions from the gas sector. The speed of the transition is amplified because of the Climate Act’s use of a 20-year global warming potential (GWP) and the inclusion of upstream emissions, including those associated with imported electricity and the extraction and transmission of imported fossil fuels. A significant amount of methane emissions associated with the use of fossil natural gas in New York occurs outside of the State. However, the State and the utilities have taken steps to reduce the methane emissions that occur within State boundaries through programs to reduce the quantity of leak-prone pipes. Current reporting indicates higher fugitive emissions are associated in areas of the State with higher quantities of leak-prone pipes in need of replacement or potential retirement. System repair will provide near-term reductions in these emissions. The New York State Public Service Commission’s (PSC) existing policy is to require utilities to remove leak-prone pipes from service and the aggressive reduction of known leaks on gas systems. Much of the leak-prone pipe replacement is necessary for safety reasons and will continue to produce real reductions in emissions, while additional replacements may be necessary for further emission reductions. In 2022, New York State Department of Environmental Conservation (DEC) adopted a new rule (6 NYCRR Part 203 – “Oil and Natural Gas Sector”) to address methane leakage from the oil and gas sector. In addition to rigorous leak detection and repair requirements, the regulation aims to reduce or prohibit the venting of fossil natural gas at wells, compressor stations, storage sites, and metering and regulating stations.³⁰³ The regulation is projected to reduce 1.2 million metric tons carbon dioxide equivalent (CO₂e) of methane emissions, the equivalent of taking 236,753 cars off the road.³⁰⁴ This regulation is a major step forward in reducing methane emissions from the gas infrastructure within the State, but there is still much to be done to fully reduce emissions as New York strategically downsizes and decarbonizes the gas system.

Key Stakeholders

Decarbonizing the gas system in New York State will be a complicated undertaking affecting a broad range of stakeholders: the utilities that need to transform their business models; gas utility customers who may need to retrofit heating, hot water, and cooking appliances in their homes and businesses; local governments that need to consider building code changes; commercial and industrial gas customers who

³⁰³ New York State Department of Environmental Conservation. “Proposed Part 203 Oil and Natural Gas Sector.” Accessed at <https://www.dec.ny.gov/regulations/122829.html>.

³⁰⁴ New York State Department of Environmental Conservation. 2021. “DEC Announces Proposed Regulations to Reduce Methane Emissions from Oil and Natural Gas Sector.” Accessed November 2021 at <https://www.dec.ny.gov/press/122850.html>.

need to consider changes to their business operations; regulators who will need to equitably and legally balance shareholder, workforce, and consumer and public interests when deciding, for example, how to prevent the stranding of assets tied to fossil fuels that are no longer able to generate an economic return because of changes associated with decarbonizing the economy. Accordingly, key stakeholders for transitioning the gas system will also include federal and State regulators (Federal Energy Regulatory Commission [FERC], Pipeline and Hazardous Materials Safety Administration, DEC, New York State Department of Public Service [DPS], and PSC), affected workers and unions, New York State Department of Labor (DOL), gas infrastructure owners, power plant owners, the New York State Energy Research and Development Authority (NYSERDA), municipalities that adopt and enforce building codes, and industrial, commercial, and residential gas customers. The adoption of measures to transition the gas system will be heavily dependent on end-use customer adoption of enhanced energy efficiency, demand response, electrification, geothermal, energy storage, potential use of alternative fuels such as RNG and green hydrogen, and future innovation strategies. Utilities have an obligation to provide safe and reliable service, so the speed of end-user adoption of fossil natural gas alternatives will affect the speed with which the utility will be able to transition its own infrastructure.

18.2 Key Considerations

Transition Away from Gas

The transition away from fossil natural gas should be carefully managed, phased, and adhere to the labor standards consistent with *Chapter 7. Just Transition*, while maintaining safety and reliability for those who still depend on the energy being delivered. The transition should take place as quickly as possible and to the maximum extent possible and include the production, transmission, and distribution components of the system, while limiting negative impacts on the workforce.

The State has already taken action toward this transition. The PSC has initiated the Gas Planning Proceeding (Case 20-G-0131) to ensure safe and reliable long-term fossil natural gas planning, which will also require consideration of achieving the GHG emission limits required by the Climate Act.

Furthermore, utility rate case proceedings that appear before the PSC are now required to incorporate a demonstration of how the cases comply with the requirements of the Climate Act, including some of the emerging strategies contained within the Scoping Plan, such as no marketing of fossil natural gas and positive marketing of electrification including geothermal heat pumps and other technologies and strategies to reduce GHG emissions. Additional regulatory actions by PSC will likely be necessary to effectuate the required transition away from gas with the condition that displaced, trained workers should be prioritized for new transitional work.

There are, however, limits to the action the PSC as regulator of gas utilities can take toward this transition under current law. For instance, existing Public Service Law states that it is “policy of this state that the continued provision of all or any part of such gas, electric and steam service to all residential customers without unreasonable qualifications or lengthy delays is necessary for the preservation of the health and general welfare and is in the public interest.” Transportation Corporations Law § 12 also requires that gas and electricity service be supplied on application of a building owner or occupant. The State should review and consider modifications to statutory provisions that may seem to be in conflict with the requirements of the Climate Act, including a review of impacts on the electric and gas systems safety, reliability, and workforce, and, if appropriate, update these provisions to bring them into alignment with the Climate Act to ensure that regulators and utilities do not have conflicting directives from the Legislature and have the clear authority required to take action consistent with the State’s climate goals and requirements.

The Climate Justice Working Group (CJWG) supports the transition away from gas infrastructure and stresses the need for cost-effectiveness and equity to ensure the transition is just. The CJWG recommends that progress be prioritized in Disadvantaged Communities, where co-pollutants pose a high cumulative burden, and supports the denial of fossil natural gas infrastructure permits in order for progress to be made in reducing GHG and co-pollutant emissions. The strategy of prioritizing Disadvantaged Communities may drive the cost of the transition higher due to the scattered placement of these communities on the gas system and the need to maintain system integrity, reliability, and the sequence of deconstructing supply assets.

Regardless, the CJWG recommends that any transition is carefully planned, detailed, and clearly communicated to ensure that expectations are aligned across stakeholders; the electric transmission and distribution system has sufficient capacity to accommodate the increased electric load due to electrification of building heating and transportation; and that meaningful contractions of the gas system (and associated operations and maintenance cost savings) can be realized. Without this level of planning, the transition will likely be more challenging, take longer to implement, be more costly than it would have otherwise been, and result in customers using other fossil fuels such as oil or propane. The Council supports the transition away from fossil natural gas use and strategic downsizing and decarbonization of the gas system in a way that is cost-effective, equitable, and just. The Council notes the coordinated plan the State develops for the gas system transition should address the concerns raised by the CJWG in a way that maintains the safety and reliability of both the gas and electric systems while prioritizing emissions

and co-pollutant reductions in Disadvantaged Communities and mitigating negative impacts on the workforce.

The following strategies will help navigate a reasonable transition away from fossil natural gas.

- **Analysis and planning:** Develop a detailed analysis to determine the most equitable and cost-effective strategy for transitioning from the use of fossil natural gas while maintaining affordable, safe, and reliable service and while considering job protection and workforce development actions. Strategic downsizing and decarbonization of substantial portions of the gas system will require significant planning due to the complexity of the system, the need to coordinate with building electrification, and the pace of required local electric transmission capacity and delivery system buildout, all while maintaining reliable and safe service. To ensure grid reliability needs are met, the transition should be completed in parallel with the New York Independent System Operator's (NYISO) Reliability Needs Assessment. The analysis should inform a detailed and strategic approach to downsizing and the contraction of the gas system while considering end-use customers who are highly reliant on gas and considering the economic impacts, feasible alternatives, and growth in the power generation sector with electrification (including the Consolidated Edison Steam System).
 - The strategy for transitioning away from fossil natural gas usage must include energy efficiency and demand response programs, which, to date, have mainly been used specifically in gas-constrained areas within existing gas service territories. Commercial and industrial customers who can shift fossil natural gas usage away from peak periods of consumption without using another fossil fuel presents an untapped opportunity. Research must be done on other demand response programs, such as utility control of large commercial water heaters that could shift fossil natural gas usage away from peak periods. The capture of waste heat from water heated for industrial or commercial purposes could reduce fossil natural gas load. Use of the proper incentives could ensure that these programs are pursued in an extremely cost-effective manner.
 - An emphasis and focus needs to be placed on permanent load reduction measures that can significantly reduce fossil natural gas usage and demand in the short term, while also providing benefits for the end users if and when buildings are electrified in the mid- to long-term. Building envelope sealing and weatherization measures provide these benefits (in the form of improved comfort by reducing drafts, cold surfaces, and noise pollution and in reducing the risk of pests and mold) and must be implemented efficiently and effectively.

- Point-of-use energy storage and advanced metering could also be used to help control consumer energy bills during the transition away from fossil natural gas. This will require coordination on various levels across the State from the agencies and entities that provide support for low- to moderate-income (LMI) customers, weatherization programs, building electrification programs, other energy efficiency programs, and workforce support to develop a comprehensive approach.
- This analysis must be a continuous process to strategically manage the transition away from the use of fossil natural gas and decarbonization of the gas system. Future adjustments should be considered in response to technological, scientific, and economic developments.
 - **Inclusion of LMI households and the gas industry workforce:** The State should develop a comprehensive equity strategy to prioritize the needs of LMI households and Disadvantaged Communities in the transition, ensuring they are not left behind. This will require meaningful engagement of LMI households and residents of Disadvantaged Communities in the transition process and prioritizing technical and financial assistance to enable these households to make energy efficiency upgrades and electrify affordably. Special consideration will need to occur for the workforce at gas utilities and its qualified contractors, many of whom are members of Disadvantaged Communities, including the development and implementation of an equitable transition plan for the gas industry workforce that includes a detailed timeline so the workforce can properly prepare and considers leveraging gas utility worker’s skillsets for the transition of the gas system. The plan should also include protections, retraining and training that leverages transferrable skills, and job transition opportunities, including for the buildout and operation of district thermal energy systems, with attention to opportunities at dual-commodity utilities. In addition, the plan should include workforce development actions that are responsive to industry needs, outline job placement opportunities, and include services to support job retention, consistent with *Chapter 7. Just Transition*. This requires both a comprehensive system-wide equity strategy and utility-level equity strategies that include adequate accountability and oversight. Electric utilities benefitting from the increased revenue of electrification of heating load should absorb some of the potential burden of the stranded costs. The recent amendment to the Public Service Law in the enactment of the Utility Thermal Energy Networks and Jobs Act to allow gas and combined gas and electric utilities to become holistic thermal energy providers will provide ongoing jobs for displaced workers and a pathway for decarbonizing and transitioning the gas system, including new business models for utilities inclusive of community-scale geothermal systems.

- **Regulation development and emissions reduction targets:** The State should support the implementation of current DEC regulations to decrease methane emissions from gas infrastructure, as well as the promulgation of additional regulations to reduce GHG emissions associated with this infrastructure and, in coordination with the PSC, develop specific emission reduction targets (including interim targets) for transmission, storage, and gas distribution utilities upstream of the customer meter. These targets are necessary to guide utility gas system planning. The Climate Act requires upstream out-of-state emissions from the extraction and transmission of fossil natural gas be included in the statewide GHG emissions inventory and therefore this significant amount of methane emissions must be reduced to achieve the statewide GHG emission limits. One policy lever the State has to lower the contribution from these emissions toward achievement of the emission limits is to reduce our consumption of fossil natural gas.
- **Permitting and service requirements:** The State should enact legislation to amend the Public Service Law and the Transportation Corporations Law to move away from promoting gas system expansion by marketing fossil natural gas to prospective customers or providing gas service lines and extensions of gas mains at no cost to new customers (such as the “100-foot rule”) aiming to ensure continued employment of displaced workers. As soon as possible, the legislation should eliminate the existing requirement that gas service be supplied on application of a building owner or occupant and have each utility regularly file a proposal for how it will meet the State’s emission-free by 2040 (100x40) electricity generation requirement and 2030 and 2050 emissions limits within its customer base. Incentives and rebates for gas equipment offered by utilities or NYSERDA should be ended immediately, particularly for sectors and building typologies where electrification is a near-term solution. To the extent consistent with reliability and safety and applicable laws, the State should deny as inconsistent with the Climate Act additional gas infrastructure permits that would interfere with the attainment of the statewide GHG emission limits. Furthermore, the State should advocate to FERC for denial of unnecessary and unjustified gas infrastructure projects that will exacerbate GHG emissions.

 - Revisions to building codes and standards should be among the first measures undertaken. New building codes must limit the use of fossil natural gas and other fossil fuels in new construction, as laid out in *Chapter 12. Buildings*.
 - The PSC has jurisdiction over the rates and operations of a number of electric and gas municipal energy systems and can direct the entities to implement decarbonization measures. In addition, the PSC has jurisdiction over the State’s privately owned water utilities. While many water utilities have fewer than 50 customers, some could be ordered to implement water usage reduction measures that would translate to reductions in both energy usage and

emissions. The PSC also has jurisdiction over community-based heat exchange systems and other approaches for providing heating and cooling to buildings at neighborhood scales. In addition, the PSC promotes and encourages funding mechanisms for beneficial electrification of heating and cooling systems.

Reduce Fugitive Emissions from Gas Infrastructure

The transition from oil and gas will take time and, during that time, the State will continue to rely on oil and gas infrastructure to deliver safe and reliable energy. To help reduce methane emissions during this period, the State should develop systems to minimize these losses. Below are a set of actions that could be implemented to achieve meaningful reductions in fugitive emissions from the system.

- **Regulatory action:** In addition to DEC's existing oil and gas methane regulations, the State should support future efforts from DEC to further control, reduce, and eliminate methane emissions from gas infrastructure. This may include implementing the use of innovative leak detection and repair technology, developing an inventory of all infrastructure and sources of methane emissions potentially subject to State regulation, and establishing operation and maintenance requirements that result in reduced methane emissions. DEC should coordinate with the PSC to develop specific targets to guide utility system planning in this regard that would be incremental to existing regulations. This should include consideration of methane leaks resulting from excavator damage and whether the current fines for damages are sufficient. The PSC Gas Planning Proceeding, Case 20-G-0131, will address long-term gas utility planning.
- **Prioritize leak prone pipes:** State agencies should prioritize repair or replacement of leak-prone pipes to reduce emissions and identify strategic opportunities to retire existing pipelines as demand declines, in addition to prioritizing measures to ensure safety. Some actions to reduce methane leakage from gas pipelines can be costly. Expending funds to reduce methane emissions from pipelines may not be justified in cases where the infrastructure could be decommissioned within the next several years. In these instances, consideration should be given to using those funds to speed the transition away from gas and the strategic decommissioning of these smaller branch pipelines that serve individual streets and neighborhoods. While it is important to address methane emissions from pipeline systems within the State, it is also critical to keep in perspective that a significant part of the emissions from our use of fossil natural gas occur outside of the State, and that these out-of-state emissions also count as statewide GHG emissions under the Climate Act.
- **Research and development:** The State should continue conducting research and development of emission measurement technologies, including continuous monitoring technologies and survey

(aerial or land) for the production, transmission, and storage of fossil natural gas. This should include working to improve emission estimates from outside the boundaries of New York that are associated with our use of fossil natural gas within the State, as these emissions are part of statewide GHG emissions under the Climate Act and are both large and uncertain.

- **Reporting and inventory:** The State should develop a program to accurately characterize gas infrastructure components through information requests to better estimate emissions and improve inventory reporting. DEC should develop an online registry to collect and organize data and information in a manner that informs and directs the strategic downsizing of infrastructure. The online registry should have a transparent planning and reporting process, include emissions from the gas industry (from wells to end of distribution network pipes) and lists of fugitive methane from sources such as landfills and wastewater treatment. The registry should track and collect data needed for interim targets. The registry should account for, report, and track environmental attributes of any alternative fuel project or fugitive methane avoidance project that ensures that all environmental impacts are identified with no double-counting of reductions or environmental benefits. In addition, the PSC should ensure that all rate orders it reviews comply with the Climate Act, and its proceeding focused on modernizing gas planning (PSC Gas Planning Proceeding [Case 20-G-0131]) should require gas utilities to monitor and report emissions as well as develop strategies for reducing emissions within their individual service territories.
- **Leakage detection and repair and orphaned wells:** The State should develop an integrated plan and coordinate efforts with utilities, gas producers, infrastructure owners, and local municipalities to deploy advanced leak detection technology and to repair leaks in remaining gas infrastructure while maintaining affordable, safe, and reliable service. The program should be designed with measures to limit leakage to the extent feasible, particularly with regard to higher-emitting infrastructure and should identify appropriate funding sources to locate and cap orphaned wells. The PSC Gas Planning Proceeding (Case 20-G-0131) should require utilities to identify leak-prone pipe for replacement, quantify leakage, consider Non-Pipe Alternatives, and maintain safe and reliable service. To cap abandoned wells, the CJWG suggests that public funds be used as a last resort and that the State consider ways the oil and gas industry could contribute to reducing emissions from these sources. To address the CJWG concerns, the State should remove the financial security dollar amounts the oil and gas industry companies are required to provide under the Environmental Conservation Law (ECL) and allow DEC to establish financial security requirements in regulation (as it does for mines) to cover the true cost of plugging and abandoning known orphaned wells. Public funds, including potential federal funding for

orphaned wells through the federal Inflation Reduction Act of 2022, will also be necessary to cover costs for plugging unmapped wells with unknown ownership.³⁰⁵

18.3 Process Going Forward

The Council has developed a framework through which agencies can develop a coordinated plan for the reduction of fossil natural gas use and the strategic downsizing and decarbonization of the gas system through an orderly transition that is equitable, cost-effective, and maintains system safety and reliability (see Table 18). Development of the plan should be led by DPS and supported by NYSERDA, Long Island Power Authority (LIPA), New York Power Authority (NYPA), and DEC. The plan should be developed in consultation with other State entities including the Office of Just Transition and other Council agencies, utilities, environmental justice groups, electric generation owners, unions, and sectoral experts and draw upon successful plans in other jurisdictions. This plan should also include a mechanism through which it can be adapted as technology and system conditions change and as New York increasingly electrifies end use applications such as transportation and space heating.

Table 18. Gas System Transition Plan Framework

Key Principles	Strategies and Guidance
Ensure gas transition plan meets greenhouse gas (GHG) emission reduction targets	<ul style="list-style-type: none"> • Develop plans for how individual gas utilities and the State’s gas system overall will reduce GHG emissions by 2030 and by 2050, as required to contribute to achieving the statewide GHG emission limits established in the Climate Act. • Include utility-specific and system-wide forecasts for the reduction in gas sales and decreasing numbers of gas customers connected to the gas system over time, as large numbers of customers transition to electrification and community thermal for heating, hot water, and other energy end uses. • Require gas utilities to publicly file annual GHG emissions reports.
Reduce energy burdens and address energy affordability concerns	<ul style="list-style-type: none"> • Identify ways to mitigate impacts on remaining gas customers as customers transition to electrification and away from use of the gas system, with a particular focus on low-income consumers. • Include a review of the costs and benefits associated with both the transition to electrification and potential adoption of alternative fuels (renewable natural gas [RNG], hydrogen) for decarbonizing the gas system to evaluate the impact on overall affordability. This should include a review of electric grid and related electric transmission and delivery system buildout costs; avoided costs of appliance electrification; gas system investments and appliance modifications to enable use of alternative fuels; fuel production costs; and costs at the homeowner/business level. • Prioritize and target public financial support of energy efficiency upgrades and electrification initiatives for distressed housing, LMI households, affordable and public housing, and buildings in disadvantaged communities in advance of or paired with electrification of heating and in a manner that lessens cost burdens on customers who currently rely on gas for home heating and who can least afford energy cost increases. Further consider prioritization and targeting of initiatives to support energy efficiency and dual-fuel solutions for subsets of

³⁰⁵ ECL § 23

Key Principles	Strategies and Guidance
	<p>New York’s building stock that will be unaffordable to electrify or where full electrification is not yet feasible.</p> <ul style="list-style-type: none"> • Further define energy affordability (e.g., New York State Public Service Commission [PSC] Energy Affordability Policy’s target energy burden is set at or below 6% of household income for all low-income households).
<p>Prioritize continued and improved safety and reliability</p>	<ul style="list-style-type: none"> • Include an analysis on what technologies will be necessary to maintain the safety and reliability of the energy systems as the State transitions the gas system including, but not limited to, zero-emission dispatchable generation. • Ensure both energy supply and demand are considered in parallel. • Ensure the buildout of the electric system can accommodate additional electrification needs in a way that ensures energy affordability and considers regional differences.
<p>Consider role of alternative fuels and technologies in future gas system planning</p>	<ul style="list-style-type: none"> • Consider strategic use of alternative fuels, aligned with the integration analysis scenarios, to meet customer needs for space heating or process use where electrification is not yet feasible or to decarbonize the gas system as it transitions. • Before considering using alternative fuels in the gas system, ensure that safety considerations are addressed and that there are demonstrated air quality, health, and GHG benefits before implementation, including requirements to avoid localized pollution in Disadvantaged Communities. • Evaluation of the use of alternative fuels should include an analysis of how these fuels contribute to achieving the overarching emissions reduction requirements of Climate Act or recommendations of the Scoping Plan on the need to significantly decarbonize the building sector. • Consider the use of non-wire and non-pipe alternatives (microgrids, energy storage, district thermal energy systems, heat pumps, dual/hybrid heat solutions, etc.) and demand management and load reduction for customer space heating and electricity needs to reduce current and future constraints on the electric grid as the State, utilities, and private developers, including electric generation owners, make significant upgrades to the transmission and distribution system, and in development of clean electric generation assets. • Ensure that any use of alternative fuels, including green hydrogen and renewable natural gas, does not result in increased leaks and emissions within the entire life cycle of the development and use of alternative fuels. • Prior to the consideration of pilots for use of alternative fuels, evaluate the technical, environmental, and financial feasibility of the pilots, including for consistency with the Climate Act. Where feasible and subject to any required state, local, and/or federal approvals, these pilots can serve as a means for testing the impacts of the use of these fuels in gas system planning.
<p>Ensure close coordination with electric system expansion</p>	<ul style="list-style-type: none"> • To ensure grid reliability needs are met, ensure the transition is completed in parallel with the New York Independent System Operator (NYISO) Reliability Needs Assessment. This should include a detailed, strategic, and coordinated approach to optimization of the electric and gas systems, and that any contracting of the gas system considers end-use customers who are highly reliant on gas, economic impacts, feasible alternatives, and growth in the power generation sector with electrification. • Coordinate the statewide gas planning processes with the electric system planning processes at the NYISO to ensure grid readiness at the wholesale power generation, transmission, and distribution levels for electrification efforts in a given region or area of the gas system. • Consider a strategic and coordinated approach to electrification and gas system transition that includes a review of different regions, timeframes, electric system readiness (generation, transmission, and local distribution capacity and supply including coordination with other transmission and distribution level proceedings) to meet electricity demand with widespread electrification, economic development efforts, and utility investments needed to inform efforts to transition customers from gas to electric heating.

Key Principles	Strategies and Guidance
	<ul style="list-style-type: none"> • Include a focus on innovation, including pilots with industry, necessary to transform the electric grid alongside the transition of the gas system.
Ensure a just transition for gas industry workforce	<ul style="list-style-type: none"> • Include a clear plan for the just transition of the gas industry workforce including what the current workforce can expect as part of the transition and the opportunities associated with it and to mitigate negative workforce impacts. • Include consideration of leveraging gas utility workers' and other workers reliant on the gas industry skillsets for the decarbonization and operation of the gas delivery system with alternative fuels, build out and operation of district thermal energy systems, and for support of dual or hybrid heating pathways. • Leverage the work of the Just Transition Working Group (JTWG) to evaluate and provide gas workforce needs to meet the demand of the future heating industry and safely transition the existing gas system, including prioritizing reemployment of displaced workers and bridging gaps for retirement eligibility. In addition, the plan should identify potential funding sources and support for programs focused on workforce development, retention of the gas industry workforce by providing financial incentives while the gas system transitions, and training including for individuals in Disadvantaged Communities. • Include workforce development actions and support for displaced workers consistent with the discussion in <i>Chapter 7. Just Transition</i>. • Include development of health and safety standards and protocols both for the decarbonization of the existing system and for the use of new technologies. • Ensure strong communication with labor and employers as new technologies are adopted or considered.
Ensure equitable access to alternative heating options in Disadvantaged Communities	<ul style="list-style-type: none"> • Prioritize technical and financial assistance to enable households in Disadvantaged Communities make energy efficiency upgrades and electrify and decarbonize affordably. • Ensure that as new technologies, including in energy efficiency, and funding opportunities become available, benefits to and suitable programs for disadvantaged communities are prioritized. • Address the concern that investments in building decarbonization may increase the rental cost of housing, particularly for low-income customers and Disadvantaged Communities.
Prioritize emissions and co-pollutant reductions in Disadvantaged Communities and ensure no disproportionate burden	<ul style="list-style-type: none"> • Ensure that GHG emissions reductions and co-pollutant reductions are prioritized in Disadvantaged Communities. • Ensure no disproportionate burden for Disadvantaged Communities including when considering infrastructure project locations and emissions and co-pollutant impacts. • Utilize the statewide GHG inventory data, the Disadvantaged Communities criteria analysis, air monitoring data, and other research to be able to track progress toward reducing GHG and co-pollutant emissions. Review of how this data can inform current GHG emissions levels and enforcement of the GHG emissions limits.
Consider health benefits and cumulative impacts, including historical burdens	<ul style="list-style-type: none"> • Include analysis to determine the feasibility, climate impacts, and health impacts of current infrastructure, new technologies, and alternative fuels prior to infrastructure investment. • Coordinate with New York State Department of Health (DOH) on data for health impacts.
Consider use of existing gas infrastructure	<ul style="list-style-type: none"> • Investments in traditional infrastructure will still be necessary to maintain reliability and safety and to achieve emissions reduction targets using a decarbonized gas system. • The plan should require greater scrutiny of investments in infrastructure that will be necessary to maintain reliability and safety for remaining customers of the existing gas delivery system, to ensure they do not result in stranded assets and make it more expensive to decarbonize the gas system. This scrutiny should include a determination of the need for investments to ensure safe and

Key Principles	Strategies and Guidance
	reliable service, cost impacts of additional investments to stranded asset costs, compliance with Climate Act, and the technical feasibility of the investment.
Identify needed changes to laws & regulations for alignment with Climate Act	<ul style="list-style-type: none"> Review the creation of new or modifications to existing statutory provisions or regulations needed to accomplish the decarbonization of the gas system and potential use of alternative fuels like renewable natural gas and green hydrogen.
Identify additional analyses needed	<ul style="list-style-type: none"> Independent analysis of alternative fuels, including green hydrogen and renewable natural gas, should include impacts on affordability; life cycle GHG emissions impacts; emissions controls that reduce/eliminate emissions; safety and reliability considerations (including pipeline safety and gas system impacts); engineering and environmental considerations; potential air quality and health impacts and best practices to minimize these impacts; workforce impacts, and safeguards to avoid continued reliance on gas and impede decarbonization and electrification efforts. Comprehensive evaluation of practical cost impacts and benefits of the implementation of the State's energy transformation on individuals, businesses, workforce, and industries in New York. Identify innovative uses of capital and alternative funding mechanisms, including federal funding, for building electrification, energy efficiency, decarbonization of the gas system, and workforce impacts analysis.
Include a communications strategy and customer education plan	<ul style="list-style-type: none"> Include a communication strategy of benefits and associated costs (inclusive of societal cost impacts, health benefits and impacts, environmental and economic benefits, etc.) from the transition to cleaner alternatives and away from use of fossil natural gas to consumers. Include a detailed strategy to educate the workforce on the benefits of the transition to cleaner alternatives and job opportunities associated with it. Include opportunities for significant public comment and engagement in the development of the gas transition plan. Include a review of current policies to ensure better public engagement and robust stakeholder participation processes. Outline how this communication strategy and customer education plan will be executed. Provide information on how the transition of the gas system will expand consumer choice; increase utility energy offerings and business model reforms; and enhance resiliency with increased energy-efficient electrification, energy storage, reduced price volatility due to less reliance on fossil fuels, and potential consideration of alternative fuels.
Include a detailed timeline for transition	<ul style="list-style-type: none"> Include a clear timeline for the gas system transition that aligns with the Scoping Plan's recommendations while assuring grid and energy delivery reliability is met. For example, the plan should align with the target dates included in the integration analysis and Buildings chapter of the Scoping Plan related to building electrification. The timeline should include information for labor, local governments, utilities, power producers, community groups, Disadvantaged Communities, etc., on what this transition means and when.

Chapter 19. Land Use

19.1 Overview

The way we use land, whether for development, conservation, or a mix of uses, directly affects the State's carbon emissions, sequestration, and storage. Smart growth land use patterns reduce transportation-based greenhouse gas (GHG) emissions by reducing automobile use and enhancing accessibility and effectiveness of public transit and pedestrian traffic, thus reducing vehicle miles traveled (VMT); sustainable land use planning and zoning can facilitate optimal siting of renewable energy; and protection of forests, cropland, and wetlands is critical for natural carbon sequestration and improves the resilience of communities. Decisions about where to conserve land, where to develop, and how to arrange and design that development constitute the critical first steps in addressing climate change in land use. These decisions directly impact the ability to achieve carbon mitigation, sequestration, and adaptation and resilience goals.

The dense and targeted development patterns that result from implementation of smart growth land use principles can support land conservation strategies that are critical to climate change mitigation. Smart growth and local government planning are important enabling actions that are needed to balance the protection and restoration of natural and working lands, development, and clean energy siting. Strategic open space conservation can help contain sprawl, direct development into more appropriate areas, and maintain large, vegetated natural lands that contribute to carbon sequestration and storage, while providing an array of additional benefits including wildlife habitat, agricultural production, flood protection, clean water, wood products, and recreation.

Land use and land management decisions that seek to maximize carbon sequestration in our natural and working lands is a key component to realizing the Climate Act goal of net zero emission across all sectors of the economy. Not only are natural and working lands critical for ongoing and enhanced carbon sequestration, avoiding conversion of such lands eliminates the prospect of additional GHG emissions release.

New York State envisions a significant shift to infill development and redevelopment of existing buildings in municipal centers with existing infrastructure to proliferate compact, mixed-use, mixed-income development, which will attract future population growth, support Disadvantaged Communities, and accelerate transit-oriented development (TOD). This development pattern would create new opportunities for open space conservation and be fully aligned with the State's transportation and

other infrastructure investments, resulting in far less automobile use and dependence and a concomitant reduction in GHG emissions from vehicles.

While land-use decision-making falls largely within the jurisdictions of municipalities (cities, towns, villages), State policies, programs, and incentives can influence and inform those local decisions to achieve more sustainable, climate-friendly land use outcomes.

To ensure zero-emissions electricity while increasing sequestration to reach net zero by 2050, local governments will be challenged with balancing these different types of land use. Smart growth and local clean energy siting assistance, paired with other land use strategies to protect natural and working lands will be necessary immediately and in the long term to help communities meet local needs while balancing land use priorities and pressures.

Existing Strategies

There are more than 28 million acres of natural and working lands in New York.^{306,307,308} Smart growth and local planning and decision-making are needed to inventory and maintain existing wetlands, high-value conservation areas, and agricultural production for GHG emissions mitigation, resilience, and adaptation benefits while balancing the increased demand for areas devoted to renewable energy production, forest land, and development.

New York has worked for decades on climate action. In addition to the aforementioned actions, there are several existing strategies that protect natural and working lands and promote smart growth. The State recently enacted legislation (Chapter 58 of the Laws of 2022) to improve and expand regulation of all freshwater, non-tidal wetlands, and adjacent areas by fundamentally changing New York’s statutory system for regulating these wetlands. The statutory changes include shifting wetland maps from regulatory to informational and decreasing the default acreage threshold from 12.4 acres to 7.4 acres.

³⁰⁶ Albright, Thomas A., Brett J. Butler, Susan J. Crocker, Jason M. Drobnack, Cassandra M. Kurtz, William H. McWilliams, Randall S. Morin, Mark D. Nelson, Rachel Riemann, Lance A. Vickers, Brian F. Walters, James A. Westfall, Christopher W. Woodall. 2020. “New York Forests 2017.” *Resource Bulletin NRS-121*. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 118 p. <https://doi.org/10.2737/NRS-RB-121>.

³⁰⁷ U.S. Department of Agriculture. National Agriculture Statistic Service. 2019. “2017 Census of Agriculture, Volume 1, Chapter 1: Part 32 State Level Data: New York.” Accessed at https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/New_York/nyv1.pdf.

³⁰⁸ Huffman & Associates, Inc. August 1999, Finalized June 2000. *Wetlands Status and Trend Analysis of New York State - Mid-1980's to Mid-1990's*. Prepared for New York State Department of Environmental Conservation. Larkspur, California. 17pp. plus attachments. Accessed at https://www.dec.ny.gov/docs/wildlife_pdf/wetstattrend2.pdf.

Implementation of these changes require updating State regulations, developing internal and external guidance, and greater administration and enforcement. Over 75,000 acres of farmland has been protected from development through the Farmland Protection Implementation Grant Program and tens of thousands of additional acres of forestland have been protected from conversion through land purchases and easements with funds from the Environmental Protection Fund (EPF). In New York, there are more than three million acres of Forest Preserve, 900,000 acres of working forest conservation easements, 800,000 acres of state forest reforestation areas, 124,000 acres of wildlife management areas, and nearly one million acres of forest in local and federal ownership. Programs like Regenerate NY, Agricultural Nonpoint Source Abatement and Control (AgNPS), the Hudson River Estuary Program, and annual spring seedling sales by both the New York State Department of Environmental Conservation (DEC) Colonel William F. Fox Memorial Saratoga Tree Nursery and statewide Soil and Water Conservation Districts (SWCDs) assist landowners with tree planting efforts and have resulted in the planting of tens of thousands of trees. The Downtown Revitalization Initiative promotes compact, mixed-use development that is energy-efficient, focuses development in downtown areas, and promotes the use of public transit and reduced dependence on personal vehicles. Since 2016, 59 communities have completed the Downtown Revitalization Initiative planning process. The Brownfield Cleanup, Environmental Restoration, and Brownfield Opportunity Area (BOA) programs offer incentives, planning and technical assistance, tax credits, and liability relief for brownfield cleanup and redevelopment. New York State Department of State (DOS) promotes smart growth through the Local Waterfront Revitalization Program, the Smart Growth Comprehensive Planning Grant Program, and the Countywide Resiliency/Smart Growth Planning Grants Program. DEC offers the Adirondack and Catskill Smart Growth Grants Program and the Climate Smart Communities Program.

Key Stakeholders

Stakeholders that promulgate and enforce land use regulations include municipalities at every level, including cities, towns, villages, counties, and special districts. Stakeholders that guide land use policy and investment include municipal planning organizations (MPOs), county planning boards, regional planning councils, Regional Economic Development Councils (REDCs), industrial development agencies and authorities, and local and regional authorities, such as the Adirondack Park Agency. Stakeholders that hold forest land in New York include DEC, New York State Department of Agriculture and Markets (AGM), New York State Office of Parks, Recreation, and Historic Preservation (OPRHP), New York State Department of Transportation (DOT), New York Power Authority (NYPA), land trusts, utility companies, municipalities, municipal associations, local communities, and private landowners. Stakeholders involved in outreach, education, and other forms of landowner assistance include U.S.

Department of Agriculture (USDA), DOS, DEC, the New York City Department of Environmental Protection, SWCDs, Cornell Cooperative Extension (CCE), the Society of American Foresters, International Society of Arboriculture, New York Society of Arboriculture, New York State Urban Forestry Council, New York Forest Owners Association, education and conservation nonprofits and nongovernmental organization (NGOs), hunting stakeholders, arborists, foresters, and unions. Stakeholders involved in research efforts include State University of New York (SUNY) College of Environmental Science and Forestry (ESF) and Cornell College of Agriculture and Life Sciences (CALs). Other stakeholders involved in developing and administering incentive programs and legislation include the New York State Department of Taxation and Finance and the Legislature.

19.2 Key Strategies

The key strategies for reducing GHG emissions and increasing carbon sequestration and storage through land use practices are described below and organized into three themes, as shown in Table 19.

Table 19. Land Use Key Strategies by Theme

Theme	Strategies
Protect, Restore, and Monitor Natural and Working Lands	LU1. Mitigate Carbon Emissions by Protection of Forest Lands LU2. Afforestation and Reforestation LU3. Avoid Agricultural and Forested Land Conversion LU4. Protect and Restore Wetlands LU5. Mapping, Research, Planning, and Assistance
Consider Forests and Farmland in Land Use Policies	LU6. Provide Guidance and Support for Afforestation and Reforestation LU7. Increase Forest and Farmland Protection in Municipal Comprehensive Plans LU8. Provide Guidance and Support on Clean Energy Siting
Promote Smart Growth	LU9. Regional and County Planning and Technical Assistance LU10. Direct Planning, Zoning, and Pre-Development Assistance to Municipalities LU11. Align State Funding Priorities LU12. Accelerate Transit-Oriented Development

Protect, Restore, and Monitor of Natural and Working Lands

Over 13.7 million acres, or 73%, of New York’s forests are owned by private landowners.³⁰⁹ When surveyed, private landowners owning 91.7% of these forested acres stated that they want to keep their

³⁰⁹ U.S. Department of Agriculture. Forest Service. 2020. “Forests of New York, 2019.” *Resource Update FS-250*. Madison, WI: U.S. Department of Agriculture, Forest Service. 2p. <https://doi.org/10.2737/FS-RU-250>.

forests as forests.³¹⁰ However, natural and working lands in many parts of the State are under pressure from development and conversion, which is causing a steady decline in the amount of carbon dioxide (CO₂) being absorbed each year.³¹¹

Afforestation and reforestation have the potential to greatly increase the carbon sequestration and storage capacity in New York State. In New York, there are 3.9 million acres that have the potential for reforestation and afforestation, including 1.6 million acres of marginal cropland and pastureland and 27,000 acres of natural lands, which would help mitigate 13.1 million metric tons (MMT) of CO₂ per year, with the greatest mitigation potential for pasturelands (9.9 MMT CO₂ per year), urban areas (1.7 MMT CO₂ per year), and biological corridors (1.49 MMT CO₂ per year).³¹² However, there may be competing uses for these lands, such as agriculture, renewable energy project siting, and development that will likely make much of this land unavailable for afforestation and reforestation efforts. Identification of areas for reforestation and afforestation is a first step to increasing forest area, as well as carbon sequestration and storage.

LU1. Mitigate Carbon Emissions by Protection of Forest Lands

New York has 18.6 million acres of forests,³¹³ which hold an estimated 1,911 MMT of carbon.³¹⁴ In addition to carbon sequestration and storage, New York's forests provide wildlife habitat, forest products, flood mitigation, recreational opportunities, and mental health benefits, and protect the State's air and water quality. Forestlands in many parts of the State are under pressure from development and forest conversion, which is causing a steady decline in the amount of CO₂ being absorbed each year. Keeping

³¹⁰ Butler, Brett J., Jaketon H. Hewes, Brenton J. Dickinson, Kyle Andrejczyk, Sarah M. Butler, Marla Markowski-Lindsay. 2016. "U.S. Department of Agriculture Forest Service National Woodland Owner Survey: national, regional, and state statistics for family forest and woodland ownerships with 10+ acres, 2011-2013." *Res. Bull. NRS-99*. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 39 p. <https://doi.org/10.2737/NRS-RB-99>.

³¹¹ Domke, Grant M., Brian F. Walters, David J. Nowak, James E. Smith, Stephen M. Ogle, J.W. Coulston, T.C. Wirth. 2020. "Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018." *Resource Update FS-227*. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. <https://doi.org/10.2737/FS-RU-227>.

³¹² Cook-Patton, S.C., T. Gopalakrishna, A. Daigneaul, S.M. Leavitt, J. Platt, S.M. Scull, O. Amarjargal, P.W. Ellis, B.W. Griscom, J.L. McGuire, S.M. Yeo, and J.E. Fargione. "Lower cost and more feasible options to restore forest cover in the contiguous United States for climate mitigation." *One Earth* V 3(6): 739-752. <https://doi.org/10.1016/j.oneear.2020.11.013>. Accessed December 2021 at <https://www.reforestationhub.org/>. Acreage values were based on Cook-Patton et al. (2020) estimates, which are being further updated at <https://www.reforestationhub.org>.

³¹³ U.S. Department of Agriculture. Forest Service. 2020. "Forests of New York, 2019." *Resource Update FS-250*. Madison, WI: U.S. Department of Agriculture, Forest Service. 2p. <https://doi.org/10.2737/FS-RU-250>.

³¹⁴ Domke, Grant M., Brian F. Walters, David J. Nowak, James E. Smith, Stephen M. Ogle, J.W. Coulston, T.C. Wirth. 2020. "Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018." *Resource Update FS-227*. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. <https://doi.org/10.2737/FS-RU-227>.

forests as forests is critical to maintaining and increasing levels of carbon sequestration and storage and preventing emissions, as forests sequester and store much more carbon than any other land use in New York. State and municipal land acquisition provide the most reliable long-term protection of forested areas from land conversion. There are currently 4.8 million acres of forestland owned by the State, local municipalities, or land trusts in New York. In 2020, 6,005 acres of land were protected through acquisition by DEC and OPRHP and 14 grants were awarded to protect forests through the Conservation Partnership Program. To maintain the State's carbon storage and sequestration levels, additional protection is needed, which can be accomplished through land acquisition and conservation easements.

The State should implement the following tactics that keep forests as forests and maintain New York's forest carbon sequestration and storage levels and prevent emissions from development. Many of the strategies and components listed below will take several years to implement and receive carbon benefits, so actions to keep forests as forests should begin as soon as possible to prevent emissions and slip back of current carbon sequestration in New York forests. Comments from the Climate Justice Working Group (CJWG) were supportive overall of the strategies listed below for mitigating carbon emissions by the protection of forest lands.

Components of the Strategy

- **Enact “Keep Forests as Forests” law:** The State should immediately enact legislation to “keep forest as forests,” requiring developers to purchase and set aside forested land when forest carbon is lost during development following the principles of avoid, minimize, and mitigate.
- **Establish programs to support local land acquisition:** DEC should considerably enhance support for local land acquisition and conservation easements by municipalities and land trusts through mechanisms such as the Community Preservation Act, Conservation Partnership Program, Forest Conservation Easements for Land Trusts, and Community Forest programs.
- **Maintain and increase State land acquisition:** DEC should continue to maintain and significantly increase land acquisition (fee and conservation easement) funding by State agencies, municipalities, and land trusts.
- **Increase collaborative efforts for statewide forest acquisition:** Statewide agencies and organizations, land trusts, programs, and local municipalities should collaboratively aim to expand upon historical land acquisition rates to acquire at least 500,000 forested acres by 2050, prioritizing forests with the highest quality carbon, climate, and other conservation benefits. Acquisition of 500,000 acres of forestlands could result in 26 MMT carbon dioxide equivalent

(CO₂e) of avoided emissions by 2050 (not counting foregone sequestration) from avoided conversion.

LU2. Afforestation and Reforestation

Following European settlement in the 1600s, New York's forest cover began to drop. This trend increased rapidly during the Industrial Revolution, and by the 1880s, less than 20% of New York was forested. With the recognition that New York must restore its forested resources, DEC's precursor, the New York State Conservation Department, began widespread planting efforts in the early 1900s. Planting efforts continued with the Civilian Conservation Corps in the 1930s and following World War II. New York is now 63% forested, but opportunities remain for additional afforestation and reforestation efforts to improve carbon sequestration, carbon storage, and all the other benefits that forests provide,³¹⁵ especially on New York's 1.6 million acres of marginal lands and areas otherwise lacking sufficient natural regeneration. Figure 31 shows forest land cover over time. The strategies within this theme propose an increase in tree planting and efforts to encourage natural regeneration of trees, which will increase carbon sequestration and storage. Seedlings take up to five years to become established after planting or natural regeneration, at which time they begin to grow more rapidly and have a greater impact on carbon sequestration.

The New York State tree nursery system was founded in 1902 to reforest areas of the State that were subject to erosion, flooding, and sedimentation. Numerous tree nurseries were established across the State to grow seedlings for afforestation and reforestation efforts. By 1973, all State nurseries were consolidated to the Colonel William F. Fox Memorial Saratoga Tree Nursery, which produces 1.2 million bareroot and plug seedlings annually, of which only 200,000 are used for planting on State forests.³¹⁶ If only marginal lands are considered for afforestation and reforestation, 872 million trees will be needed over the next 30 years (more than 29 million/year).³¹⁷ However, if all potential locations are considered, a total of 2.2 billion seedlings will be needed (73 million/year).³¹⁸ A large expansion in the workforce is

³¹⁵ Verschoor, K., and G. Van Duyne. *Tree Planters' Notes* 55(2):4-13. 2012. Accessed at https://rngr.net/publications/tpn/55-2/forestry-and-tree-planting-in-new-york-state/at_download/file.

³¹⁶ Ibid.

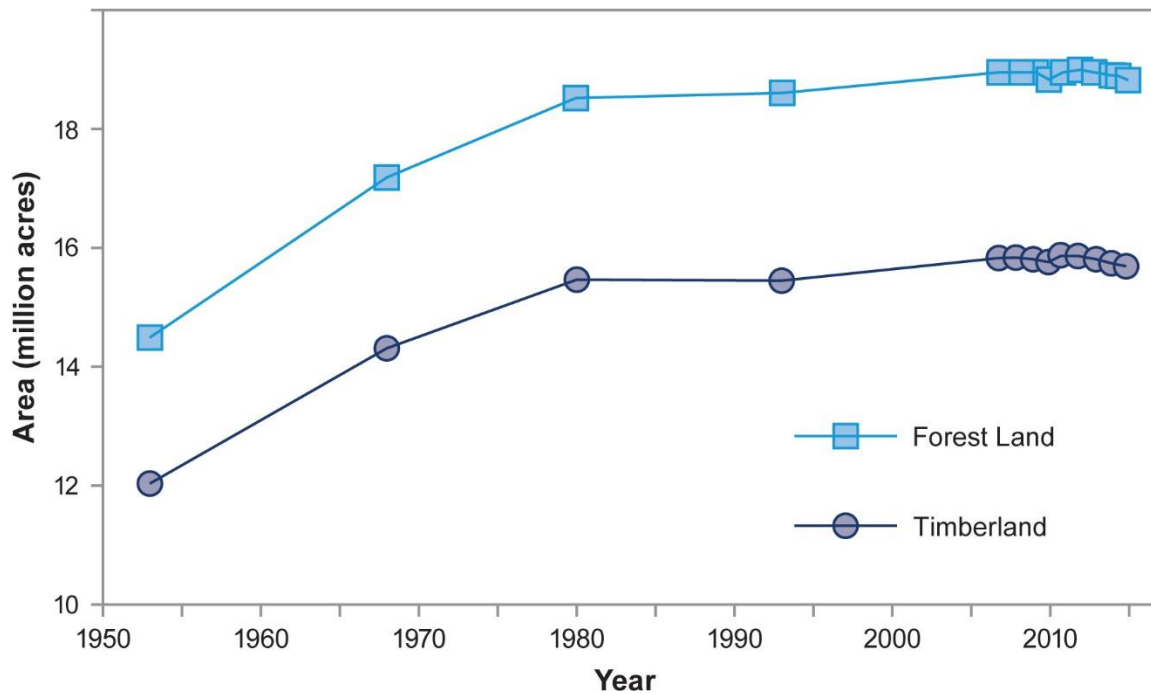
³¹⁷ Fargione J., D.L. Haase, O.T. Burney, O.A. Kildisheva, G. Edge, S.C. Cook-Patton, T. Chapman, A. Rempel, M.D. Hurteau, K.T. Davis, S. Dobrowski, S. Enebak, R. De LaTorre, A.A.R. Bhuta, F. Cabbage, B. Kittler, D. Zhang, R.W. and Guldin. 2021. "Challenges to the Reforestation Pipeline in the United States." *Front. For. Glob. Change* 4:629198. <https://doi.org/10.3389/ffgc.2021.629198>.

³¹⁸ Cook-Patton, S.C., T. Gopalakrishna, A. Daigneaul, S.M. Leavitt, J. Platt, S.M. Scull, O. Amarjargal, P.W. Ellis, B.W. Griscom, J.L. McGuire, S.M. Yeo, and J.E. Fargione. "Lower cost and more feasible options to restore forest cover in the contiguous United States for climate mitigation." *One Earth* 3(6): 739-752. <https://doi.org/10.1016/j.oneear.2020.11.013>.

needed to support afforestation and reforestation efforts to plant seedlings and implement regeneration practices. Afforestation and reforestation practices in New York could support \$176 million in total annual wages with 5,596 full-time equivalents in new jobs by 2035, mainly in rural areas of the state.³¹⁹

In order to ensure that reforestation and afforestation are effective GHG emissions mitigation strategies by 2030 and 2050, these efforts need to be started as soon as possible to allow time for seedling establishment. The CJWG feedback was supportive overall of the strategies listed below for the Afforestation and Reforestation strategy.

Figure 31. New York Forest Land Cover Over Time



Source: Figure showing forest land (at least 10% tree canopy cover) and timberland (forestland capable of producing wood crop) by year, New York, 1953 to 2016 (Albright et al. 2020).

Components of the Strategy

Develop a Statewide Reforestation and Afforestation Plan: DEC should work with other agencies and partners to develop a plan that sets ambitious and collaborative goals that span across agencies and organizations, programs, local municipalities, nurseries and landscaping companies, and landowners for reforestation and afforestation by 2030, 2040, and 2050. State

³¹⁹ Woollacott, J., K. Franze, C. Wade, N. Taylor, and K. Austin. 2022. *Economic Impacts of Investing in Climate Mitigation in New York State Forests and Agriculture*.

agencies, authorities, partners, and organizations should broadly encourage and support statewide tree planting, tree regeneration, and tree maintenance programs to establish and maintain 1.7 million acres (approximately 680 million trees) by 2040. This would result in more than 4.9 MMT CO₂e of additional annual sequestration by 2050.³²⁰ A statewide reforestation and afforestation plan would help increase market coordination with nurseries, seed collectors, and a planting workforce to synchronize implementation needs.

- **Prioritize locations for afforestation and reforestation:** DEC should identify areas where afforestation and reforestation are the most likely to succeed using data provided by the Reforestation Hub,³²¹ experts, and other authorities. Of the potential land available, factors that may impact afforestation and reforestation success include the soil and site conditions, the level of deer browse, the presence of invasive species or other competing vegetation, and limitations on lands with other important uses such as rights-of-way and utility corridors.
- **Reforest rights-of-way:** DOT should work with public and private partners on reforestation efforts in right-of-way areas of the State. These partnerships should determine and focus on tree and shrub species compatible with power transmission and distribution rights of way, roadside areas, pipelines, railroads, and other right-of-way areas and develop programs for afforestation and reforestation in these locations. Public outreach for right tree, right place is needed.
- **Invest in and update the Colonel William F. Fox Memorial Saratoga Tree Nursery:** The State should provide funding to increase the State tree nursery's staff and infrastructure capacity to support large-scale afforestation and reforestation efforts, including expanding tree species offerings to meet adaptation and resiliency challenges and implementing upgrades to enhance seed collection, seed storage, seedling production, workforce development, and pre- and post-planting practices.
- **Increase and accelerate seed collection:** DEC should create a program to increase statewide tree seed collection across the state. This program should establish a network of seed collectors and an efficient method to deliver seeds to the Colonel William F. Fox Memorial Saratoga Tree Nursery for processing, storage, and use.

³²⁰ Wightman, J.L., and P.B. Woodbury. 2020. *New York Agriculture and Climate Change: Key Opportunities for Mitigation, Resilience, and Adaptation*. Final Report on Carbon Farming project for the New York State Department of Agriculture and Markets. https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/2/7553/files/2020/07/CarbonFarming_NYSAGM_FINAL_May2020.pdf

³²¹ Cook-Patton, S.C., T. Gopalakrishna, A. Daigneaul, S.M. Leavitt, J. Platt, S.M. Scull, O. Amarjargal, P.W. Ellis, B.W. Griscom, J.L. McGuire, S.M. Yeo, and J.E. Fargione. "Lower cost and more feasible options to restore forest cover in the contiguous United States for climate mitigation." *One Earth* V 3(6): 739-752. <https://doi.org/10.1016/j.oneear.2020.11.013>.

- **Increase grant program funding:** The State should increase funding for the Urban and Community Forestry Grants to assist local municipalities in the management of the urban forest which can reduce risks associated with extreme heat, drought, and flooding. This would include funding for planning, planting, and maintenance of trees. The State should also increase funding opportunities such as Regenerate NY or the ReLeaf program’s Community Canopy program for private individuals to establish and maintain privately owned trees. This component aligns with adaptation and resilience strategies discussed further in *Chapter 21. Adaptation and Resilience* and Appendix H.
- **Prioritize locations for urban forest tree planting:** Urban and community forest cover is declining by about 6,720 acres annually.³²² As urban and community forest cover decreases, so do the critical benefits that these trees provide, such as carbon sequestration, reduced heating and cooling costs, reduced heat island effects, air and water quality improvement, and flood mitigation. In addition to the Urban and Community Forestry program, DEC should develop an opportunity assessment to focus tree establishment and maintenance efforts within urban areas and communities where the most climate, societal, and public health benefits are likely to be achieved.
- **Provide guidance and support:** DEC should work with partners to develop guidance and provide support and funding to local communities for planning and implementing planting and maintenance projects that help communities adapt to climate change. This may include sharing resources (like equipment, staff, and bulk ordering). This will help communities maintain critical ecosystem services like flood mitigation, clean air, clean water, reduced sediment and nutrient runoff, reduced energy use, shade, reduce risks associated with extreme heat, and improve human health. This component aligns with adaptation and resilience strategies discussed in further in *Chapter 21. Adaptation and Resilience* and Appendix H.
- **Fund cost-share programs:** The State should continue to expand the funding for cost share programs, such as Regenerate NY, to assist forest landowners in widespread implementation of reforestation and afforestation efforts. These existing programs can help move reforestation/afforestation efforts forward while larger efforts, such as the NY Tree Corps become established.
- **Develop equipment loan program:** The SWCC should develop a tree planting equipment loan program to give landowners and operators access to specialized equipment for small- and large-scale tree planting projects.

³²² Nowack, David J., and Eric J. Greenfield., 2018. “Declining urban and community tree cover in the United States.” *Urban Forestry & Urban Greening* 32, 32-55.

- **Provide free tree seedlings:** DEC should expand or create new, free tree seedling programs such as Trees for Tributaries and Buffer in a Bag programs to assist landowners with planting projects. DEC should also explore partnerships with local governments and regional organizations to scale up programs.
- **Establish NY Tree or Climate Corps:** DEC should establish NY Tree or Climate Corp to provide direct tree establishment and maintenance services to public and private landowners. Staff for a NY Tree or Climate Corps would be regionally based and work with DEC Lands and Forests and local SWCDs, trees for tributaries, and other restoration programs to coordinate location selection, site needs, and implementation. A regionally based Tree Corps would be provided with several teams of staff (at least one team per DEC region) and equipment to establish and maintain seedlings at no or low cost to landowners.

LU3. Avoid Agricultural and Forested Land Conversion

The objective of this strategy is to maintain and protect the State’s potential for carbon sequestration on agricultural and forested lands through avoided conversion. It will also help to enhance farm viability, increase food security, potentially reduce future GHG emissions from VMT when implemented with smart growth measures, and protect forest benefits including wildlife habitat, local forest products, and flood protection. The components below should target avoided conversion of both small and large parcels, as appropriate.

In the past five to 10 years, 65,327 acres of forest land have been converted to other uses each year, such as development, renewable energy production, or agriculture, while only 37,909 acres of non-forest have reverted to forests annually.³²³ This strategy proposes additional research and legislation to keep forests as forests. Research activities would include determining and prioritizing the most efficient and effective conservation activities and policies to keep forests as forests and prevent emissions. Legislative changes could take several years and would support forestry activities and require mitigation following development of forests to offset forest conversion emissions and sequestration loss.

Agricultural land can capture carbon in the land base and prevent future emissions from vehicle use by preventing sprawl development. Though well-managed forests sequester more carbon than agricultural lands, properly managed agricultural lands can store carbon and provide other co-benefits. Protecting

³²³ U.S. Department of Agriculture Forest Service. 2020. “Forests of New York, 2019.” *Resource Update FS-250*. Madison, WI. 2p. <https://doi.org/10.2737/FS-RU-250>.

farmland has the potential to maintain or improve local food production, community resilience, water quality, air quality, storm and flood mitigation, public infrastructure protection, drought resilience, wildlife habitat, economic development, rural viability, and employment. All of these may have associated health benefits. This strategy requires continued support from public policy and funding for land acquisition, conservation easements, and tax incentives; outreach to landowners for interest in selling lands or conservation easement opportunities; coordination with vast numbers of municipalities with different zoning and planning goals (home rule); improved data connecting land conversion and quantification of GHG emission reduction; and understanding of the opportunities for land access and intergenerational land transfer.

Components of the Strategy

- **Increase funding and capacity of existing programs:** The State should increase funding for farmland and forestland protection programs to plan for agriculture and forestry and purchase development rights (through conservation easements) by the State, municipalities, and land trusts.
- **Increase support for historically unrepresented farmers:** AGM should assist farmers in securing long-term leasing and farm transfer to historically unrepresented and beginning farmers. This should support youth engagement, internships, and educational opportunities.
- **Strengthen State programs that support agriculture:** AGM should continue and strengthen agricultural assessment and agricultural districts programs.
- **Enhance local capacity to conserve lands:** The State should increase local capacity to conserve agricultural, forested, and other natural lands through statewide authorization of the Community Preservation Act, for the purposes of land conservation for carbon sequestration, and to support land use patterns that reduce GHG emissions such as transit-oriented development. Consideration should also be given to elevating the Conservation Partnership Program, Forest Conservation Easements for Land Trusts, Community Forests program, and other programs that facilitate land acquisition/conservation.
- **Expand legislation:** The State should expand legislation to secure local government's ability to designate Minimum Maintenance Roads to reduce subdivision and development pressure on roads that may result in conversion of farmland and forestland to other land uses.
- **Research avoided conversion impacts:** DEC and AGM should continue researching ways to support avoided conversion of forest lands and farmland, respectively, including by quantification of No Net Loss, prioritizing conservation activities, and monitoring to quantify policy impacts.

- **Increase support for succession and farmland and forestland access:** AGM and DEC should support farmland and forestland access and succession with the advancement and development of programs that make farmland and forestland more affordable and assist farmers and private landowners to navigate generational transfer issues. AGM and DEC should also expand education and technical assistance for beginning farmers and forest landowners and generational transfer. Farmland-focused efforts should focus on assisting farmers with business planning and modeling and expanding supply chain development for new products.
- **Link farmland protection with environmental management programs:** AGM, DEC, USDA Natural Resources Conservation Service (NRCS), and USDA Farm Services Agency should make connections between existing programs (such as Agricultural Environmental Management [AEM], Climate Resilient Farming [CRF], and Agricultural Nonpoint Source Abatement and Control [AgNPS]) to increase co-benefits. This action should target protected farmland for agricultural best management practices (BMPs) that reduce GHG emissions and sequester carbon like soil health management practice systems.
- **Foster new datasets to support decision-making:** AGM and DEC should work with partners to develop new datasets to support avoided conversion and develop monitoring and quantification methodologies to measure the impacts of avoided conversion.
- **Strengthen Right to Practice Forestry law:** The State should enact legislation to strengthen the Right to Practice Forestry law (Environmental Conservation Law, ECL § 9-0815) to prevent municipalities from unreasonably restricting or regulating forestry operations on private land.
- **Mitigate impact from renewable energy projects on forests and agricultural lands:** DEC and AGM should work with the New York State Energy Research and Development Authority (NYSERDA) and Office of Renewable Energy Siting (ORES) to facilitate the siting of renewable energy projects, including solar on appropriate sites, to avoid adverse impacts to New York forests and agricultural lands in order to mitigate impacts to agricultural production, and carbon storage and sequestration. In some cases, this may include rejection of a State subsidy, tax credits, and/or renewable energy credits in forests or agricultural lands with high carbon, climate, or other related benefits. This strategy should also align with the recommendations put forward by the Farmland Protection Working Group and the Agricultural Technical Working Group for further actions and research to mitigate the impact of renewable energy projects on agricultural lands.

LU4. Protect and Restore Wetlands

This strategy focuses on maintaining and enhancing the carbon sequestration potential of freshwater, non-tidal wetlands; coastal and estuarine tidal wetlands; submerged aquatic vegetation; and other coastal

habitats in New York through protection, restoration, and monitoring. While GHG emissions reduction by wetlands may be low compared with forests in New York, it is important to note that many of the State's wetlands are forested, and all wetlands are part of the natural infrastructure necessary for climate adaptation and resilience and collectively contribute to overall carbon storage and sequestration strategies.

Protection of New York's 2.4 million acres of freshwater, non-tidal wetlands (1990s estimate) can contribute to sequestration goals necessary to reach the State's net zero emissions goal.³²⁴ Today, some freshwater wetlands receive protection from ECL Article 24 and from Section 404 of the federal Clean Water Act. However, many remain vulnerable to alterations that can diminish or destroy their ability to store and sequester carbon, provide habitat, filter water, and mitigate flooding. At the federal level, recent changes to the 2020 promulgated Navigable Waters Protection Rule removed protections for a significant number of wetlands. At the State level, the threshold for freshwater wetland protection will drop from 12.4 to 7.4 acres in 2028, and implementation of the expanded protection will require changes to regulations, updated guidance, and greater administration and enforcement. Restoration and monitoring can further expand the role of wetlands and our understanding of their sequestration potential and opportunities. Estimates suggest that more than half of New York's historic wetlands were lost due to activities like filling, draining, and dredging; preventing similar trends is critical in the face of climate change and continuing pressure from development and incompatible land use change. Suggested legislative and regulatory actions and increased funding would address these gaps and provide opportunity for comprehensive protection, restoration, and monitoring of wetlands.

These recommendations are expected to be moderately difficult to implement. Risks to consider include potential opposition to increased regulation or municipal resistance to land protection. Institutionally, there may be insufficient funding and staff or policy differences in permitting agencies. In addition, there may be competing interests (such as agriculture and renewable energy) and variable landowner interest in selling or easements. Collectively, these potential barriers could be addressed through new funding (like the "Clean Water, Clean Air, and Green Jobs" Environmental Bond Act), partnerships, and prioritizing and increasing funding for the New York Open Space Conservation Plan to support climate strategies. Other possible mitigants include cross-agency and cross-industry communication and coordination;

³²⁴ Huffman & Associates, Inc. August 1999, Finalized June 2000. *Wetlands Status and Trend Analysis of New York State - Mid-1980's to Mid-1990's*. Prepared for New York State Department of Environmental Conservation. June 2000. Larkspur, California. 17pp. plus attachments.

stakeholder engagement, outreach, and education; and reimbursement programs for lost municipal tax revenue.

Components of the Strategy

Efforts in this area can expand and enhance existing programs at relatively low cost, with funding primarily for increased agency staff and land acquisition.

Nature-Based Features

- **Incentivize the use of natural and nature-based features through Army Corps of Engineers regional permits:** DOS, DEC, and DOT should develop regional permits (or specific Nationwide Permit 54 regional conditions) with Army Corps of Engineers to incentivize use of natural and nature-based features to enhance resilience and ecosystem benefits of freshwater and tidal wetlands.

Freshwater Wetlands

- **Increase investment in freshwater wetlands:** The State Legislature, DEC, and DOS should increase investment in the protection, restoration, and monitoring of freshwater, non-tidal wetlands, and adjacent areas, including riparian areas, to maximize carbon sequestration potential (such as the “Clean Water, Clean Air, and Green Jobs” Environmental Bond Act, the EPF, and grants programs like DEC’s Water Quality Improvement Program and the Conservation Partnership Program). This should be accomplished within 10 years with assistance from stakeholders that may include OPRHP, conservation NGOs, counties, municipalities, land trusts, and SWCDs.
- **Prioritize protection and restoration of wetlands with the potential to sequester carbon:** The State should fund research that will evaluate the methane emissions and carbon sequestration associated with freshwater impoundments and the impact of their specific water-level and salinity management strategies. DEC should also identify historically drained freshwater wetlands where the oxidation of organic carbon in drained soils is an ongoing source of CO₂ to the atmosphere. These areas should be prioritized for any voluntary buyouts and restoration to wetland status.

Tidal Wetlands

- **Address sea-level rise in State coastal regulations:** DEC should revisit implementation of the tidal wetlands and coastal erosion hazard areas regulatory programs in light of sea-level rise

projections, develop internal and external guidance, and determine whether changes in law and regulations are necessary (such as a review of 6 NYCRR Part 661 to consider whether existing elevation, distance, and setback limits on tidal wetlands and adjacent area jurisdiction will remain adequate as sea level rises).

- **Increase planning and investment in existing tidal wetlands and other coastal habitats:** The Legislature, DEC, and DOS should increase investment in the protection, restoration, and monitoring of existing tidal wetlands, including submerged aquatic vegetation, to protect their ability to sequester carbon from declines due to marsh drowning, sediment starvation, and seagrass die-offs caused by pollution in runoff and coastal water quality (such as the “Clean Water, Clean Air, and Green Jobs” Environmental Bond Act or the EPF, and grants programs like the Conservation Partnership Program). DEC should develop a portfolio of design-build and shovel-ready marsh restoration projects so that New York can compete with neighboring coastal states for high-quality dredge material from Army Corps of Engineers and is ready to take advantage of federal cost-sharing opportunities. As sea level rises, marshes that are unable to migrate are expected to drown and become a source of CO₂ to the atmosphere. According to the Intergovernmental Panel on Climate Change (IPCC) and the U.S. Environmental Protection Agency (EPA), these emissions occur as flooded organic matter (e.g., stored soil carbon and biomass) decomposes and are considered anthropogenic. Depending on the rate of sea-level rise, failure to allow marshes to migrate inland as sea level rises is expected to reduce the size of the land use carbon sink as these areas drown and begin to act as a net source of CO₂. Much of New York’s coastline is highly urban and hardened. Planning and investment are required to allow marshes to migrate rather than drown in these areas. **Plan for sea-level rise and allow marshes to migrate in the future:** DEC should work with municipal partners to create mitigation banks that acquire, restore, and monitor larger tracts of tidal wetland habitat by bundling credits purchased by applicants for State tidal wetlands permits when their projects cause smaller amounts of unavoidable habitat loss, such as the Sawmill Creek wetland mitigation bank.³²⁵ DEC should identify future potential marsh migration routes as sea-level rises and prioritize these parcels for purchase and restoration, fund municipal coastal debris removal efforts, map and remove historical fill and other obstacles to marsh migration on public land, remove abandoned boats and other large marine debris that smother and damage existing tidal wetlands, and create an

³²⁵ New York City Economic Development Corporation. “Saw Mill Creek Wetland Mitigation Bank Credits.” Accessed November 2021 at <https://edc.nyc/project/marshes-initiative>.

insurance program that defrays the financial risk associated with cleaning up legacy pollutants when municipalities acquire coastal properties for marsh restoration and protection.

LU5. Mapping, Research, Planning, and Assistance

This strategy focuses on maintaining and enhancing the carbon sequestration potential of natural areas in New York, including wetlands, coastal habitats, forests, and grasslands, through improved mapping (both regulatory and non-regulatory), research, conservation planning guidance, stewardship, and assistance for local governments and landowners.

Regulatory programs and land acquisition are two important strategies for maintaining and restoring carbon sequestration potential. These programs must be enhanced with current science, conservation guidance, and increased capacity of partners like local government planners and landowners who routinely make decisions that have lasting impacts on natural areas, including those that have little protection like small wetlands and forests. These strategies are needed to pair priority conservation areas with priority growth areas – a key component of smart planning and smart growth that can sustain large, functioning natural areas that provide health benefits to people and other ecosystem services like flood mitigation, habitat for plants and animals, and opportunities for outdoor recreation for residents and visitors.

Newly available technologies and non-regulatory models from other regions and states can inform these enabling strategies and include relatively low-cost mapping, analysis, research, technical assistance, and funding. Success will require agency staff to provide technical assistance, training, and project management and to provide funding for small grants, research, mapping, analysis, development of implementation material and tools, and stewardship initiatives. Also important are sufficient funding and partnerships to ensure adequately resourced programs, additional education and outreach to communities, and targeted training and technical assistance for key decision-makers and stakeholders.

Components of the Strategy

- **Update wetland and natural resource mapping:** DEC should apply the best available technology to update maps of wetlands (regulated and unregulated, tidal and non-tidal), shallow water habitats, Significant Coastal Fish and Wildlife Habitats, Coastal Erosion Hazard Areas, and priority forests and natural areas. DEC should also ensure all maps and inventories are accurate and publicly available, and schedule recurring updates using the best available technology. This

effort should engage OPRHP, DOS, conservation NGOs, research partners, SWCDs, and other State agencies in the process.

- **Consider technologies:** The State should consider emerging and tested mapping technologies, including those applied in light detection and ranging technology, such as Enhanced Wetlands Mapping in the New York City Watershed, Land Cover Mapping and Modeling Initiatives in Chesapeake Bay Watershed and Delaware River Basin, Object-based Wetland Mapping Approach for Pennsylvania, and the National Oceanic and Atmospheric Administration’s new high resolution land cover data products.
- **Develop a statewide conservation framework:** DEC should develop a statewide conservation framework.³²⁶ The framework should incorporate current, accurate spatial data on critical ecosystems (terrestrial and aquatic), including priority ecosystem complexes and future needs that address climate adaptation needs (such as landscape connectivity, wetland migration pathways, and source water areas), and provides basis for prioritizing State funding, tax relief, land acquisition, and technical assistance programs to conserve priority natural areas and promote smart growth. This should be publicly accessible, and DEC should also provide outreach and assistance to ensure appropriate and effective use of framework. This effort should engage stakeholders such as OPRHP, DOS, conservation NGOs, research partners, SWCDs, regional planning commissions, and land trusts. This component aligns with the adaptation and resilience strategies discussed in further in *Chapter 21. Adaptation and Resilience* and Appendix H.
- **Assist local governments to create land use policies:** DOS and DEC should assist county and local governments to create land use policies, land conservation programs, and smart growth strategies that prioritize and protect wetlands, forests, grasslands, stream buffers, and other natural areas through actions such as statewide authorization of the Community Preservation Act. This should include providing training and support on use of Community Risk and Resiliency Act (CRRRA) model local laws and other best practices in planning and zoning for conservation. Key partners include regional and county planning commissions, conservation NGOs, and SWCDs.
- **Fund Conservation Advisory Councils and Environmental Management Councils:** The State should provide funding for Conservation Advisory Councils, Environmental Management

³²⁶ Example of regional conservation frameworks in New York include the Hudson River Estuary Wildlife and Habitat Conservation Framework and the Tompkins County Unique Natural Areas, Conservation Plan and Strategy. A statewide example is the Florida Critical Lands and Waters Identification Project. An increasing number of statewide datasets are available to inform a New York framework; examples include the Open Space Institute’s Climate Resilient Landscape Initiative and NY Natural Heritage Program databases and models.

Councils, and other municipal committees with similar roles to support their work in conservation and land use planning, nature-based solutions, and climate action.

- **Provide conservation incentives to landowners:** The State should enhance and create landowner incentives and other techniques to conserve and restore forests, tidal and non-tidal wetlands, grasslands, and natural areas and utilize living shoreline and nature-based solutions such as tax abatement programs, tax incentives, land conservation programs, and payments for ecosystem services. Landowner incentives and techniques to conserve and restore forests include support for existing restoration, forest technical assistance, and land acquisition programs, and creating new tax incentives, payments for ecosystem services, and legislation to prevent forest conversion. Additional details on forest restoration and conservation are included in multiple strategies in *Chapter 15. Agriculture and Forestry* and *Chapter 19. Land Use*.
- **Research and monitor carbon storage and sequestration potential:** The State should fund research, analysis, and monitoring to determine carbon storage and sequestration potential of tidal and non-tidal wetlands, submerged aquatic vegetation, forests, and other priority natural areas, to increase understanding of mitigation opportunities and to establish siting protocols and priorities for conservation and restoration. New York is expected to undergo hydrological changes that are likely to change the distributions of hydric soils across the state, and therefore the rates at which wetlands sequester and store carbon in their soils and emit methane. This, combined with further saltwater intrusion into coastal freshwater habitats, is likely to affect the balance of carbon sequestration and methane emission by New York's land use sector in an as yet unquantified way.
- **Develop new benefit-cost analysis tools:** DEC, in collaboration with DOS and research partners, should develop benefit-cost analysis tools that incorporate the value of carbon for use in planning, environmental assessment, and permitting of conservation and restoration projects.
- **Develop demonstration projects:** DEC and DOS should initiate climate resilient demonstration projects by working with existing wetland protection, restoration, or natural and nature-based features projects to add additional components for maximizing climate resilience and carbon sequestration capacity, developing quantification models and best practices, and monitoring effectiveness.
- **Develop a service corps program:** DEC and OPHRP should create a conservation and restoration service corps program³²⁷ for early and experienced professionals and a youth climate conservation corps for unemployed young people ages 18 to 25. The programs should focus on

³²⁷ GulfCorps is an example of a conservation corps focused on creating resilient coasts and communities in five Gulf Coast states.

ecosystem stewardship, management, and restoration activities to maximize carbon sequestration in natural and developed areas (such as tree plantings in lower-income neighborhoods, wetland restoration, and native grassland establishment in municipal parks). These programs would support a just transition and “green job” career training. This component aligns with adaptation and resilience strategies discussed further in *Chapter 21. Adaptation and Resilience* and Appendix H.

Consider Forests and Farmland in Land Use Policies

Local governments and organizations provide planning, guidance, and support for land use and to residents. However, many municipalities lack a comprehensive plan and/or zoning that clearly address afforestation or reforestation. Municipal comprehensive plans are used to proactively guide development and other community planning, and while these plans often include information from natural resource inventories, critical barriers, and other local and regional smart growth planning resources to help inform the plan, they often do not include forestland and farmland. The following strategies discuss how to better equip municipalities with the proper tools to ensure the protection of New York’s natural and working lands, while still advancing renewable energy.

LU6. Provide Guidance and Support for Afforestation and Reforestation

Some municipalities and private landowners lack the expertise and capacity to support afforestation and reforestation projects, which may result in land being put toward other uses. This strategy involves providing funding and personnel resources to directly support communities and landowners in their planning and planting efforts as well as developing trainings and materials to increase outreach and education to local municipalities and organizations. This strategy would take several years to get in place, so it needs to be started as soon as possible to allow time for seedlings to become established in time to be a part of GHG emissions mitigation strategies by 2030 and 2050.

Components of the Strategy

- **Provide guidance for local communities:** DEC should develop guidance and provide support for local communities to plan and implement planting projects that help adapt to climate change.
- **Increase landowner assistance:** DEC should enhance agency and partner capacity to deliver technical assistance and education programs including planting plans and species selection for landowners. This includes assisting with planting plans and site and species selection, promoting tree planting programs, and increasing capacity through partnerships to meet requests, ensure minimal overlap of services, capture accomplishments, and coordinate efforts.

LU7. Increase Forest and Farmland Protection in Municipal Comprehensive Plans

This strategy proposes creation of tools to help municipalities identify and fund inventories of forest and farmland, development of BMPs, and a requirement to include forestland and farmland in planning efforts, which will help communities target lands for conservation and prevent emissions from land use conversion. Development of tools and BMPs would take several years.

Components of the Strategy

Identify Land Resources

- **Survey land resources:** DEC, in partnership with AGM and DOS, should conduct a quantitative survey of land resources across the State and identify critical barriers including options of using idle and underutilized lands.
- **Support the development of local natural resource inventories:** State agencies, such as DEC, DOS, and/or AGM, should provide funding to further development of natural resource inventories, critical barriers, and other local and regional smart growth planning and decision-making resources (such as maps to identify suitable reforestation locations) that include forestland and farmland. These resources should support local and regional smart growth planning and decision-making (such as maps to identify suitable reforestation locations, highest value cropland, and idle lands for farming).

Support Best Practices in Planning

- **Develop guidance for BMPs:** DOS and DEC should develop guidance and BMPs for the inclusion of forestland protection in municipal comprehensive plans, including strategies and best practices for land conservation, and identifying priority areas for conservation. DOS should fund technical assistance to implement guidance and BMPs effectively.
- **Require forest inclusion in planning:** State agencies should require the inclusion of forestland and farmland protection in State-funded municipal comprehensive plans.

LU8. Provide Guidance and Support on Clean Energy Siting

The Climate Act contains significant requirements for clean energy development, such as the distributed solar and energy storage targets. Local land use decisions are an important part of meeting these requirements in ways that revitalize communities and grow the economy. As discussed further in *Chapter 20. Local Government*, communities often do not have the capacity to plan for renewable energy siting.

The following components would better equip local municipalities and other decision-makers with the tools they need to effectively consider natural and working lands when planning for clean energy projects. This strategy has similar components as those presented in *Chapter 13. Electricity* (Strategy E4) and *Chapter 20. Local Government* (Strategy LG3).

Components of the Strategy

- **Develop new planning tools and resources:** NYSERDA should collaborate with community stakeholders, the agriculture and forestry sector, the solar industry, and utilities to develop new planning tools and resources to minimize the impact of energy siting on forest and agricultural lands. These tools would include mapping to help municipalities undertake a comprehensive evaluation of the potential for clean energy development in their communities and to plan proactively for deployment that maximizes local benefit and minimizes impact on lands with high-quality soils, forests, and other competing uses. These tools should also assist municipalities in considering co-location opportunities for agriculture and renewable energy generation.
- **Enhance technical and financial support:** NYSERDA should collaborate with regional planning boards to provide technical and financial support to help local governments plan for and review clean energy projects including wind, solar, transmission, distribution, storage, and vehicle charging. Incentives should be based on proximity of generation to current load centers and/or economic development sites that could combine infrastructure planning to incorporate renewable energy, storage, increase electric capacity and/or need for infrastructure to both achieve Climate Act requirements and to ensure site readiness of select locations for economic growth.

Promote Smart Growth

Smart growth is compact, mixed-use, mixed-income community development that is walkable, bikeable, and transit-accessible and contains a diversity of housing choices, open spaces, and public gathering places accessible to people of all ages, incomes, backgrounds, and mobility capabilities. Smart growth promotes locational precepts that seek to direct and concentrate development in what are referred to as priority development areas – such as downtowns, main streets, municipal centers, transit-oriented areas, abandoned manufacturing facilities, and Disadvantaged Communities, among others. Complementarily, smart growth seeks to prohibit or restrict development in what are called priority conservation areas, where development is less desirable for ecological, agricultural, hydrological, or recreational reasons, among others. Smart growth land use patterns reduce GHG emissions largely in the transportation sector by reducing automobile use, measured as VMT. More specifically, automobile travel is reduced by

decreasing the travel distance between daily locations through a denser concentration of different land uses that we regularly access; reducing the number of car trips necessary for daily activities by concentrating that mix of destinations within walking, biking, or transit distance of one another; and providing mobility alternatives to the automobile, such as walking, biking and public transportation (also known as mode-shifting).

The State has taken several steps to promote smart growth and re-investment in downtowns, cities, and other municipal centers. The Downtown Revitalization Initiative, for example, provides \$100 million annually to redevelop and revitalize 10 downtowns, awarding \$10 million to one community in each of the State's 10 economic development regions. The State has also funded smart growth, sustainability, and climate mitigation and resiliency planning through a number of programs, including the DOS Countywide Resiliency Planning program, DEC's Climate Smart Communities and Adirondack/Catskill Smart Growth grant program, and NYSERDA's Cleaner, Greener Communities initiative. And most recently, DOS piloted a Smart Growth Comprehensive Planning grant program to provide much-needed resources to municipalities to develop updated comprehensive plans to guide future development and promote smart growth at the local level. The New York land bank law has yielded the most robust set of land banks in the nation, redeveloping vacant properties and combating blight in disinvested neighborhoods. The State's historic preservation tax credit has generated significant investments in historic buildings in traditional downtowns. The Complete Streets law has helped to create walkable, bikeable, transit-friendly communities for all users. And the State passed the Smart Growth Public Infrastructure Policy Act to curtail State investments in sprawl. Continuing and expanding upon the implementation of municipal, county, and regional smart growth plans, policies, zoning, and projects will play a critical role in continuing to achieve the mandates of the Climate Act through reduced VMT.

The following smart growth recommendations seek synergies that result in a proliferation of smart, equitable planning, zoning, and projects, while synchronizing with supportive transportation and housing policies and practices. In particular, the strategies and recommendations align with related transportation goals such as doubling public transportation service outside the MTA service area by 2035 and significantly expanding service within the Metropolitan Transportation Authority's (MTA) service area, equitable transit-oriented development (E-TOD), and shifting to low- or no-carbon transportation alternatives to a single-occupancy automobile. State agencies and local government officials responsible for implementing these smart growth recommendations should reference the California Sustainable Communities and Climate Protection Act as a guide for integrated land use, housing, and transportation planning, recognizing any shortcomings and the different governance structures of California and New

York.³²⁸ This California statute, effective January 1, 2009, requires integration of planning processes for transportation, land use, and housing and offers local governments regulatory and other incentives to encourage more compact new development and transportation alternatives.

These strategies and recommendations acknowledge and respect the fact that land use zoning falls largely within the authority of municipalities (cities, towns, and villages). The State, however, can influence those local land use decisions through direct planning grants, regional/county planning, technical assistance and capacity-building, and State and local incentives, disincentives and, where appropriate, mandates. These strategies and recommendations also acknowledge that smart growth principles should be implemented differently between rural, suburban, and urban areas of the State, accounting for local conditions and needs, and thus, State resources should be tailored to fit those differing conditions and needs.

Counties and regional planning entities can provide support to municipalities to develop local land use plans and local laws that promote smart growth. It is also critical to recognize the prioritization of Disadvantaged Communities in the development of these recommendations. Smart growth strategies and recommendations represent part of a decades-long effort to address past discriminatory land use policies in historically marginalized communities and level the playing field.

LU9. Regional and County Planning and Technical Assistance

Regional and county planning should guide future growth, redevelopment, and conservation at the multi-municipal scale. There should be facilitation and support of collaborative multi-municipal smart growth comprehensive planning at the county and regional scales to inform and guide land use decisions, including designation of priority development areas and priority conservation areas. While land use zoning, which determines final land use and development decisions, falls within the jurisdiction of municipalities, this broader regional lens is necessary to inform those local decisions to serve broader land use goals that transcend municipal boundaries – i.e., regional economies, daily travel patterns and transportation systems, housing needs (particularly the availability of permanent affordable housing to meet the entire region’s needs and avoid displacement and gentrification, as highlighted by the CJWG) hydrologic functions, open space preservation, and ecosystem health, among others.

³²⁸ S.B. 375, 2007-08 Reg. Sess., Chapter 728, Stats. 2008 (Cal. 2008).

Components of the Strategy

- **Achieve alignment with regional sustainability plans and principles:** State funding agencies and sources should align selection criteria with the priorities and principles contained in the Cleaner, Greener Communities Regional Sustainability Plans, to the extent practicable.
- **Achieve alignment with REDC plans and projects:** ESD, DOS, DEC and NYSEDA should identify opportunities to increase coordination with REDCs and to ensure that REDC regional strategic plans align with sustainability/smart growth/equity principles and to identify opportunities to revitalize Disadvantaged Communities and legacy/rust belt cities through implementation of the strategies in this Scoping Plan.
- **Support county-based resiliency planning:** DOS should expand Countywide Resiliency Planning grants to incentivize county-wide smart growth comprehensive plans that adhere to clear State goals and outcomes. These plans should include health impact assessments where feasible and relevant, particularly in Disadvantaged Communities that have experienced health disparities.
- **Prioritize areas for development and conservation:** The State, particularly DOS and DEC, should develop criteria and incentives for regional entities and counties to identify priority development areas (including areas appropriate for clean energy siting) and priority conservation areas in consultation with local jurisdictions and communities. The following definitions of priority development areas and priority conservation areas were developed in consultation with the Land Use and Local Government Advisory Panel and the CJWG.
 - Priority development areas are areas appropriate for a concentration of compact, mixed-use, mixed-income development with a variety of housing options at all levels of affordability. Priority development areas should have the proper infrastructure in place or have been identified as sites for infrastructure investment (see Strategy E3 and Strategy E7 in *Chapter 13. Electricity*) to accommodate greater density and should be walkable, bikeable, and transit-accessible. Primary examples may include BOAs, downtowns, central business districts, municipal centers, hamlets, former industrial districts, infill projects in developed areas, obsolete fossil fuel-based power plants, re-development/adaptive-use of existing buildings, TOD/E-TOD, Disadvantaged Communities, dead/dying malls, and vacant property clusters designated by land banks, among others.
 - Priority conservation areas are areas that preserve and restore vital habitats, landscape connectivity, biodiversity, natural water movement, local food security, and passive recreation. They may include wetlands, riparian areas, Critical Environmental Areas (as

defined by New York's State Environmental Quality Review Act [SEQRA]), forests, agricultural lands and other natural areas and working lands, among others.

- **Expand State funding eligibility for regional and community-based organizations:** The State, particularly DOS, should extend eligibility for funding in program solicitations for select smart growth-related planning and implementation grants to regional planning councils and, where appropriate, qualified community-based organizations.
- **Further empower counties to implement shared regional smart growth priorities:** DOS, in collaboration with counties and local governments, should evaluate opportunities through the use and potential expansion of General Municipal Law § 239 County Review to further empower counties to implement shared regional smart growth priorities throughout metropolitan and micropolitan statistical areas in municipal planning, zoning, and subdivision proposals.
- **Encourage local tax incentives for infill and downtown redevelopment:** DOS should work with the industrial development agencies and authorities in each region to proliferate tax incentive policies in their Uniform Tax Exemption policies to incentivize infill and downtown redevelopment.

LU10. Direct Planning, Zoning, and Pre-Development Assistance to Municipalities

The State should provide direct planning and zoning assistance to local communities and promote municipal implementation of mitigation strategies through enhanced technical assistance, increased support for local adoption of zoning and land use regulations consistent with smart growth principles, and local policies that support sustainable, equitable development and the accelerated expansion of local clean energy while also ensuring and enhancing public outreach, education and engagement, particularly in frontline communities that have historically been disenfranchised and discriminated against in the local land use decision-making process. This strategy aims to empower local governments to achieve smart growth planning and development.

Components of the Strategy

- **Provide State support for comprehensive plans:** DOS should expand the Smart Growth Comprehensive Planning grant program to assist municipalities in the efficient development and adoption of smart growth-focused comprehensive plans, district/corridor plans and zoning, including form-based codes. Assistance should extend to compliance with SEQRA, including completion of Generic Environmental Impact Statements (GEISs) and should include providing guidance to communities undertaking comprehensive planning and/or re-zoning to put moratoria

on projects such as new gasoline stations, underground storage or sprawl-type subdivision and development that may be counter to smart growth and climate goals. Particular attention should be given to disadvantaged and smaller rural communities that have less capacity, funds, or staff for comprehensive planning.

- **Expand technical assistance programs to support municipal smart growth planning:** The State should expand the roles and responsibilities of DOS Smart Growth planning, NYSERDA Clean Energy Communities Regional Coordinators, and DEC Climate Leadership Coordinators to provide smart growth planning and zoning technical assistance and capacity-building to municipalities, which would include the integration of land use, transportation, economic-development, and housing planning and projects.
- **Develop model smart growth local laws:** DOS should collaborate with other State agencies as appropriate, including DEC, New York State Homes and Community Renewal (HCR), New York State Office of Temporary and Disability Assistance (OTDA) and NYSERDA, to develop model local laws to assist municipalities of various sizes and capacities to implement smart growth plans and zoning laws, including model inclusionary zoning to address gentrification, displacement, and the concentration of poverty. Model local laws to address density and affordability should also be developed, including zoning and site plan review laws that accommodate a variety of densities and uses for localities as a baseline. Such laws should also make available siting for supportive housing, group homes, homeless shelters, multifamily housing, accessory dwelling units, and other affordable housing and the expediting of local review of supportive housing or affordable housing where at least 20% is affordable at 80% Area Median Income or below.
- **Consolidate all State funding opportunities:** All State funding programs should be included in the annual Consolidated Funding Application, to the extent practicable, and the State should provide a centralized source of information on all State funding opportunities for municipalities and not-for-profits. This will help with ease of access to State funding opportunities for Disadvantaged Communities.
- **Enhance the awareness of State resources by publishing a Sustainable Development Resource Guidebook:** The State should develop a Sustainable Development/Climate Act Resource Guidebook to serve as a resource to assist regional entities, counties, municipalities, and developers in navigating, accessing, and integrating State programs relevant to sustainable community and clean energy development. This should improve accessibility and ease coordination across programs.
- **Provide municipalities with baseline data for planning:** The State should build on existing State data portals such as NYSERDA's Climate Science Clearinghouse and the DOS Geographic

Information Gateway to provide a centralized, user-friendly digital repository of data resources useful to regional/county/local planners in the development of smart growth land use plans, zoning codes and projects, including data on affordability and other equity matters, Disadvantaged Communities, climate change projections, affordability, poverty, and public health. This data resource should be framed as a one-stop shop to consolidate data and planning tools related to climate change mitigation and adaptation, disaster risk reduction, and regional and local land use planning and clean energy siting.

- **Expand site/facility re-use planning:** NYSERDA and DOS should support community-based planning to inform redevelopment of obsolete power plant sites and brownfields, particularly through NYSERDA’s Just Transition Reuse Planning Program and the DOS BOA program, in furtherance of the principles developed by the Just Transition Working Group (JTWG).
- **Ensure equitable development while avoiding displacement and gentrification:** DOS and other State agencies should explore opportunities to address displacement, gentrification, the concentration of poverty, segregation, and inequitable access to opportunity by providing assistance and resources for community land trusts, land banks, and inclusive zoning that promotes mixed-income, affordable, rental and supportive housing, and shared/community-centered ownership models.
- **Provide outreach and educational materials to support equitable development:** The State should provide model outreach materials, trainings, and other tools and guidance to support pre-development community outreach, engagement, and education for smart growth projects to generate support, awareness, capacity, and buy-in prior to a developer filing the project with a municipal board. These model outreach and educational materials should reflect the differing conditions and needs between rural, suburban, and urban areas of State, and as such, this model should be created in coordination with community-based organizations, local government officials, universities, and others, as needed.
- **Increase the role of community-based organizations in local planning:** DOS should provide grant funding to support community-based organizations to develop local land use plans for Disadvantaged Communities that can inform and guide development to reduce emissions, adapt to climate change, and achieve a just transition. Examples of such plans include UPROSE’s Green Resilient Industrial District, El Puente’s Green Light District, THE POINT Community Development Corporation’s South Bronx Community Resiliency Agenda, and PUSH Buffalo’s PUSH GREEN / PUSH BLUE.

LU11. Align State Funding Priorities

State funding should align with smart growth and equity goals and seek to eliminate funding that induces sprawl, particularly with new infrastructure. This is the stated purpose goal of the State Smart Growth Public Infrastructure Policy Act. The Smart Growth Act, however, has been utilized primarily in a review and advisory capacity, rather than as a basis for granting funds for smart growth and, just as important, denying funds for sprawl. An interagency working group should develop amendments to the Smart Growth Public Infrastructure Policy Act to implement its goal and the requirements of the Climate Act more fully. The amendments should include definitions of priority development areas, priority conservation areas, E-TOD, and climate justice, along with stronger requirements for State spending beyond the limited existing scope of public infrastructure to comport and align with these definitions.

Components of the Strategy

- **Refine/align State smart growth public infrastructure act criteria:** The State should enact legislation to amend the 11 Smart Growth criteria contained in the State Smart Growth Public Infrastructure Policy Act to define public infrastructure and more accurately identify infrastructure projects that enable both smart growth and sprawl, as well as align those criteria more directly with the Climate Act, with an emphasis on equity and affordability. These amendments should include definitions of priority development areas and priority conservation areas. The amendments should also expand the purview of the law to apply to all State agencies and authorities and all relevant State programs, including planning and design grants (not just infrastructure).
- **Prioritize funding for smart growth:** State programs should prioritize funding for infrastructure projects that most clearly support smart growth principles and outcomes, as determined through the smart growth review that agencies must conduct through the Smart Growth Public Infrastructure Policy Act, particularly projects in priority development areas.
- **Provide stable funding for Restore NY and the Environmental Restoration Program:** The State should provide regular funding for Restore NY and DEC's Environmental Restoration Program to ensure dependable availability of support for the restoration of distressed, vacant, abandoned, contaminated, and/or brownfield areas.
- **Expand priority State support for BOA projects:** The State should expand and enforce the "priority and preference" provision in the BOA statute to include other relevant grants beyond those already identified in statute.

- **Streamline relevant funding opportunities:** The State should assess opportunities to merge, combine, or closely coordinate related relevant programs across agencies in order to provide consistency and offer a more streamlined presentation of funding opportunities for communities, to the extent consistent with legal requirements.

LU12. Accelerate Transit-Oriented Development

Smart Growth planning should accelerate mixed-use, mixed-income TOD, with an emphasis on E-TOD, around key transit hubs served by rail and bus rapid transit. TOD creates compact, mixed-use, mixed-income, walkable communities within a half-mile of rail or transit hubs. TOD decreases dependence on cars, expands mobility options such as walking and biking and generates the critical mass of residents and commuters needed to support an expansion of public transit services. TOD also presents an ideal opportunity to meet equity and climate justice goals of the Climate Act by incentivizing green affordable housing near transit, which also reduces transportation costs for lower-income households. E-TOD ensures that affordability, climate justice and environmental justice play a prominent role in the TOD equation in planning, zoning, funding, project implementation, and public policies on the State and local levels.

Several State programs have sporadically funded TOD, including HCR’s Low-Income Housing Tax Credit program, Downtown Revitalization Initiative, Better Buffalo Fund, Local Waterfront Revitalization Program and REDC Strategic Plans and priority projects, among others. The State should, however, provide dedicated and priority funding, in existing and new programs, specifically to support TOD because TOD/E-TOD shows the greatest promise of reaching the Climate Act’s GHG emission reduction and equity goals in land use. While land use patterns generally take time to shift and produce measurable climate results, TOD can be expedited with State support given its defined geographic scope and focus; TOD also produces more measurable GHG reduction outcomes. The CJWG recommends a statewide program to plan and develop E-TOD.

Components of the Strategy

- **Support TOD planning and zoning:** The State should support municipal E-TOD plans and zoning, including form-based codes, through a grant program and guidance and technical assistance (including model local laws).
- **Promote equity tools and resources:** The State should promote and support equity tools and models, such as community land trusts, land banks, inclusionary zoning and shared/community-

centered ownership, and equity models to address displacement, gentrification, and the concentration of poverty.

- **Require TOD plans around commuter rail:** The State should require communities with commuter rail stations to have an adopted TOD plan that meets State criteria to be eligible for supportive State TOD resources, with due consideration for smaller rail stations that may not have a full TOD plan.
- **Prioritize TOD in the Smart Growth Public Infrastructure Policy Act:** The State should enact legislation to amend the State Smart Growth Public Infrastructure Policy Act to more effectively direct State resources to projects that advance TOD, as well as add a definition of, and criteria for, TOD that includes rail and bus and the particular transit needs of rural areas. Amendments should extend applicability of this law to all State agencies and authorities and all relevant State programs, including planning and design grants (not just infrastructure).
- **Provide subsidies for E-TOD:** The State should explore enhanced subsidies for TOD projects, especially those that include a meaningful threshold level of affordable housing and incorporate tools and measures such as community land trusts, land banks, inclusionary zoning, and shared/community-centered ownership models.
- **Expand TOD as a State housing goal:** The State should include the TOD State Housing Goal in HCR's 9% Low-Income Housing Tax Credit program in all relevant State solicitations, consider other opportunities for tax credits for projects in TOD areas that are consistent with adopted TOD plans, and meet State criteria for equity and affordability, such as an additional "bump up" of Brownfield Cleanup Program tax credits in designated BOAs that are also TODs.
- **Support for GEISs:** The State should fund and support GEISs to streamline the review process in TODs. This can be accomplished by creating a revolving fund for municipalities to undertake GEISs for TOD zoning and projects. If a developer agrees to build according to the TOD zoning and accepts certain community benefits components, such as affordable housing, green infrastructure, green building or public spaces, the developer will pay back into the fund a portion of the cost of the GEIS (consider using tax increment financing for this purpose).
- **Support local parking management policies that reduce automobile-dependence:** DOS, in collaboration with municipalities, MPOs, and affected agencies, should explore opportunities to support and incentivize lower municipal parking minimums and/or parking maximums in consideration of decreased household need, given proximity and accessible of transit. State programs, for instance, can recognize and reward applications for TOD funding in municipalities that have enacted such parking management reforms.

- **Structured parking:** The State should support planning to facilitate appropriate structured parking to achieve a desired TOD density and explore opportunities to defray the cost of structured parking in conjunction with TOD development (e.g., State funding, low-cost financing, and tax credits, as well as the development of best practices for design and construction of structured parking that integrates ground-level retail and that can be retrofitted for other uses should the demand for parking decline in the future).
- **Improve municipal coordination with transit entities:** The State should require municipalities to notify the relevant transit entities of planning, zoning, and projects that will impact transit ridership and parking needs to allow transit agencies an early opportunity to offer input on such potential impacts.

Chapter 20. Local Government

20.1 Local Government and the Climate Act

Local governments in every region of the State—small, large, urban, rural, and suburban—are taking significant action in ways that contribute directly to meeting the requirements and goals of the Climate Act. Local governments are well-positioned to have a far-reaching impact on community action. State programs that partner with communities and local governments are helping drive rapid adoption and widespread participation and can have a big impact.

Partnership with local governments is a keystone of the State’s clean energy, adaptation and resilience, and greenhouse gas (GHG) emissions mitigation strategies. Support for local efforts will help ensure access to the benefits of these actions for all New Yorkers, particularly those in Disadvantaged Communities who have suffered disproportionately from negative impacts of past decisions.

Municipalities and other local government entities, including industrial development agencies, local development corporations, and special purpose districts, have an important role to play in meeting Climate Act mandates. They enact codes, develop projects, adopt policies, and regulate land use, all of which are critical to supporting all members of the community in moving toward a more energy-efficient future. They also control assets like street lighting systems, wastewater treatment plants, landfills, and public transit systems. By implementing energy efficiency measures and choosing clean sources of energy for their own facilities and operations, municipalities reduce overall GHG emissions and pave the way for broader adoption of such measures. They enact codes, develop projects, adopt policies, and regulate land use. When communities lead by example, clean energy, energy efficiency, and sustainability are more likely to be priorities for residents, businesses, and institutions.

In developing the following recommendations, several discussion sessions were held with local officials from across the State to gather input. A number of important themes emerged from these discussions. Counties and regional organizations have important roles as leaders and conveners in efforts to address GHG emissions mitigation. Many local governments are motivated by a desire to achieve cost savings that come from energy efficiency in municipal operations and facilities but are constrained in action. State funding could address existing limitations in technical assistance, incentives, and resources provided to local governments for GHG mitigation. Local governments are increasingly engaged in providing education and training, outreach, and technical assistance. Local governments also face challenges with aging infrastructure and housing stock. They also identified the need for uniformly applied State mandates in accelerating change at the local level and reducing competition between local governments

and between regions. Finally, local government leaders stressed the importance of considering the differing needs of municipalities, based on geographic location, population size, and density, to support meeting Climate Act requirements.

State programs, including Clean Energy Communities and Climate Smart Communities, were identified as providing value to local governments, whether through grants, free technical assistance, or recognition for local leadership. The New York State Energy Research and Development Authority (NYSERDA) Clean Energy Communities program creates a clear path forward for communities to implement clean energy actions that have the greatest potential for impact. To date, 809 communities, representing more than 18 million New Yorkers, have completed more than 3,200 high-impact actions. These actions empower the constituents of participating communities to choose clean and efficient energy as part of their everyday lives. The Climate Smart Communities program is led by New York State Department of Environmental Conservation (DEC) in partnership with six other State agencies: NYSERDA, New York Power Authority (NYPA), New York State Department of State (DOS), New York State Department of Health (DOH), New York State Department of Transportation (DOT), and New York State Department of Public Service (DPS). Started in 2009, the program provides guidance, and financial and technical support to local governments to take locally driven climate action. The first step in the certification process is to register by pledging to reduce GHG emissions and adapt to climate change. To date, over 360 municipalities have committed to taking action on climate change by passing the Climate Smart Communities pledge, and over 100 communities have achieved Climate Smart Communities certification by going beyond the pledge and documenting accomplishments.

These programs are supported by a statewide coordinator network consisting of regional planning and development boards, associations, and councils, like the Central New York Regional Planning and Development Board and the Genesee/Finger Lakes Regional Planning Council. These organizations have long-standing relationships with local governments in their regions, and State programs can leverage those relationships for the benefit of the programs. These coordinators are trusted local partners to the government officials and staff in their regions. In addition to free, on-demand technical support, State programs offer online toolkits that include step-by-step guides, calculators, case studies, and model language that communities can incorporate into legislation.

20.2 Key Strategies to Support Local Climate Action

There are five key strategies highlighted in this sector, as shown in Table 20.

Table 20. Local Government Sector Key Strategies

Strategies
LG1. Establish Community Greenhouse Gas Dashboard
LG2. Develop Local Energy Policies
LG3. Provide Clean Energy Siting Support for Local Governments
LG4. Promote Municipal Leadership to Support Clean Energy Adoption
LG5. Provide State Support and Guidance

LG1. Establish Community Greenhouse Gas Dashboard

One strategy for supporting local climate action is to develop a statewide dashboard of community GHG emissions inventories to promote local climate action planning, monitor equity considerations, measure progress, and ensure data consistency at the county and municipal levels.

This strategy calls for a community dashboard that local governments and other stakeholders can use to understand GHG emissions, energy use trends, and identify opportunities for improvement. The dashboard would bring together data from several sources to describe the complete community GHG emissions picture, including government facilities as well as residential, commercial, and industrial emissions.

The dashboard must be easy to use and provide good, actionable information that local government officials and staff and community stakeholders can use to inform decision-making at the local level. Not all required data are currently reported at the county, city, town, and village levels. The process could establish data-reporting requirements in a manner similar to the PSC requirement that electricity and natural gas consumption data be reported by utilities (see PSC “Order Adopting the Utility Energy Registry” in Case 17-M-0315 issued April 20, 2018). The dashboard could include data on energy production and actions that reduce GHG emissions.

Components of the Strategy

- **Form a community GHG working group:** NYSERDA and DEC should establish a Community GHG Working Group consisting, as appropriate, of Metropolitan Planning Organizations (MPOs), utilities, State agencies, academic institutions, consultants, labor representation, community benefit organizations, and regional and municipal officials. The group may consider several activities:

- Review existing guidance including the International Council for Local Environmental Initiative’s U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions to identify methods
 - Identify and secure New York-specific data needed to complete the emission inventories
 - Develop standards for local community GHG emissions inventories
- **Support modernization of GHG emission accounting to facilitate data accessibility:** NYSERDA should incentivize software developers to create new software and other tools that allow for clear and transparent accounting of GHG emissions to inform and support local climate action. These tools should include considerations for the emissions accounting methodology required by the Climate Act.
 - **Launch the community dashboard:** NYSERDA, working with DEC and community stakeholders, should launch and maintain the dashboard, ensuring that GHG emissions inventory information is accessible to all communities in a manner that ensures data security and protects privacy.

LG2. Develop Local Energy Policies

Local government plays a critical role in enabling and promoting energy efficiency in our communities. This strategy is intended to encourage and support local governments to demonstrate leadership in energy efficiency by developing model above-minimum energy conservation codes and construction policies. This includes adopting the NYStretch Energy Code and promoting its adoption, enhanced code enforcement including streamlined permitting, third-party inspections, and shared enforcement, and Property Assessed Clean Energy financing.

Many local governments, especially small, resource-constrained communities, struggle with tight budgets and limited staff capacity, which limits their ability to take local climate actions. State programs, like Clean Energy Communities and Climate Smart Communities, that offer clear guidance, grants, technical assistance, and recognition can motivate communities to take local climate action and demonstrate climate leadership with a focus on equity.

Components of the Strategy

- **Leverage existing NYSERDA and DEC programs:** NYSERDA and DEC should continue to update the Clean Energy Communities and Climate Smart Communities programs to encourage adoption of emerging local energy policies and pro-active climate action.

- **Expand NYPA Clean Energy Services Program:** New York Power Authority (NYPA) should continue the existing Clean Energy Services program and expand the program to reach more communities.
- **Expand the regional coordinator network:** NYSERDA and DEC should expand the type of services offered by the regional coordinator network to enhance and strengthen assistance to local governments and related entities across a range of climate actions. This expansion should increase support to small, resource-constrained, and underserved communities.

LG3. Provide Clean Energy Siting Support for Local Governments

This strategy facilitates clean energy siting through development and promotion of model local laws and streamlined permitting. Local governments often have limited capacity to anticipate and plan for renewable energy and energy storage development in their communities. Similar to the previous strategy, programs like Clean Energy Communities and Climate Smart Communities that offer clear guidance, grants, technical assistance, and recognition can motivate communities to adopt appropriate siting policies at the local level. This strategy has similar components as those presented in *Chapter 13. Electricity* (Strategy E4) and *Chapter 19. Land Use* (Strategy LU8).

Components of the Strategy

- **Create model local laws and regulations:** NYSERDA, DEC, and DOS should work with community stakeholders and the clean energy industry to develop and promote model local laws and development regulations through the Clean Energy Communities and Climate Smart Communities programs. These model local laws and development regulations should minimize the impact of clean energy siting on forests and agricultural lands, as well as consider co-locational opportunities for agriculture and renewable energy generation.
- **Promote New York State Solar Permit Adoption:** Within one year, NYSERDA and DOS should work with code enforcement officers to promote local adoption of the New York State Solar Permit and other local actions to streamline the permitting process for clean energy technologies, including energy storage, at a variety of scales.

LG4. Promote Municipal Leadership to Support Clean Energy Adoption

This strategy connects homes, businesses, and community institutions with clean energy products and services through Community Choice Aggregation (CCA) programs, microgrids, district systems, and community-scale campaigns to encourage adoption of innovative technologies to generate savings and reduce GHG emissions for consumers in an equitable manner.

To achieve Climate Act mandates, broad-based consumer demand for clean energy products and services is necessary. Communities have tremendous capacity to use bulk purchasing, shared-services, community campaigns, and other forms of aggregation to drive this demand to new heights. This strategy calls for State programs to encourage local governments to adopt policies aimed at the widespread deployment of clean distributed energy resources (DERs). The intent is to allow more consumers to participate in the energy markets in ways that advance Climate Act goals and requirements while improving project economics, saving money, and generating new sources of revenue and ownership for consumers.

This strategy also calls for State programs to support policies, including CCA, which is a local program to purchase power in bulk for virtually all homes and small businesses in a participating community. CCA allows local elected officials to choose the source of energy for their communities. Most communities that have implemented CCA procure 100% renewable energy as their default supply. Many CCA programs are working to capture the economic benefits of clean energy more broadly. Several CCAs are in operation in New York State and have developed opportunities around opt-out community solar, energy efficiency, heat pumps, electric vehicles (EVs), demand response, and energy storage.

Components of the Strategy

- **Encourage the adoption of clean technologies:** NYSERDA should work with community stakeholders to promote community-scale campaigns to encourage the adoption of clean technologies to generate value and savings for consumers.
- **Expand workforce development for the clean energy economy:** NYSERDA, in collaboration with unions and the clean energy industry, should expand workforce development programs focused on training and job placement in clean energy and emerging technologies.

LG5. Provide State Support and Guidance

This strategy discusses continuing and expanding program opportunities, incentives, technical assistance, financial support, and centralized procurement services to motivate local governments, local government municipal bodies such as Conservation Advisory Committees and Environmental Management Councils, and related public entities to improve assets they control with high-impact actions. This includes LED lighting, energy efficiency upgrades, heat pump projects, methane recovery for energy production from wastewater treatment and landfills, solar on municipal premises, and municipal and school district fleet electrification.

Local governments and related public entities could realize greater savings while also achieving significant GHG reductions if they worked through shared services models. Shared services can come in different forms. For example, to accelerate adoption of clean technologies and policies, local governments may be encouraged to work together through intermunicipal conference calls, planning institutes, roundtables, or work groups. State programs that offer clear guidance, grants, technical assistance, and recognition can motivate local governments and related public entities to improve the assets they control.

Components of the Strategy

- **Encourage energy benchmarking:** NYSERDA should encourage local governments to track and report the energy use of municipal buildings and facilities (benchmarking).
- **Encourage energy efficiency:** NYSERDA should work with community stakeholders to provide technical support to help local governments and related public entities reduce energy use and GHG emissions of buildings and operations through aggressive energy efficiency measures, including, but not limited to, weatherization.
- **Provide technical support for clean energy projects:** NYSERDA should work with community stakeholders to provide technical support to help local governments and related public entities develop and implement clean energy projects.
- **Reduce grid interconnection costs:** NYSERDA, in collaboration with the clean energy industry, should evaluate options to reduce interconnection costs for municipally owned priority sites.
- **Prioritize methane recovery:** NYSERDA, working with community stakeholders, should prioritize funding for projects that recover methane from wastewater treatment and landfills for on-site energy production in a manner consistent with the strategies in *Chapter 16. Waste* (Strategy W4 and Strategy W9).
- **Support direct energy purchasing:** NYSERDA and DPS should develop tools and resources to help municipalities procure energy and enable direct purchases of energy by municipalities from the wholesale market.
- **Support fleet electrification:** NYSERDA and DEC should support electrification of municipal and school district fleets while increasing fleet-wide fuel economy.
- **Support building electrification:** NYSERDA should provide policy guidance and financial support to municipalities that adopt building electrification and energy efficiency policies that incorporate insights from cities like Ithaca that have made ambitious commitments and developed innovative decarbonization plans.

- **Increase recycling and reduce waste:** DEC should seek to increase waste reduction and recycling rates in municipal operations and in the community (see also *Chapter 16. Waste Strategy W1, Strategy W2, and Strategy W8*).
- **Support intermunicipal planning and coordination on cross-boundary issues:** NYSERDA, DEC, and DOS should encourage intermunicipal coordination and planning on cross-boundary issues while easing access to funding opportunities without penalizing Disadvantaged Communities that may not have similar partnerships in place.
- **Support capacity-building for local governments and related public entities:** The State should provide educational materials and training to local governments and related public entities, so that they understand what resources are available to them and are prepared to receive funding.

Chapter 21. Adaptation and Resilience

21.1 Overview

Even with strong and innovative strategies in place to curb greenhouse gas (GHG) emissions, the impacts of climate change are already being felt and are only projected to accelerate. Climate change mitigation strategies alone are not sufficient to prepare for the impacts of present and future climate change.

Therefore, New York State must take bold action to adapt to climate change and enhance resilience in communities, infrastructure, and systems.

Resilience is the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions. In human systems, adaptation is the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, adaptation is the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate.³²⁹

Climate change impacts and the ability to adapt are distributed unevenly across different communities and population groups. Disadvantaged Communities and historically marginalized communities in particular often face greater risks while contending with historic socio-economic and environmental burdens and exposures. Underinvestment and historic injustices additionally limit available capacities and resources to effectively anticipate, plan for, and adapt to climate change. The strategies presented in this chapter emphasize equity in adaptation and resilience to address these historic and persistent injustices and inequities.

For energy systems, resilience is the ability of the energy infrastructure to be prepared for, withstand, adapt, and quickly recover from disruptions such as severe weather, natural, and man-made disasters. Adaptation is the process of adjusting to new climate conditions to reduce risks to valued assets.³³⁰

³²⁹ Intergovernmental Panel on Climate Change. 2012. “Glossary of terms.” In: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press, Cambridge, UK, and New York, NY, USA, pp. 555-564.

³³⁰ United States Global Change Research Program. 2021. “U.S. Climate Resilience Toolkit.” Glossary. Accessed at <https://toolkit.climate.gov/content/glossary>.

This chapter contains strategies to enhance climate resilience and adaptation organized under three themes: building capacity, communities and infrastructure, and living systems.

21.2 Key Strategies

The components of the key strategies are derived from the initiatives and their respective components recommended to the Climate Action Council (Council) by the Land Use and Local Government Advisory Panel. A detailed description of the strategies and components can be found in Appendix H. The adaptation and resilience strategies are organized into three themes, listed below in Table 21.

Table 21. Adaptation and Resilience Key Strategies by Theme

Theme	Strategies
Build Capacity	<p>AR1. Commit to Creating, Implementing, and Updating a Comprehensive and Equitable State Climate Change Adaptation and Resilience Plan</p> <p>AR2. Incorporate Equitable Adaptation and Risk-Reduction Considerations into Relevant State Funding and Regulatory Programs, Projects, and Policies</p> <p>AR3. Strengthen Meaningful Community Engagement and Public Education and Build Adaptive Capacity across All Sectors</p> <p>AR4. Identify and Evaluate Options for Supporting Equitable Adaptation and Resilience Practices and Projects, and to Enhance Insurance Protection</p>
Enhance Community and Infrastructure Resilience	<p>AR5. Provide State Agency Planning and Technical Support for Equitable Regional and Local Adaptation and Resilience Plans and Projects</p> <p>AR6. Evaluate Opportunities to Ensure Equitable Consideration of Future Climate Conditions in Land Use Planning and Environmental Reviews</p> <p>AR7. Develop Policies, Programs, and Decision Support Tools to Reduce Risks Associated with Coastal and Inland Flooding</p> <p>AR8. Develop Policies and Programs to Reduce Human Risks Associated with New Patterns of Thermal Extremes</p> <p>AR9. Ensure the Reliability, Resilience, and Safety of the Energy System</p>
Enhance Resilience of Living Systems	<p>AR10. Develop Policies and Programs to Reduce Risks Threatening Ecosystems and Biodiversity</p> <p>AR11. Enhance Climate Resilience and Adaptive Capacity of the Agricultural Sector, while Preparing to Take Advantage of Emerging Opportunities</p> <p>AR12. Preserve and Protect the Ability of Forest Ecosystems to Sequester Carbon</p>

Priority Actions

Each strategy comprises several actionable components. Actions that provide the leadership, direction, and resources necessary for New York to fully address its substantial vulnerabilities, while prioritizing equitable treatment for all, are listed here as the highest priority for implementation. These highest-priority actions are to appoint a Chief State Resilience Officer (CSRO); convene an adaptation and resilience sub-cabinet; develop a comprehensive State climate change adaptation and resilience plan based on a common vision of resilience; develop a policy on evaluation of equity and justice impacts of State adaptation and resilience decisions and of existing impacts of displacement and harm and provide

guidance on use of such evaluation to prioritize action in Disadvantaged Communities; establish a campaign to build public awareness and educate students from P-12 on the importance of climate change; and create a resilient infrastructure fund through bonding.

Additional actions that are important to ensure availability of information, financial resources, and regulatory authority to adapt to reduce risks associated with climate hazards are listed here as high priority. High-priority actions include continuing the ongoing update to New York's climate change assessment and initiating other research; adopting a process to ensure integration of State infrastructure investments to ensure efficient use of land and other resources and consideration of adaptation and resilience; reporting on options to enhance hazard mitigation funding, prefund disaster recovery, and transfer catastrophic risk to the insurance and capital markets; supporting development of local resilience, continuity, and adaptive capacity;³³¹ facilitating consideration of climate change in local regulatory and planning programs; and developing or updating guidance for mitigation of climate change risks in permit and State Environmental Quality Review Act (SEQRA) reviews.

State agencies must pay particular attention to ensuring the availability of resources, including federal funds distributed by the Federal Emergency Management Agency and other federal agencies, to enhance climate resilience in Disadvantaged Communities. Interagency coordination and consultation with affected communities to ensure effective delivery of these resources to Disadvantaged Communities will be critical to their success. The Climate Justice chapter summarizes strategies that apply to this chapter and include avoiding displacement of risk, equitable distribution of adaptation benefits, consideration of multiple, pre-existing or consecutively occurring exposures, and providing assistance to help Disadvantaged Communities overcome existing barriers.

Indicators, Metrics and Monitoring

Development and tracking of indicators and metrics will be critical components of planning and implementation of the recommended actions. Process metrics should be developed during work planning, and program plans and policies should include descriptions of indicators and metrics to be tracked and, where appropriate, reported. Indicators, metrics, and monitoring should be focused on outcomes and include indicators related to equity and benefit flows. However, as most of the following strategies

³³¹ Adaptive capacity: The combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities. IPCC Annex II. Glossary of Terms, Ibid. https://archive.ipcc.ch/pdf/special-reports/srex/SREX-Annex_Glossary.pdf

comprise recommendations to develop plans, detailed discussion of indicators and metrics, and the means to monitor them, is beyond the scope of this document and premature for most of the recommended actions. Indicators, metrics, and monitoring programs should be developed during work planning for each recommended action. Resilience Metrics is one of numerous resources available regarding selection of indicators and metrics.³³²

Build Capacity

The “build capacity” theme comprises four strategies related to statewide planning, consideration of future conditions in State decision-making, enhancement of general understanding of climate change, improving the public’s adaptive capacity, and identifying options for financing adaptation actions and reducing or shifting risk.

AR1. Commit to Creating, Implementing, and Updating a Comprehensive and Equitable State Climate Change Adaptation and Resilience Plan

New York is vulnerable to a variety of climate hazards, many of which will become more severe as the climate changes, and suffers substantial property loss, as indicated in Table 22. Note that the values reported in the table include only personal and public property losses and do not include long-term economic losses, medical costs, losses of social capital, community cohesion and capacities, or loss of life. Despite this vulnerability, New York has not committed substantial resources to comprehensive adaptation planning and coordination. Without the State’s commitment of resources, planning, and coordination, under-resourced and Disadvantaged Communities will continue to lack necessary resources and capacities to effectively anticipate, plan for and adapt to local impacts. The Council recommends that the State couple its nation-leading goals to mitigate climate change with similarly ambitious goals to adapt to it.

Table 22. Average Annual Property Loss from Severe Hazard Events in New York, 1996–2017³³³

Hazard	Avg. loss	Hazard	Avg. loss	Hazard	Avg. loss
Flooding	\$129,000,000	Ice Storm	\$4,070,000	Lightning	\$466,000
Wind	\$24,100,000	Coastal Hazards	3,750,000	Heat Wave	\$86,000
Snowstorm	\$15,500,000	Cold Wave	\$855,000	Tsunami/Seiche	\$22,000
Hail	\$3,600,000	Hurricane	\$758,000	Wildfire	\$8,720
Tornado	\$6,370,000				

³³² Resilience Metrics can be accessed at <http://resiliencemetrics.org/>.

³³³ MitigateNY. “National Climatic Data Center Storm Events Dataset.” Accessed October 24, 2022 at <https://mitigateny.availabs.org/hazards,>.

Components of the Strategy

- **Provide executive-level coordination of adaptation and resilience activities:** The Governor should appoint a Chief State Resilience Officer (CSRO) who would convene an adaptation and resilience sub-cabinet. Importantly, the CSRO’s portfolio must include all State adaptation and resilience activities, including oversight of relevant bond fund expenditures, and not be limited to disaster response. The CSRO must ensure incorporation of just transition principles into all adaptation and resilience activities and should report directly to the Director of State Operations. The adaptation and resilience sub-cabinet should comprise heads of relevant State agencies and authorities and be chaired by the CSRO.
- **Develop an adaptation and resilience plan:** The CSRO and adaptation and resilience sub-cabinet should oversee development of a comprehensive State climate change adaptation and resilience plan. This plan and the CSRO should ensure not only that programs are applied equitably, but that, as feasible, adaptation and resilience activities serve to ameliorate environmental, health, social, and economic inequities in historically marginalized communities and in Disadvantaged Communities. Planning should also include consultation with Indigenous Nations.
- **Complete vulnerability assessments and adaptation plans:** New York State Department of Environmental Conservation (DEC), with support from New York State Office of General Services (OGS), should complete preliminary agency vulnerability assessments and adaptation plans and identify and prioritize State adaptation and resilience projects.
- **Continue assessments and research:** The New York State Energy Research and Development Authority (NYSERDA) should continue its ongoing update to the climate change assessment, and DEC or other agencies should initiate or fund additional research.

AR2. Incorporate Equitable Adaptation and Risk-Reduction Considerations into Relevant State Funding and Regulatory Programs, Projects, and Policies

Incorporating equity into adaptation considerations in State programs is important for ensuring Disadvantaged Communities are protected against the effects of climate change and have the capacity and necessary resources to anticipate, plan for and adapt to climate impacts. Implementation of this strategy would be complementary to the goals of the Climate Justice chapter and include mainstreaming equity and justice considerations across programs, including proactive use of such programs to address economic and environmental inequities, consistent use of science-based projections in State decision-making,

consideration of lived experience and local expertise, and development of climate-resilient design guidelines for State-funded projects, among others.

Components of the Strategy

- **Provide guidance on use of climate change projections:** DEC should release guidance describing projected climatic changes, including the inequitable distribution of risks, impacts and vulnerabilities, to support relevant decision-making.
- **Coordinate infrastructure investments:** The CSRO should provide recommendations to the Executive Chamber to adopt a process to ensure integration of federal, State, and local infrastructure investments to ensure efficient and equitable use of land and other resources, addressing historic and present climate and environmental injustices in infrastructure design, siting, and land use decisions, and consideration of adaptation and resilience.
- **Evaluate equity and justice:** The State should establish a comprehensive set of goals, processes, and selection criteria for identifying and implementing adaptation and resilience projects that involve meaningful community consultation and empowerment, especially in historically marginalized communities and Disadvantaged Communities; develop a formal policy on evaluation of equity and justice impacts of State adaptation and resilience decisions, including consideration of benefit flows and evaluation of outcomes; and provide guidance on use of such evaluation to prioritize action in Disadvantaged Communities.
- **Adopt resilient design guidelines:** OGS and DEC should convene a work group to adopt climate resilient design guidelines for State-funded projects.
- **Amend the Smart Growth Public Infrastructure Policy Act:** The State should amend the Smart Growth Public Infrastructure Policy Act and similar statutes to require consideration of climate hazards and climate equity and development of guidance by relevant agencies.
- **Enhance design capacity:** OGS should convene a work group to establish policies and procedures to require design professionals and contractors on State-funded projects to consider future climate conditions.
- **Assess climate vulnerabilities during land and water planning:** DEC, New York State Department of State (DOS), and other agencies that undertake or fund land or water planning activities should adopt policies to ensure all State land and water use plans include assessment of climate vulnerabilities and, as appropriate, strategies to promote resilience and reduce risk.

- **Enhance resilience of manufactured homes:** The State should review current safety codes and standards related to manufactured homes (including mobile homes) and consider the need for additional regulation, incentives or guidance to enhance resilience to climate hazards, particularly flooding, thermal extremes, indoor air quality, and high winds. As feasible, resilience programs for manufactured homes should be coordinated with programs to improve energy efficiency and access to sources of renewable energy.

AR3. Strengthen Meaningful Community Engagement and Public Education and Build Adaptive Capacity across all Sectors

Equitable participation in decision-making is particularly critical in adaptation and resilience planning to ensure that impacts and vulnerabilities are recognized and that climate risks are not displaced to communities that have historically been excluded from decision-making processes. Meaningful engagement processes, opportunities to participate in decision-making and capacity-building will be critical for local communities to successfully adapt to climate change. Public awareness of the need for the Climate Act and its implementing actions is critical to its ultimate success. Ensuring individual and household resilience will be crucial in reducing risks associated with climatic events. Climate adaptation provides significant opportunity for vocational training and job growth that can be targeted to vulnerable communities and those in transition from reliance on fossil fuel-based industries.

Components of the Strategy

- **Raise student and public awareness:** The State should convene a work group to establish a well-resourced campaign to build student and public awareness of climate change effects and solutions, provide workforce development and early career development opportunities, and effect beneficial lifestyle changes.
- **Provide disaster preparedness and response training for building operations staff:** NYSERDA and partner agencies should establish a program to train building operations staff in disaster preparedness and response.
- **Establish a resilience audit program:** NYSERDA, in consultation with DEC, New York State Homes and Community Renewal (HCR), New York State Office of Temporary and Disability Assistance (OTDA), and the New York State Division of Homeland Security and Emergency Services (DHSES) should establish a residential and small business resilience audit program.

AR4. Identify and Evaluate Options for Supporting Equitable Adaptation and Resilience Practices and Projects, and to Enhance Insurance Protection

The costs of dealing with the effects of climate change will be significant and will continue to rise as the planet warms. These costs may include investments to reduce risk or costs to respond to, and recover from, natural events, exacerbated by climate change. Unfortunately, the benefits of these investments are often difficult to quantify as they generally consist of avoided remedial costs, and the payback is realized only after an event occurs or some dangerous threshold is crossed. Although insurance can serve to spread risk, strategies to enhance insurance coverage must include consideration of renters and owners of at-risk properties who do not participate in the National Flood Insurance Program, and the potential effects of insurance premium increases on low-income households. The components of this strategy are intended to secure the funds necessary to make necessary investments in resilience and enhance insurance protection.

Components of the Strategy

- **Create a resilient infrastructure fund and prioritize investments in Disadvantaged Communities:** The State should create a resilient infrastructure fund through bonding, such as through the “Clean Air, Clean Water, and Green Jobs” Environmental Bond Act. In developing investment programs, the State should explore creation of equitable methods for benefit-cost analysis and valuing damages and losses.
- **Establish an insurance-premium surcharge for high-value, high-risk properties:** Impose a surcharge on insurance premiums for select lines of insurance to support risk-reduction and adaptation projects.
- **Authorize community preservation funds for all municipalities:** The State should enact legislation authorizing all municipalities to establish community preservation funds.
- **Focus anchor-institution investment on community benefit and wealth building:** New York Department of Health (DOH) should encourage anchor institutions (large, usually nonprofit organization tethered to their communities, like universities, medical centers, or local government entities) to focus community benefit investments on projects to equitably address climate change and build local community wealth.
- **Explore hazard mitigation funding alternatives:** The Division of Budget, or other appropriate agency, should report on options to enhance hazard mitigation funding and to prefund disaster recovery, and to transfer catastrophic risk to the insurance and capital markets.
- **Improve insurance coverage:** DEC and partners at all levels of government should implement strategies to increase take-up rates of flood insurance and other coverage related to climate hazards.

- **Restrict anti-concurrent causation clauses:** The State should adopt legislation to prohibit or restrict anti-concurrent causation clauses for sewer backup insurance coverage where flooding is the cause.

Enhance Community and Infrastructure Resilience

Enhancing resilience of communities and infrastructure includes strategies to assist municipalities to prepare for and react to increasingly severe climate hazards. The strategies include recommendations to expand State support for regional and local planning, assist municipalities and local communities in their efforts to incorporate future conditions into local planning and regulatory decisions, recommendations to address risks due to flooding and extreme heat, and recommendations to ensure resilience of the energy system. Implementation of all components of these strategies should prioritize use of natural resources and nature-based features to enhance resilience.

AR5. Provide State Agency Planning and Technical Support for Equitable Regional and Local Adaptation and Resilience Plans and Projects

Local officials have consistently advised that they lack resources, including not only funds, but technical expertise and access to information and decision-support tools to support effective adaptation planning. This strategy would accelerate current efforts to provide guidance, and financial and technical support for community and regional planning and implementation, for mainstreaming of climate change considerations into local planning and regulatory programs and for consideration of local economic resilience under future climate conditions in planning decisions. This strategy would also provide planning for climate-induced migration, both into and within the State.

Components of the Strategy

- **Develop local adaptation capacity:** DEC, DOS, and other agencies should expand programs to support development of local resilience, continuity and adaptive capacity and consideration of climate change in local regulatory and planning programs.
- **Promote local economic resilience:** DOS, Empire State Development (ESD), and other relevant agencies should support development of local economic resilience strategies, climate-adapted economic development, business continuity planning, and local government climate financing and budgeting.
- **Deploy online tools:** DEC and partner agencies, including DOS, NYSERDA, DHSES, and the Office of Information Technology Services, should support deployment of online tools to

facilitate vulnerability assessments, adaptation planning and implementation. As feasible, guidance documents and online tools should be made available in several languages.

- **Support recovery planning:** DOS and DEC should support community-led pre-event, long-term recovery planning. Such planning should include consideration of managed retreat from highly vulnerable areas.
- **Consider relocation and buyouts as alternatives to electrification:** NYSERDA, in consultation with DEC, HCR, and DOS, should analyze relocation and buyout of properties as potential alternatives to electrification of at-risk buildings.
- **Establish post-disaster strike teams:** The CSRO should establish strike teams to equitably assist municipalities with resilient post-disaster recovery.
- **Plan for climate migration:** The State should convene a work group, to include DEC, NYSERDA, DOS, HCR, DHSES, Governor’s Office of Storm Recovery, subject experts from State University of New York (SUNY) or other universities, and refugee resettlement agencies, to develop a strategy to address climate migration, including consideration of differential effects of relocation strategies in Disadvantaged Communities.

AR6. Evaluate Opportunities to Ensure Equitable Consideration of Future Climate Conditions in Land Use Planning and Environmental Reviews

Work to mainstream consideration of climate change in environmental reviews is ongoing, but much remains to be done, and local governments require more explicit authority to consider climate change and biodiversity in comprehensive plans.

Components of the Strategy

- **Provide guidance on assessment of climate risks:** DEC should accelerate ongoing efforts to develop or update guidance for mitigation of climate change risks, avoiding maladaptation in permit and SEQRA reviews, and amend the SEQRA Handbook and workbooks.
- **Facilitate adaptation projects:** DEC should amend the project review process to facilitate approval of climate adaptation projects.
- **Consider climate and biodiversity in comprehensive plans:** The State should enact legislation amending relevant statutes to include consideration of climate mitigation, adaptation and resilience, and biodiversity as potential topics in comprehensive plans.
- **Protect forests and farmland:** The State should require consideration of forest and farmland protection in all comprehensive and other land use plans that it undertakes or funds.

AR7. Develop Policies, Programs, and Decision Support Tools to Reduce Risks Associated with Coastal and Inland Flooding

Flooding is New York's primary climate hazard, and we can expect both insured and uninsured losses to increase as sea level continues to rise and more frequent extreme precipitation events result in more extensive and deeper floods, including dangerous flash flooding in urban areas not previously considered flood prone. Components of this strategy would provide improved map and other information resources, funding, and regulations to reduce flood risks.

Components of the Strategy

- **Increase pace of floodplain assessments:** DEC should increase the pace of local floodplain assessments to identify flood hazards.
- **Right-size infrastructure:** DEC should hire a statewide technical assistance coordinator to support municipalities in right-sizing culverts and bridges to reduce flood risk and improve habitat connectivity.
- **Support Community Rating System participation:** DEC and DHSES should provide support and incentives for municipal participation in the Federal Emergency Management Agency's Community Rating System.
- **Strengthen State building code:** DOS should amend State building code to account for sea level rise and enhanced riverine flooding and for potential use of innovative structures, such as amphibious buildings.
- **Develop statewide mapping strategy:** DEC should develop a statewide flood-risk mapping strategy.
- **Digitize dam failure inundation maps:** DEC should digitize dam failure inundation maps and integrate with other geographic resources to improve emergency planning and response as well as explore approaches to use these maps to enhance public information and outreach efforts.
- **Support dam removals:** DEC should support dam removals that reduce flood risk and improve aquatic habitat quality.
- **Enact flood risk disclosure law:** The State should enact an enforceable flood-risk disclosure law, applicable to both purchases and leases of real property.

AR8. Develop Policies and Programs to Reduce Human Risks Associated with New Patterns of Thermal Extremes

In most years, more Americans die from the effects of extreme heat than from flooding and frequency of extreme heat events is one of the most direct effects of global warming. At the same time, changes in

atmospheric circulation patterns, perhaps precipitated by loss of sea ice, may lead to periods of extreme cold in New York. Components of this strategy include support for cooling centers, heat emergency planning, weatherization, and access to thermal resilience programs for vulnerable populations.

DEC and NYSERDA are currently developing an extreme heat action plan. They have convened the interagency Extreme Heat Action Plan Work Group (EHAPWG), which released the “Interim Recommendations: Preparing for Extreme Heat” report in July 2022.³³⁴ These interim recommendations include development of a heat adaptation plan by January 1, 2024, and of a heat-specific annex to the State’s comprehensive Emergency Management Plan by June 1, 2023. The EHAPWG has initiated these planning processes and anticipates that those plans will include implementation of all components of this strategy.

Components of the Strategy

- **Implement the extreme heat action plan:** DEC and NYSERDA should coordinate with the EHAPWG to ensure the equitable implementation of all provisions of the extreme heat action plan. The EHAPWG should create a mechanism for evaluating implementation progress and tracking extreme heat related health outcomes and regularly update the extreme heat action plan.
- **Consider building cooling requirements:** The State should assess feasibility of adopting codes and standards for residential building cooling.
- **Develop cooling centers and enhance accessibility:** DEC and DOH, in coordination with the EHAPWG, should continue to support development and operation of cooling centers, including assessments to increase accessibility via public transportation.
- **Develop guidance for considering extreme heat risks in planning, zoning and permitting:** The EHAPWG should develop guidance for considering extreme heat risks, the urban heat island effect, and extreme heat inequities in planning, zoning and permitting decisions, including SEQRA analysis and comprehensive plans.
- **Develop regional and local heat emergency plans:** DOH should support development of regional and local heat emergency plans that prioritize the health and stability of vulnerable communities. DHSSES should facilitate incorporation of these heat emergency plans into county and municipal hazard mitigation plans.

³³⁴ New York State. 2022. *Interim Recommendations: Preparing for Extreme Heat*. Albany, NY. 48pp. Accessed October 24, 2022, at https://www.dec.ny.gov/docs/administration_pdf/ehapinterimrecommendationsreport.pdf.

- **Strengthen weatherization requirements:** DOS should amend the State building code to require more effective weatherization from thermal extremes.
- **Enhance thermal resilience in vulnerable populations:** OTDA and NYSERDA should promote and facilitate access to programs that provide cooling, weatherization, and solar assistance to vulnerable populations.
- **Develop and implement a comprehensive outreach and communications strategy to reduce risks of extreme heat:** DOH, in coordination with the EHAPWG, should develop a comprehensive strategy for internal and external communications that reduce extreme heat risks, including assessing adequacy of, and addressing deficiencies in, current advisories, agency/authority internal communications, and other internal and external outreach and public education initiatives.
- **Adopt a green infrastructure plan:** DEC and other relevant agencies should develop a strategy to promote and incentivize use of green infrastructure and natural resources, including urban forests, to reduce climate risks. In support of this planning, DEC will identify locations of urban heat islands in Disadvantaged Communities.

AR9. Ensure the Reliability, Resilience, and Safety of the Energy System

The increasing frequency of severe climatic events has exposed vulnerabilities in the State’s energy system and the need to improve the reliability and resilience of the energy system, as well as the resilience of those who depend on that energy system in buildings and for transportation. Assessment of system vulnerabilities to increasing climate hazards and investment to ensure system resilience will be required. Energy system providers must continually reassess infrastructure vulnerabilities across the entirety of their service territories to determine appropriate resilience initiatives to mitigate potential disruptions due to the effects of climate change and make their infrastructure more adaptable to weather extremes.

Components of the Strategy

- **Periodically revise existing energy system resilience standards and assess vulnerabilities:** In February 2022, New York enacted legislation requiring utility corporations subject to Public Service Law § 25-a, combined gas and electric corporations, to complete vulnerability assessments to evaluate each electric corporation's infrastructure, design specifications, and procedures and to submit to the New York State Public Service Commission (PSC) climate vulnerability and resiliency plans. The PSC should require regulated utilities and operators of critical infrastructure to incorporate updated climate change projections into required

vulnerability assessments as the assessments are updated and should periodically review established resilience standards and vulnerabilities to climate hazards to ensure their incorporation into PSC-approved risk-reduction plans. Municipal utilities, cooperative utilities, Long Island Power Authority (LIPA), New York Power Authority (NYPA), and other utilities not regulated by the PSC should be supported in the development of their own requirements and plans.

- **Develop strategies for grid outages and extreme weather events:** The CSRO or other designated individual should convene a work group, comprising New York State Department of Public Service (DPS), DHSES, New York State Department of Transportation (DOT), DEC, NYSERDA, NYPA, and other relevant entities, to develop strategies to ensure availability of fuel and power for emergency vehicular fleet operations and essential public transportation during power grid outages. This work group should also establish a resilience plan for EV-charging infrastructure to ensure access to transportation, including evacuation during extreme weather events. Strategies should also consider values of solar-plus-storage and vehicle-to-grid systems.
- **Promote capital improvements:** NYSERDA, in consultation with DPS, DOS, and other relevant entities, should promote capital improvements in buildings to endure grid failures and to facilitate buildings' ability to accept power when the system is re-energized.
- **Include photovoltaic (PV) and electric vehicle (EV) charging in building code:** DOS, in consultation with NYSERDA, should include requirements for PV and EV charging readiness in the building code.
- **Support local renewable and storage systems:** NYSERDA, in consultation with DPS, DHSES, and local governments, should develop a comprehensive strategy to support development of islandable microgrids and district systems using renewable sources of energy to provide locally generated power and behind-the-meter storage, especially in critical facilities, for use during grid emergencies.

Enhance Resilience of Living Systems

As used in this document, the term “living systems” refers to the State’s natural ecosystems, its agricultural systems, and its forested lands. Strategies recommended to enhance resilience of living systems include addressing risks to ecosystems and biodiversity, enhancing resilience and adaptation of the agricultural sector, and protecting the ability of forests to serve as carbon sinks.

AR10. Develop Policies and Programs to Reduce Risks Threatening Ecosystems and Biodiversity

The components of this strategy provide for a variety of mechanisms to ensure conservation or protection of the most important pieces of our life-sustaining ecosystems. These initiatives include a focus on intentional planning to identify and protect critical ecosystems and to establish and protect connectivity at several scales, ranging from the landscape scale to enable populations to migrate northward and upward as the climate warms, to project-specific planning to ensure wildlife and aquatic organism connectivity. Several of the components below are reflected in strategies of *Chapter 15. Agriculture and Forestry* and *Chapter 19. Land Use*.

Components of the Strategy

- **Improve local wildlife and aquatic connectivity:** DEC and DOT should improve local wildlife and aquatic connectivity, including through use of standardized environmentally friendly design features, during transportation infrastructure improvement projects, as practicable, and as identified by statewide critical terrestrial and aquatic habitat and conservation planning efforts.
- **Expand conservation easements to include other areas:** DEC and New York State Department of Agriculture and Markets (AGM) should expand development of conservation easement and incentive programs (such as the Source Water Buffer Program) to include areas of farms set aside for conservation of wetlands, stream corridors, riparian buffers, or wildlife corridors.
- **Incorporate BMPs from species management plans:** DEC, ORES, NYSERDA, DOS, and DOT should incorporate best management practices (BMPs) from species management plans into State and federally funded or regulated projects, including renewable energy projects, in or near occupied habitats to reduce and mitigate ecosystem impacts.
- **Amend Real Property Tax Law to incentivize private forest stewardship:** The State should enact legislation to amend Real Property Tax Law to incentivize private forest stewardship for a broader range of goals, including biodiversity, wildlife habitat protection, water resource protection, outdoor recreation, and carbon sequestration.
- **Prioritize biodiversity and carbon sequestration:** DEC should heighten consideration of biodiversity and enhancement of carbon sequestration among the priorities in State forest land planning and adopt guidance for development of unit management plans that includes conservation of biodiversity and increased carbon sequestration as priorities.
- **Expand implementation of the Invasive Species Comprehensive Management Plan:** DEC and AGM should advance biocontrol of forest pests, and expand implementation of relevant parts

of the Invasive Species Comprehensive Management Plan, including two key priorities: advancing prevention and early detection and improving the response to invasive species.

- **Ensure protection of stream buffers:** The State should create a regulatory program to ensure protection of stream buffers to protect and enhance water and habitat quality, reduce flood risk, and prevent soil erosion.

AR11. Enhance Climate Resilience and Adaptive Capacity of Agricultural Sector, while Preparing to Take Advantage of Emerging Opportunities

Included below are recommendations to improve water and energy efficiency on farms, incorporate other climate-resilient practices into farm operations, and continue research and outreach to help farmers prepare for the effects of a changing climate. However, these recommendations do not address the entire gamut of climate hazards New York growers, agricultural workers, and farm communities face and should not be interpreted as a complete agricultural adaptation plan.

Components of the Strategy

- **Establish a farm water and energy efficiency program:** AGM and NYSERDA should develop and support a water and energy efficiency realization program to meet agricultural needs related to climate change, including decision-support tools, power upgrades, and strategies to reduce equipment costs.
- **Promote resilient crops:** The State should expand support for research and outreach on climate-resilient crop varieties; technology to provide freeze and frost protection; strategies to address invasive species, pathogens, and pests; and increased use of perennial crops for food and feed.
- **Promote agricultural and watershed-based BMPs:** AGM should assess, develop, and promote agricultural and watershed-based BMPs for flood attenuation, drought mitigation, and water quality protection.

AR12. Preserve and Protect the Ability of Forest Ecosystems to Sequester Carbon

In recognition of the important role healthy forests play in sequestering carbon, ensuring forests retain their sequestration potential under future conditions should be considered in State acquisition programs. As with agriculture, this strategy does not constitute a complete adaptation plan for our forests. Many recommendations described in Strategy AR10, also address the goal of protecting the ability of our forests to continue to sequester carbon. This strategy complements the strategies described in *Chapter 15. Agriculture and Forestry*, which serve to enhance the ability of our forests to remove carbon dioxide (CO₂) from the atmosphere and sequester it in healthy trees and forest soils.

Component of the Strategy

- **Consider resilience in land acquisition:** DEC, OPRHP, AGM, and other agencies and authorities should include resilience criteria in State acquisition programs.
- **Provide forest resilience guidance:** DEC should provide guidance on forest and tree climate change vulnerabilities and options for increasing forest resilience, including promotion of more climate resilient tree species, where applicable.

Measuring Success

Chapter 22. Essential Elements

With State-level actions such as the passage of the Climate Act and continued procurement of large-scale renewable energy resources, New York has proven to be a leader in addressing climate change. The release of the Scoping Plan advances New York to the next level. It has been well-established that the threat of climate change is great and can only be fully addressed when stakeholders are in alignment and coordinate mitigation efforts. Success of this Scoping Plan requires several essential elements including partnerships, outreach and education, and workforce and economic development.

22.1 Partnerships

New York witnessed the importance of partnerships firsthand in the response to the COVID-19 pandemic. From supply chains, businesses, and people to science, resources, and policies, New York is inextricably linked to the international community. When New York leads, the results echo loudly to its peers, but it cannot stand alone. Partnerships with a wide range of entities will be critical to ensure the success of this Scoping Plan and reaching the State's climate directives. New York has long been part of collaborative environmental projects and programs at the federal, regional, and local levels. Programs such as Regional Greenhouse Gas Initiative (RGGI) and participation in the U.S. Climate Alliance have enabled New York to make progress at the State level while having a greater regional and national impact.

Continued collaborative efforts are critical to ensure successful and consistent climate policy on a greater scale. While New York continues to act at the State level, federal action, and continued cooperation at the regional and national levels, is vital to increase overall policy effectiveness and minimize leakage to the greatest extent. When all levels of government work together, climate action is accelerated, resources are shared more efficiently, and jurisdictions can address the impacts in a more holistic way.

Climate change and the policy development required to address it presents a unique need and a unique opportunity for interagency collaboration at the State level. Dozens of State entities were engaged in the process and supported the development of this Plan. While New York State Department of Environmental Conservation (DEC) and New York State Energy Research and Development Authority (NYSERDA) will continue to lead in the implementation of the Climate Act, collaboration must continue and expand as the State moves forward with implementing the Scoping Plan. Meeting the greenhouse gas (GHG) emission reduction requirements and the need to build resiliency to adapt to the changing climate will

require action from all State agencies and authorities, as well as continued cooperation between agencies, authorities, and the Legislature.

Federal Action

Several strategies in this Plan highlight the opportunity to leverage new federal action for New York. While New York will continue to lead on climate action, a cohesive national approach will provide the emission reductions of a scale necessary to mitigate potentially catastrophic climate change. Historically, the federal government has taken measures to address climate change and reduce GHG emissions through the Clean Air Act and related actions, such as the regulation of GHGs from cars, trucks, and buses. More recently, the Biden Administration set a target to reduce economywide GHG emissions by 50% to 52% of 2005 levels by 2030. Additionally, and as referenced in *Chapter 2. The Time is Now to Decarbonize Our Economy*, the Biden Administration is leveraging its purchasing power through a Buy Clean policy to promote the use of construction materials with lower-embodied emissions and pollutants. Recent action to implement the American Innovation and Manufacturing Act and sign the Kigali Amendment to the Montreal Protocol to phasedown hydrofluorocarbons (HFCs) is reassuring to see the federal government once again taking responsibility for controlling HFC emissions and reinstating its leadership role in international policy. The federal government's strides to increase offshore renewable energy development and expand transmission capacity is critical to the transition to a clean economy. The White House also recently released a report to the National Climate Task Force that recommends actions to accelerate nature-based solutions for climate progress. These recommendations include updating permitting and environmental review processes, incentivizing nature-based resilient infrastructure, leading by example in management of federal facilities, workforce training, and continued research and innovation.³³⁵

The Biden Administration's Justice40 Initiative is critically important to climate action at the federal level and important to consider in the context of New York's leadership in this area and the Climate Act's robust climate justice requirements and goals. This initiative seeks to address the history of national environmental policy decisions that have failed to adequately account for environmental injustice, including the disproportionate, disparate, and cumulative impacts pollution and climate change have on low-income communities and communities of color. The recently released Climate and Economic Justice Screening Tool will help federal agencies better identify communities that can benefit from this initiative.

³³⁵ White House Council on Environmental Quality, White House Office of Science and Technology Policy, White House Domestic Climate Policy Office. 2022. *Opportunities for Accelerating Nature-Based Solutions: A Roadmap for Climate Progress, Thriving Nature, Equity, and Prosperity*. Report to the National Climate Task Force. Washington, D.C.

The consideration of environmental justice and impacts to overburdened and underserved communities at the federal level, and careful coordination between the State and federal government, will amplify the benefits New York's Disadvantaged Communities will realize from the Climate Act.

As is the case at the State level, and as is highlighted across the sector strategies, an important complement to these federal programs and initiatives is funding. The recent enactment of the Infrastructure Investment and Jobs Act, the Inflation Reduction Act, and the CHIPS and Science Act provides critical support to not only adapt to and mitigate climate change, but these acts also seize economic development opportunities that are associated with the transition to a clean economy. New York will continue to advocate for additional statutory and regulatory measures to reduce GHG emissions and to green the electricity grid while communicating the importance of avoiding federal preemption and allowing states to take additional action.

Federal Resources to Support Climate Action and a Just Transition in New York

Through the combination of the Infrastructure Investment and Jobs Act, the Inflation Reduction Act, and the CHIPS and Science Act, there are now unprecedented levels of federal funding available to support climate action and the realization of a just transition in New York. There are numerous federal programs and incentives that should be leveraged in New York to drive the transition to a clean energy economy and support a just transition.

- Clean energy manufacturing tax credits to support buildout of domestic supply chains and high-road manufacturing careers, including similar wage and apprenticeship requirements
- Hydrogen production and investment tax credits including similar prevailing wage and apprenticeship requirements
- Investment tax credit for commercial geothermal and thermal energy storage systems, which will be beneficial to community thermal energy network deployment and cost-effectiveness
- Advanced nuclear electricity tax credits and research and development funding, along with Zero-Emission Nuclear Power Production Credit for existing nuclear facilities (with prevailing wage requirement)
- Tax credits for Qualified Advanced Energy Projects, which offer funding to industrial/manufacturing projects that re-equip an industrial or manufacturing facility with equipment designed to reduce greenhouse gas emissions or re-equip, expand, or establish an industrial or manufacturing facility for the processing, refining, or recycling of defined critical materials

- Numerous requirements for the payment of prevailing wage, utilization of apprenticeships, and domestic content to receive full and bonus values for most/all clean energy tax credits
- Energy community bonus adders for many clean electricity tax credits, making it more economical to site projects located at a brownfield site, in a metropolitan area with elevated local employment/tax revenues from fossil fuel industries, or in a metropolitan area suffering a recent coal power plant or coal mine closure
- Electric vehicle (EV) tax credits with requirements for final assembly in North America, supporting existing and future growth of U.S. auto manufacturing and associated workforce, as well as funding to build out a network of EV chargers
- Investments in public transit, including over \$2.1 billion to New York in 2022
- Funding through the U.S. Environmental Protection Agency (EPA) to replace existing school buses with zero- and low-emission models
- Alternative Fuel Refueling Property Credit for property placed in service through 2032, including prevailing wage and apprenticeship requirements
- \$2 billion in grants to re-tool existing auto manufacturing facilities to produce hybrid, plug-in electric hybrid, plug-in electric drive, and hydrogen fuel cell electric vehicles
- New Sustainable Aviation Fuel Credit for the sale or use of a qualified mixture of Sustainable Aviation Fuel and kerosene in the U.S. after 2022 through 2024, and new Clean Fuel Production Credit for low-emissions clean transportation fuel produced after 2024 and sold prior to 2028
- New financing mechanisms for infrastructure reuse and repurposing, through the U.S. Department of Energy's Loan Program Office
- Funding for infrastructure resilience, including funds through the Army Corps of Engineers for flood mitigation

The federal government also recently made significant investments in U.S. national laboratories, including approximately \$200 million for the Brookhaven National Laboratory. These funds will, in part, support clean energy research.

New York has also recognized gaps that have been left by the federal government in the past and has taken action to address them. When the federal government withdrew from the Paris Agreement, New York worked collaboratively and formed the U.S. Climate Alliance, which enables states to collectively commit to reducing emissions consistent with the goals of the Paris Agreement and share data and best practices to set and achieve climate goals. This partnership has enabled actions like the development of shared roadmaps, model regulations, and guidance for action such as to protect natural and working lands,

enable building electrification, reduce short-lived climate pollutants, and integrate the Social Cost of Greenhouse Gases into state policy.

Regional Collaboration

Northeast and Mid-Atlantic states have a history of working together to explore regional policies to reduce carbon emissions and other pollutants. Most states in the region, as well as the District of Columbia, have set economywide GHG reduction goals through statute, executive order, or in climate change or energy plans. The Climate Act requires a different accounting framework for GHGs than is typically used by other jurisdictions, and while there is no standard or consistent mechanism or accounting framework across states for these policies and goals, working in partnership with other jurisdictions can magnify the benefits and reduce the costs of climate action.

As a participant in RGGI, the first cap-and-invest program in the U.S., New York has used this regional market-based mechanism to drive down GHG emissions in the power sector, while raising funds for environmental initiatives statewide. New York has also taken more recent regional action, including signing a Memorandum of Understanding with 14 other states and Washington, D.C., to commit to a goal that 100% of all new sales of medium- and heavy-duty (MHD) trucks be zero-emission vehicles (ZEVs) by 2035. New York also participates in several and various regional research initiatives and programs:

- Great Lakes Commission
- Great Lakes St. Lawrence Governors and Premiers³³⁶
- Great Lakes Wind Feasibility Study
- Chesapeake Bay Watershed Program³³⁷
- The Peconic Estuary Partnership
- Hudson River Estuary Program
- Hudson River National Estuarine Research Reserve³³⁸

³³⁶ Members of Great Lakes St. Lawrence Governors and Premiers work as equal partners to grow the region's \$6 trillion economy and protect the world's largest system of surface fresh water.

³³⁷ The Chesapeake Bay is the largest estuary in the United States. It is home to more than 2,700 species of plants and animals and produces about 500 million pounds of seafood per year. The Bay's watershed covers portions of six states and Washington, D.C.

³³⁸ Information regarding the partnership between the National Oceanic and Atmospheric Administration, DEC's Office of Climate Change, and the U.S. Climate Alliance can be accessed at <https://www.hrner.org/usca-prioritizing-nys-coastal-wetlands-for-resilience-and-blue-carbon/>.

These initiatives enable governments to share data and collaborate on potential solutions to climate-related issues facing various communities. It illustrates that there are several different ways for states to participate on a regional scale. New York will continue to strive for regional participation in order to use the most cost-effective and efficient options for GHG mitigation.

Supporting Local Governments

Local governments are on the frontlines of addressing climate change. Local leaders are the most well-equipped to understand community needs and are uniquely positioned to take action that will reduce GHG emissions. Implementing many of the strategies in this Scoping Plan will require action by local governments. New York's local governments have their hands full meeting the day-to-day needs of their communities. These strategies will not be successful without providing adequate support for local governments. New York has worked to address this through programming across several agencies. The Climate Smart Communities program at DEC offers technical assistance and guidance as well as grant opportunities to local governments. It enables participating governments to transition to a clean economy and improve their climate resiliency. Through its NY-Sun program, NYSERDA offers guidance and technical assistance to local governments to facilitate the expansion of solar development, and through its Clean Energy Communities program, NYSERDA distributes grants to local communities that showcase actions that have a high impact on the community's ability to become more sustainable overall.

New York also supports local governments through the Regional Economic Development Council (REDC) initiative. Through a consolidated funding process, regional councils can apply for grants for different projects and programs, many of which are geared toward environmental protection.

Continued support of New York's local governments is critical to enable the State to take climate action. Strategies in *Chapter 19. Land Use* and in *Chapter 20. Local Government* provide a solid foundation to support local government decision-making to meet the emission limits. Initiatives in these chapters include the development of a community dashboard to promote local planning and measure progress and strategies to enable the deployment of renewable energy resources across the State.

Other Partnerships

Partnerships will need to expand beyond governmental actors in order to successfully mitigate and adapt to climate change. The sector strategies discuss the dozens of stakeholders that should be engaged when considering and implementing the GHG emissions mitigation strategies in this Plan. Stakeholder engagement in the implementation of the Scoping Plan is essential to ensure the policies and programs are

responsive to the needs of the stakeholder community and meet the equity requirements of the Climate Act. New York will continue to seek collaborators such as educational institutions, community-based organizations, labor, industry, and not-for-profit organizations, as well as engage in public/private partnerships. The New York SmartGrid Consortium is one example of a wide variety of entities working together to improve the reliability and resiliency of the electric grid.³³⁹ Economywide cooperation is critically necessary to address climate change. These partnerships have proven successful and will need to expand moving forward. While New York can and will continue to set examples for other states through statewide action, this Scoping Plan recommends advocacy for additional action at the federal level, as well as cooperation with regional and local governments, and the broader stakeholder community to ensure that GHG reduction requirements are met.

22.2 Outreach and Education

Outreach and education to empower every New Yorker to take part in the transition to a clean economy are essential elements to ensure successful implementation of the Climate Act and the strategies described in this Scoping Plan. Throughout this Scoping Plan there is the acknowledgement of the need for outreach and education, from increased outreach to farmers about nutrient management in the agricultural sector to engaging the public through marketing campaigns about the transition to energy-efficient and zero-emission buildings. There is also a recognition of the need for P-12 curricula to include climate change education. The scale of change outlined in this Plan requires a coordinated effort on outreach and education across all sectors of the economy. There are efficiencies of cost and time to be gained by developing a comprehensive outreach and education campaign rather than conducting this outreach by sector or by programs. Avenues to accomplish this include public education campaigns, targeted outreach to current or potential regulated entities, engagement with researchers and innovators, and general engagement and outreach to the key stakeholders that will be involved in the implementation of the various strategies. Recommendations presented in this Plan related to outreach and education include commonalities across sectors such as developing new curricula in P-12 schools as well as higher education and ensuring coordination between the State and local governments when engaging residents about climate action.

22.3 Workforce and Economic Development

As the State advances new economic development initiatives, as well as implements the policies and programs designed to achieve the Scoping Plan's goals, another essential element to the success of this

³³⁹ Information regarding the New York SmartGrid Consortium can be accessed at <http://nysmartgrid.com/>.

Scoping Plan is workforce development across all sectors of the economy. Several recommendations to meaningfully address workforce needs are presented in *Chapter 7. Just Transition*, as well as information related to the job creation opportunity that is associated with the scale of the transition required to meet the Climate Act directives. The chapter discusses the mechanisms that the State uses and should continue to use or expand upon to develop a skilled workforce that will be able to implement the emissions-reducing strategies included in this Plan, including in the electricity, industry, buildings, transportation, agricultural, forestry, and waste sectors, but also to take advantage of new economic activity that results from attracting new clean-tech industries to New York.

The strategies and principles detailed by the Just Transition Working Group (JTWG) can be applied to these sectors to ensure a just and equitable transition across the whole economy and will generate numerous opportunities for New York's existing and emerging workforce.

Equal to the emissions and equity outcomes that are guiding this Scoping Plan, economic development is an equivalent goal for New York in the transition to a clean energy economy. The clean energy transition both in New York and nationally provides the opportunity for New York manufacturers to develop new products and expand their clients, and it also offers the opportunity for new manufacturers to develop a base in New York for ready access to the State's and the region's large building, transportation, and energy sectors. This requires strategic planning and coordination in the short-term in order to focus development in regions of the State where this could have the greatest impact, particularly in legacy/rust belt cities and Disadvantaged Communities.

Building on the business attraction efforts already underway by Empire State Development (ESD), which have resulted in significant economic development in offshore wind, energy storage, and clean transportation, a clean-tech-focused economic development plan should identify specific businesses and technologies that could benefit, in part through incentives for private investment, from the work New York is undertaking to meet the requirements of the Climate Act. It should also include an enhanced marketing strategy to attract these manufacturing and clean-tech businesses to New York, with a specific focus on in legacy/rust belt cities and Disadvantaged Communities. Market assessment, new business development, and entrepreneurship relating to minority-owned businesses should be prioritized along with support to develop these enterprises. This goes hand-in-hand with the pillar of achieving a just transition through promoting good, family-sustaining, union jobs accessible to all New Yorkers. It is important to ensure a coordinated effort at the state level in order to achieve the greatest results.

Chapter 23. Reporting

Successful implementation of the Scoping Plan strategies requires monitoring and reporting on the results of our efforts and a robust public process. Reporting requirements provide transparency and public access to information and awareness of where improvements can be made in our emissions reduction activities. Information ranging from annual greenhouse gas (GHG) emissions to how well the policies implemented are working to meet the GHG emission limits will be released in a range of reports that are required by the Climate Act. Reporting is critical to track how New York is meeting the GHG emission limits.

In addition to the reports required by the Climate Act, New York will measure, track, and report on the investments, benefits, and positive outcomes for Disadvantaged Communities associated with the Climate Act's requirements for clean energy and energy efficiency spending, and as discussed in *Chapter 6. Advancing Climate Justice*.

The State needs to ensure that there are sufficient data collected over time to measure progress and inform policy. To successfully monitor emission sources, the State will need to invest in information technology solutions to gather, analyze, and share data on GHG and co-pollutant emissions. Implementing many of the strategies in the Scoping Plan will necessitate electronic systems for New York State Department of Environmental Conservation (DEC) and other relevant State entities to efficiently collect information from many reporting entities, ensure quality, and to make data accessible and transparent to the public. Regulated entities and emission sources may be required to submit to DEC or other State entities compliance items, such as emissions data or payments, and robust data management tools will ensure that DEC and other relevant entities can monitor compliance with the technical and financial requirements of programs or regulations adopted pursuant to the Climate Act. New York should use other jurisdictions as models for developing these systems, including California's Mandatory Reporting of GHG Emissions Regulation³⁴⁰ and U.S. Environmental Protection Agency's (EPA) Electronic Greenhouse Gas Reporting Program.³⁴¹

³⁴⁰ Information on the California Air Resources Board MRR program can be accessed at <https://ww2.arb.ca.gov/mrr-regulation>.

³⁴¹ Information on EPA's Electronic Greenhouse Gas Reporting Program can be accessed at <https://www.epa.gov/ghgreporting>.

23.1 Annual Inventory

DEC issued the first annual Statewide GHG Emissions Report, or inventory, of GHG emissions in New York in 2021 and will issue an annual report each year thereafter, as required by the Climate Act.³⁴² Due to the nature of national emissions reporting and data collection, the annual inventory reports the GHG emissions from 1990 up to two years prior to the date of release, as the most recent information available.

This annual inventory reports include information on all GHG emission sources in the State, including the relative contribution of each type of GHG and each type of source to the statewide total. The reports also include, as part of the statewide total, an estimate of GHG emissions from the generation of electricity imported into New York and from the extraction and transmission of fossil fuels imported into the State.³⁴³ DEC will continually refine and improve the methodology used by the annual inventory report based upon the best available information and informed by public feedback.

23.2 Implementation Report

Every four years, DEC will issue a report, after consultation with the Climate Action Council (Council) and the Climate Justice Working Group (CJWG), on the implementation of GHG reduction measures, as required by the Climate Act. The first implementation report will be released no later than January 1, 2028.³⁴⁴

The implementation report will include, but is not limited to, an analysis of whether New York is on track to meet the statewide GHG emission limits and if the existing regulations are sufficient to meet the limits or require modifications. Information on the social benefits from the regulations and on the compliance costs for regulated entities, DEC, and other State agencies will also be included. The report will also highlight the impacts from regulations on Disadvantaged Communities and their access to or community ownership of services and commodities identified in the Barriers and Opportunities Report. The implementation report will provide information to the public on the progress toward achievement of the Climate Act requirements and will also serve to inform the regular updates to the Scoping Plan that are required under the Climate Act.

³⁴² ECL § 75-0105(1).

³⁴³ ECL § 75-0105(3).

³⁴⁴ ECL § 75-0119.

23.3 Review of Renewable Energy Program

Every two years, starting no later than July 1, 2024, the New York State Public Service Commission (PSC) will issue a comprehensive review of the renewable energy program established by the Climate Act. In this review, the PSC will evaluate the progress in meeting the overall targets for deployment of renewable energy systems and zero-emission sources including factors that will, or are likely to, frustrate progress toward the targets. It will also examine the distribution of systems by size and load zone and annual funding commitments and expenditures.

23.4 Air Quality Monitoring

Pursuant to the Climate Act, DEC established a Community Air Monitoring Program. The Climate Act requires that DEC deploy community air monitoring systems in no less than four Disadvantaged Communities that have been identified as the highest priority for exposure to toxic air contaminants and criteria air pollutants. Information collected by these systems will be shared with the public and be used to inform the development of a strategy by June 1, 2024, to reduce emissions of these pollutants in Disadvantaged Communities affected by a high cumulative exposure burden.

As described in *Chapter 6. Advancing Climate Justice*, DEC and the New York State Energy Research and Development Authority (NYSERDA), in consultation with the CJWG and community leaders, identified 10 communities and have deployed hyperlocal air monitoring technology to collect air quality data in each of them. This is an historic, new effort to monitor air quality in Disadvantaged Communities across the State and use the data collected to develop strategies to reduce pollution in these communities, including the GHGs that contribute to climate change. This statewide community air monitoring effort is the largest ever undertaken in the United States.

Chapter 24. Future Work

This Scoping Plan is designed to lay out the policies and programs necessary to help New York meet the greenhouse gas (GHG) emission limits established in the Climate Act. The Climate Act requires that the final Scoping Plan be updated at least once every five years. As information about New York’s progress on the GHG emission limits is reported, an updated Scoping Plan will be released to ensure that the policies in place will keep New York on the path to meet the requirements of the Climate Act.

The next State Energy Plan adopted by the State Energy Planning Board will incorporate the recommendations included in this Scoping Plan. These recommendations will ensure that New York continues to reduce GHG emissions while maintaining an affordable and resilient energy system.

Going forward, New York will promulgate regulations, enact new laws, and adopt policies and programs to implement the strategies and recommendations in this final Scoping Plan.

Appendices List

Appendix A: Advisory Panel Recommendations

Appendix B: Climate Justice Working Group Feedback on Advisory Panel Recommendations

Appendix C: Just Transition Working Group Recommendations to the Council on Measures to Minimize the Carbon Leakage Risk and Minimize Anti-Competitiveness Impacts of Potential Carbon Policies and Energy Sector Mandates

Appendix D: Power Generation Sites Identified by the Just Transition Working Group

Appendix E: Just Transition Working Group Recommendations to the Council on Issues and Opportunities Related to the Energy-Intensive and Trade-Exposed Entities

Appendix F: Environmental and Health Data for Quantifying Health Benefits of Climate Policy

Appendix G: Integration Analysis Technical Supplement

Appendix H: Adaptation and Resilience Recommendation Components