

Large-Scale Commercial Carbon Capture Retrofit of the San Juan Generating Station

Project Number (FOA-0002058)

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U.S. Department of Energy
National Energy Technology Laboratory
Carbon Capture Front End Engineering Design Studies and CarbonSafe
2020 Integrated Review Webinar
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Program Overview Slide 1 of 2

Funding (DOE and Cost Share)

	FY 2020		FY 2021		Total Project	
	Federal	Cost Share	Federal	Cost Share	Federal	Cost Share
Enchant	\$275,000	--	\$362,888	--	\$637,888	--
Farmington	--	\$5,000	--	\$5,000	--	\$10,000
MHI	--	\$3,012,105	--	\$3,012,106	\$0	\$6,024,211
Baker Tilly	\$45,000	--	\$44,000	--	\$89,000	--
S&L	\$1,025,000	--	\$1,265,855	--	\$2,290,855	--
Navigant	\$200,000	--	\$30,000	--	\$230,000	--
EJM	\$125,000	--	--	--	\$125,000	--
Total	\$1,670,000	\$3,017,105	\$1,702,743	\$3,017,106	\$3,372,743	\$6,034,211
Cost Share	35.63%	64.37%	36.08%	63.92%	35.85%	64.15%

From PMP dated May 22, 2020

Overall Project Performance Dates

October 15, 2019 – June 30, 2020

Note: Until DOE receives verification of 100% of the Recipient's cost share contribution, only \$503,384 of DOE funding is available for work performed by the Recipient.

Program Overview Slide 2 of 2

- **Project Participants**

- Jason Selch, Enchant Energy, Principal Investigator
- Cindy Crane, Enchant Energy, Chief Executive Officer
- Peter Mandelstam, Enchant Energy, Chief Operating Officer
- Hank Adair, City of Farmington, Co-Applicant
- Project Partners: Enchant has coordinated a team of highly qualified sub-awardees, independent contractors, vendors and participants to complete the proposed project including Sargent & Lundy LLC (S&L), Navigant Consulting (Navigant), EJM Associates, LLC (EJM), and Baker Tilly (BT). Additionally, Enchant is working with the City of Farmington and Mitsubishi Heavy Industries America, Inc. (MHIA) as sub-recipients of this award. City of Farmington is also a cost-share supporter.

- **Overall Project Objectives:**

The overall goal of this project is to perform a Front-End Engineering Design (FEED) study for the retrofit of the San Juan Generating Station (SJGS) with post-combustion carbon capture. The FEED study will document the initial engineering and cost estimates for the retrofit project, including the levelized cost of carbon capture on an existing plant, and provide estimates of the technical and economic viability of extending the life of the existing SJGS coal-fired power plant through the installation of post-combustion carbon capture. The FEED study will enable SJGS to move forward into detailed engineering, procurement, installation, and operation in future work.

Technology Section (Slide 1 of 2)

Technology / Site Selection

The CCUS technology to be used is Mitsubishi Heavy Industries America's amine-based carbon capture system. San Juan Generating Station site has two units of coal-fired generating capacity, existing pollution control equipment for mercury, SO₂, NO_x and particulates, and is approximately 21 miles from the Cortez Pipeline, a CO₂ transmission line connected to Permian Basin used for enhanced oil recovery (EOR).

Site Selection Strengths:

- Access to several regional transmission lines
- Adjacent to low cost coal mine (mine mouth plant)
- Redundant infrastructure
- Sufficient water rights
- Path to ownership of 95% of SJGS in two years
- Public-private partnership with City of Farmington
- Low cost of CO₂ capture forecast per Sargent & Lundy report

Technology development / Site Characterization efforts prior to current project

- 2010 - PNM commissions Sargent & Lundy study on feasibility of adding carbon capture to SJGS. Study finds carbon capture not economically feasible.
- Pursuant to and EPA settlement, PNM shuts down units 2 and 3 of SJGS and completes environmental improvements creating a two-unit plant with following environmental features:
 - Low NO_x Burners (LNB)
 - Under Fired Air (Unit 1 Only)
 - Over Fired Air (OFA)
 - Selective Non-Catalytic Reduction (SNCR) for NO_x removal
 - Brominated Activated Carbon Injection (ACI)
 - Baghouses for mercury removal
 - Wet Flue Gas Desulfurization (WFGD)
 - Zero Liquid Discharge (ZLD) water handling currently, and also post CCUS
- 2019 Enchant Energy commissions Sargent & Lundy site specific study of SJGS and finds carbon capture economically feasible due to plant characteristics and 45Q tax credits.

Technology Section (Slide 2 of 2)

Economic benefits of site selected

- Significant Regional Benefits- Without carbon capture this plant would be shut down because of the requirements of the New Mexico Energy Transition Act. The addition of carbon capture allows for continued operation of SJGS will maintain approximately 450 permanent jobs at the plant and adjacent mine along with approximately 1,000 direct related contractor jobs.
- The plant will continue to be a significant source of property tax payments for the Central Consolidated School District. The construction of the CCUS facilities will also create 2 million worker hours.
- SJGS will provide dispatchable low-emissions electric power to the grid in the Western United States.

Integration of CO2 Capture, transport and storage/utilization

- Plans to for an approximately 21-mile pipeline to connect the SJGS plant to the Cortez Pipeline are underway as part of the broader project. In addition, New Mexico Tech is principle investigator on a \$22 million DOE cooperative funding agreement awarded under the Department of Energy Funding Opportunity Announcement, DEFOA-0001999. The project: "San Juan Basin Carbon SAFE Phase III: Ensuring Safe Subsurface Storage of CO2 in Saline Reservoirs" is designed to perform the analyses necessary to permit a carbon dioxide injection well in a site near SJGS. Test well drilling is anticipated to be finished by May 2021.
- Carbon capture facility will utilize approximately 29% of electricity generated from SJGS.

Technical Approach/Project Scope (Slide 1 of 2)

Milestone Title and Description	Planned Completion Date
Kickoff Meeting	5/22/2020
Updated Project Management Plan	5/30/2020
Design Basis Finalized	6/25/2020
Constructability Review	9/10/2020
HAZOP Review Completed	1/7/2021
Process Island Design Completion	1/21/2021
Balance of Plant Engineering Completion	2/5/2021
Studies and Investigations Completion	7/2/2021
Cost Estimating Completion	7/2/2021
FEED Study Package	7/31/2021
Final Report	10/29/2021

Technical Approach/Project Scope (Slide 2 of 2)

Project success criteria:

- Permitting Agency Concurrence
- Balance of Plant Design Integration
- Project Execution Schedule
- Calculation of Cost of Capture
- FEED Study package

Significant project risks and mitigation strategies:

- Significant cost share requirement requires accessing third-party financing at early stage of project development /Enchant has hired the Bank of America and Baker Tilly Capital to assist.
- Schedule Delays/Remote Work, Flexibility& Redundant Resources
- Travel Delays/Virtual Meetings
- Permitting Approval/Frequent Consultation with Permitting Authorities

Progress and Current Status of Project (Slide 1 of 6)

Recent significant accomplishments and how they tie to the site/technology/design/commercialization challenges

- The primary activity and specific accomplishment were the months of work to produce the Design Basis. The Design Basis is the culmination of a great deal of FEED work. The Design Basis will now guide the rest of the FEED study.
- Performance study has demonstrated that SJGS can run at 85% net capacity factor once capital is invested to address deferred maintenance.
- Modeling of revenue from sale of CO₂ and 45Q tax credit supports plant dispatch at 85%. Anchor customer is carbon capture facility.
- Transmission study plus filed Transmission Service Requests show sufficient capacity for SJGS transition to merchant model.

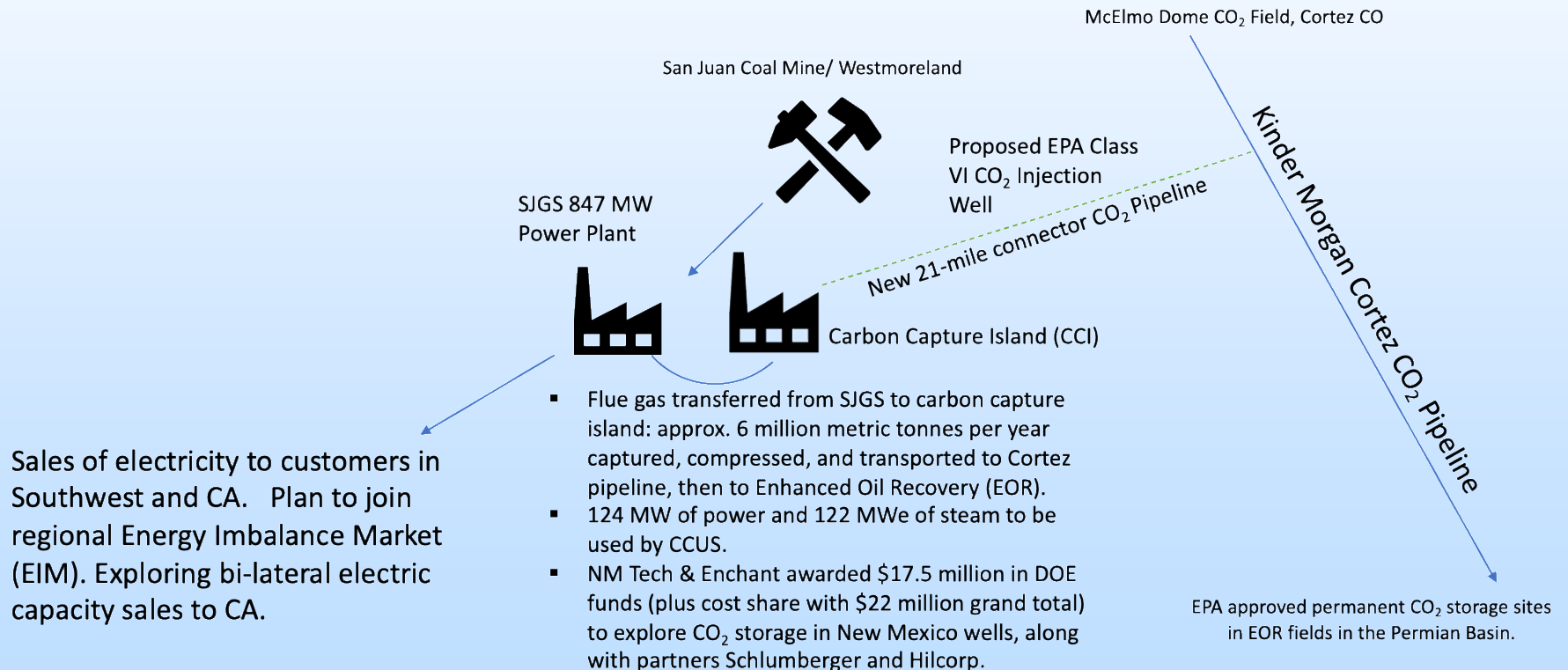
Progress and Current Status of Project (Slide 2 of 6)

Status for host site selection/access:

Enchant Energy is scheduled to take possession of the San Juan Generating Station on June 30, 2022. In order to be able to begin construction of the Carbon Capture Island before June 30, 2022, Enchant Energy is in the process of negotiating an early site access agreement with the current and former plant owners, for a plot of land next to the plant with the plant owners.

Progress and Current Status of Project (Slide 3 of 6)

Regional integration of CO₂ Capture, transport and storage/utilization



Progress and Current Status of Project (Slide 4 of 6)

Gaps/Challenges/Hurdles: technology, design, supply chain, regulatory, access, site characteristics:

- The project will comply fully with the New Mexico Energy Transition Act (ETA).
- Discussions are underway to dovetail the CCUS construction schedule with the implementation of the ETA.
- Plant is not in an area governed by an Independent System Operator (ISO) potentially requiring more complex transmission contracts.

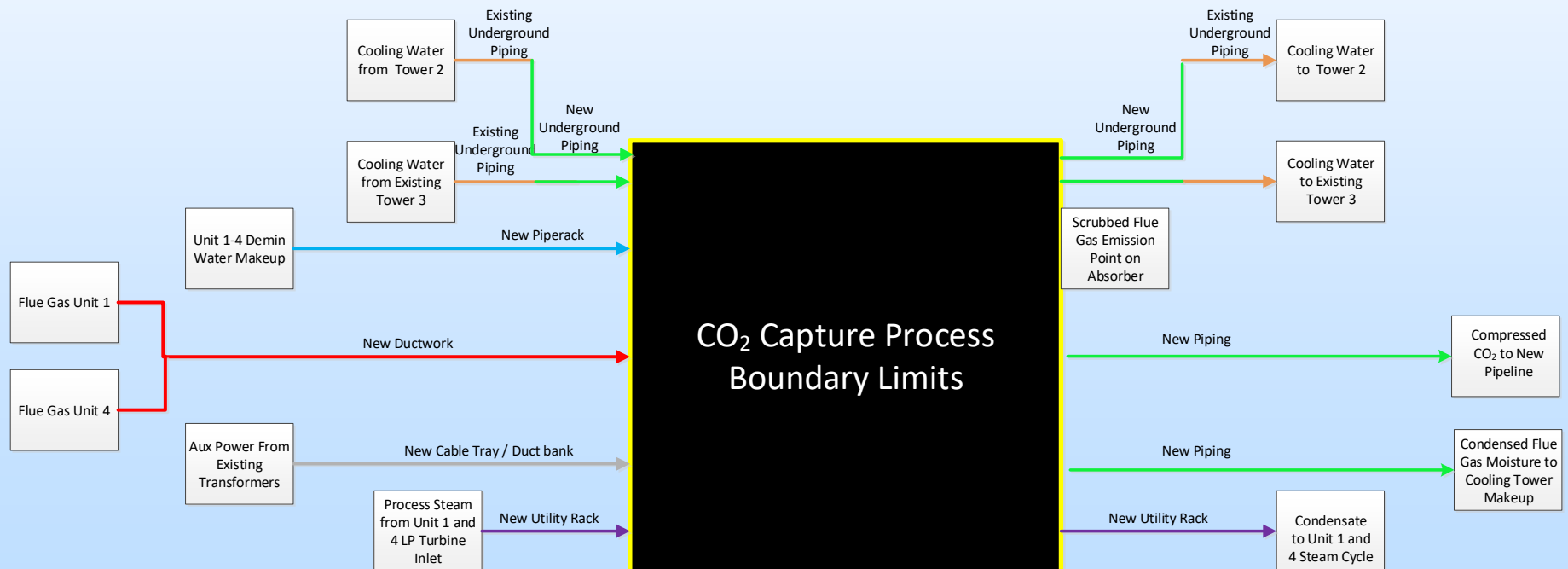
Progress and Current Status of Project (Slide 5 of 6)

Synergy opportunities:

- There are synergistic opportunities to work with the DOE, New Mexico School of Mining and Technology, and others on the project to do the work necessary to permit a Class VI injection well for sequestration of CO₂.
- There is an executed MOU and work is underway with San Juan College and the City of Farmington on a training and certification program related to the building and operation of carbon capture facility that can benefit both local workers and workers across the county as amine-based carbon capture technology implementation grows.

Progress and Current Status of Project (Slide 6 of 6)

Project Design Basis – SJGS Plant Integration of Amine-based Carbon Capture



The CCUS island will be designed based on four equivalent trains of capture based on maximum equipment sizing and minimum turndown requirements.

Summary Slide

Project Summary:

The overall goal of this project is to perform a Front-End Engineering Design (FEED) study for the retrofit of the San Juan Generating Station (SJGS) with post-combustion carbon capture. The FEED study will document the initial engineering and cost estimates for the retrofit project, including the levelized cost of carbon capture on an existing plant, and provide estimates of the technical and economic viability of extending the life of the existing SJGS coal-fired power plant through the installation of post-combustion carbon capture. The FEED study will enable SJGS to move forward into detailed engineering, procurement, installation, and operation in future work.

Discuss your key findings, lessons learned, and future plans:

- The key preliminary findings of the FEED study are that the technology, team and plant will be able to successfully built and operated. As a result of work to date, the design is optimized for recovery using four carbon capture trains instead of three as originally planned. In addition, 90% of carbon dioxide will be capture per engineering studies as supported by technology guarantees by MHIA.
- In this reporting period, Enchant Energy LLC (Enchant) along with its partner, Farmington, worked closely with the other FEED study members, including Sargent & Lundy (S&L), Mitsubishi Heavy Industries America (MHIA), and Kiewit Power Constructors (Kiewit) (collectively, the EPC Team). The primary activity and specific accomplishment were the months of work to produce the Design Basis. (Submitted to Andrew Jones in July 2020 and attached here as Exhibit A). The Design Basis is the culmination of a great deal of FEED work. The Design Basis will now guide the rest of the FEED study. The Design Basis lays out, in great detail over its 125 pages, all of the technical design aspects of the Carbon Capture Island (CCI). The DOE/NETL funding was critical to give Enchant, Farmington, and the EPC team the ability to wrestle with all of the design aspects of this innovative and world's largest proposed carbon capture facility.

For More Information

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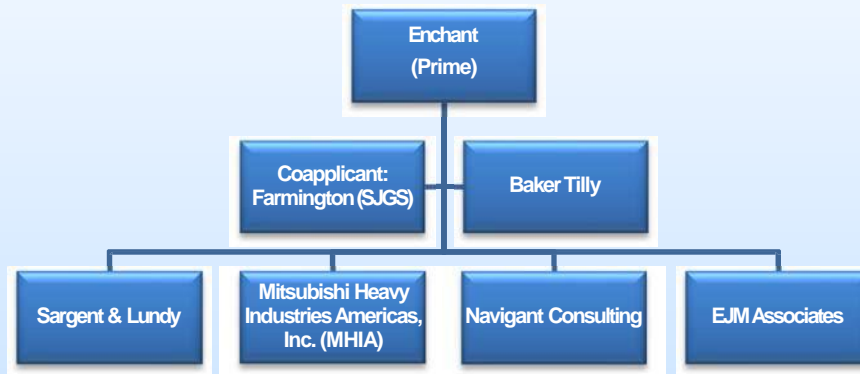
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Appendix 1

Organization Chart



Appendix 2

High Level Gantt Chart

Major**/Minor*	Task/ Subtask	Milestone Title and Description	Planned Start Date	Planned Completion Date	Percent Complete	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021
*	1.0	Kickoff Meeting	Oct-19	May-20	100									
*	1.0	Updated Project Management Plan	Oct-20	May-20	100									
**	2.1	Design Basis Finalized	28-Feb-20	Jun-20	100									
**	2.3	Constructability Review	28-Feb-20	Sep-20	80									
**	2.3	HAZOP Review Completed	28-Feb-20	Jan-21	20									
**	2.1	Process Island Design Completion	28-Feb-20	Jan-21	20									
**	2.2	Balance of Plant Engineering Completion	28-Feb-20	Feb-21	50									
**	2.3	Studies and Investigations Completion	28-Feb-20	Jul-21	50									
**	2.4	Cost Estimating Completion	28-Feb-20	Jul-21	0									
**	3.0	FEED Study Package	28-Feb-20	Jul-21	40									
**	1.0	Final Report	31-Jul-21	Oct-21	0									