



**Enchant Energy Corporation response to
Institute for Energy Economics and Financial Analysis (IEEFA) report
dated July 2019 on the planned retrofit of San Juan Generating Station
with Carbon Capture Technology**

In July 2019, the Institute for Energy Economics and Financial Analysis (IEEFA) published a report on the plans of Enchant Energy to retrofit San Juan Generating Station (SJGS) in New Mexico with Carbon Capture technology. [The IEEFA report](#) responded to Enchant Energy's announced plans for SJGS as evaluated in the [Pre-feasibility Report that Enchant Energy commissioned from the engineering firm](#), Sargent & Lundy that was released to the public and posted on the [Enchant Energy website](#) on July 9, 2019. Sargent & Lundy is a world-class engineering firm with over 125 years of industry experience that has performed work for PNM at SJGS and other currently operational CCUS projects.

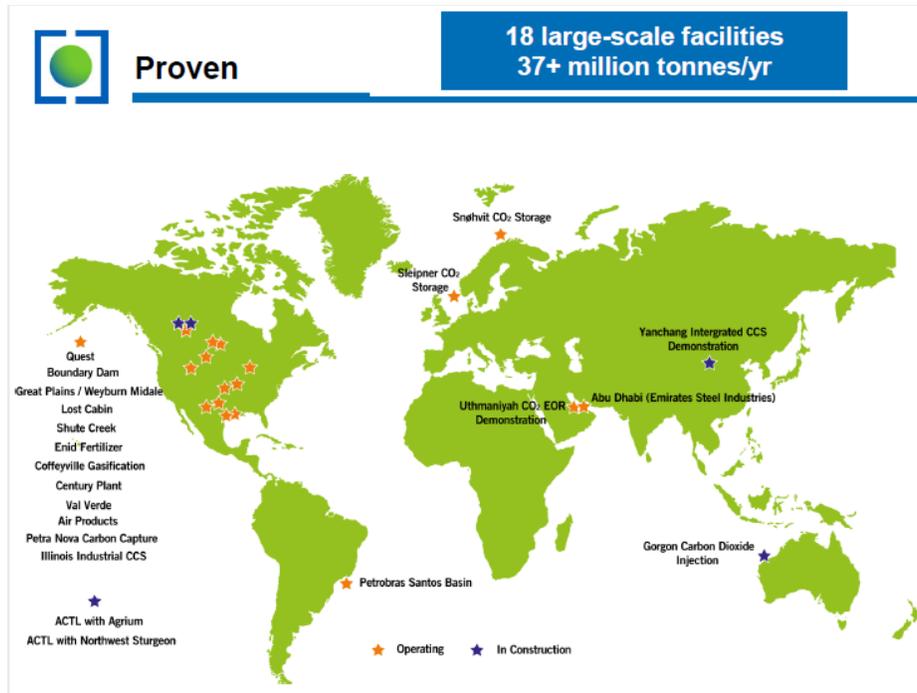
Enchant Energy has prepared the following response as the IEEFA report contains numerous inaccuracies and misleading statements.

**Enchant Energy response to specific statements in report.
(IEEFA Quote in Bold)**

- ***“It (the SJGS Enchant Energy CCUS Project Plan) overlooks how the deployment of carbon-capture technology around coal-fired generation remains a mostly academic, unaffordable exercise;”***

The technology slated for installment at SJGS, an amine-based post-combustion technology, has been demonstrated to be effective in removing 90% of CO₂ emissions in two major coal-fired power plants in North America: Boundary Dam in Canada, online since 2014, and Petra Nova in Texas, online since 2017. The Petra Nova plant uses an amine-based post-combustion technology developed by Mitsubishi Heavy Industries that removes the Co₂ from the emissions

and has several operating installations. As shown below from the Global CCS Institute web site, there are a total of 18 Carbon Capture installations in operation, which in the aggregate, capture 37 million metric tons per year of CO₂ emissions.



In their report, IEEFA misleadingly highlights two well-known CCS failures, which utilized a type of technology different than the amine-based post-combustion technology that is planned to be used at SJGS. These two plants, the Kemper Plant developed by Southern Company and the Edwardsport plant developed by Duke Power, used a pre-combustion coal-gasification technology and, as such, their failures have no bearing on the success or failure of the San Juan Generating retrofit and its planned amine-based technology.

The IEEFA report states that the technology is “unproven”. We have posted on the Enchant Energy website [several reports on Carbon Capture Technology](#) by major, reputable energy and environmental organizations, including the US Department of Energy, the Clean Air Task Force, the Global CCS Institute, and the International Energy Agency. All of these organizations and many others regard the carbon capture technology planned for SJGS as proven technology.

The IEEFA report states that carbon capture is “an unaffordable exercise.” The Sargent & Lundy report thoroughly contradicts that claim. The Sargent & Lundy report shows that the estimated retrofitting cost of \$1.3 billion is offset almost two-fold by the \$2.5 billion of 45Q tax credits that will be generated from capturing 6 million metric tons of CO₂ for 12 years, the

length of time the 45Q tax credit is currently authorized to run. In addition, the Sargent & Lundy report also shows that the estimated operating cost of, including the cost of power used in, CO₂ compression and the carbon capture process will be covered by the proceeds of selling CO₂ to the EOR industry. Therefore, Enchant Energy believes the cost is affordable and financeable, and will not increase the cost of generation for the power that is sold to the grid.

Readers can learn more about advances in CCUS by reviewing information contained on the website of the [Global Carbon Capture and Sequestration Institute](#) website.

- ***“It (the SJGS Enchant Energy CCUS Project Plan) presumes the project could commence within two years, avoiding regulatory requirements that typically take longer to complete, and that it could be done in a cost-effective way;”***

Enchant Energy and its team of world-class professional advisors will continue to examine the operational and financial merits of the SJGS CCUS project. Contrary to the IEEFA assertion, Enchant Energy is not making hard and fast “presumptions” – particularly “presumptions” involving time frames that are somehow intended to “avoid regulatory requirements.” Should the SJGS CCUS project be deemed by investors anything but “cost-effective,” Enchant Energy will not move forward with the project. However, the preliminary Sargent & Lundy feasibility report suggests the project is worthy of additional detailed study. That detailed study, known as a FEED (Front End Engineering and Design) Study, is an important next step for the project. We plan to initiate the FEED study in September 2019.

The IEEFA report declares that the “Timetable for project-ready plans is unrealistic, as are cost projections,” incorrectly stating “20 months” as the length of time Enchant Energy anticipates for the project to be completed. In fact, the expected construction time as outlined in the S&L study is 30 to 36 months, excluding the time needed to complete the FEED (Front-end Engineering and Design) Study, which could take an additional 6-20 months.

Regarding cost-effectiveness, the IEEFA uses two examples of cost over-run projects to support their claim. As discussed above, however, those two projects utilized a totally different carbon capture technology than the amine-based post-combustion technology proposed for SJGS. In addition, IEEFA ignores the fact that: i) the Sargent & Lundy report adds a contingency amount equal to 20% of the estimated direct costs to account for possible cost overruns; and ii) the Sargent & Lundy report also indicates that use of competitive bidding among the three potential amine-based technology providers could result in a significant reduction to the projected \$797 million of direct costs of the retrofit as shown below:

Table 5-1: Capital Cost Summary of CO₂ Capture System (\$2019)

	Material / Equipment	Labor	Total
BOP Cost	\$ 110,360,000	\$ 79,250,000	\$ 189,610,000
Civil / Sitework	\$ 4,020,000	\$ 7,150,000	\$ 11,170,000
Mechanical /Equipment	\$ 31,370,000	\$ 37,500,000	\$ 68,870,000
Structural / Ductwork	\$ 58,560,000	\$ 24,770,000	\$ 83,330,000
I&C	\$ 5,630,000	\$ 820,000	\$ 6,450,000
Electrical	\$ 14,780,000	\$ 10,010,000	\$ 24,790,000
CO₂ Island Cost (Including Compression Island)	\$ 253,010,000	\$ 309,230,000	\$ 562,240,000
Pipeline Cost (Furnished / Installed)			\$ 40,000,000
Total Direct Capital Cost			\$ 796,850,000
EPC Construction Overheads ¹			\$ 119,530,000
Engineering ²			\$ 39,840,000
EPC Contingency			\$ 159,370,000
EPC Risk Fee			\$ 79,690,000
Total Indirect Costs			\$ 398,430,000
Total EPC Cost			\$ 1,195,280,000
Owner's Cost			\$ 100,000,000
Total Project Cost³			\$ 1,295,280,000

Note 1. Construction Overheads Includes:
 Scaffolding, Overtime, Per Diem, Consumables, Sales Tax, Contractors Administration Fee, Contractor Profit
 Note 2. Engineering Includes:
 Engineering services, Field Support, Start-Up/Commissioning, SUI Parts/Initial Fills
 Note 3. Costs Exclude:
 Escalation, AFUDC, Right of Way & Land Purchase, Insurance, Site Security

- ***““It (the SJGS Enchant Energy CCUS Project Plan) banks on the unlikelihood of being able to find a market in the distant Permian Basin oilfield for the carbon dioxide it would capture;”***

The SJGS CCUS project does “bank” on making CO₂ sales to oil producers in the “the distant Permian Basin oilfield.” These buyers have been using CO₂ for decades in enhanced oil recovery (EOR) operations. The assertion advanced by the IEEFA about the “unlikelihood” of making such sales in the “distant” market demonstrates its complete failure to investigate the CO₂ markets or, worse, IEEFA’s desire to distort marketplace realities and opportunities in an effort to undermine the project in the public’s eye.

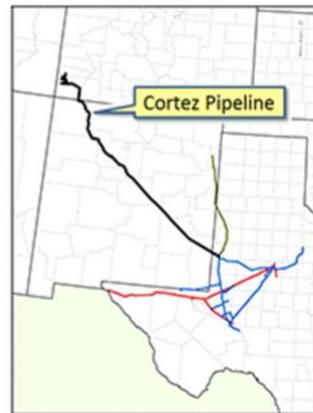
For the record, Enchant Energy has received strong expressions of interest from multiple CO₂ buyers in the Permian Basin.

In service since the early 1980s, the largest CO₂ pipeline in the US, Kinder Morgan's Cortez Pipeline, from Southwestern Colorado to Denver City, Texas passes through San Juan County, New Mexico and has the capacity to carry 1.5 bcf/day of CO₂. The pipeline's capacity is approximately 5 times greater than the amount expected to be captured and compressed at SJGS. The Cortez Pipeline is connected to EOR fields in New Mexico and Texas. These sites are EPA-approved CO₂ storage sites, meaning that they are subject to continuous monitoring to ensure that 99.99% of CO₂ pumped into the ground is properly – and permanently – stored.

Please find below a map showing the Cortez CO₂ pipeline from the Kinder Morgan website:

Cortez Pipeline and McElmo Creek Pipeline

The Cortez Pipeline and the McElmo Creek Pipeline serve the McElmo Dome and Doe Canyon CO₂ source fields in southwestern Colorado. Kinder Morgan operates the approximately 500 mile Cortez Pipeline which carries CO₂ from the McElmo Dome and Doe Canyon to the Denver City, Texas, hub. The Cortez pipeline system is capable of transporting 1.5 billion cubic feet of CO₂ per day. The McElmo Creek Pipeline is an approximately 40-mile pipeline that supplies the McElmo Creek unit in Utah and is operated by Resolute.



- ***“It (the SJGS Enchant Energy CCUS Project Plan) does not say where long-term project liabilities would lie;”***

The long-term remediation and reclamation liabilities for SJGS (for past, current and exiting owners) are governed under terms of existing agreements governing SJGS operations. In a reconfigured SJGS with CCUS, the necessary funding mechanisms to cover final remediation and reclamation expenses will continue to be set aside. Funds to be applied against these expenses have been building through contributions by all parties with a participation interest in SJGS since SJGS first began operations in the 1970s.

The City of Farmington is not assuming a greater ownership share in the plant and is not assuming additional liability over and beyond what it has committed to as a 5% owner; the City is not assuming any liability involving the retrofit project itself unless it chooses to participate in the carbon capture aspects of the project. Enchant Energy will assume responsibility for 95% of

ongoing liabilities. Under a variety of U.S. and State of New Mexico laws, Enchant Energy and the City of Farmington will continue to set aside their respective shares of funds for remediation.

- ***“It (the SJGS Enchant Energy CCUS Project Plan) does not address the absence of customers, the probable limited transmission access for power from the plant beyond 2022, and the inevitable rise in electricity costs owing to the parasitic load created by the installation of carbon capture equipment;”***

Enchant Energy acknowledges that while transmission access is vital to the project, that access is subject to the strict and comprehensive rules of the Federal Energy Regulatory Commission that regulates the nation’s interstate transmission service. SJGS is fortunate to have access to several transmission lines, connecting it to markets in Colorado, Utah, Nevada, Arizona, New Mexico, and California as shown below.



The IEEFA mistakenly states that the parasitic load will result in an “inevitable rise in electricity costs.” The Sargent & Lundy report explains that CCS at SJGS will not increase electricity generation costs because the cost of parasitic load (referred to as “derating” in the Sargent & Lundy Report) will be fully reimbursed by the project’s CO₂ customers. Effectively, these customers could be Enchant Energy’s largest single load and revenue source following installation and operation of the carbon capture retrofit equipment.

The table below from the Sargent & Lundy Report shows that the purchased steam and power cost has been incorporated in the \$39 - \$43 cost of capture in their study. Sales of CO₂ will cover the \$100 - \$115 million of annual operating costs which includes the purchased steam and power cost.

Table 5-2: Annual O&M Cost Summary of CO₂ Capture Systems (\$2019)

Description	85% Capacity Factor	100% Capacity Factor
Total Fixed Operating Cost	12,360,000	12,360,000
Annual Operating Labor	2,430,000	2,430,000
Maintenance Material & Labor	9,930,000	9,930,000
Total Variable Operating Cost	87,579,000	103,029,000
Demin Makeup Water	30,000	40,000
Water Treatment	830,000	970,000
CO ₂ Island Chemical and Disposal Costs	28,839,000	33,919,000
Purchased Steam & Power Cost	57,880,000	68,100,000
Total Annual O&M Cost (\$/yr)	99,939,000	115,389,000

Table ES-1: Cost of CO₂ Capture

Description	Units	85% Capacity Factor	100% Capacity Factor
Total Project Cost	\$	1,295,280,000	1,295,280,000
CCF		0.1243	0.1243
Annualized Capital Cost	\$/yr	161,000,000	161,000,000
Annual O&M Cost	\$/yr	99,939,000	115,389,000
Total Annual Cost	\$/yr	260,939,000	276,389,000
CO ₂ Captured	mmscfd	313	368
Annual CO ₂ Captured	tonnes/yr	6,000,000	7,060,000
Cost of Capture	\$/tonne¹	43.49	39.15

Note 1. Cost of capture reported as dollars per metric ton (equivalent to 2,240 lbs).

- ***“It (the SJGS Enchant Energy CCUS Project Plan) plays up the importance of using newly enhanced tax credits for carbon capture to finance the project, while leaving out the fact that the credits would be available only if and when the project is operational, a highly unlikely outcome. How would the project actually be funded? Who are the investors?”***

Financing the SJGS CCUS project will come from the sale of packaged 45Q tax credits and other capital. It is true that the plant must be operational in order for investors to receive tax credits, which is no different from tax-credit-financed renewable solar and wind projects. Capital raised

will be from sophisticated investors, who will buy into the project with protections and an understanding of the risks, just like they do in other energy projects supported by tax credits.

- ***“What happens—as is likely—if the project costs more than forecast? Would Farmington be made to cover the shortfalls?”***

The City of Farmington is spending no money on the CCUS project and hence has no liability for CCUS construction shortfalls. There is no construction required at SJGS for it to continue as an electricity generation facility. As an inducement to finance the construction of the CCUS project, protections against cost over-runs such as a fixed price EPC (Engineering, Procurement, Construction) contract and/or performance guaranties will be provided to prospective investors in the tax equity financing.

- ***“What retrofits to the existing units, now 43 and 37 years-old, would be needed to ensure they continue operating going forward? Who would fund those upgrades?”***

PNM upgraded Units 1 and 4 of SJGS in order to comply with the partial shutdown agreement associated with the regional haze agreement between the U.S. EPA, State of New Mexico and PNM. PNM’s own analysis of those upgrades is that they are operable for up to 30 more years in full compliance with federal and state emissions requirements. In fact, PNM used this analysis as support for why it was in favor of this agreement.

Normal maintenance and capital replacements are part of the operation of this or any generating plant. These are financed as needed using the most favorable financing mechanism available at the time.

- ***“Who will buy power from the retrofitted plant? “***

The two largest initial power customers will be the CCUS project itself and the City of Farmington. In addition, there are numerous other potential buyers throughout the Western United States that have expressed interest in participating.

Enchant Energy believes there is a growing demand in the Western United States for low-emissions fossil-fueled power to support the shift towards renewables. This is the market niche ideally suited for a reconfigured SJGS with CCUS. In addition to extremely low CO₂ emissions, the reconfigured SJGS CCUS plant already has low mercury, NO_x and SO_x emissions. Following

the retrofit, the plant would be run as a full-time baseload facility that will complement an emerging wholesale electricity market with increasing amounts of variable wind and solar generation.

- ***“Is there a viable long-term market for the captured CO₂? “***

Absolutely. As discussed above, the long-term market for CO₂ is robust due to the favorable economic and environmental benefits of using enhanced oil recovery, particularly in the Permian Basin of West Texas and New Mexico.

- ***“Who would be liable for the ultimate requisite cleanup operations at the plant and how would the cleanup be funded? What, specifically, would Farmington’s liability be?”***

Largely addressed above, current and historical SJGS plant and mine remediation liabilities (like that of all the plant’s owners, both current and past) are based on existing agreements. In many cases, these agreements have been approved in rate cases overseen by various state public regulation commissions. These agreements and the associated funding requirements are based on assumptions and cost-sharing arrangements related to percentage ownership shares. They apply to current, past, and future owners of the SJGS.

The cash balances or other funding mechanisms, such as bonds and trust funds, are audited and available to the public for each participant in SJGS.

- ***“While Enchant Energy has an alluring name and while it purports to have compassionate community intent—its business model is not workable and its San Juan Generating Station retrofit pitch appears to be largely self-serving,” the report states. It recommends that the City of Farmington, to ensure its interests, keep the following questions in mind as it considers Enchant Energy’s proposal: “***

Enchant Energy and the City of Farmington are both “self-serving.” Like all businesses large and small, Enchant Energy exists to make a profit and so does the City of Farmington Electric Utility System. To do anything else would be irresponsible.

Adding CCUS capability to SJGS extends the plant life of SJGS by enabling it to comply with the stringent CO₂ emissions limit imposed by the New Mexico Energy Transition Act. This, in turn, helps the City of Farmington defer expenses (estimated in its Integrated Resource Plan at \$120 million) in replacing generating capacity it currently receives from SJGS.

But the benefit of this project to the community and to address global climate change is much larger than the benefits to Farmington and Enchant alone. By continuing to provide over 1,500 on-going salaried and contract jobs, a significant percentage of the higher paying jobs in the San Juan County region, the continuation of SJGS will provide stability to the regional economy. In addition, an estimated 40 percent of the jobs at the mine and power plant are held by members of the Navajo Nation and the continuation of SGJS is particularly important to them. The Nation is already adapting to the loss of jobs and revenues from the contemplated December 2019 shut-down of the Navajo Generating Station and associated coal mine in Arizona. The SJGS retrofit offers them the promise of continued well-paying job opportunities.

A successful CCUS retrofit of SJGS could also result in the project becoming a show-case project that could spur further technology and investment benefitting the area and throughout the state. As a front-runner in this promising technology, the upside economic potential is enormous. It is quite possible that San Juan County and New Mexico could become the global leader and very center of future CCUS technology advancements.

Those in the know agree that the benefits of the project as a means to address climate change are enormous. The installation of CCUS will reduce CO₂ emissions by 6 million metric tons per year. This represents a reduction of over 12% in energy-related CO₂ emissions for the entire state of New Mexico based on the most recent emissions data published by the United States Energy Information Administration. <https://www.eia.gov/environment/emissions/state/analysis/>

This reduction is also greater than shutting down the plant and replacing it with a combination of gas-fired generation and renewables. More broadly, the successful execution of the CCUS retrofit at SJGS will facilitate the growing use of this key technology in fighting climate change in other locations in North America and throughout the world. To learn more about the importance of CCS technology, we have shared a [documentary, produced by the International Brotherhood of Boilermakers, on the Enchant Energy web site.](#)