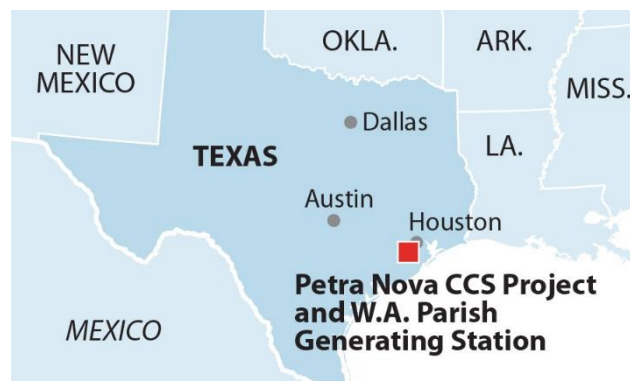


Petra Nova Mothballing Post-Mortem: Closure of Texas Carbon Capture Plant Is a Warning Sign

*Red Flags for Investors on Coal-Fired CCS
Projects; Shutdown Lays Bare the Risks Around
Proposals That Include Enchant Energy's in New
Mexico and the Tundra Project in North Dakota*

Executive Summary

The 240-megawatt Petra Nova carbon capture and storage project at Unit 8 of NRG Energy's W.A. Parish Generating Station near Houston is the only operational coal-fired power plant CCS facility in the U.S. As such, it is frequently cited by promoters of CCS retrofits at other coal-fired power projects as proof that the process works and that it is an economically viable option for cleaning up coal-fired generation.



But there have long been serious questions about the performance at Petra Nova. These questions have only been heightened by NRG's official announcement in late July that it mothballed the carbon capture project in the spring due to falling oil prices. NRG's plans for the project remain uncertain, with the company only saying it could be brought back online "when economics improve."¹

The mothballing of Petra Nova highlights the deep financial risks facing other proposed U.S. coal-fired carbon capture projects, including Enchant Energy's plan for the San Juan Generating Station in New Mexico and Minnkota Power Cooperative's Tundra Project at the Milton R. Young Station in North Dakota.

NRG's decision to shutter Petra Nova also underscores the serious lack of transparency surrounding the plant and its operations. This lack of transparency is all the more worrisome given that the plant's alleged success is being used to support the development of other CCS projects. In truth, essential questions about

¹ "Low oil prices force Petra Nova into 'mothball status'", E&E News, July 28, 2020.

its performance and feasibility have never been answered, an awkward fact that should give potential investors in similar projects serious pause.

Six questions persist:

- Before it was mothballed, was Petra Nova really consistently capturing 90% of the carbon dioxide in the 240MW slipstream it was processing?
- Why didn't the project capture as much CO₂ as proponents had predicted?
- What has it cost to capture a ton of CO₂ at Petra Nova?
- Has the captured CO₂ actually boosted oil production at NRG's affiliated oil field?
- Has the Petra Nova project been economic?
- What does the mothballing of Petra Nova mean for the project's future financial viability?

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Any investor considering taking a position in any future coal-fired CCS project will want these six questions fully answered. As it stands, coal-fired CCS has not been shown to be a financially viable proposition, making investments in planned coal-based CCS projects high risk, at best.

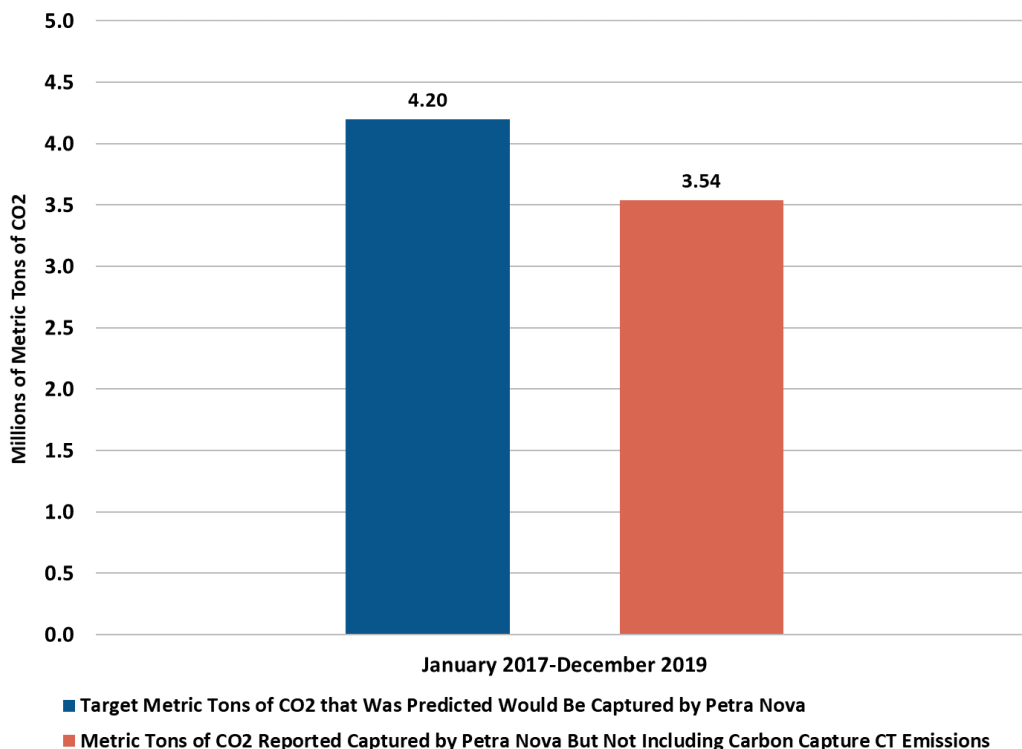
Did the Project Really Consistently Capture 90% of the CO₂?

No.

Petra Nova was originally expected to capture at least 1.4 million metric tons of CO₂ annually, or a total of 4.2 million metric tons from 2017-2019.² However, as the graphic below shows, the project fell well short of that goal during its first three years of operation.

² DOE Office of Scientific and Technical Information (OSTI). W.A. Parish Post-Combustion CO₂ Capture and Sequestration Project, Final Public Design Report. February 17, 2017.; EIA, Today in Energy. [Petra Nova is one of two carbon capture and sequestration power plants in the world.](#) October 31, 2017; DOE Office of Fossil Energy, National Energy Technology Laboratory. [W.A. Parish Post-Combustion CO₂ Capture and Sequestration Project Summary.](#) September 2012.

Figure 1: Actual vs. Target Amounts of CO₂ Captured at Petra Nova



Sources: NRG, Inc., U.S. Department of Energy.

Overall, Petra Nova captured 662,000 fewer metric tons of CO₂ than projected during its first three years of operation. That is a serious shortfall that merits investor caution. The promise for investors considering putting money into CCS projects is that in return for funding a project's construction, they will recover their investment through a steady stream of payments via the federal government's 45Q tax credits, which offer \$35 per metric ton for plants like Petra Nova that use the captured CO₂ for enhanced oil recovery activities and \$50 per metric ton for CO₂ sequestered underground.

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Big as these figures are, they present a best-case scenario, since the calculation does not factor in emissions from the gas-fired turbine used by NRG to operate the Petra Nova carbon capture equipment. That facility emitted more than 1.1 million metric tons of CO₂ from 2017-2020, a total that significantly reduced the net amount of emissions captured, which in turn could very well have cut potential payouts to investors.

Why Hasn't Petra Nova Captured as Much CO₂ as Proponents Said It Would?

No one will say.

Either the carbon capture facility had unanticipated equipment problems, or management decided at some point not to operate the facility as much as expected because it simply wasn't economic to run. Petra Nova's owners, the U.S. Department of Energy (which funded a substantial portion of the cost of building the facility), and the manufacturer of the carbon capture equipment all have failed to provide any information to the public to support the claims that it was operating as planned and was capturing 90% or more of the CO₂ it processed.³ Instead, potential investors in similar projects are expected to accept their claims.

What Has It Cost Petra Nova to Capture a Ton of CO₂?

No one will say.

The best estimate at the moment is that it cost at least \$60 per metric ton to capture CO₂ at Petra Nova. But no one with direct knowledge will say. That estimate is taken from DOE statements regarding CO₂ capture costs in general and is not specifically tied to Petra Nova. The latest official DOE statement on coal-based carbon capture costs came from Steven Winberg, DOE's assistant secretary for fossil energy. Winberg said during a June webinar that the cost of CO₂ capture needs to come down 50%, to \$30 per metric ton, if it is to be commercially viable.⁴ Since the only operational coal-fired CCS project is at Petra Nova, it is only

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³ For example, see the Los Alamos National Laboratory [Preliminary Assessment of Post-combustion Capture of Carbon Dioxide at the San Juan Generating Station](#), December 12, 2019.

⁴ Platts, June 11, 2020, "U.S. DOE wants to cut carbon capture costs 50%, official touts CO₂ already stored"

reasonable to assume the current CO₂ capture cost is \$60 per metric ton.

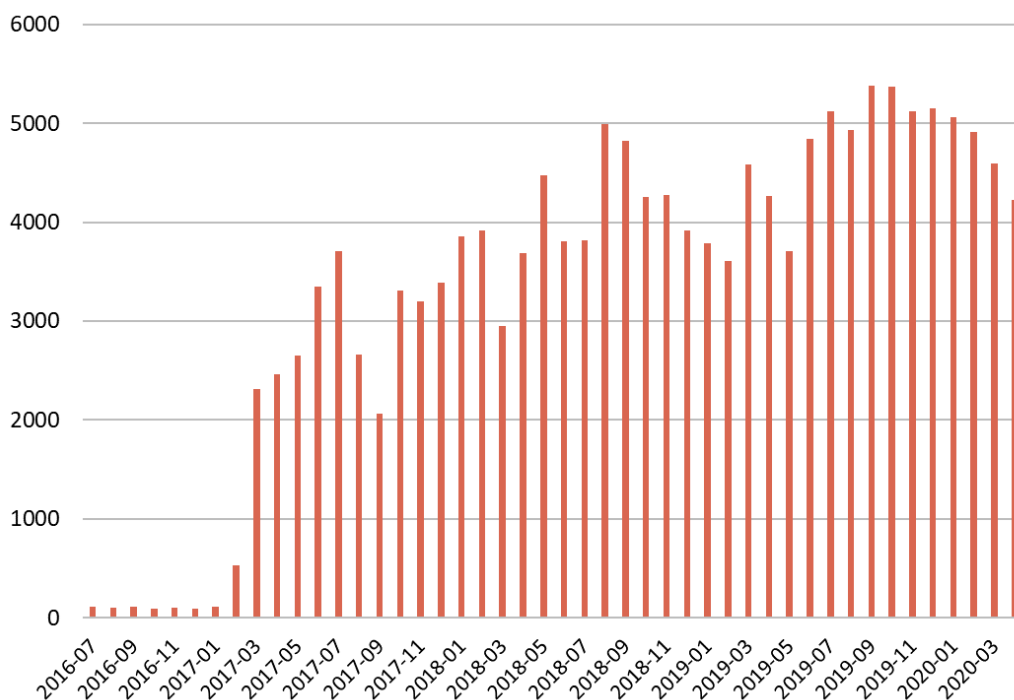
That number should matter a great deal to potential investors. The more expensive it is to capture CO₂, the greater the risk that the revenue streams from 45Q tax credits and the sale of electricity from such projects will fail to cover project costs. That, in turn, could force the project to restructure, push it into bankruptcy, or prompt it to shut down entirely, putting investors at risk of being unable to recover their sunk costs.

Has the Captured CO₂ Boosted Oil Production?

Yes, but not by anywhere close to the amount predicted.

NRG originally said the CO₂ captured at Petra Nova would be used to increase oil production at its West Ranch field, to 15,000 barrels/day (b/d) from less than 1,000 b/d. However, as shown in the figure below, daily production from the beginning of 2017 through the first four months of 2020 has only rarely topped 5,000 b/d.

Figure 2: West Ranch Oil Production (bbl/day)



Source: [TexasDrilling.com](https://www.texasdrilling.com).

This raises two pertinent questions as to the viability of using CO₂ for EOR activities:

- Have Petra Nova’s owners been injecting all the plant’s captured CO₂ into the West Ranch field since the project began in 2017?
- Have the owners decided not to inject all the captured CO₂ because EOR is

no longer competitive with fracked oil?

Both questions should worry potential investors in other EOR-based CCS projects. If the injected CO₂ didn't boost oil production as much as expected, there is no hope of recovering the project's capital and operating costs. And if the CO₂ wasn't injected, there is no \$35 tax credit. Either way, investors lose.

Has the Project Been Economic?

No, at least not according to NRG's string of project-related impairment charges and its reliance on subsidies.

According to company financial reports, NRG invested \$300 million to bring the Petra Nova project online. Over the past four years, NRG recorded three separate impairment charges related to the plant and to Petra Nova Parish Holdings, the subsidiary that operates the facility. These charges have totaled \$310 million.

**Clearly, Petra Nova
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the company had hoped.**

The first charge, in 2016 before the project was even complete, totaled \$140 million. At the time, NRG cited declining oil prices as the reason for the impairment.⁵ NRG took a second impairment of \$69 million on Petra Nova in 2017 based on a revised view of oil production expectations.⁶ The third impairment, for \$101 million, was taken in 2019.⁷

Clearly, Petra Nova was never the money maker the company had hoped. What should be even more alarming to potential investors in similar projects is that Petra Nova benefitted from a \$190 million grant from the U.S. Energy Department and received \$250 million in concessionary lending from the Japan Bank for International Cooperation (JBIC) and Mizuho Bank, Ltd.^{8,9}

What Does the Mothballing of Petra Nova Mean for the Project's Future Financial Viability?

The answer to this key question is unknown at this time.

First, it is unclear whether the spring shutdown of the plant is meant to be temporary or permanent. Either way, management's decision to mothball the project due to declining oil prices strongly suggests that Petra Nova will not be

⁵ U.S. Securities and Exchange Commission (SEC). [NRG 10-K](#) for the Year Ended December 31, 2016.

⁶ SEC. [NRG 10-K](#) for the Year Ended December 31, 2017.

⁷ SEC [NRG 10-K](#) for the Year Ended December 31, 2019.

⁸ "Petra Nova CCUS Project in USA," JX Nippon Oil and Gas [presentation](#), June 8, 2018.

⁹ Petra Nova is 50 percent owned by Japan's JX Nippon Oil and Gas Exploration and the carbon capture technology was developed by Mitsubishi and Kansai Electric, which helps explain the financial support from the Japanese government and Mizuho.

financially viable in coming years as it will remain at the mercy both of short-term oil price volatility and longer-term market trends reducing the nation's use and dependence on fossil fuels. This uncertainty should give potential investors in similar CCS projects pause.

The Capacity Factor Problem

Beyond these questions, there is one thing we do know about Unit 8 at the Parish plant: From 2017-2019, the first three full years of operation at Petra Nova, the unit has posted an average capacity factor of 71.8%—essentially identical to the 71.5% posted in the three years prior to the CCS project coming online. This is important since boosters of other projects suggest that their retrofitted plants will operate at higher capacity factors than they actually have achieved in recent years (e.g., San Juan Generating Station). Running at higher capacity factors is essential to make the projects pencil out because these higher capacity factors mean the power plant is producing more CO₂ emissions, which then can be captured and sequestered, earning more tax credits for the project's investors. But these claimed higher capacity factors are just claims, claims that should be a bright red flag for potential investors who will be left shorthanded if the project backers' assertions don't pan out.

Additional risk comes from broader market dynamics that can be difficult to forecast. Here, the performance at Parish Unit 8 is a perfect example. The plant was a steady performer through the end of 2019, but 2020 has been a different story. For the first four months of the year (according to the most recent data available from the Energy Information Administration), the unit's capacity factor was just 45.9%. An investor expecting a certain level of CO₂ emissions and the receipt of 45Q tax credits based on unrealistically high and/or long-term levels of generation (and CO₂ capture) was clearly out of the money at Petra Nova this year. This phenomenon could certainly be repeated at other carbon capture projects, a very real possibility that should concern potential investors.

**The project's backers
are selling a dream;
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Conclusion

Investors would do well to conduct their due diligence before investing in any coal-fired CCS projects. The performance at Petra Nova raises serious questions about the viability of such projects. Investors would be wise to demand answers to those questions.

The project's backers are selling a dream; it is investors' responsibility to understand that dream could easily turn into a nightmare.

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