

Testimony of David Greeson
NRG Energy
Petra Nova project

Written Testimony of:

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My name is David Greeson, Vice President of Development for NRG Energy, Inc. I have 36 years of experience in the electric power industry in both regulated utilities and independent power companies. I have developed 5 major power projects in the US that total more than \$3 billion of investment and includes the \$1 billion Petra Nova Carbon Capture and Enhance Oil Recovery project that I'll be speaking about today.

The Petra Nova project began as an initiative by NRG to find a way to de-carbonize our coal-fired generation fleet and do it without increasing the cost of electricity. At NRG everything we do is subject to competition. We are not a utility with captive customers, but rather win each customer by providing a better value than their other choices. In 2009 when we began this project, there were good reasons to believe that policies were coming that would make it difficult for coal-fired power plants to continue to deliver low-cost, reliable power, a value that our customers and shareholders had come to expect.

The final design of the project was guided by two constraints:

- The project could not impact the cost to produce electricity from the host coal unit or negatively impact its ability to participate in the Texas electric market.
- The project would include enhanced oil recovery since it was (and is still today) the only know way to simultaneously (a) handle significant volumes of CO₂ and (2) in the absence of a price on carbon emissions, create a revenue stream that had a chance of off-setting the cost of building and operating carbon capture.

Today, after seven years of diligent work by all stakeholders, the plant is on-line capturing 5,000 tons per day of CO₂. Thanks to a lot of planning, preparation, and persistence I'm proud to report that the project was on-time and on-budget which is an amazing accomplishment for a first of its kind deployment of a technology at full commercial scale. The plant is operating as designed, which means that we now have a coal-fired power plant that has the same carbon footprint as a natural gas-fired unit.

As you can see from slide 5 in the attachment to this testimony, the project is really five projects in one:

1. Design to interface with the host coal-fired plant in a way that did not impact its cost or its operations.
2. Install a carbon capture technology that had never been built at this scale before and had many design improvements that were not in the one-tenth scale unit built several years earlier.
3. Design and build an 81-mile CO₂ pipeline without the power to condemn or expropriate private property.
4. Prepare a large oil field that had been in production since the 1930s by finding and plugging to today's standards virtually all the existing wells, drill over 200 new modern wells, and install a large processing plant on the surface to handle the new oil production.

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5. Re-establish a pipeline link to the crude oil market since the previous facilities had been abandoned years ago.

The carbon capture system starts by pre-treating the flue gas by cooling and removing any remaining trace amounts of sulfur in a vessel called the quencher. Next treated flue gas is blown through the 340' tall absorber tower where CO₂ comes into contact with a liquid solvent and dissolves into the liquid. Now laden with CO₂ the solvent is pumped to a closed vessel where it is heated by steam which causes the CO₂ to come out of solution as a gas again. Now segregated, CO₂ is compressed and shipped down an 81-mile pipeline where it is injected into the oil field. I've included a picture of the Petra Nova CCS facility in the attachment.

Please keep in mind that NRG's power plant does not pay for any of the carbon capture and enhanced oil recovery project. Even the steam and power needed by the carbon capture system is provided by Petra Nova's captive cogeneration system.

Once CO₂ arrives at the oil field it is injected into the oil-bearing formation where CO₂ acts as a solvent, dissolving into the oil and thereby lowering the viscosity. This allows stubborn oil that is clinging to the surface of the rock in the reservoir to flow freely to wells to be recovered. Once at the surface the oil-water-CO₂ mixture is separated and the oil is sold to the market. The produced water is re-injected into the oil formation and the CO₂ is recompress and likewise re-injected. With each cycle of injecting and producing the CO₂ some is permanently lost and therefore sequestered in the oil formation.

NRG considers itself very fortunate to have the partners in this project, beginning with the US DOE when we finalized the grant agreement in 2010. The State of Texas establishing meaningful incentives in 2009-11. Hilcorp joined the project in 2011 as our oil field operator and designer/operator of the enhanced oil recovery system. JX Nippon Oil and Gas Exploration, who is the largest oil company in Japan, became NRG's 50-50 partner in 2014 after a year and a half of working on the project pro bono. And finally the Japanese Government through its Japanese Bank for International Cooperation and Nippon Export and Investment Insurance agencies made a limited recourse loan to the project to complete the capital requirements.

The project has been in full commercial operations for 5 months now. I am pleased to report that all systems are working well and oil production is rising sharply. In December of 2016 just 5 months ago this oil field was producing less than 300 barrels of oil per day. Today, it is producing 3,400 barrels per day and climbing. It is currently estimated that an incremental 60 million barrels will be produced from this field.

I look expectantly to the future of CCS in the US and then to the rest of the world. The US is blessed with plenty of oil fields that will respond well to CO₂ and our coal-fired generation fleet is still young enough to warrant the investment needed for coal to take its place in the sustainable energy future. But upfront capital costs remain the hurdle and federal subsidies to wind and solar further stack the deck against clean coal. Yet there is reason for optimism. Congress is considering measures to bring parity to low carbon technologies. Also, reductions in the cost to build amine systems like the Petra Nova project will happen. New innovations in membranes are now out of the lab and are being tested in small field trials. New formulations of solvents may be commercially ready in 3-5 years that could significantly reduce the size of the capture system and thereby reduce the cost.

Thank you.



Safe harbor statement

This presentation contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934. Forward-looking statements are subject to certain risks, uncertainties and assumptions and typically can be identified by the use of words such as "expect," "estimate," "should," "anticipate," "forecast," "plan," "guidance," "believe" and similar terms. Such forward-looking statements include our future growth and financial performance, Company operations, developments in renewables, and project development. Although NRG believes that its expectations are reasonable, it can give no assurance that these expectations will prove to have been correct, and actual results may vary materially. Factors that could cause actual results to differ materially from those contemplated above include, among others, general economic conditions, hazards customary in the power industry, weather conditions, competition in wholesale and retail power markets, the volatility of energy and fuel prices, failure of customers to perform under contracts, changes in the wholesale and retail power markets, changes in government regulation of markets and of environmental emissions, the condition of capital markets generally, our ability to access capital markets, unanticipated outages at our generation facilities, adverse results in current and future litigation, failure to identify or successfully implement acquisitions and repowerings, the inability to implement value enhancing improvements to plant operations and companywide processes, our ability to realize value through our commercial operations strategy, and our ability maintain successful partnering relationships.

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Approximately **50K** MWe of global, diverse energy*

Nearly **3,000,000** recurring customers within NRG retail brands

One of the nation's largest **SOLAR** Power generators

Ownership interest in nearly **140** power-generation facilities across 29 states

Largest independent power producer in U.S.

Fortune 200

*NRG and NRG subsidiaries generate 148,500 MW of power capacity for owners.

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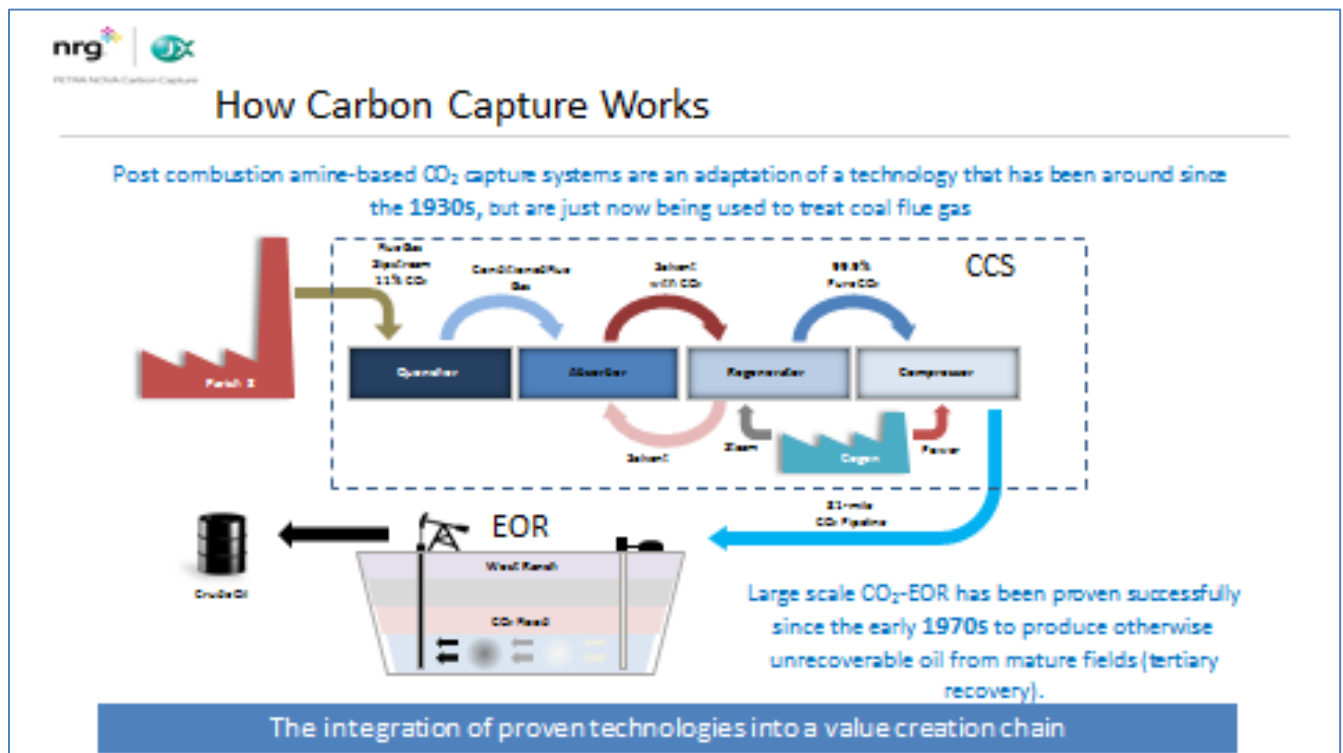
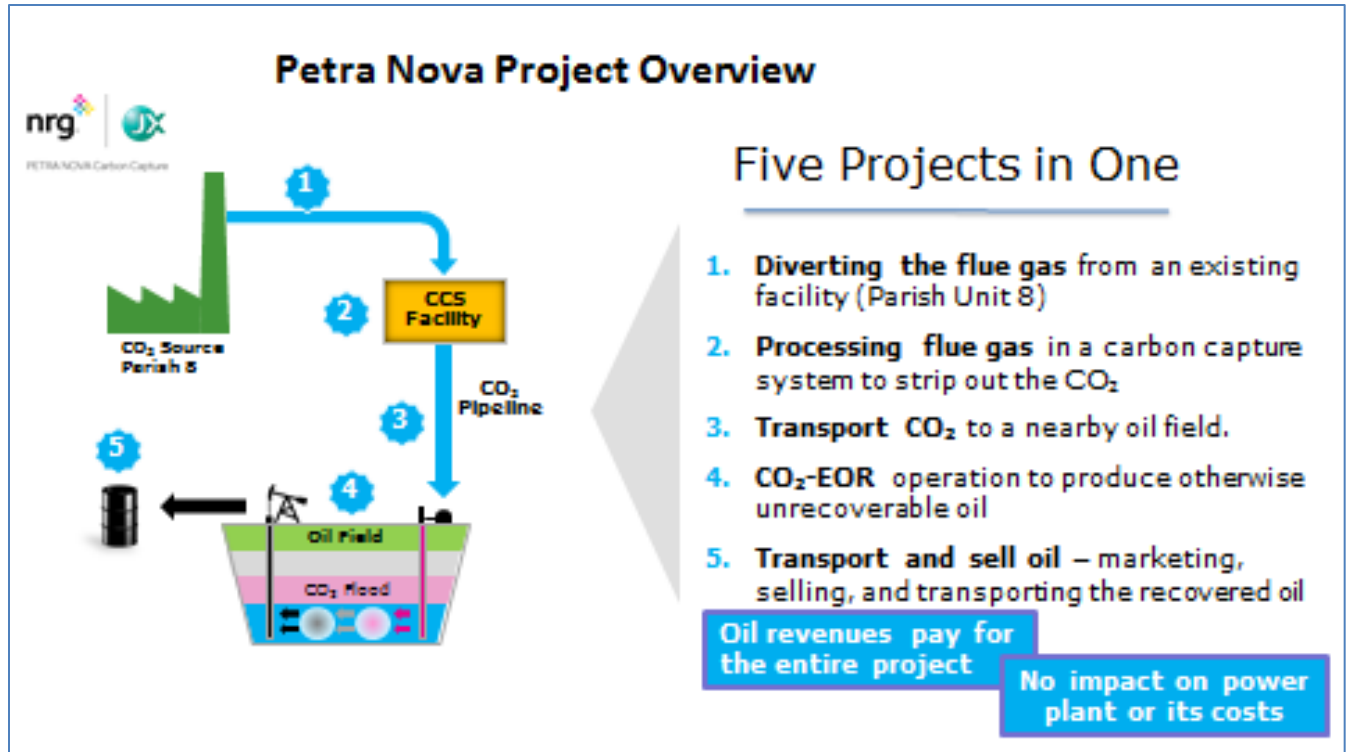
Carbon capture at commercial scale



Achieved COD on Dec. 29, 2016

ON TIME AND ON BUDGET

- 240MWe equivalent CO₂ scrubber on a 640MW coal-fired power plant
- Captures approximately 1.6 million tons per year of carbon dioxide (CO₂)
- CO₂ is used to enhance oil production at the West Ranch Oilfield
- Sequestering 5,200 tons of CO₂ per day



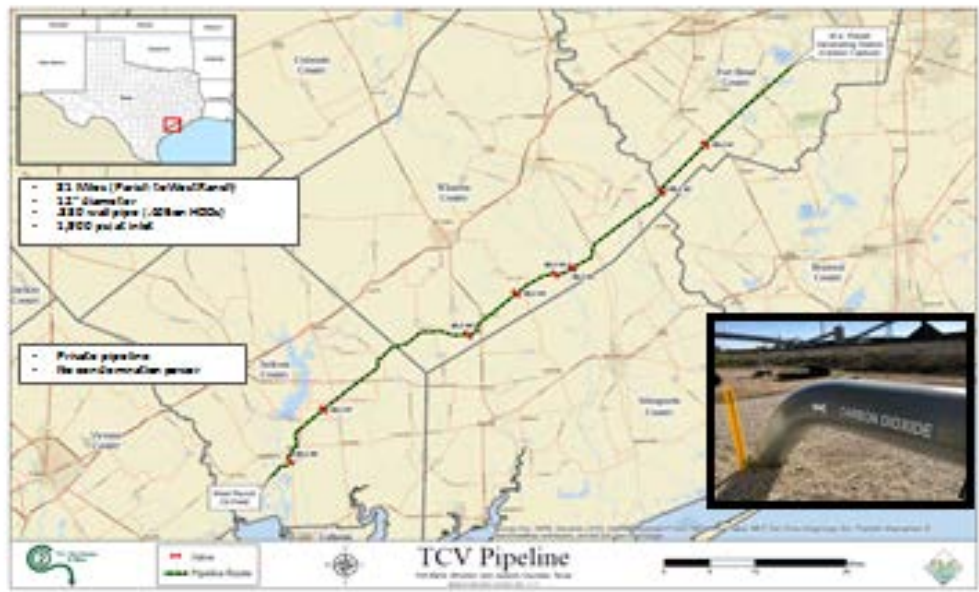
Carbon Capture System Site Layout



Petra Nova
Carbon Capture
Site



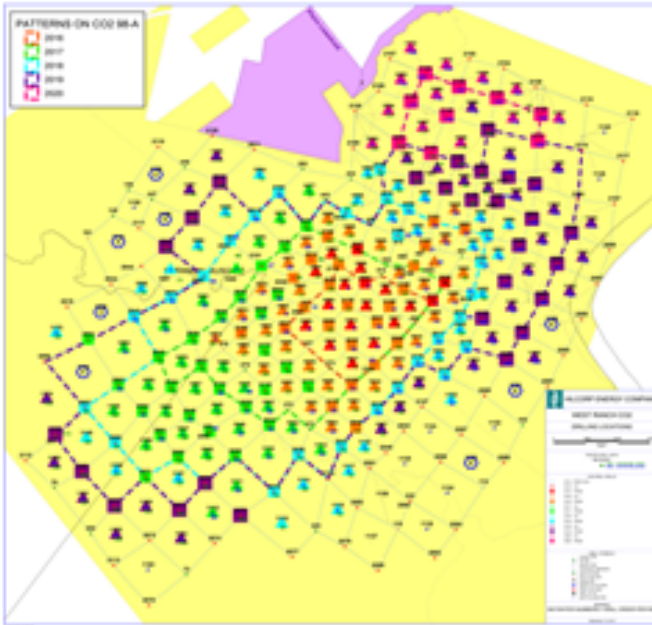
CO2 Pipeline Route



Flat terrain
and flat
topography
through
agricultural
area



Enhanced Oil Recovery Project



West Ranch Field Development

- Field will be flooded using a "5-spot" pattern (each producer surrounded by 4 injectors)
- A comprehensive monitoring, verification, and accounting plan is in place to track the flow of CO₂ and to insure that it is sequestered in the reservoir.
- University of Texas Bureau of Economic Geology developed the plan to sync with oilfield operations.



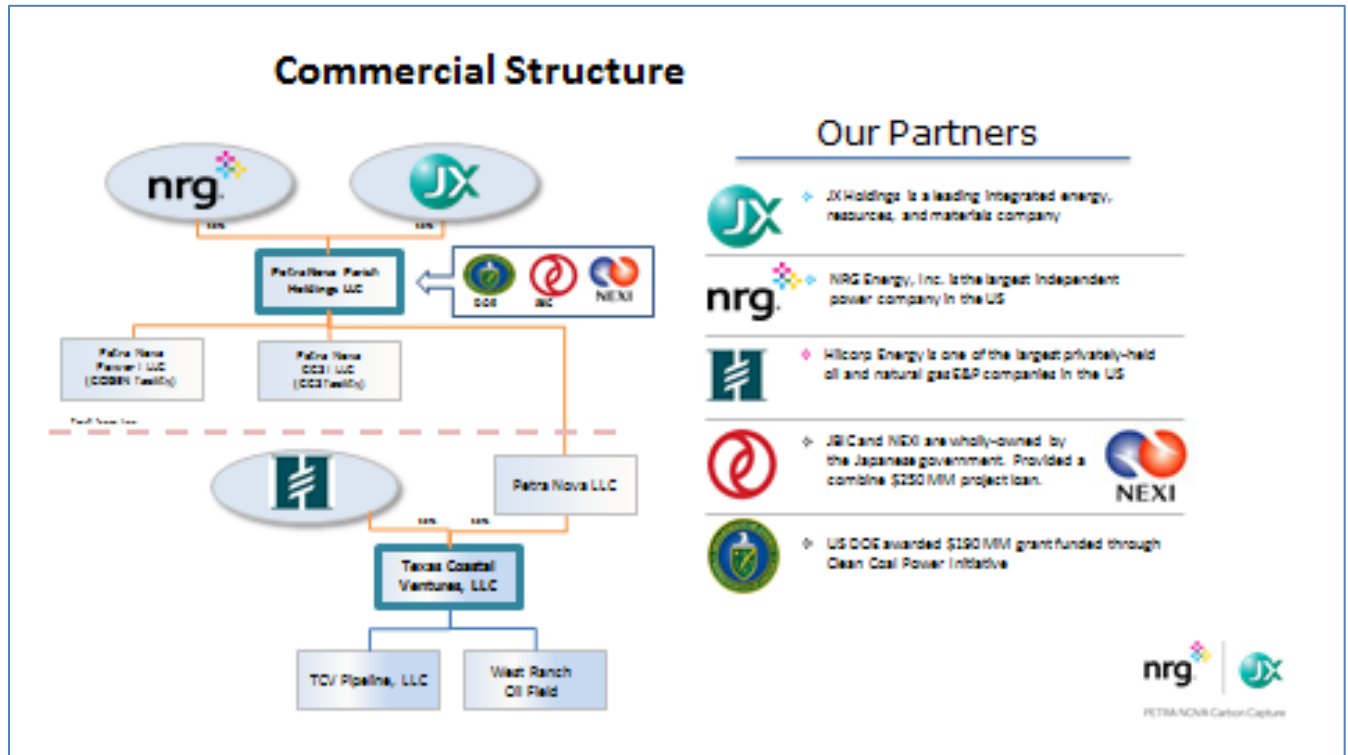
Oilfield Facilities Recapture and Inject CO₂



West Ranch Field Central Facilities

- 200 new wells to be drilled (over 100 now complete)
- 2 central processing facilities to separate oil-CO₂-water
- All produced CO₂ and water is reinjected into the formation





Petra Nova Carbon Capture and Enhanced Oil Recovery Project



Thank you!