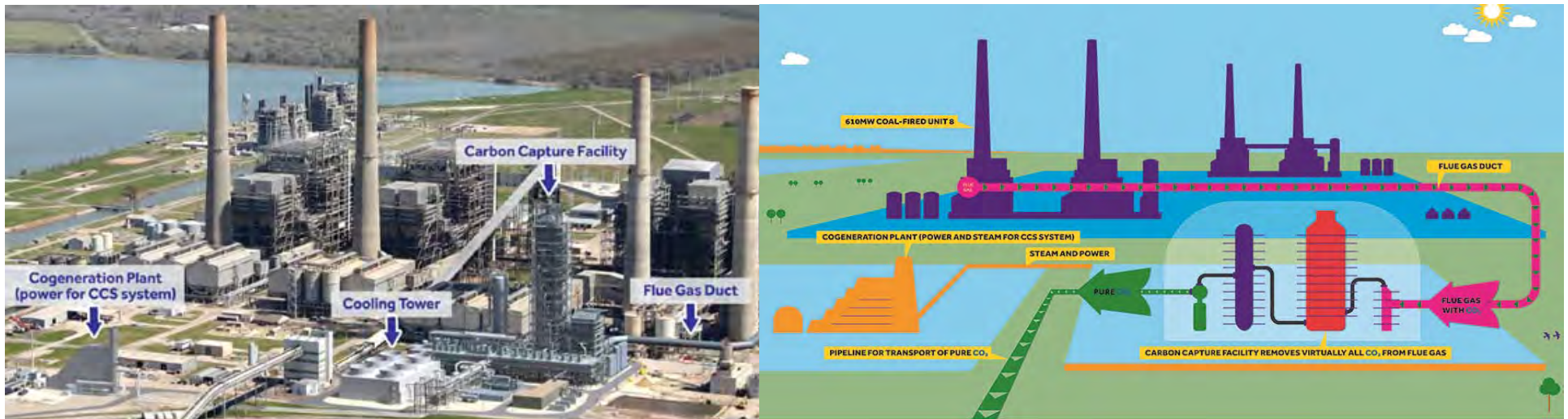




# Petra Nova Carbon Capture Project

October 5, 2016

# Project Overview

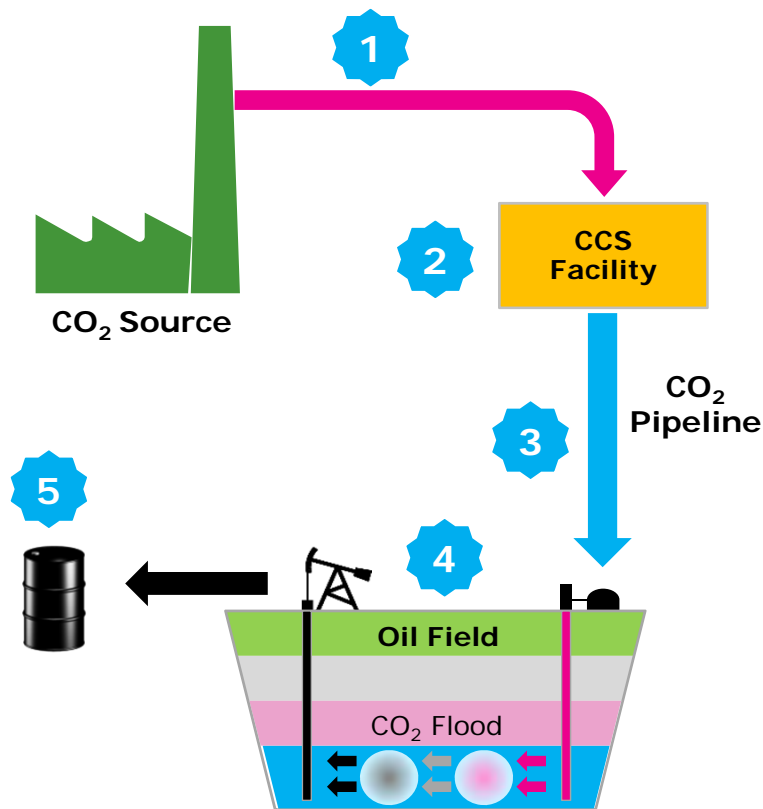


## Carbon capture at commercial scale

We are building the world's largest post-combustion carbon capture-enhanced oil recovery project

- Will capture approximately 1.6 million tons per year of carbon dioxide (CO<sub>2</sub>) from a 240 MW slip stream of flue gas from WA Parish Unit 8
- Captured CO<sub>2</sub> will be used to enhance production at the West Ranch Oil Field
- The CCS facility is expected to be operational by the end of 2016

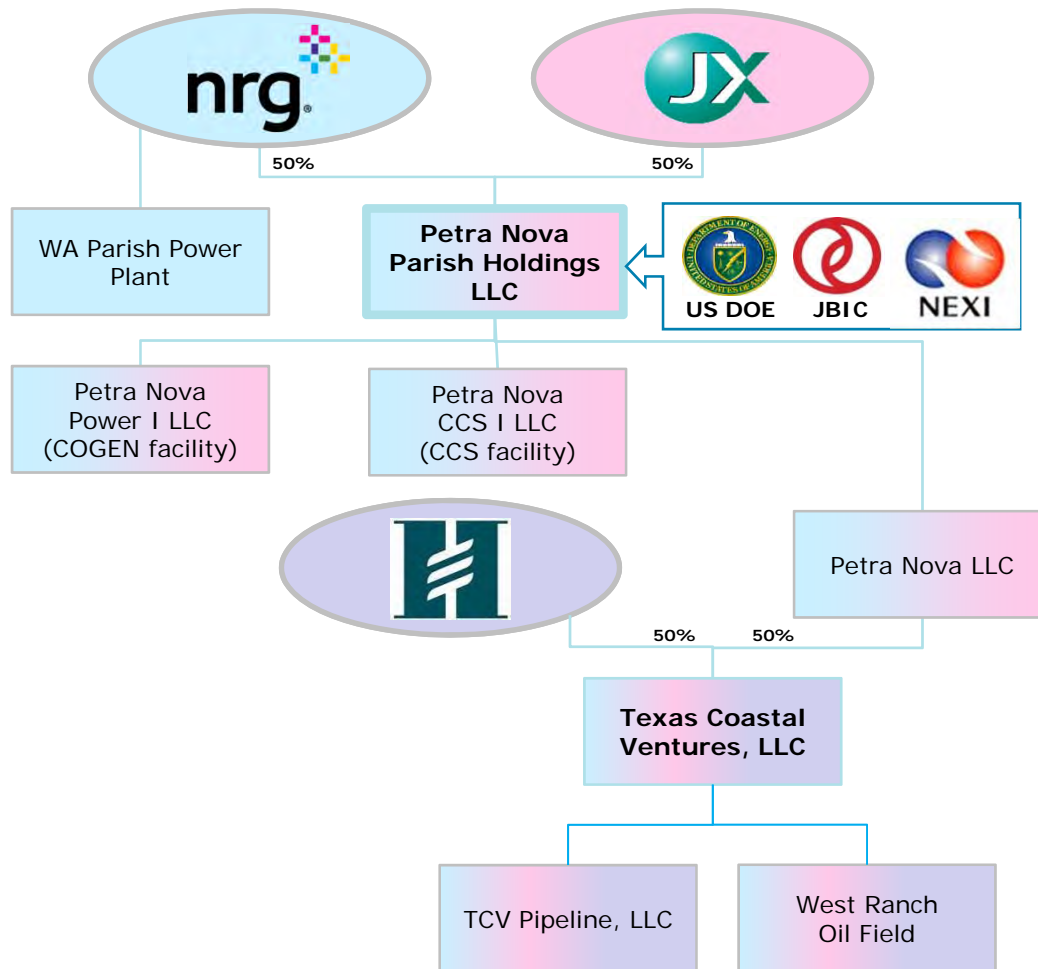
# Five Projects in One



1. Diverting the flue gas from an existing facility (WA Parish Unit 8)
  2. Processing the flue gas in a treatment system to strip out the CO<sub>2</sub>
  3. Transporting the CO<sub>2</sub> to a nearby oil field
- Our partner at West Ranch Oil Field will be:
4. Conducting a CO<sub>2</sub>-EOR flood to produce otherwise unrecoverable oil
  5. Marketing, transporting and selling the recovered oil

Turning a liability into an asset

# Project Structure and Our Partners



## Partner Summary

**nrg**  
NRG Energy

- ✦ Largest independent power producer in the U.S.
- ✦ Nearly 3,000,000 recurring retail customers
- ✦ 3<sup>rd</sup> largest renewable generation company in the U.S.
- ✦ Fortune 200 company

**JX**  
JX Nippon Oil & Gas Exploration

- ✦ A core business company that engages in oil and natural gas exploration and production business in the JX Group, which is the leading integrated energy, resources and materials business group in Japan
- ✦ Currently conducting oil and natural gas E&P business in 14 countries around the world

**Hilcorp Energy**

- ✦ One of the largest privately-held oil and natural gas E&P companies in the U.S.
- ✦ Strong track record of implementing new production techniques into mature reservoirs
- ✦ Specialized team that has extensive experience implementing CO<sub>2</sub> floods

**US Department of Energy**

- ✦ Awarded US\$190 million grant
- ✦ Funded through Clean Coal Power Initiative

**Japan Bank for International Cooperation**

- ✦ Policy-based financial institution of Japan
- ✦ Wholly-owned by the Japanese government
- ✦ Outstandings (Loans and Equity Participations) of JPY13.8 trillion (US\$136 billion)

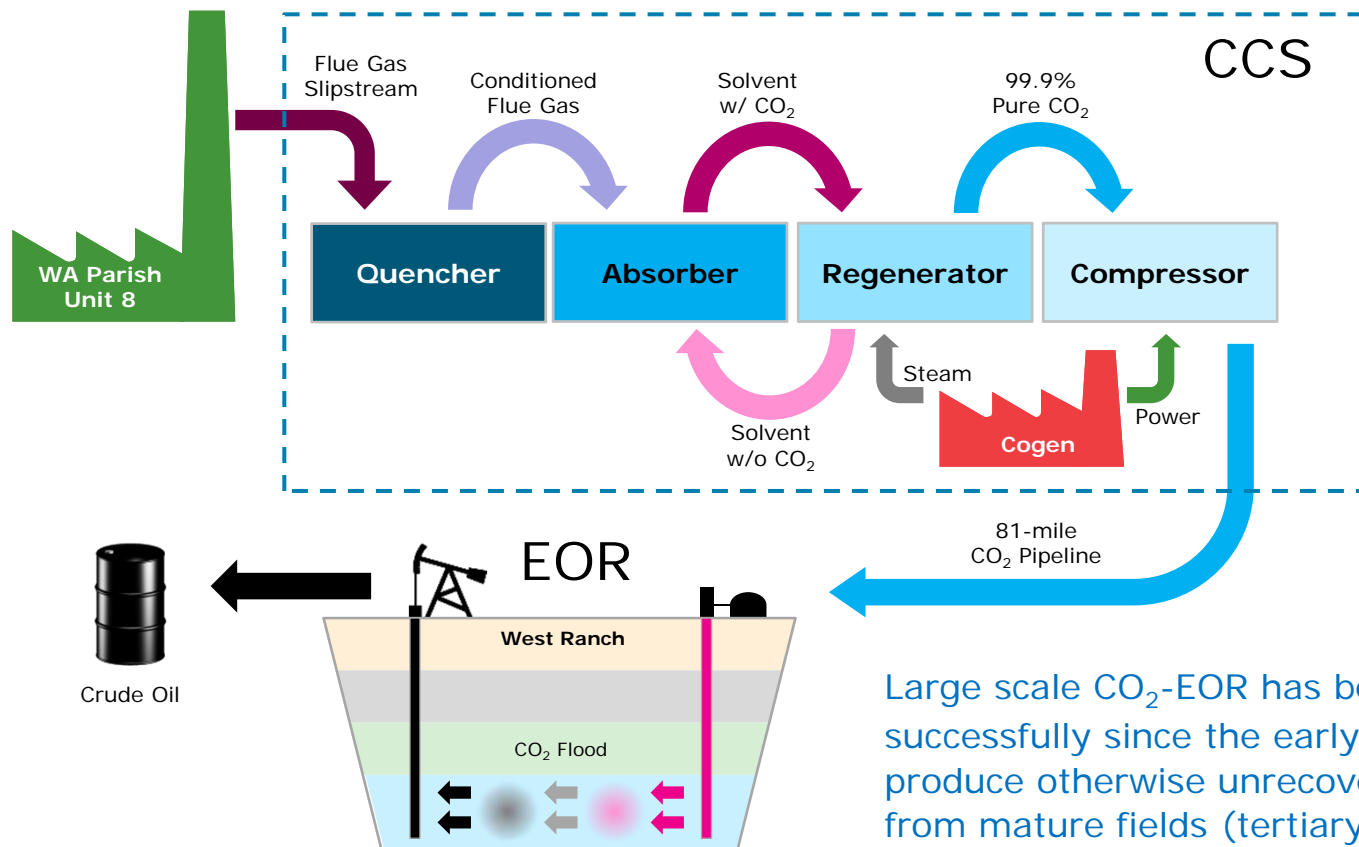
**NEXI**

- ✦ Commercial loan from Mizuho Bank insured by Nippon Export and Investment Insurance (NEXI), which is wholly owned by the Japanese government

Well-Structured Project with Strong and Experienced Partners

# How It Works

Post Combustion Amine-Based CO<sub>2</sub> capture systems are based on technology that has been around since the **1930s**, but have more recently been adapted to treat coal-fired flue gases



Large scale CO<sub>2</sub>-EOR has been proven successfully since the early **1970s** to produce otherwise unrecoverable oil from mature fields (tertiary recovery)

The integration of proven technologies into a value creation chain

# Petra Nova Rendering



# CCS Project Update

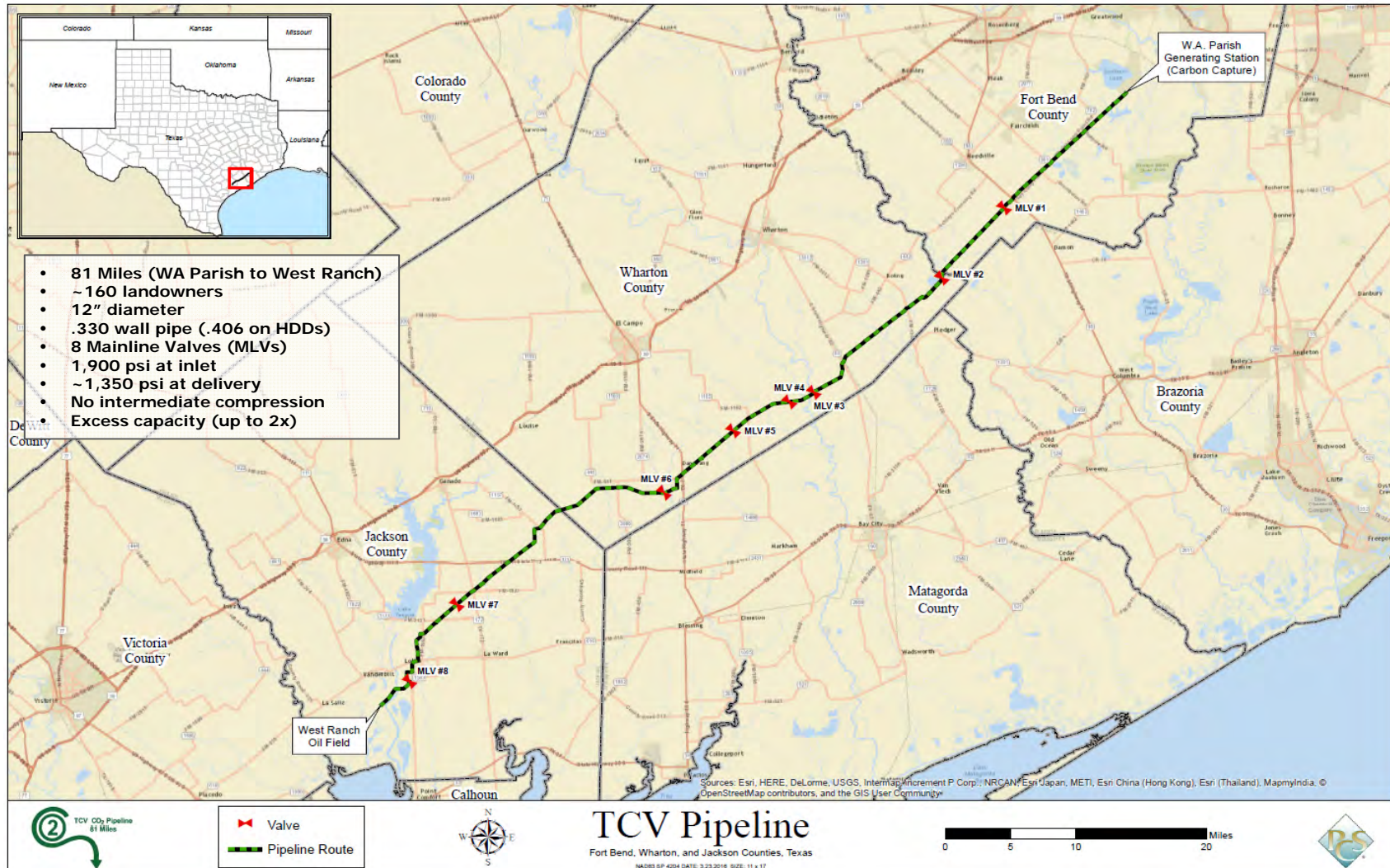


Construction is nearing completion

Commissioning and Start-Up are currently underway

On Schedule and budget

# TCV's CO2 Pipeline



Flat, rural, and co-located with existing utilities



# West Ranch Field Development



- **Drilling**  
75+ injection/production wells have been drilled
- **Permitting**  
Drilling and injection permits continue to be ahead of the need
- **Construction**  
Top-side facilities will be ready to take CO2 when deliveries start
- **Re-pressurization**  
Water injection began in July 2016 to support initial CO2 flood



# Reasons for Our Success So Far

- ✓ Upfront planning
- ✓ Right contractor
- ✓ Vertical integration, selling CO<sub>2</sub> alone doesn't work
- ✓ Willing partners in the oilfield and at Petra Nova
- ✓ Co-location of pipeline
- ✓ Agility in commercial structure and project design

# Benefits and Advantage of the Unique Business Model



## Unique business model

- ✓ Coal-fired power plants are a large and un-tapped CO2 source
- ✓ On-shore oil industry is very short CO2 – even in the Permian Basin of Texas
- ✓ A carbon capture project is typically a large cost center (no revenues)
- ✓ A CO2-EOR project unlocks tremendous value if CCS owners and oilfield operators can share the uplift and both win
- ✓ At West Ranch, recoverable reserves went up to well over **60 million barrels** at the sanctioning of the CCS & CO2-EOR projects

- Turning CO2 into a productive asset in demand
- Enhancing oil production while reducing the footprint to the global environment at the same time

# Financing

Project Cost = US\$1 billion

Sources of Capital:

## **US DOE CCPI grant**

- ✓ US\$190 million from the United States Department of Energy (DOE) Clean Coal Power Initiative Program (CCPI)

## **Project finance loans**

- ✓ US\$175 million from the Japan Bank for International Cooperation (JBIC)
- ✓ US\$75 million from Mizuho Bank, Ltd.
  - ✓ Mizuho's portion is insured by Nippon Export and Investment Insurance (NEXI)

## **Equity contributions**

- ✓ NRG and JX\* each will contribute up to US\$300 million in equity
  - \* JBIC has a minor equity interest in JX Nippon Oil Exploration (EOR), which is a 50% owner of Petra Nova Parish Holdings

# Other Incentives

## **State of Texas**

- ✓ Property tax exemption for “pollution control equipment”
- ✓ Sales tax exemption on carbon capture equipment
- ✓ Oil production tax abatement for anthropogenic CO2 use in EOR
- ✓ Franchise (gross receipts) tax credit

## **US Government**

- ✓ Grant mentioned on the previous slide
- ✓ Other potential:
  - ✓ Proposal to reconfigure the 45Q Tax Credit program under consideration by the US Congress

# MVA Plan for Injected CO<sub>2</sub>

In order to ensure that the CO<sub>2</sub> remains permanently sequestered underground, a Monitoring, Verification and Accounting program to determine whether CO<sub>2</sub> or other fluids are migrating from the production formation in the planned EOR area is being developed and implemented.

The MVA program is being administered by the West Ranch operator (Hilcorp) and the Bureau of Economic Geology (a part of the at Gulf Coast Carbon Center at the University of Texas at Austin).

# CCS Overview



# Cogen Overview





# In Summary



**World's largest**  
post-combustion carbon capture-enhanced oil recovery project

**1.6 million tons per year**  
of existing CO<sub>2</sub> emissions captured and sequestered

**Asset Life Extension**  
Refurbishment of existing mature domestic energy resources (plant and field)

**60 Million Barrels**  
of otherwise unrecoverable oil over the next 10 years

**Carbon Capture Utilization & Storage (CCUS)**  
a compelling opportunity that can help reach climate policy goals,  
revive established industries, and enhance national energy security

First actual commercialization of post combustion carbon capture