



NRG Energy CCPI Program Update

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USEA Presentation

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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,” “will” and similar terms. Such forward-looking statements include information relating to enhanced oil recovery and carbon capture. Although NRG believes that these 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 power markets, the volatility of energy and fuel prices, failure of customers to perform under contracts, changes in the wholesale power markets, changes in government regulation of markets and of environmental emissions, the condition of capital markets generally, successful partnering relationships, construction delays and the inability to implement value enhancing improvements to plant operations and companywide processes.

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Acknowledgements



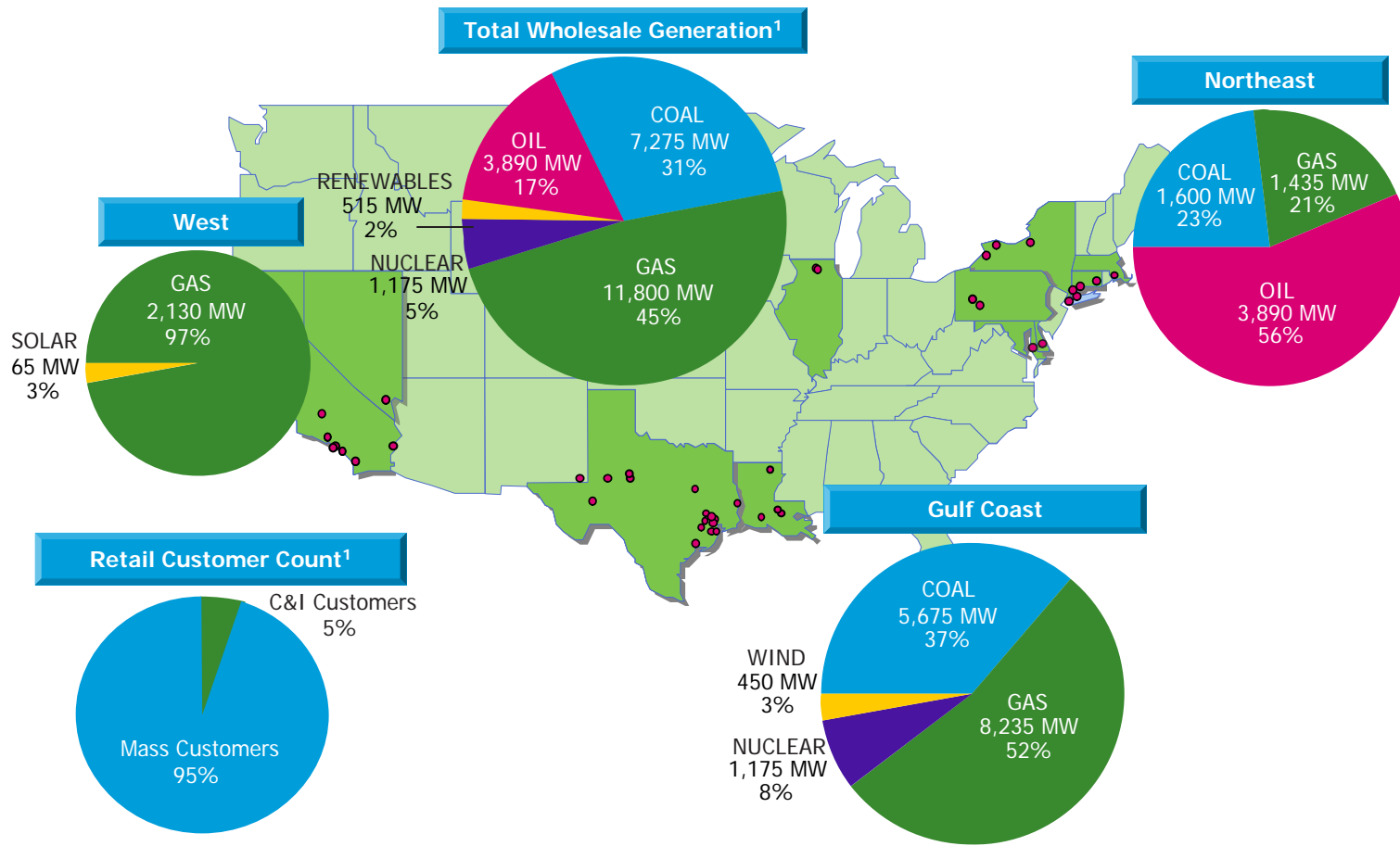
- The Department of Energy – selection under CCPI-3
- Funding from American Recovery and Reinvestment Act (ARRA)



NRG Energy Footprint



- Independent Power Producer with ~24,500 MW in operation in U.S.
- Owner of electricity retailers Reliant Energy, Green Mountain Energy, and Energy Plus
- Fortune 300 company with \$9 billion in revenues



Note: Includes 116 MW as part of NRG's Thermal assets. For combined scale, approximately 1,800 MW is dual-fuel capable. Reflects proforma domestic generation capacity as of 9/30/2011, including recent PV activations. 1,005 MW of international capacity not included.

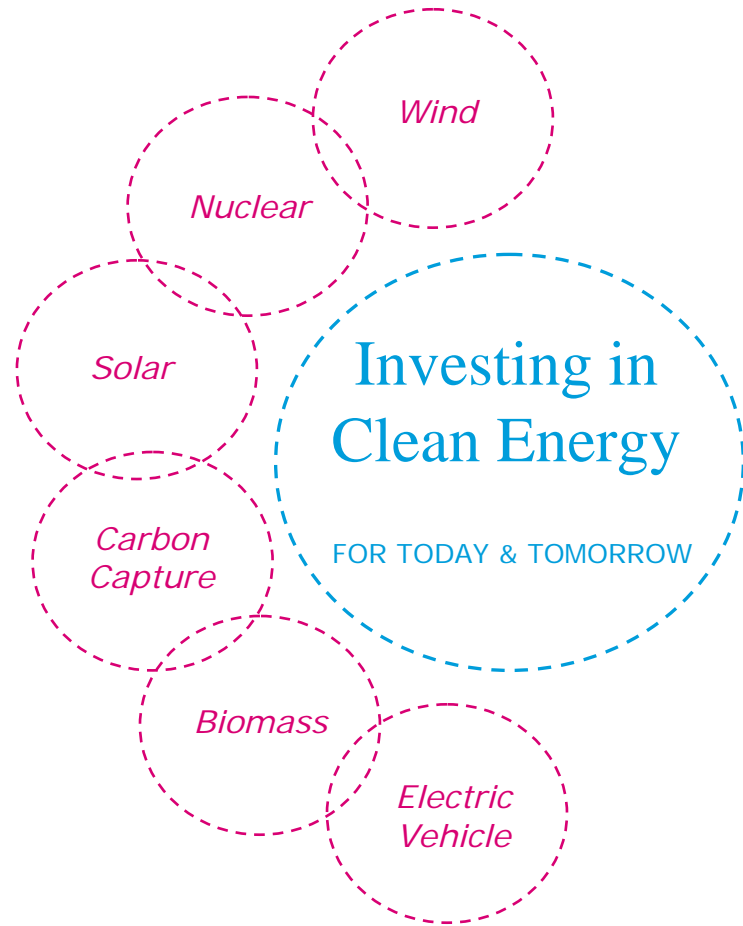
¹Includes customer count data for Reliant retail (as of 12/31/2010) and Green Mountain Energy totaling ~1,900,000 customers



NRG Clean Energy Investment Strategy



- Clean energy solutions improve the economy, national security, the environment, and our health.
- NRG is contributing to this fight by investing in promising clean energy technologies such as nuclear, solar, wind, and biomass.
- NRG's Clean energy investment strategies offers NRG the benefit of growing and diversifying its energy footprint.
- Future success should be less aligned with natural gas markets.

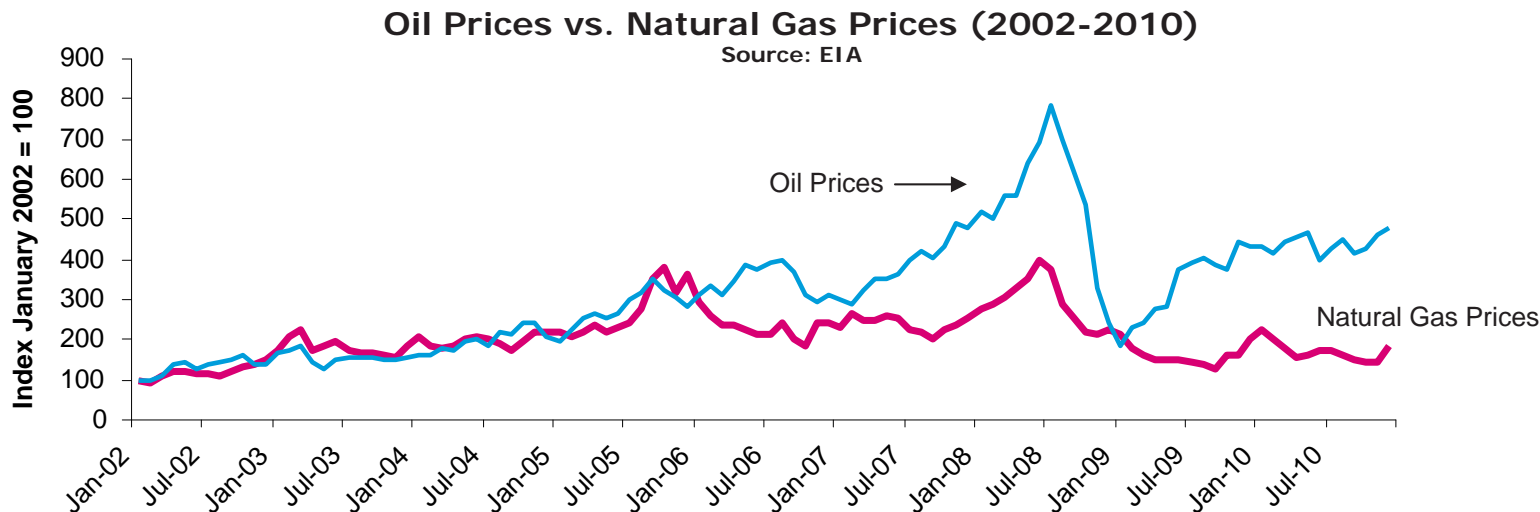


NRG is a industry leader focused on providing a diverse set of clean energy solutions

NRG Carbon Capture Strategy



- NRG started thinking about Carbon Capture in 2006/2007 (Huntley IGCC project) originally as a hedge against carbon legislation.
- Carbon Capture with EOR (Enhanced Oil Recovery) is also another way for NRG to diversify from natural gas prices now that oil prices are no longer correlated to natural gas.



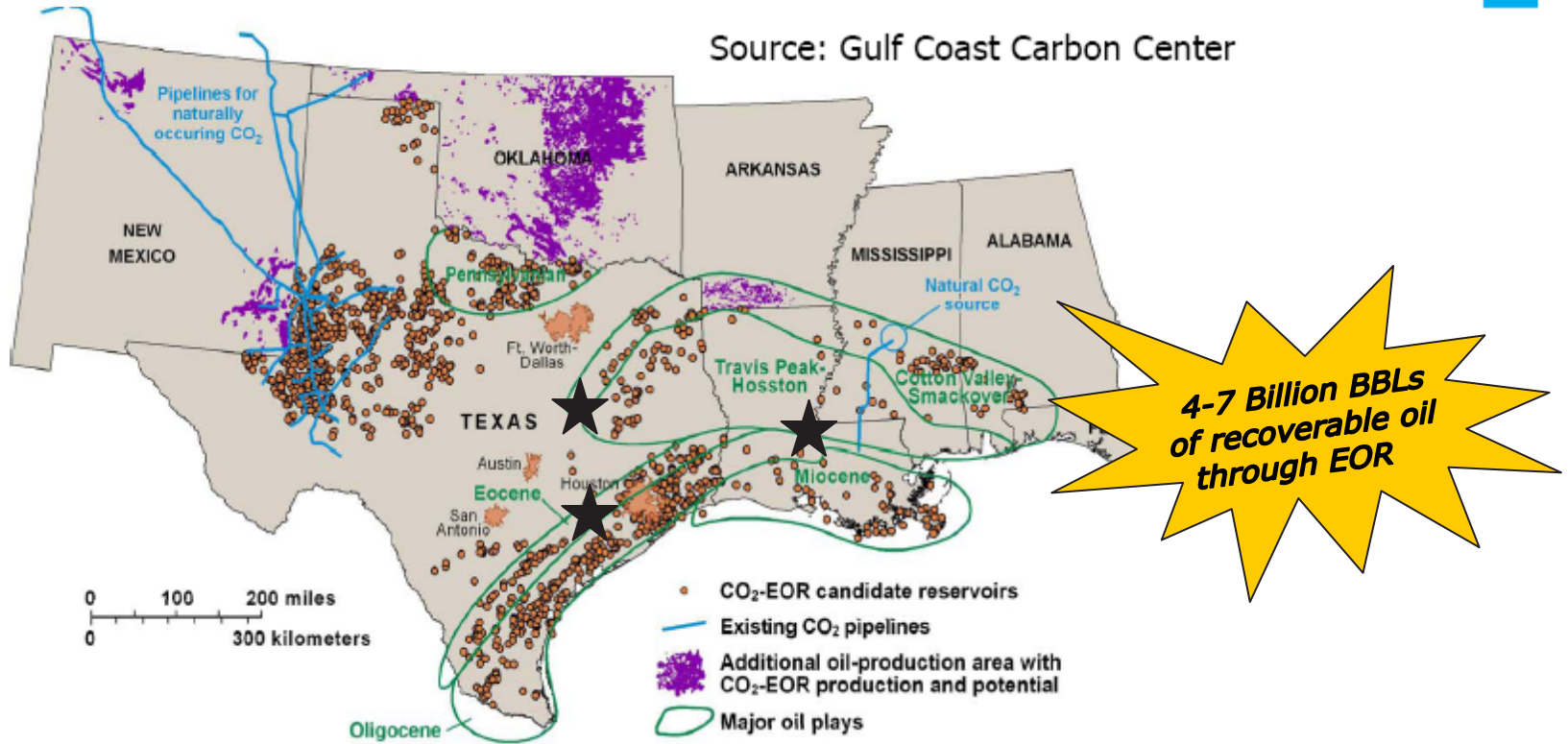
Carbon Capture technology used in conjunction with EOR is a “double-win” as it reduces greenhouse gas emissions while producing otherwise unrecoverable domestic oil reserves

NRG Carbon Capture Strategy



Oil Fields Near NRG Plants

Source: Gulf Coast Carbon Center



A successful first-of-a-kind demo could lead to an opportunity for the region

NRG DOE Partnership



- The DOE Clean Coal Power Initiative (CCPI) is a cooperative, cost-shared program between the government and industry aimed at demonstrating advanced coal-based power generation technologies including carbon capture and storage.
- CCPI Round 3 Criteria:
 - Capture and sequester, or put to beneficial reuse, >300,000 TPY of CO₂ emissions
 - Minimum coal or coal refuse energy input: 55%
 - Attain 50% CO₂ capture efficiency in treated flue gas (target 90%)
- NRG filed CCPI application in August 2009 to build a 60 MWe demonstration post combustion capture project (~375,000 TPY of CO₂) at its WA Parish Plant near Thompsons, TX.
- Our project was selected in March 2010.

***US Department of Energy selects NRG for Post-Combustion
Carbon Capture Demonstration Project in Texas***
Wednesday March 10, 2010

- DOE announced that NRG would receive a \$167M (50%) grant.
- Cooperative Agreement (CA) signed May 7, 2010.

NRG's CCPI Project Objectives



- Demonstrate applicability and impacts of Post Combustion Carbon Capture on a coal fired plant.
- Demonstrate Fluor Econamine FG PlusSM process technological advances aimed at lowering energy requirement of the capture process.
- Demonstrate advanced solvents from Fluor and UT.
- Demonstrate how a full sized Carbon Capture system can be added to an existing coal plant by supplying steam from a CCGT cogeneration plant.
- Demonstrate technologies and protocols for CO₂ monitoring, verification, and accounting (MVA).
- Identify concepts that improve economics and/or efficiencies that make progress toward DOE's goal of achieving 35% increase, or less, in the cost of electricity (COE).

By integrating EOR with CO₂ capture, we hope to demonstrate economically viable CO₂ capture on a utility scale

Project Participants



- Lead Sponsor and host site



- CCPI Program Cost Share

FLUOR - CO₂ Capture Process Technology



- Balance Of Plant Integration



- Chemical Eng. - Advanced Solvent Testing

- Bureau of Economic Geology (BEG)- Monitoring, Verification and Accounting (MVA)

E&P Co.

- Enhanced Oil Recovery (EOR) Operator



Project Phased Execution



Phase 1: Project Definition / Front End Engineering Design (FEED)

- Advance engineering and develop detailed cost estimate
- Prepare and file an air permit application
- Support determination regarding compliance with the National Environmental Policy Act (NEPA)

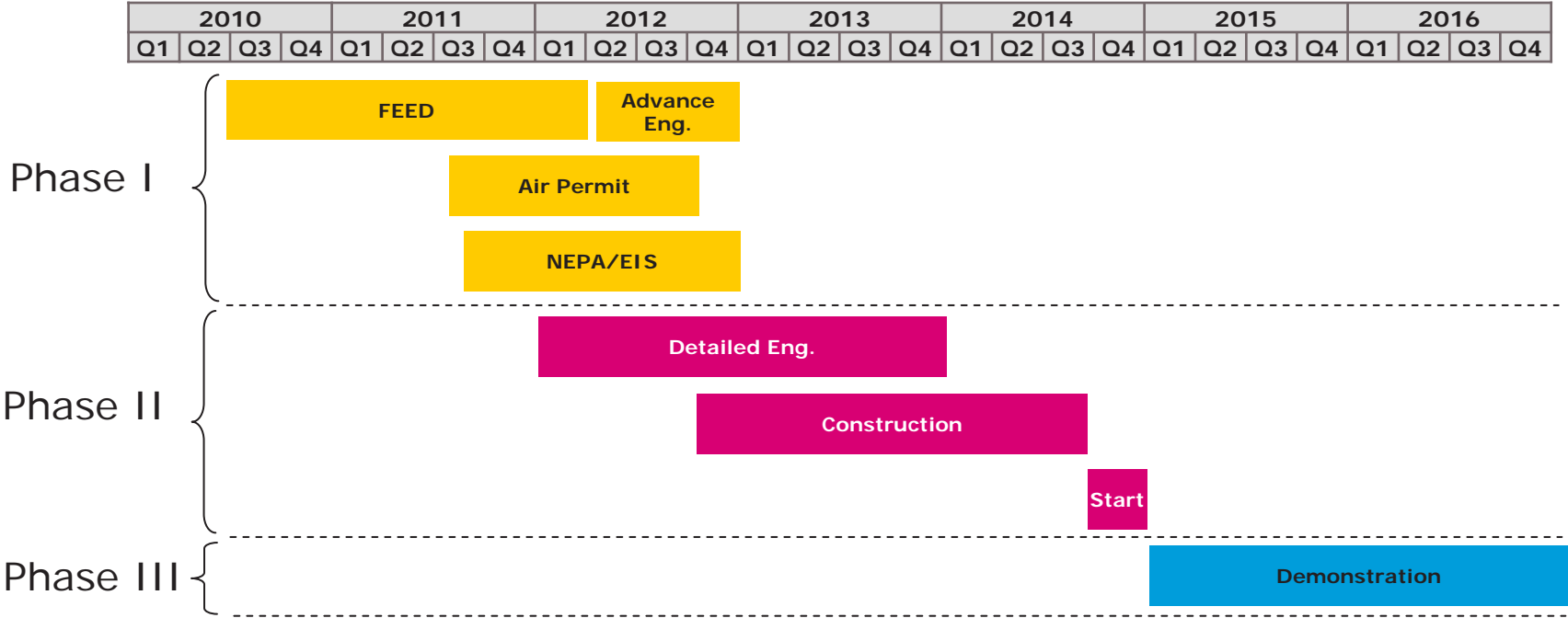
Phase 2: Detailed Engineering, Procurement & Construction

- Conduct detailed engineering
- Procure required materials and equipment
- Construct the carbon capture unit and related balance of plant items

Phase 3: Demonstration and Monitoring

- Demonstrate the specific advanced technologies
 - Carbon capture process
 - Advanced solvents
- Use the CO₂ for EOR and demonstrate technologies and protocols for sequestration monitoring, verification and accounting of the CO₂.

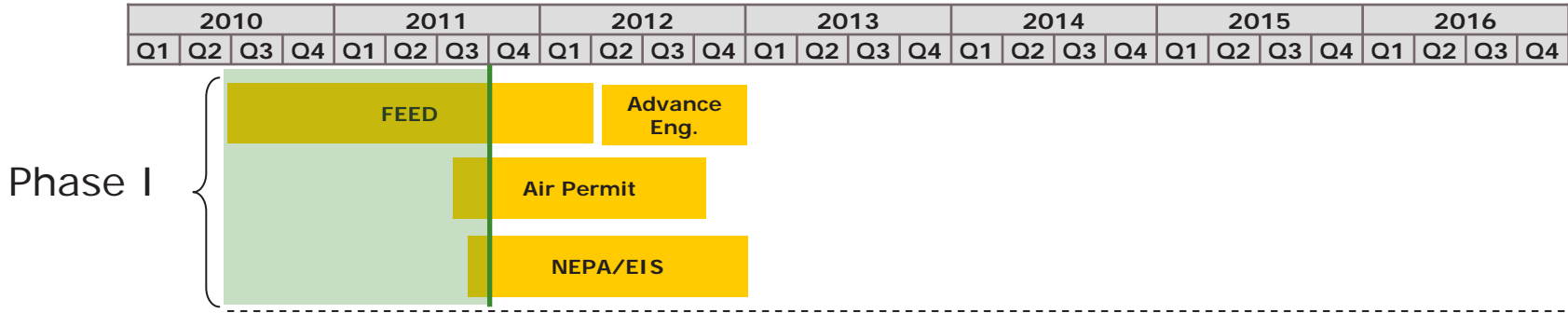
Schedule



NOTES

The permitting processes, Air and NEPA, drive the schedule.

Schedule Progress



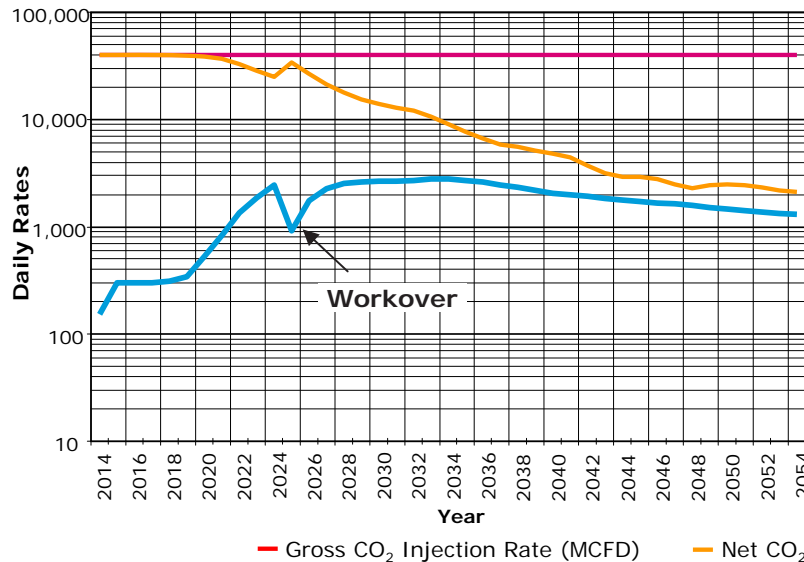
- The team is finishing up the 60 MW technical feed, assembling estimates, and issuing technical findings reports.
- Air permit application was filed in September.
- The CO₂ EOR offtake arrangement is being finalized.
- With a EOR candidate targeted, NEPA/EIS activities are being initiated.
- Preliminary reservoir engineering, modeling, and characterization of the candidate reservoir with the CO₂ supply suggests some optimization work should be done.

Enhanced Oil Recovery

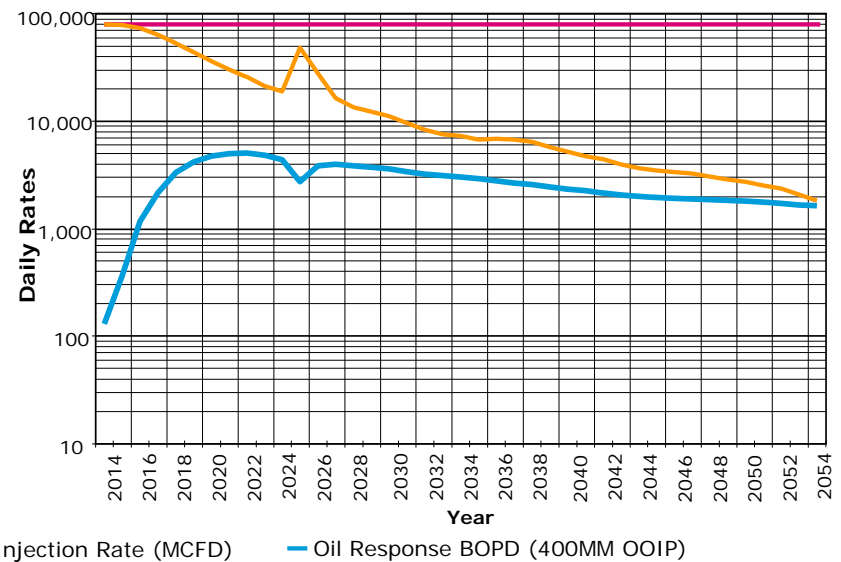


- The original 60 MW proposal and size primarily focused on fulfilling the CCPI program’s demonstration objectives.
- As we attempted to marry up the EOR side of the equation to the CO₂ production of a 60 MW project, we learned that there were no available nearby fields that contained desirable CO₂ flood characteristics and would respond to injection from the volume produced by a 60 MW system.

120 MWe Model Simulation (40,000 MCF/Day)



215 MWe Model Simulation (80,000 MCF/Day)



The 60MWe 20,000 MCF/day CO₂ production rate is too small to induce meaningful oil production

Scaling up the project



- NRG is now performing an expanded FEED study to determine the right-size facility to support the CO₂ miscible flooding requirements of the candidate oil fields and generate improved returns.

Original Plan

- 60 MW Equivalent Slipstream
- Combustion Turbine – 45 MW
- Export Power ~ 25 MW
- Project Cost ~ \$334 million*
- 375,000 TPY of CO₂

Expanded Study

- 240 MW Equivalent Slipstream
- Combustion Turbine – 80 MW
- Export Power ~ 30 MW
- Project Cost ~ TBD
- 1,500,000 TPY of CO₂

- Although EOR can potentially help offset the costs of CCS systems, to cover the costs and risks of serial #1, governmental support is needed in order to drive these projects and technologies into commercial development and implementation.

EOR using CO₂ from coal plants has significant potential, but first-of-a-kind projects face a number of substantial hurdles

NRG WA Parish



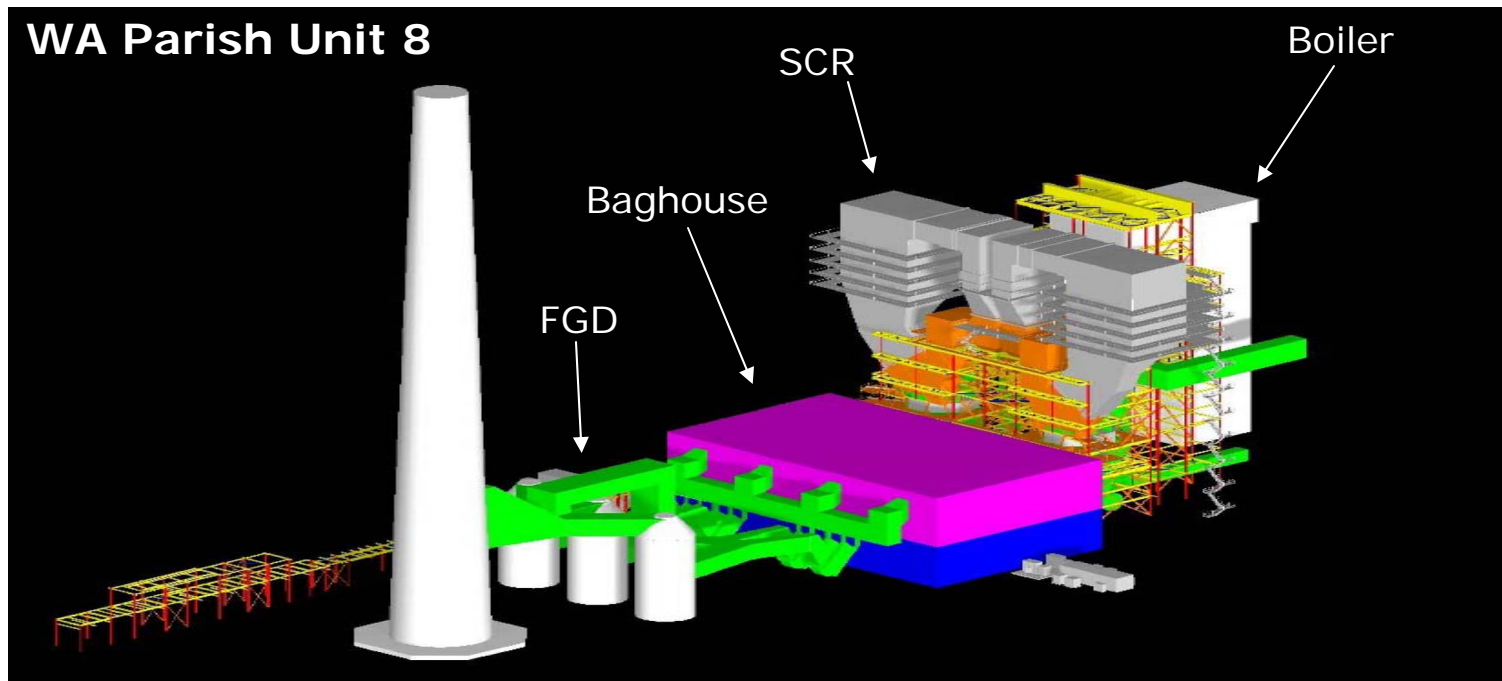
- The W. A. Parish facility is located in Thompsons, Texas, 25 miles southwest of downtown Houston.
- There are a total of eight generating units at this site. Units 1 through 4 are gas-fired and generate 1,175 MW of electricity. Units 5 through 8 are coal-fired and generate 2,490 MW of electrical power. The station also has a black start GT.
- The four coal units consume approximately 36,000 tons of coal a day on average.
- Coal is transported over 8 days from the Powder River Basin in Wyoming to Texas by train carrying approximately 14,000 tons per train.
- In total, the plant provides approximately enough power to serve over 3 million homes.



NRG WA Parish Unit 8



- NRG's WA Parish Unit 8 was commissioned in 1982 and is rated at 610 MW (Net)
- Unit 8 Emission Control Equipment
 - Low sulfur coal (PRB)
 - Low NOx burner/overfire air system
 - Selective catalytic reduction (SCR)
 - Baghouse system for particulate control
 - Desulfurization system (FGD)

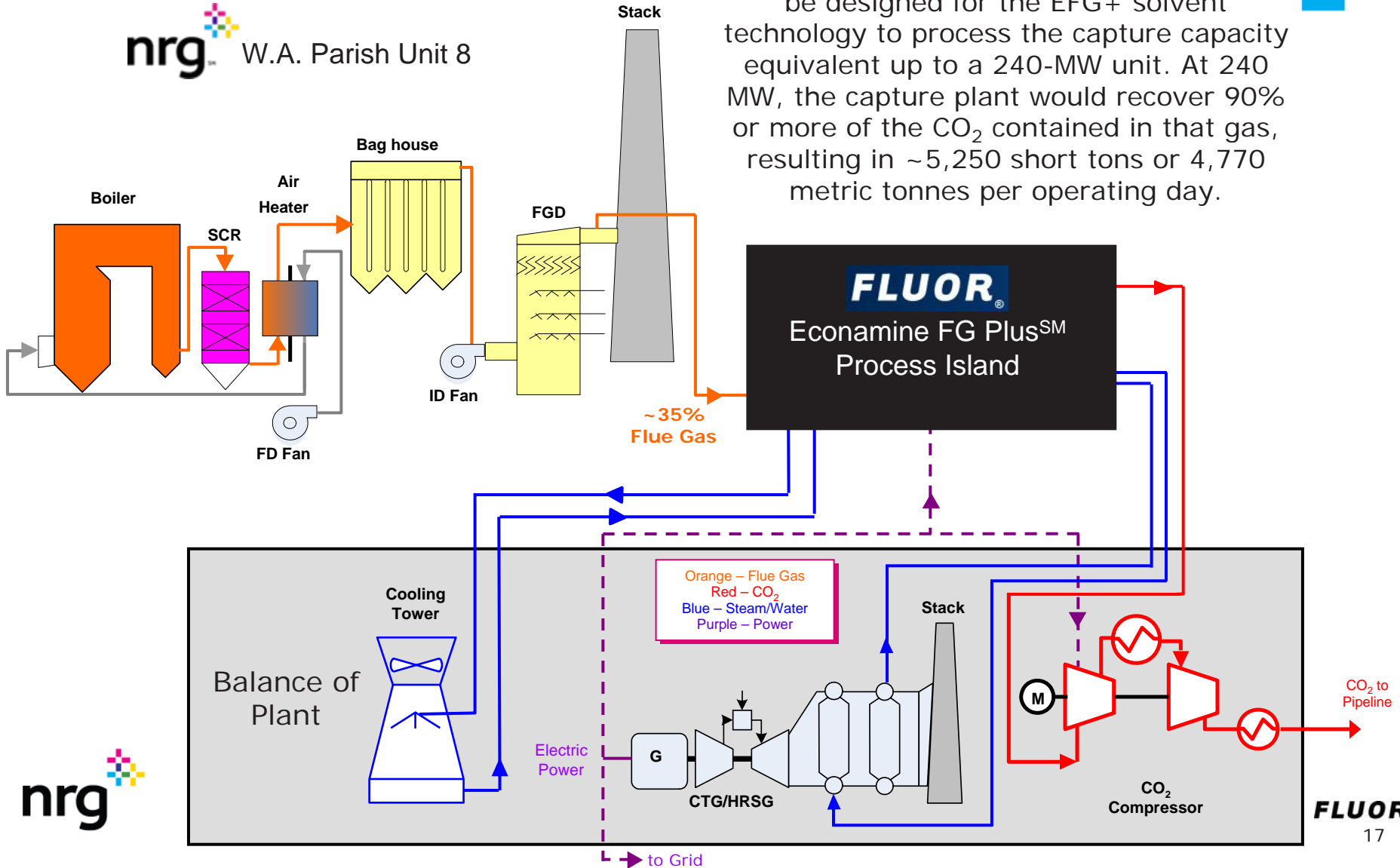


Process Flow Diagram



nrg W.A. Parish Unit 8

The CO₂ capture plant for the NRG site will be designed for the EFG+ solvent technology to process the capture capacity equivalent up to a 240-MW unit. At 240 MW, the capture plant would recover 90% or more of the CO₂ contained in that gas, resulting in ~5,250 short tons or 4,770 metric tonnes per operating day.



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FLUOR

Fluor Econamine FG PlusSM













- Econamine FG PlusSM technology is a proven, cost-effective process for the post – combustion removal of CO₂ from low-pressure, oxygen containing flue gas streams*
- Fluor has been involved in CO₂ capture since the early 1990's
- World-wide licenses to date: 27 plants
- Executing an order for 8 more plants
- Built the reference plant at Bellingham in 1990
 - Still remains the largest diameter column in the world in Post Combustion Capture
- Fluor continues to enhance the technology. Over the last 6 years, significant improvements have been made:
 - Fluor has a good knowledge of the variables that affect process performance
 - Extensive pilot testing on structured packing resulted in accurate mass transfer and packing volume prediction
 - The gas path pressure drop reduction initiative resulted in a significant blower power saving of 42%

Fluor Econamine Projects



Flue gas source:

- | | | | |
|---|---------------------|---|--------------------|
|  | Heavy Fuel Oil |  | Steam Reformer |
|  | Gas Turbine Exhaust |  | Gas Engine Exhaust |
|  | Gas Fired Reformer |  | Coal Mixture |
|  | HFO Fired Boiler |  | Natural Gas |
|  | Light Fuel Oil |  | LPG |

CO₂ Use:

- Food industry
- Urea Plant
- Methanol Plant
- Enhanced Oil Recovery (EOR)

Post Combustion Amine Systems

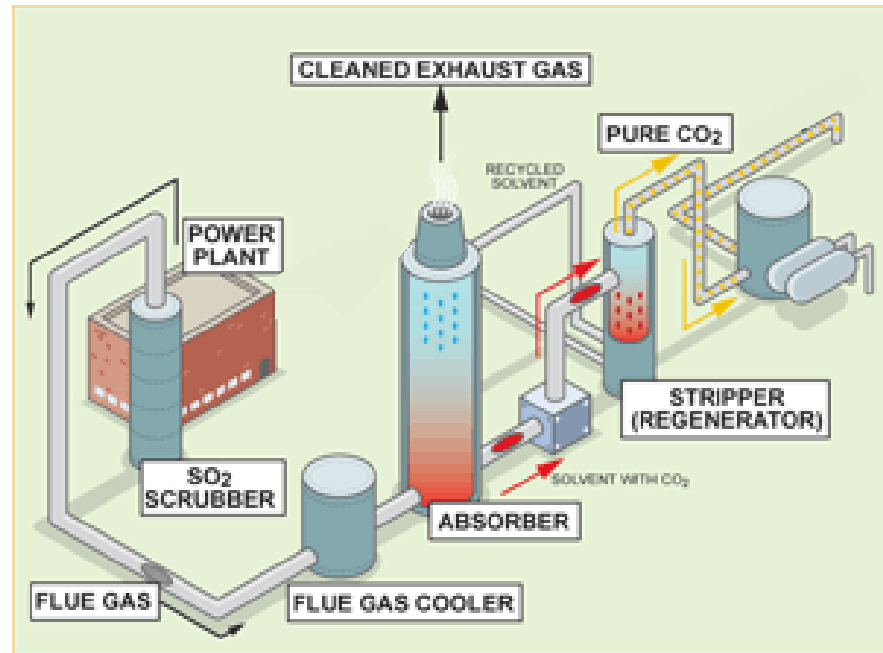


- Post Combustion CO₂ Capture plant consists of three main sections:

- Flue gas cooler
- Absorber (for CO₂ recovery)
- Stripper (for solvent regeneration)

- Flue Gas Cooler

- The primary objective of the cooler is to cool and condition the flue gas prior to entering the absorber



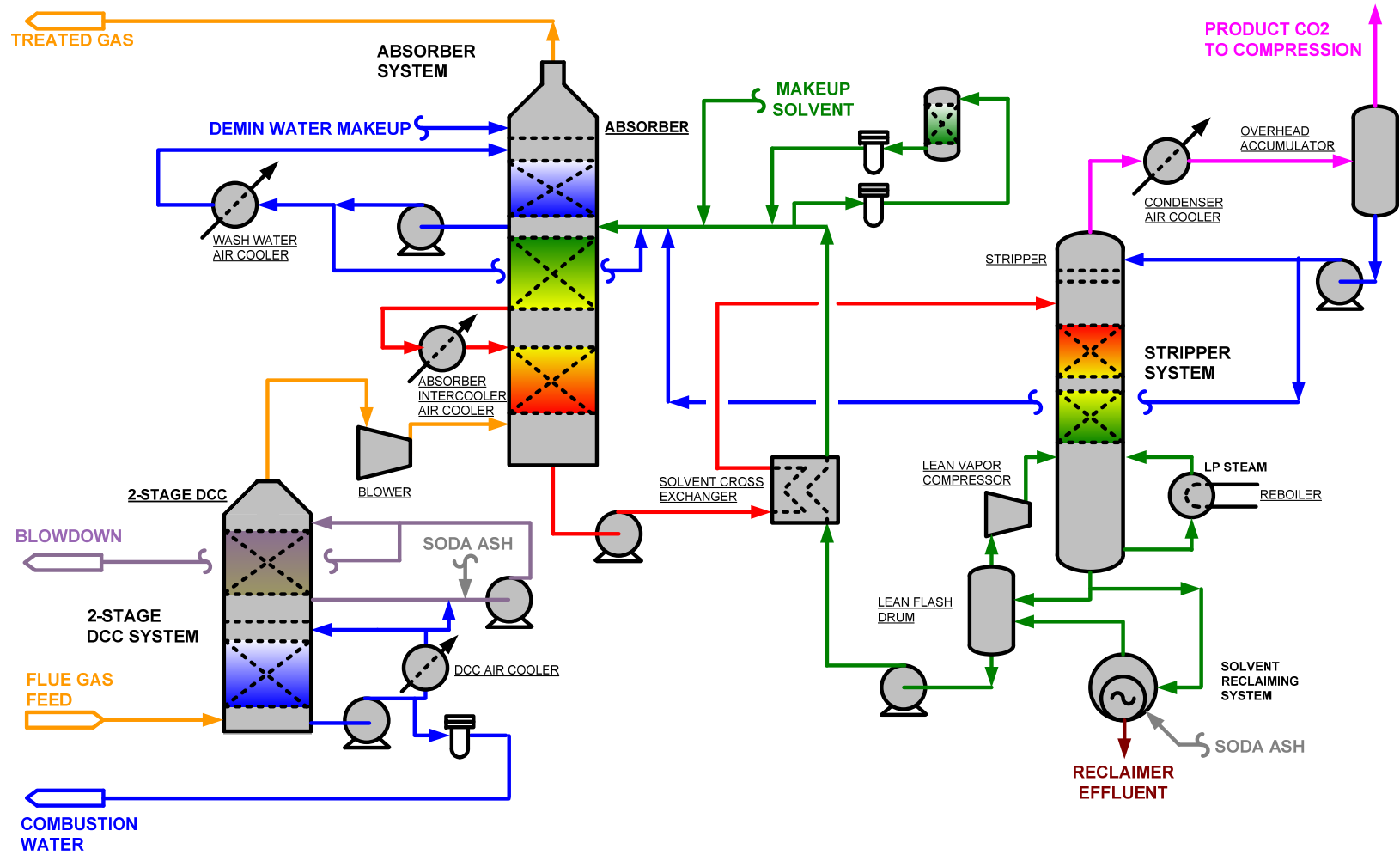
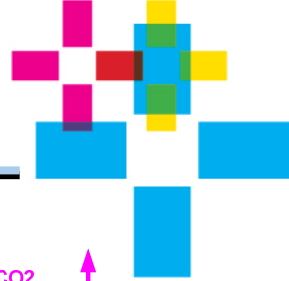
- Absorber

- This is where CO₂ reacts chemically with the MEA based solvent capturing the CO₂ in the solvent

- Stripper

- This is where CO₂ is released (in concentrated form) and the original solvent is recovered. The process uses a low pressure (LP) heated flash system for solvent reclaiming

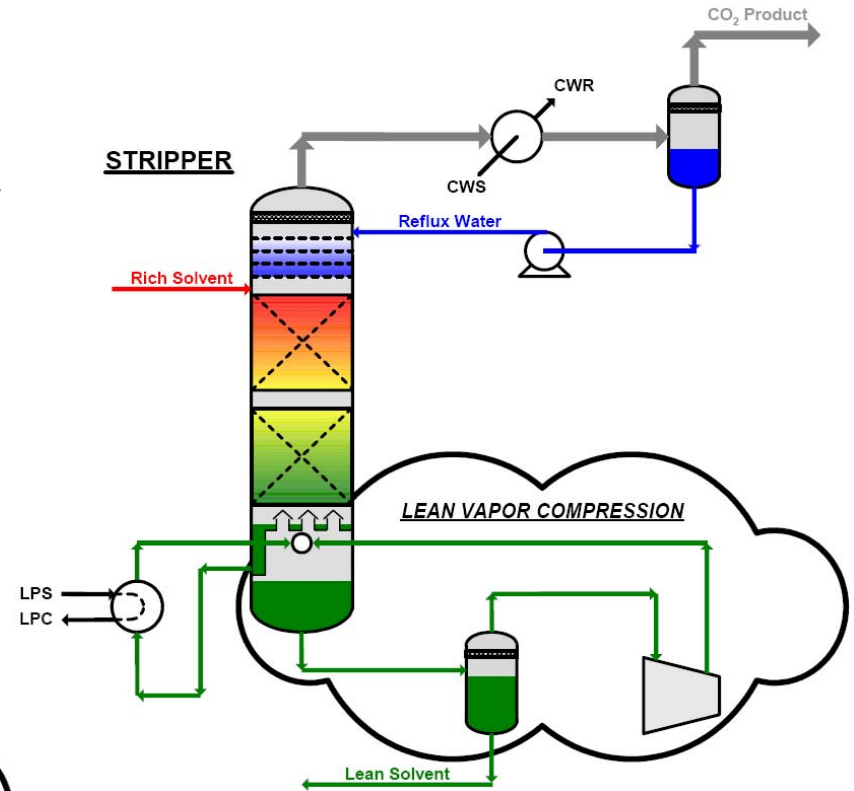
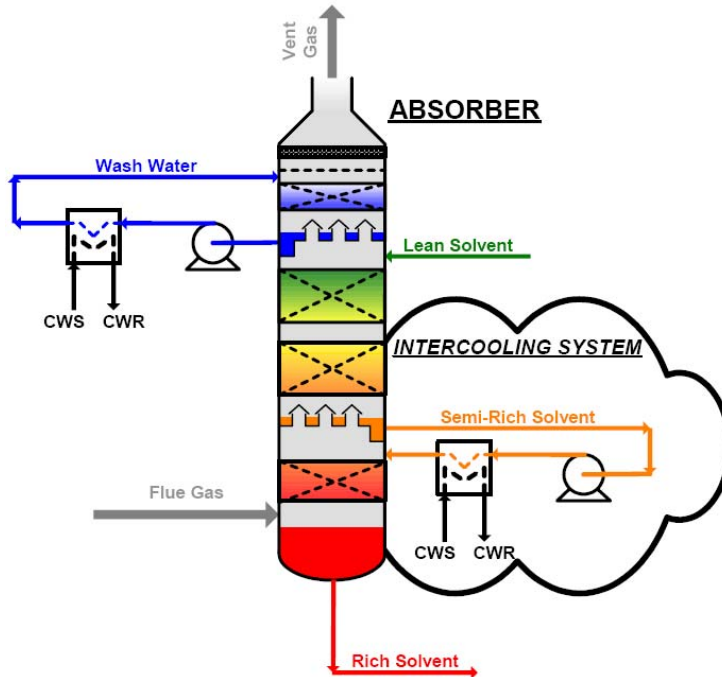
Econamine FG PlusSM – Typical Flow Sheet



Unique Features in EFG+ Design



- Integrated Flue Gas Conditioning
 - Flue Gas Cooling
 - Trim SO₂ Removal
- Intercooled Absorber
- Lean Vapor Compression on Reboiler
- New Solvent Formulations
- Advance Reclaimer Design



Econamine FG PlusSM – Reference Plant



Project Profile

- Plant location: Bellingham, Ma
- Capacity 365 Tons/day
- CO₂ Concentration: 3.5% v/v
- O₂ Concentration: 13 to 14% v/v
- 100% air cooled (unique feature...only one in the world)
- Product Usage: Food-grade CO₂
- Status: Continuous operation since 1991 with a 98.5% on-stream factor in 2004
- Plant was shutdown in 2005 on expiration of the natural gas contract

Bellingham Plant Aerial View



Scale up of Columns



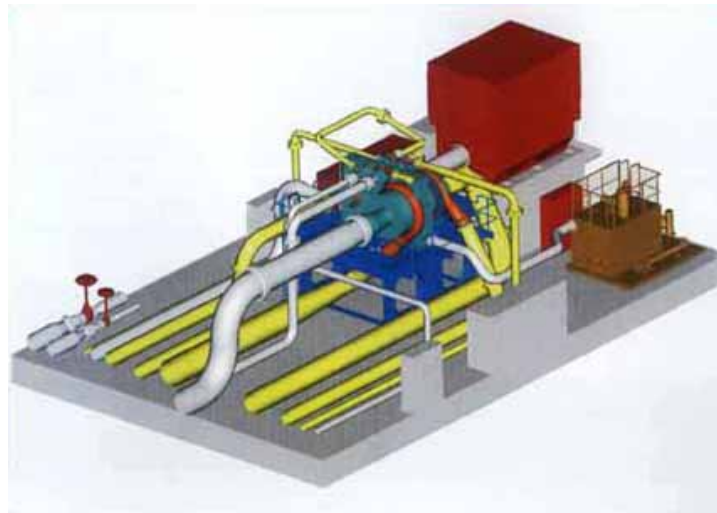
		Bellingham	NRG 60 MW	NRG 240 MW
DCC	Dia. ft	23	23	44
	Height ft	37	128	95
Absorber	Dia. ft	20	24	62
	Height ft	115	121	167
Stripper	Dia. ft	8	13	27
	Height ft	81	84	86

- Bellingham reference plant has the world's largest DCC and Absorber
- The DCC, Absorber and Regenerator columns for the 240 MW capacity are larger than the Bellingham plant
- Fluor has built columns with diameters to 45 ft
- Gas and liquid distribution in columns is of great importance
- Computational Fluid Dynamics (CFD) studies of large columns have been completed to develop a scale-up strategy

CO₂ Compression



- Preliminary Design:
 - One Compressor, 2,100 psig discharge ~30,000 hp
 - Supercritical product sent to pipeline for EOR
- Two leading compressor vendors have offered integrally geared centrifugal machines for this project
 - MAN Turbo supplied the CO₂ compressors at Dakota Gas – world's largest currently in operation
 - Three machines of identical size 2,900 psig discharge; 20,000 hp each



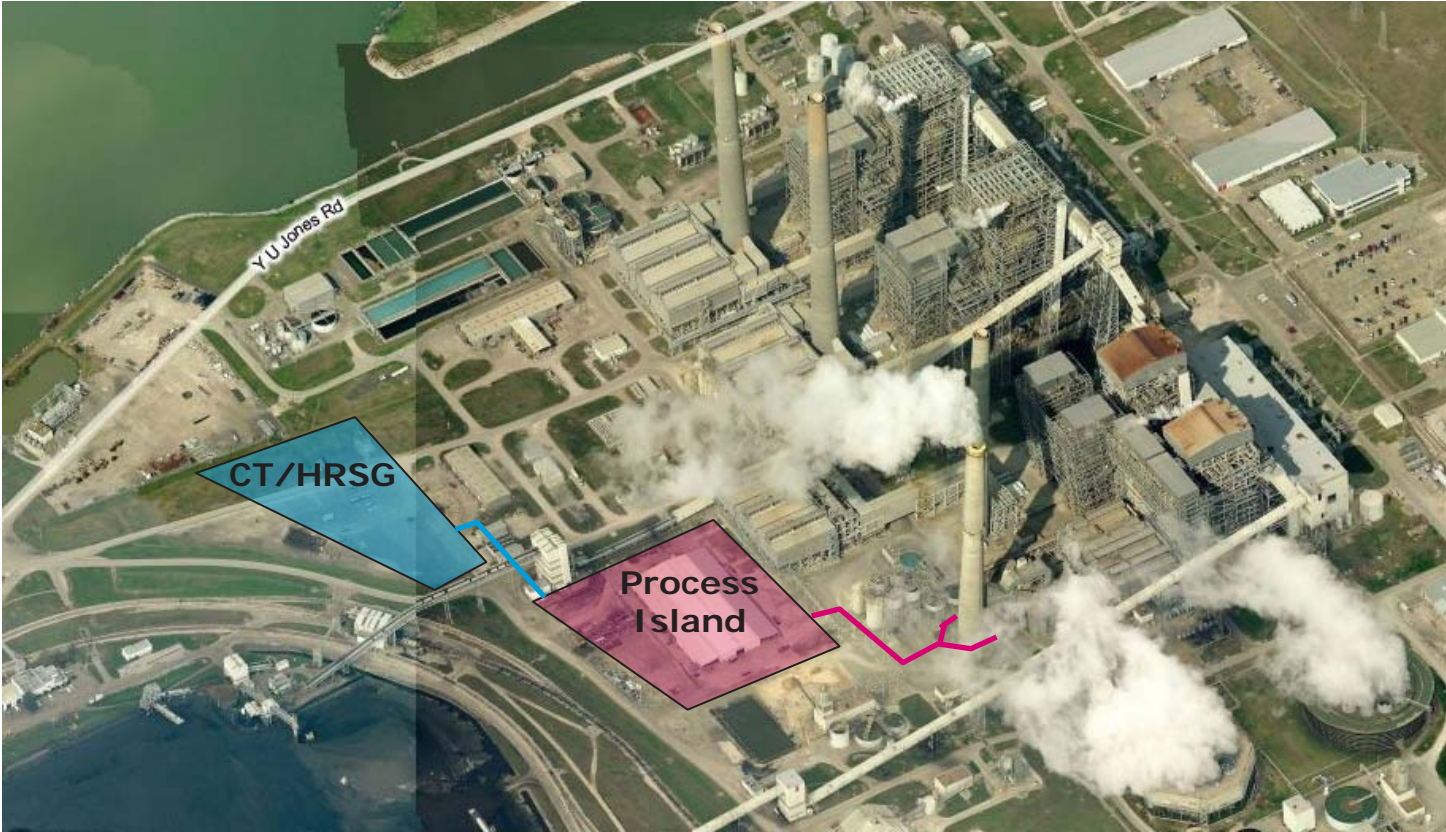
Balance of Plant Integration



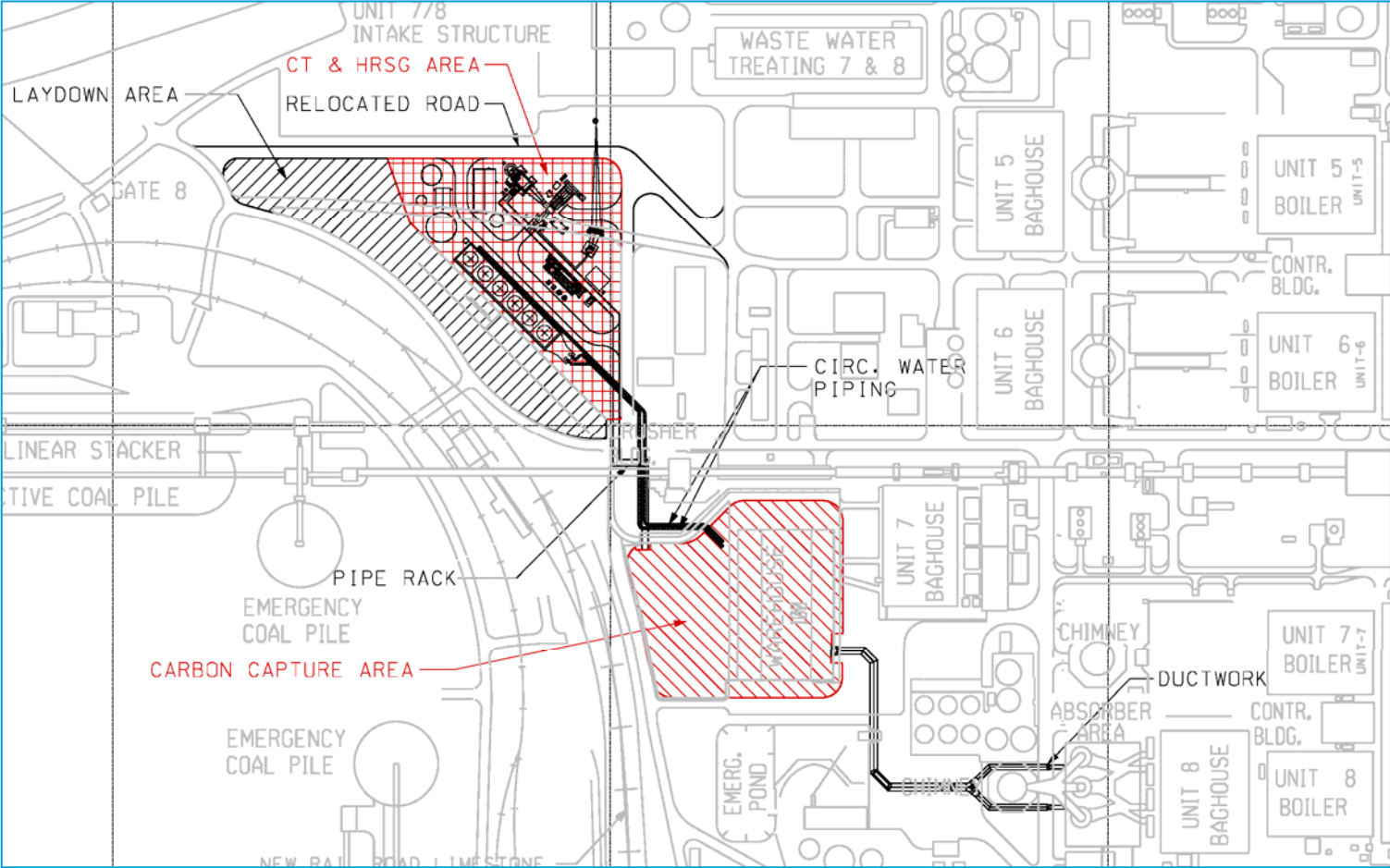
- Regeneration of the solvent requires the addition of heat in the form of low-pressure steam. Although the steam needed could be supplied from the intermediate-pressure/low-pressure (IP/LP) crossover connection on the Unit 8 steam turbine, parasitic energy drain and the redesign or interruption of existing MW production systems could compromise the operations of the unit.
- For this reason and others, the project plans to install a natural-gas-fired combustion turbine (CT) with a waste heat boiler to supply the heat required. A CTG and HRSG can be sized to produce the required quantity of steam at the desired pressure and temperature offering more flexibility for changes in capture plant steam conditions without impacting the existing unit's steam cycle.
- A cooling tower is required to provide cooling water to support the operations of the DCC, the CO₂ absorber and stripper, and CO₂ compression.



Site Arrangement



Site Arrangement



Site Arrangement



Design and Construction challenges

- Site Limitations/Existing Operations
- Facility Integration
- Over 800 feet of wet gas duct to process area
- 3 parallel wet FGD Scrubbers for SO₂ control and bypass duct for temperature control in Dry-Stack

Design Considerations

- Quality of gas delivered to EFG+
- Impact on existing Stack Emissions
- Issues associated with Plant Turndown
- Minimize cost of ductwork and supports

Summary



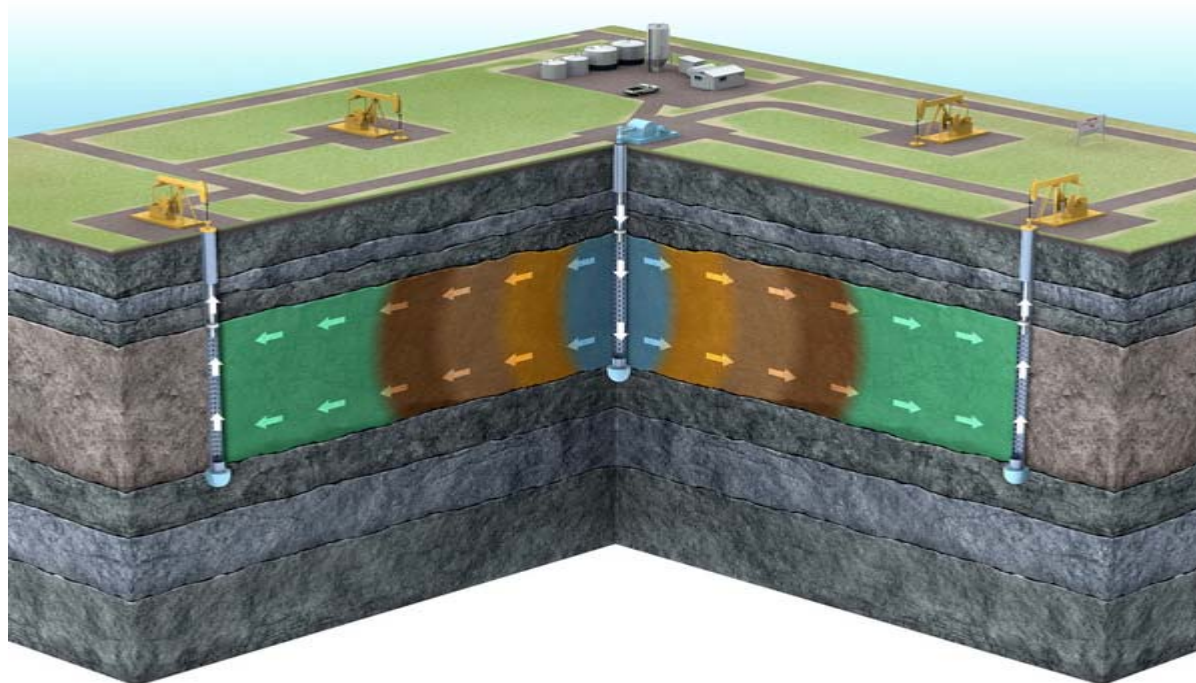
- NRG has selected Fluor's Econamine FG Plus (EFG+) advanced amine-based post combustion CO₂ capture technology.
 - Fluor's EFG+ process utilizes simple, reliable equipment that is well-known to the gas-treating industry.
 - The technology does not require a custom-manufactured or expensive solvent. The solvent is readily available and inexpensive and is produced by solvent manufacturers worldwide.
- NG CT/HRSG Combined-Heat-Power simplifies retrofit due to relative ease in matching CT to parasitic load and steam demands
- Existing plant performance is not degraded or disrupted by installation of Carbon Capture system
- EOR provides a value-added revenue stream that helps support CCS development

The success of this project will set a template for future CO₂-EOR projects involving existing coal-fired power plants

CCS Action Plan



- Complete the Expanded FEED study
- Finalize the CO₂ offtake and EOR arrangement
- Complete National Environmental Policy Act (NEPA)
- Conduct detailed design and construction activities



Questions?



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