

**U.S. Department of Energy
W.A. Parish Post-Combustion CO₂
Capture and Sequestration Project
Final Environmental Impact Statement
Summary
February 2013
DOE/EIS-0473**



**Office of Fossil Energy
National Energy Technology Laboratory**



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COVER SHEET

Responsible Federal Agency: U.S. Department of Energy (DOE)

Title: W.A. Parish Post-Combustion CO₂ Capture and Sequestration Project, **Final** Environmental Impact Statement (DOE/EIS-0473)

Location: Southeastern Texas, including Fort Bend, Wharton, and Jackson counties

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Abstract:

This **Final** Environmental Impact Statement (EIS) evaluates the potential impacts associated with the U.S. Department of Energy's (DOE) Proposed Action to provide financial assistance to NRG Energy, Inc. (NRG) and with NRG's proposed W.A. Parish Post-Combustion Carbon Dioxide (CO₂) Capture and Sequestration Project (Parish PCCS Project). DOE's Proposed Action would provide \$167 million in cost-shared financial assistance to NRG under the Clean Coal Power Initiative (CCPI) Program to support construction and operation of NRG's Parish PCCS Project. The funding would be used for project design and development, procurement of capital equipment, construction, and CO₂ monitoring during the 35-month demonstration period of the integrated CO₂ capture and compression system.

NRG's proposed Parish PCCS Project would construct a CO₂ capture facility at its 4,880-acre W.A. Parish Plant in rural Fort Bend County near the small town of Thompsons, Texas. The capture facility would use an advanced amine-based carbon dioxide (CO₂) absorption technology to capture at least 90% of the CO₂ from a 250-megawatt equivalent (MWe) portion of the flue gas exhaust from Unit 8 at the W.A. Parish Plant. The project would be designed to capture approximately 1.6 million tons of CO₂ per year from the plant exhaust, which would otherwise be emitted to the atmosphere. The captured CO₂ would be compressed and transported via a new approximately 81-mile-long, 12-inch-diameter underground pipeline to the existing West Ranch oil field in Jackson County, Texas. The CO₂ would be used for enhanced oil recovery (EOR) and ultimately sequestered in geologic formations approximately 5,000 to 6,300 feet below ground surface (bgs).

DOE is the lead federal agency responsible for preparation of this EIS. DOE prepared the EIS pursuant to the National Environmental Policy Act (NEPA) and in compliance with the Council on Environmental Quality (CEQ) implementing regulations for NEPA (40 Code of Federal Regulations [CFR] 1500 through 1508) and DOE NEPA procedures (10 CFR 1021). The EIS evaluates the potential environmental impacts of the Parish PCCS Project as part of DOE's decision-making process to determine whether to provide NRG with financial assistance for its proposed project. The EIS also analyzes the No-Action Alternative, under which DOE would not provide financial assistance for the proposed project.

In addition, the Final EIS provides the comments received on the Draft EIS, DOE's responses to those comments, revisions made in response to the comments, and changes made to the proposed project

between the preparation of the Draft EIS and Final EIS. Vertical lines in the left margins indicate where text from the Draft EIS has been revised or supplemented for this Final EIS. Revised text is also shown in boldface font (as in this paragraph). Appendix J in Volume II contains the public comments on the Draft EIS and DOE's responses.

Four written comments (letters) were received on the Draft EIS, two from representatives of federal agencies (U.S. Environmental Protection Agency and U.S. Department of the Interior), one from a representative of a state agency (Texas Parks and Wildlife Department), and one from a representative of a Native American tribe (Coushatta Tribe of Louisiana). In addition, one member of the general public made an oral comment at the public hearing. Detailed information on the nature of these comments, as well as DOE's responses, may be found in Table S-1, in Chapter 1 of Volume I of this document, and in Appendix J of Volume II of this document.

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ACRONYMS

Acronym	Definition
%	percent
°F	degrees Fahrenheit
AF	acre-feet
aka	also known as
Approx.	Approximately
Ar	argon
BEG	Texas Bureau of Economic Geology
bgs	below ground surface
BMPs	best management practices
ca.	circa
CCPI	Clean Coal Power Initiative
CCS	carbon capture and sequestration
CCTP	Climate Change Technology Program
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO ₂	carbon dioxide
COE	cost of electricity
CT	combustion turbine
dBA	decibel, A-weighted
DERC	Discrete Emission Reduction Credits
DOE	U.S. Department of Energy
e.g.	for example (Latin: <i>exempli gratia</i>)
EIS	Environmental Impact Statement
EMT	emergency medical technician
EOR	enhanced oil recovery
EPA	U.S. Environmental Protection Agency
EPAct05	Energy Policy Act of 2005
ERC	emission reduction credit
ES&H	environmental safety and health
ETP	Energy Transfer Partners
FEMA	Federal Emergency Management Agency
FM	Farm-to-Market Road
FOA	funding opportunity announcement
FR	Federal Register

Acronym	Definition
GHG	greenhouse gas
gpd	gallons per day
H₂O	water
HAZMAT	hazardous material
HCl	hydrochloric acid
HDD	horizontal directional drilling
HEC	Hilcorp Energy Company
HF	hydrofluoric acid
HGB MSA	Houston Galveston Brazoria Metropolitan Statistical Area
HRSG	heat recovery steam generator
HVTL	high-voltage transmission line
i.e.	that is (to say); in other words (Latin: id est)
lb/hr	pounds per hour
lbs	pounds
mD	millidarcies
MECT	Mass Emission Cap & Trade
mgd	million gallons per day
MLV	main line valve
MMTA	million metric tons per annum
MP	milepost
msl	mean sea level
MSA	Metropolitan Statistical Area
MTA	metric tons per annum
MW	megawatt
MWe	megawatt equivalent
N₂	nitrogen
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NETL	National Energy Technology Laboratory
NGL	natural gas liquid
NH₃	ammonia
NNSR	Nonattainment New Source Review
NO	nitrogen oxide
NO₂	nitrogen dioxide
NOI	Notice of Intent
NO_x	nitrogen oxides
NRG	NRG Energy, Inc.

Acronym	Definition
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
O₂	oxygen
O₃	ozone
Parish PCCS Project	W.A. Parish Post-Combustion CO ₂ Capture and Sequestration Project
PCCS	Post-Combustion CO ₂ Capture and Sequestration
PM₁₀	particulate matter with a diameter of 10 microns or less
ppmv	parts per million by volume (1 ppmv = 0.0001%)
psia	pounds per square inch absolute
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
ROI	region of influence
ROW	right-of-way
RRC	Railroad Commission of Texas
SIP	State Implementation Plan
SO₂	sulfur dioxide
SO₃	sulfur trioxide
STEC	South Texas Electric Cooperative
SWPPP	Stormwater pollution prevention plan
TCEQ	Texas Commission on Environmental Quality
TCV	Texas Coastal Ventures LLC
THC	Texas Historical Commission
TPWD	Texas Parks and Wildlife Department
tpy	tons per year
TSDF	treatment, storage, and disposal facility
TXDOT	Texas Department of Transportation
U.S.	United States
UIC	Underground Injection Control
USACE	U.S. Army Corps of Engineers
USDW	underground source of drinking water
VOC	volatile organic compound
WWTP	wastewater treatment plant

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GLOSSARY

*Please refer to acronyms list for definitions of acronyms used below.

Term	Definition
“A-weighted” Scale	Assigns weight to sound frequencies that are related to how sensitive the human ear is to each sound frequency. Frequencies that are less sensitive to the human ear are weighted less than those for which the ear is more sensitive. A-weighted measurements indicate the potential damage a noise might cause to hearing.
100-year floodplain	Land that becomes or will become submerged by a flood that has a chance to occur every 100 years (1% annual chance of flooding).
500-year floodplain	Land that becomes or will become submerged by a flood that has a chance to occur every 500 years (0.2% annual chance of flooding).
Ambient noise level	Background noise associated with a given environment. Ambient noise is typically formed as a composite of sounds from many near and far sources, with no particular dominant sound.
Amines	A group of organic compounds of nitrogen, typically derived from ammonia, with one or more of the hydrogen atoms in ammonia replaced by one or more organic functional groups. Amines include amino acids and a wide range of primary, secondary, and tertiary amines used for dyes, pharmaceuticals, and gas treatment.
Aquifer	Underground geologic formation composed of permeable layers of rock or sediment that holds and/or transmits water.
Best Management Practice	Method for preventing or reducing pollution impacts resulting from an activity. BMPs include non-regulatory methods designed to minimize harm to the environment.
Carbon dioxide (CO₂)	A common chemical compound, abbreviated as CO ₂ , composed of two oxygen atoms covalently bonded to a single carbon atom. CO ₂ is a colorless, odorless, nonpoisonous, GHG created by combustion and emitted from natural and human activities, including the burning of fossil fuels to generate electricity and operate motor vehicles.
Cultural resources	Archaeological sites, historical sites (e.g., standing structures), Native American resources, and paleontological resources.
Cumulative effects	The impact to the environment that results from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.
Decibel	Unit used to express the intensity of sound.
Dissolution	Process of dissolving a substance into a liquid.

***Please refer to acronyms list for definitions of acronyms used below.**

Term	Definition
Effluent	Waste stream flowing into the atmosphere, surface water, groundwater, or soil.
Emergent	Erect, rooted herbaceous plants, such as cattails and bulrush, which dominate wetlands.
Endangered Species	Plants or animals that are in danger of extinction. A federal list of endangered species can be found in 50 CFR 17.11 (wildlife), 50 CFR 17.12 (plants), and 50 CFR 222.23(a) (marine organisms). Texas maintains its list of endangered species with the TPWD.
Environmental Justice	The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies. Executive Order 12898 directs federal agencies to make achieving environmental justice part of their missions by identifying and addressing disproportionately high and adverse effects of agency programs, policies, and activities on minority and low-income populations.
Erosion	The process by which particles of soils or other material are removed and transported by water, wind, and/or gravity to some other area.
Fault	A subsurface fracture or discontinuity in geologic strata, across which there is observable displacement as a result of earth movement.
Floodplain	Flat or nearly flat land adjacent to a stream or river that experiences occasional or periodic flooding.
Flue gas	Residual gases after combustion that are vented to the atmosphere through a flue or chimney.
Formation	The primary unit associated with formal geological mapping of an area. Formations possess distinctive geological features and can be combined into "groups" or subdivided into "members" or "units".
Fossil fuel	Coal, oil, or natural gas, formed from vegetation and animals under high pressure and temperatures during a past geological age.
Fresh water	Water with bacteriological, physical, and chemical properties that make it suitable for beneficial use. (e.g., with TDS concentrations less than 1,000 mg/L).
Fugitive dust	Airborne particulate matter, typically associated with disturbance of unpaved haul roads, wind erosion of exposed surfaces, and other activities in which soil is removed and redistributed.
Greenhouse gas	Gas that contributes to the greenhouse effect by absorbing infrared radiation and ultimately warming the atmosphere. GHGs include water vapor, nitrous oxide, methane, CO ₂ , O ₃ , halogenated fluorocarbons, hydrofluorocarbons, and perfluorinated carbons.

***Please refer to acronyms list for definitions of acronyms used below.**

Term	Definition
Groundwater	Water obtained from an underground source (i.e., from an aquifer); may supply wells and/or springs.
Growth faults	Faults caused when sediment layers slump or subside at different rates. Growth faults are common along the Gulf of Mexico.
Hazardous waste	Waste that exhibits at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity), or that is specifically listed by the EPA as a hazardous waste. Hazardous waste is regulated under RCRA Subtitle C.
Historic Property	Prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places.
Laydown area	Material and equipment storage area during the construction phase of a project.
Lithic scatter	Concentration of waste flakes resulting from the manufacture of stone tools.
Low income population	A community that has a proportion of low-income population greater than the respective average.
Major aquifers	Aquifers that produce large amounts of water over large areas.
Megawatt	Unit of power equal to 1 million watts. A power plant with 1 MW of capacity operating continuously for one year could supply electricity to approximately 750 households.
Minor aquifers	Aquifers that produce minor amounts of water over large areas or large amounts of water over small areas.
Minority	Individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.
Minority population	Identified where either more than 50% of the population of the affected area is minority, or the affected area's minority population percentage is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.
Mitigation	Efforts to lessen the severity or to reduce adverse impacts, including: avoiding the impact altogether by not taking a certain action or parts of an action; minimizing impacts by limiting the degree or magnitude of the action; repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation; and compensating for the impact by replacing or providing substitute resources or environments.
National Ambient Air Quality Standards	Uniform, national air quality standards established by EPA that restrict ambient levels of certain pollutants to protect public health (primary standards) or public welfare (secondary standards). Standards have been set for CO, lead, NO ₂ , O ₃ , particulate matter, and SO ₂ .
National Environmental Policy Act	Signed into law on January 1, 1970, NEPA declared a national policy to protect the environment and created the Council on Environmental Quality in the Executive Office of the President. To implement the national policy, NEPA requires that environmental factors be considered when federal agencies make decisions, and that a detailed statement of environmental impacts be prepared for all major federal actions significantly affecting the human environment.

***Please refer to acronyms list for definitions of acronyms used below.**

Term	Definition
Nitrogen oxides (NO_x)	A product of combustion by mobile and stationary sources and a major contributor to the formation of O ₃ in the troposphere.
Nonattainment	An area that does not meet air quality standards set by the Clean Air Act for specified localities and time periods; locations where pollutant concentrations are greater than the NAAQS.
Notice of Intent	Notice that an EIS will be prepared and considered. It is published in the <i>Federal Register</i> as soon as practicable after an agency knows that an EIS is required for a proposed action.
Ozone (O₃)	A form of O ₂ found naturally in the stratosphere and that provides a protective layer for shielding the Earth from ultraviolet radiation. O ₃ occurring in the lower atmosphere is harmful and is classified as a criteria pollutant.
Palustrine	Living or thriving in a marshy environment.
Particulate matter	Small particles of solid or liquid materials that, when suspended in the atmosphere, constitute an atmospheric pollutant.
Permeability	Rate at which fluids flow through the subsurface; reflects the degree to which pore space is connected.
Potable water	Water that is safe and satisfactory for drinking and cooking.
Prime farmland	Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion.
Produced water	Brine separated from produced oil or gas at an oil field. Produced water may also be called brine, salt water, or process water.
Proposed Action	The activity proposed to accomplish a federal agency's purpose and need, often requiring an analysis of potential environmental impacts. A proposed action includes the project and its related support activities (pre-construction, construction, and operation, along with post-operational requirements).
Pulverized coal	Crushed coal used to fuel a coal power plant. Currently the principal electric generation technology in the U.S.
Region of influence	The physical area that bounds the environmental, sociologic, economic, or cultural features of interest for the purpose of analysis.
Riparian	Pertaining to, situated, or dwelling on the bank of a river or other body of water.
Scoping meeting	An early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action.
Scrubber	A device that removes noxious gases (such as SO ₂) from flue gases by using absorbents suspended in liquid solution.
Scrub-shrub	Woody vegetation less than 20 feet (6 meters) tall. Species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions.
Sediment	Material that has been eroded, transported, and deposited by erosional processes, typically wind, water, and/or glaciers.
Sedimentation	The process or action of depositing sediment.

***Please refer to acronyms list for definitions of acronyms used below.**

Term	Definition
Seismic	Pertaining to, characteristic of, or produced by earthquakes or Earth vibrations.
Sensitive receptor	As used in this analysis, any specific resource (i.e., population or facility) that would be more susceptible to the effects of the impact of implementing the proposed action than would otherwise be.
Sequestration	Process of injecting the CO ₂ captured from an industrial or energy-related source into deep subsurface geologic formations for long-term storage.
Slipstream	The portion or percentage of the flue gas exhaust that is diverted to another location for alternative uses, including monitoring, research, or separate testing.
Stream	A continually, frequently, or infrequently flowing body of water that follows a defined course. The three classes of streams are: ephemeral—a channel that carries water only during and immediately following rainstorms; intermittent—a watercourse that flows in a well-defined channel during the wet seasons of the year, but not the entire year; and perennial—a watercourse that flows throughout the year or more than 90% of the time in a well-defined channel.
Sulfur dioxide (SO₂)	A heavy, pungent, colorless, gaseous air pollutant formed primarily by the combustion of fossil fuels.
Supercritical CO₂	CO ₂ usually behaves as a gas in air or as a solid known as dry ice. If the temperature and pressure are both increased (above its supercritical temperature of 88°F [31.1°C] and 73 atmospheres [1073 psi]), it can adopt properties midway between a gas and a liquid, such that it expands to fill its container like a gas, but has a density like that of a liquid.
Surface water	All bodies of water on the surface and open to the atmosphere, such as rivers, lakes, reservoirs, ponds, seas, or estuaries.
Topography	The configuration of a surface including its relief and position of the natural and manmade features.
Topsoil	The upper native soil layer; generally the layer that supports plant growth.
Turbidity	Capacity of material suspended in water to scatter light. Highly turbid water is often called muddy, although all manner of suspended particles contribute to turbidity.
Underground Source of Drinking Water	Any aquifer or part of an aquifer that (1) supplies any public water system; or (2) contains a sufficient quantity of groundwater to supply a public water system, and currently supplies drinking water for human consumption or contains fewer than 10,000 milligrams per liter of total dissolved solids; and (3) is not an exempted aquifer.
Vibration	Force that oscillates about a specified reference point. Vibration is commonly expressed in terms of frequency, such as cycles per second, Hertz, cycles per minute, or strokes per minute.
Viscosity	Measure of a fluid's resistance to flow.

***Please refer to acronyms list for definitions of acronyms used below.**

Term	Definition
Volatile organic compound	A VOC is one of a group of carbon-containing compounds that evaporate readily at room temperature. As defined in 40 CFR 51.100(s), a VOC is any compound of carbon that participates in atmospheric photochemical reactions, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, and other organic compounds designated by EPA as having negligible reactivity.
Wastewater	A combination of liquid and water-carried wastes from residences, commercial buildings, and/or industrial facilities.
Wetland	<p>An area that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions.</p> <p>Wetlands generally include swamps, marshes, bogs, and similar areas and have the following general characteristics:</p> <ol style="list-style-type: none">(1) Vegetation typically adapted to inundated or saturated soil conditions;(2) Hydric soils or soils associated with low oxygen conditions; and(3) The area is inundated either permanently or periodically at mean water depths less than 6.6 feet, or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation.

INTRODUCTION

The United States (U.S.) Department of Energy (DOE) prepared this Environmental Impact Statement (EIS) to evaluate the potential impacts associated with its Proposed Action to provide financial assistance to NRG Energy, Inc. (NRG) and with NRG's proposed W.A. Parish **Post-Combustion Carbon Dioxide (CO₂)** Capture and Sequestration Project (Parish PCCS Project). DOE's Proposed Action is to provide \$167 million in cost-shared funding to support construction and operation of NRG's proposed Parish PCCS Project under the Clean Coal Power Initiative (CCPI) Program. Congress established the CCPI Program to enable and accelerate the deployment of advanced technologies to promote clean, reliable, and affordable electricity for the U.S. The CCPI operates as a cost-shared partnership between government and industry to develop and demonstrate advanced coal-based power generation technology at the commercial scale. DOE selected NRG's Parish PCCS Project and four other projects during the CCPI Round 3 solicitation.

NRG's proposed Parish PCCS Project would construct a CO₂ capture facility at NRG's 4,880-acre W.A. Parish Plant in rural Fort Bend County near the small town of Thompsons, Texas. The CO₂ capture facility would use an advanced amine-based carbon dioxide absorption technology to capture at least 90% of the CO₂ from a 250-megawatt equivalent (MWe) portion of the flue gas exhaust from Unit 8 at the W.A. Parish Plant. The project would be designed to capture approximately 1.6 million tons of CO₂ per year from the plant exhaust that the facility would otherwise emit to the atmosphere. The captured CO₂ would be compressed and transported via a new approximately **81**-mile-long, 12-inch-diameter underground pipeline to the existing West Ranch oil field in Jackson County, Texas, near the town of Vanderbilt. The CO₂ would be used for enhanced oil recovery (EOR) and ultimately sequestered in geologic formations approximately 5,000 to 6,300 feet below ground surface (bgs).

DOE is the lead federal agency responsible for preparation of this EIS. DOE prepared the EIS pursuant to the National Environmental Policy Act (NEPA) and in compliance with the Council on Environmental Quality (CEQ) implementing regulations for NEPA (40 Code of Federal Regulations [CFR] 1500 through 1508) and DOE NEPA procedures (10 CFR 1021). The EIS also evaluates the potential environmental impacts of the Parish PCCS Project as part of DOE's decision-making process to determine whether to provide NRG with financial assistance for the project.

DOE'S PURPOSE AND NEED

The *purpose* of DOE's Proposed Action under the CCPI Program is to demonstrate advanced coal-based technologies at a commercial scale that capture and geologically sequester CO₂ emissions. The principal *need* addressed by DOE's Proposed Action is to satisfy the responsibility Congress imposed on DOE to demonstrate advanced coal-based technologies that can generate clean, reliable, and affordable electricity in the U.S. The CCPI Program selects projects with the best chance of achieving the program's objectives as established by Congress: commercialization of clean coal technologies that advance efficiency, environmental performance, and cost competitiveness well beyond the level of technologies currently in commercial service.

The proposed project would help DOE, through the CCPI Program, meet its congressionally mandated mission to support advanced clean-coal technology projects. This specifically includes those projects that have progressed beyond the research and development stage to a point of readiness for operation at a scale that, once demonstrated, can be readily implemented across the commercial sector. Post-combustion CO₂ capture offers the greatest near-term potential for reducing power sector CO₂ emissions because it can be used to retrofit existing coal-based power plants and can also be tuned for various levels of CO₂ capture, which may accelerate market acceptance (NETL 2010a). A successful commercial-scale demonstration of amine-based carbon capture technology at NRG's W.A. Parish Plant with beneficial use of the CO₂ at an existing oil field would also generate technical, environmental, and financial data from the design, construction, and operation of the CO₂ capture facility, pipeline, and EOR/ CO₂ monitoring facilities at the oil field. These data would be used to evaluate whether the deployed technologies could be effectively and economically implemented at a commercial scale.

NRG'S PROJECT OBJECTIVES

Consistent with DOE's requirements under CCPI Round 3, NRG identified the following objectives for the Parish PCCS Project:

- Demonstration of an advanced amine-based CO₂ absorption technology;
- Integration of a custom-built cogeneration plant into the project to meet the specific power and steam requirements of the CO₂ capture system;
- Demonstration of EOR with CO₂ sequestration in a nearby oil field; and
- Demonstration of a CO₂ monitoring program.

ALTERNATIVES CONSIDERED BY DOE

Section 102 of NEPA requires that agencies discuss the reasonable alternatives to the Proposed Action in an EIS. The term "reasonable alternatives" is not self-defining, but rather must be determined in the context of the purpose expressed by the underlying legislation. The purpose and need for a federal action determines the reasonable alternatives for the NEPA process. Any reasonable alternative to the Proposed Action must be capable of satisfying the purpose and need of the CCPI Program.

The alternatives considered by DOE were limited to the applications submitted to DOE in response to requirements specified in the CCPI Round 3 solicitation. DOE considered all the applications that met the mandatory eligibility requirements as expressed in the funding opportunity announcement. In a competitive process, DOE can only consider site or technology combinations included in the applications received. The applicant must provide at least a 50–50 cost share and bears the responsibility for designing and executing the project. DOE's action concerning these applications was to decide which projects

would receive DOE financial assistance from among the eligible applications submitted. Unlike a project owned by DOE, when projects are selected in a competitive process in response to a funding opportunity announcement, DOE does not make decisions concerning the location, layout, design, or other features of the project. In other words, DOE must select among the eligible projects submitted to DOE by the applicants. DOE cannot re-write an applicant's proposal and thereby compromise an open, fair, and competitive funding opportunity. DOE's initial decision is to select projects to receive federal financial assistance for a project definition phase, prior to DOE's final decision.

After DOE selects a project for an award, the range of reasonable alternatives becomes the project as proposed by the applicant, any alternatives still under consideration by the applicant, and the no action alternative. DOE's final decision, documented in a Record of Decision (ROD), is to either accept or reject the project as proposed by the proponent, including its proposed technology and selected sites. However, DOE may specify mitigation measures that would be required as part of the proposed project.

No-Action Alternative

Under the No-Action Alternative, DOE would not provide cost-shared funding for the proposed Parish PCCS Project. In the absence of DOE cost-shared funding, NRG could still elect to construct and operate the proposed project; therefore, the DOE No-Action Alternative could result in one of **three** potential scenarios:

- The proposed Parish PCCS Project would not be built; or
- The proposed Parish PCCS Project would be built by NRG without benefit of DOE cost-shared funding.
- **NRG plans to construct a natural gas-fired cogeneration plant without the benefit of DOE cost-shared funding, either as a stand-alone project or as part of the Parish PCCS Project.**

DOE assumes that if NRG proceeded with project development in the absence of DOE cost-shared funding, the project would include the features, attributes, and impacts as described for the proposed project. However, without DOE participation, it is possible that the project would be canceled. Therefore, for the purposes of analysis in this EIS, the DOE No-Action Alternative is defined as the No-Build Alternative. This means that the project would not be built and environmental conditions would not change from the current baseline (i.e., no new construction, resource use, or CO₂ capture and storage would occur).

Therefore, under the No-Action Alternative, the project technologies (i.e., large-scale CO₂ capture and geologic sequestration) may not be implemented in the near term. Consequently, commercialization of these technologies for large-scale, coal-fired electric generation facilities would be postponed and may not be realized. This scenario would not contribute to the CCPI goals to invest in the demonstration of advanced coal-based power generation technologies that capture and sequester, or put to beneficial use, CO₂ emissions. While the No-Action Alternative would not satisfy the purpose and need for the Proposed Action, this alternative was retained for comparison to the effects of the proposed project, as required under CEQ Regulations (40 CFR 15012.14). The No-Action Alternative reflects the current baseline condition and serves as a benchmark against which the effects of the Proposed Action can be evaluated.

NRG plans to proceed with construction and operation of individual project components such as a natural gas-fired cogeneration plant without DOE funding for other purposes not related to the Parish PCCS Project. The construction of the natural-gas cogeneration plant would not be part of the cooperative agreement with DOE. This plant would begin operation in 2013. The initial operation of the electric generating plant would be to provide peaking power for other NRG needs

unrelated to the Parish PCCS Project. At a later date, possibly 2015, the electric generating plant would be used to power the compressors of the carbon capture facility. This would result in a variation of the No-Action Alternative that would have low environmental impacts, primarily in the area of air quality. A discussion of potential air quality impacts is provided in Section 3.2.4, Direct and Indirect Impacts of the No-Action Alternative.

Alternative Project Applications Considered During the CCPI Procurement Process

DOE's alternatives for CCPI – Round 3 consisted of the other eligible applications received in response to FOA DE-FOA-0000042, *Clean Coal Power Initiative - Round 3, Amendments 005 and 006*. DOE received 36 applications that met the minimum eligibility requirements listed in the FOA under Round 3 of the CCPI. These applications provided DOE with a range of options for meeting the objectives of Round 3 of the CCPI. DOE reviewed each of the 36 applications that met minimum eligibility requirements to evaluate potential environmental consequences and made preliminary determinations regarding the level of NEPA review required. DOE documented the potential environmental consequences for each application in an environmental critique that was considered by the selection official. The environmental critique was summarized in a publicly available environmental synopsis, prepared in accordance with DOE's NEPA implementing regulations (10 CFR 1021.216). DOE also reviewed each eligible application for technical and financial merit. Through this review process, DOE considered both potential environmental consequences and the ability of each application to meet DOE's purpose and need.

Considering technical and financial merit along with the potential environmental impacts associated with each application's proposal, DOE ultimately determined that the proposed Parish PCCS Project and four other proposals would best meet the goals and objectives of the CCPI Program. After selection, DOE must complete a project-specific NEPA analysis for each selected project before making a final decision. Although each of these projects is eligible for cost-shared funding under CCPI, no other relationship exists among them. The selection and potential execution of each standalone project has no effect or bearing on the other projects.

NEPA PROCESS

DOE published a Notice of Intent (NOI) to prepare an EIS in the *Federal Register* (FR) on November 14, 2011, under Docket ID No. FR Doc. 2011-29333; (76 FR 70429). The NOI identified potential issues and areas of impact that would be addressed in the EIS. DOE also published notices in local newspapers announcing the public scoping meeting locations and times. DOE held public scoping meetings on November 30, 2011, at the Needville High School in Needville, Texas, and December 1, 2011, at the Jackson County Services Building in Edna, Texas. These two meetings were attended by a total of ten members of the public, including two elected officials, along with project staff from DOE, NRG, and other project partners.

The 30-day public scoping period ended on December 15, 2011. DOE received four scoping comments at the Public Scoping Meetings. These comments, which were delivered verbally at the November 30, 2011 meeting, involved questions about ownership of the pipeline and use of eminent domain to obtain property for the pipeline; availability for inspection of a certified payroll (i.e., to report prevailing wages according to the requirements of the Davis-Bacon Act); how much DOE funding would be provided for the project; water requirements for the CO₂ capture system; and any potential impact on consumers' electricity bills.

DOE distributed the Draft EIS on September 13, 2012 to the elected officials, agencies, Native American tribes, organizations, and members of the public identified in the distribution list found in Chapter 10. DOE filed the Draft EIS with U.S. Environmental Protection Agency (EPA), which published its Notice of Availability in the Federal Register on September 21, 2012 (77 Federal Register 58539). EPA's notice started the 45-day comment period on the Draft EIS, which ran from September 21, 2012 to November 5, 2012.

On September 21, 2012, DOE published its own Notice of Availability of the Draft EIS (77 Federal Register 58533) which also announced two public hearings and gave directions for commenting on the Draft EIS. Public hearings were held in two locations: Thompsons, Fort Bend County, Texas, on October 10, 2012 and Edna, Jackson County, Texas, on October 11, 2012. These hearing locations were selected based on their proximity to the project, venue size, and venue availability. Collectively, 18 members of the public attended the public hearing in the two locations. One individual presented a verbal comment at the hearings. Summaries of the public hearings and comments received during the Draft EIS comment period are provided in Appendix J.

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

During preparation of the Final EIS, DOE considered all comments received on the Draft EIS individually and collectively. An identification number was assigned to each originator of comments, including those at the public hearing. A total of five individuals, tribes, and agencies provided comments on the Draft EIS as follows:

- Two representatives of federal agencies (EPA, U.S. Department of the Interior)
- One representative of a state agency (Texas Parks and Wildlife Department)
- One representative of a Native American Tribe (Coushatta Tribe of Louisiana)
- One representative of the general public (verbal testimony)

After reviewing the comments received, a list of issues was developed. The Final EIS addressed each of these issues, as shown in Table S-1. Appendix J of the Final EIS provides a complete summary of the public hearing for this proposed project as well as DOE's methodology for responding to public comments, copies of the transcript from the public hearing, original comment documents in their entirety, and DOE's response to each comment.

Table S-1 General Comments Received During the Draft EIS Public Comment Period and Related Revisions to the EIS

Issues	Description	Location of Related Revisions in Final EIS
Use of coal as fuel	Comment expressed concern about emissions from coal burning.	Response provided in Appendix J, Attachment 7
Use of NO ₂ emission credits to offset VOC emission	Commenter concurred with use of credits and indicated that Texas Commission on Environmental Quality (TCEQ) approval is needed.	Section 3.2

Table S-1 General Comments Received During the Draft EIS Public Comment Period and Related Revisions to the EIS

Issues	Description	Location of Related Revisions in Final EIS
Use of Horizontal Directional Drilling (HDD) to cross under waterways	Commenter recommended use of HDD to cross under perennial waterways with unique characteristics.	Section 3.9
Mitigation of wetlands impact	Commenter recommended verification of extent of Traditional Navigable Waters and provision of compensatory mitigation for permanent impacts to 7.4 acres of wetlands. Also recommended use of approved wetland functional assessment models to determine wetland types and extent of mitigation required to restore unavoidable adverse impacts to Waters of the U.S.	Section 3.8
Impacts on state or global rare plant communities	Commenter recommended use of TPWD's Rare Plant Communities List to identify rare plant communities and contacting TPWD to discuss mitigation if impacts are identified.	Section 3.9; and addressed in Appendix J, Attachment 7
Environmental Justice Analysis	Commenter noted that environmental justice applicability analysis in Draft EIS appears to be flawed and/or misleading, and recommended that environmental justice impact be properly addressed by following the Council on Environmental Quality's environmental justice guidelines and Executive Order 12898.	Section 3.19
Mitigation measures for construction-related emissions	Commenter recommended use of mitigation measures to reduce impacts of NO _x , CO, PM, SO ₂ , and other pollutants from construction activities. Measures include dust source controls, mobile and stationary source controls, and administrative controls.	Section 4

Table S-1 General Comments Received During the Draft EIS Public Comment Period and Related Revisions to the EIS

Issues	Description	Location of Related Revisions in Final EIS
Threatened and Endangered Species	Commenter recommended that Threatened and Endangered Species information be in compliance with U.S. Fish and Wildlife Service Consultation Handbook.	Section 3.9, and addressed in Appendix J, Attachment 7
Whooping cranes in Fort Bend and Wharton counties, Texas	Commenter noted that lack of documented sightings of whooping cranes within the region of influence is not sufficient data to predict where whooping cranes may be found in the future.	Section 3.9
Bald eagle nests	Commenter recommended conducting additional surveys for bald eagle nests.	Section 3.9
Protection of fresh water mussel species	Commenter recommended use of silt fences and filter fabric to reduce sedimentation in the Colorado River and tributaries, review of Best Management Practices, and coordination with the U.S. Fish and Wildlife Service's Clear Lake Ecological Services Field Office.	Section 3.9
Impacts on migratory birds	Commenter recommended consultation with U.S. Fish and Wildlife Service's Region 2 Migratory Bird Program for specific nesting seasons, and avoidance of habitat alteration, removal, or destruction during nesting system. Also recommended use of surveys to determine presence of migratory birds prior to construction, down-shielding of bright lighting, use of alternative routes and directional drilling, and adherence to pipeline conditions from the USACE.	Section 3.9

SUMMARY OF CHANGES IN THE ENVIRONMENTAL IMPACT STATEMENT

Since publication of the Draft EIS in September 2012, NRG has made some refinements to its proposed project and provided supplemental information. These refinements are reflected in the analysis in the Final EIS text.

- At its option, NRG would proceed with construction of a natural gas-fired cogeneration plant without DOE cost sharing and would begin operation in 2013. The initial operation of the electric generating plant would be to provide peaking power for other NRG needs that are unrelated to the Parish PCCS Project. At a later date, possibly 2015, the electric generating plant would be used to power the compressors of the carbon capture facility. The potential environmental impacts of the construction and operation of the electric generating plant have not been separated from the other components of NRG's proposed project to retain a conservative upper estimate of environmental impacts.
- NRG has made minor realignments to its proposed route to accommodate landowner concerns or to allow for better access for directional drilling to place the proposed pipeline under a paved road. The proposed route was modified to accommodate landowner concerns in two notable areas; between milepost 33 and milepost 38; and, between milepost 47 and milepost 49. As a result of the realignments, the proposed route is now approximately 81 miles long, an increase of approximately 1 mile. The realignments are illustrated in a set of maps in Appendix D-4.
- NRG has increased the length of access roads that they expect to use and potentially improve from approximately 40 miles to 43 miles.
- As a result of NRG's changes in the pipeline alignment and access roads, the approximate overall amount of land that would be included in the pipeline ROW and access roads would increase from 1,028 to 1,197 acres.
- Additional field surveys were conducted to identify occurrences of freshwater mussels in waterways that would be crossed by the pipeline as requested by the Texas Parks and Wildlife Department. The methodology and results of the mussel investigations are described in Section 3.9.2.1.3.
- Trenching investigations were conducted to identify subsurface cultural resource features at river and stream crossings where horizontal directional drilling (HDD) techniques would be used, as requested by the Texas Historical Commission. The trenching methodology and results are described in Section 3.10.
- The realigned pipeline corridor was evaluated for changes in risk to human health due to an unlikely sudden release of CO₂. The updated results and figures are included in Appendix F, Risk Evaluation and in Section 3.15. Revisions to the cumulative effects analysis were made to include the potential for impacts to freshwater mussels identified after publication of the Draft EIS (see Section 5, Cumulative Impacts).
- Appendix J was added to Volume II, and provides a description of the public hearing, DOE's methodology for responding to public comments, a copy of the transcript from the public hearing and original comment documents in their entirety, and DOE's response to each comment.
- A description of the public hearings that were held in October 2012 is provided in Section 1.7 and in Appendix J of Volume II.

DESCRIPTION OF NRG'S PROPOSED PROJECT

NRG's proposed project consists of four components: a CO₂ capture facility and supporting infrastructure at the W.A. Parish Plant, a CO₂ pipeline, EOR operations at the West Ranch oil field, and a CO₂ monitoring program at the oil field. The design, construction, and operation of the CO₂ capture facility and the design and implementation of the CO₂ monitoring program are the primary focus of the DOE's Proposed Action. The CO₂ pipeline and EOR components of NRG's proposed project are connected actions that would not be conducted if not for the Proposed Action. Each of the four components of the Parish PCCS Project is summarized below and in Table S-2. Figure S-1 shows the general location of the proposed project components. Figure S-2 presents an overall schematic of the PCCS concept.

1. **CO₂ Capture Facility:** The proposed project would retrofit one of the W.A. Parish Plant's existing coal-fueled units (Unit 8) with a post-combustion CO₂ capture system constructed within the existing W.A. Parish Plant site. A new natural gas-fired cogeneration plant, estimated to be 80 MW in size, would also be constructed on the plant property to produce the auxiliary power and steam needed by the proposed CO₂ capture system. The captured CO₂ would be compressed to the pipeline pressure (i.e., 2,115 pounds per square inch absolute [psia]) and dehydrated within the CO₂ capture facility before delivery to the CO₂ pipeline. The compressed CO₂ would be a supercritical fluid (i.e., resembling a liquid but expanding to fill space like a gas) with a density heavier than air and a very low viscosity (i.e., flows readily).
2. **CO₂ Pipeline:** Captured CO₂ would be transported via a new, approximately **81**-mile-long, 12-inch-diameter underground pipeline to the West Ranch oil field, located near the city of Vanderbilt in Jackson County, Texas. The anticipated pipeline route includes mostly rural and sparsely-developed agricultural lands in Fort Bend, Wharton, and Jackson Counties. NRG plans to use existing mowed and maintained utility rights-of-way (ROWs) to the extent practicable to minimize environmental impacts and avoid sensitive resources. As proposed, NRG's pipeline would be collocated along or within existing mowed and maintained utility ROWs (i.e., high-voltage transmission line [HVTL] and pipeline ROWs) for approximately **75%** of the route. A joint venture between NRG and Hilcorp Energy Company (HEC), known as Texas Coastal Ventures LLC (TCV), would operate the pipeline.
3. **EOR Operations:** The Parish PCCS Project would deliver up to 1.6 million tons of CO₂ per year to the West Ranch oil field, where the CO₂ would be injected into the 98-A, 41-A, Glasscock, and Greta sand units of the Frio Formation, which lie approximately 5,000 to 6,300 feet bgs. The portions of the West Ranch oil field in which EOR operations would be conducted are currently owned or leased by TCV. HEC has been contracted to conduct the EOR operations.
4. **CO₂ Monitoring Program:** TCV would implement a program to monitor the injection and migration of CO₂ within the geologic formations at the EOR site based on a CO₂ Monitoring Plan developed in cooperation with the Texas Bureau of Economic Geology (BEG). In addition to satisfying the CO₂ monitoring requirements of the CCPI Program, the CO₂ monitoring program that would be conducted at the West Ranch oil field would be designed to satisfy the monitoring, sampling, and testing requirements of the Railroad Commission of Texas (RRC) certification program for tax exemptions related to use of CO₂ for EOR and use of CO₂ from anthropogenic sources.

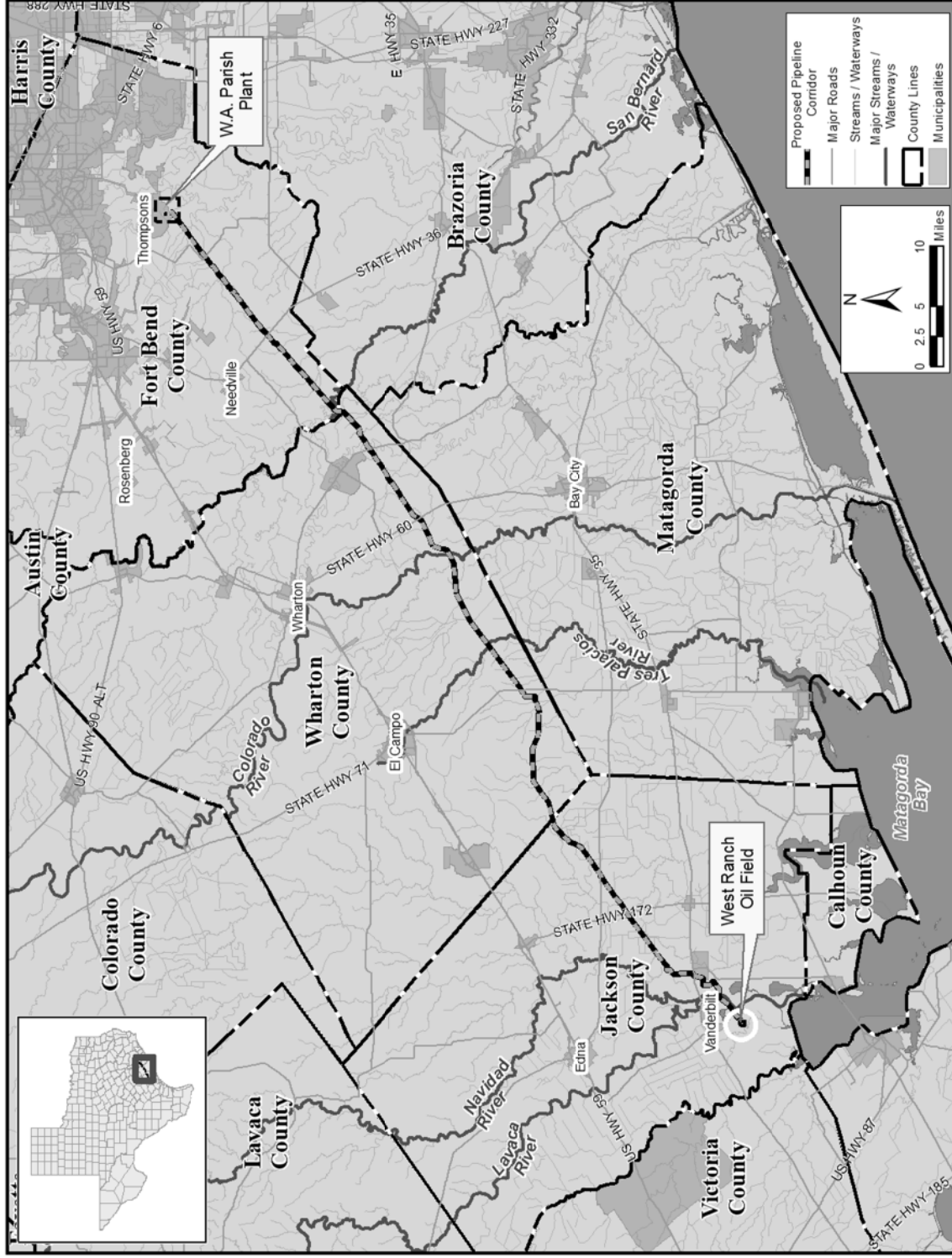


Figure S-1. Map of Project Area

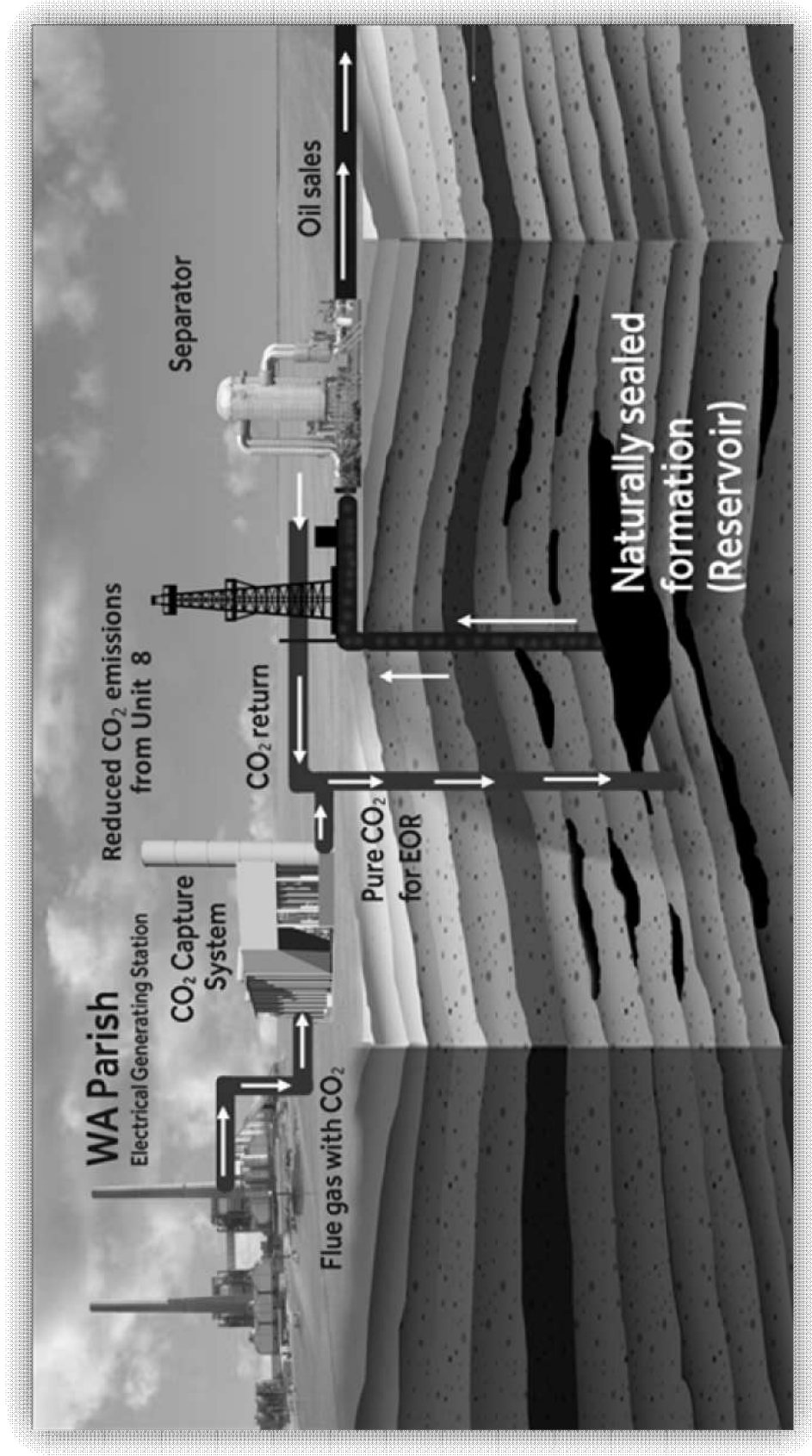


Figure S-2. Schematic of the PCCS Concept

Table S-2. Proposed Parish PCCS Project Features

Project Component	Description	Characteristics (Approximate Dimensions)
CO₂ Capture Facility	<p>Location: A CO₂ capture facility would be constructed at NRG's W.A. Parish Plant. The facility would use an advanced amine-based absorption technology to capture CO₂ from a 250-MW flue gas slipstream at the plant's 650-MW Unit 8 pulverized coal-fired electric generating unit.</p> <p>Capacity: Approximately 1.6 million tons of CO₂ per year.</p>	<p>Facility Footprint: 29 acres, as shown in Figure S-3</p>
CO₂ Pipeline	<p>Route: A new, approximately 81-mile-long, 12-inch-diameter underground pipeline would be collocated along or within existing mowed and maintained utility ROWs for approximately 75% of its length. Aboveground facilities would include approximately 12 main line valves (MLVs) and two meter stations. One meter station would be located within the W.A. Parish Plant. The second meter station would be located near milepost (MP) 77.</p> <p>Operator: TCV would own, operate, and maintain the pipeline.</p>	<p>Construction ROW Width: Generally 100 feet, reduced to 75 feet in some areas to minimize impacts to wetlands</p> <p>Permanent ROW Width: 30 feet</p> <p>MLV Area: 100 square feet</p> <p>Meter Station Area: 0.25 acres</p>
EOR Operations	<p>Location: The approximately 5,500-acre EOR area would be located within the portion of the West Ranch oil field currently owned/leased by TCV. A central CO₂ recycle facility would be constructed near the center of the EOR area in a disturbed area previously occupied by a gas processing facility.</p> <p>Quantity: TCV estimates that approximately 9 injection wells and 16 production wells would be used initially for EOR operations. As many as 130 injection wells and 130 production wells would be used over the 20-year span of the project. Existing wells at the West Ranch oil field would be used (i.e., refurbished or deepened as needed) to the extent practicable for the proposed project. New injection wells would be drilled if the existing wells cannot be reworked for injection. New wells would be installed on existing well pads to the extent practicable. As shown in Figure S-4, injection and production wells would be arranged in overlapping 5-spot patterns. Each 5-spot pattern would consist of four injection wells surrounding one production well. Each injection well would be installed to a sufficient depth that it could be used for injection into the 98-A, 41-A, Glasscock, and Greta sand units. A schematic illustrating the EOR process is provided in Figure S-5.</p>	<p>Facility Footprint: 5,500 acres</p> <p>Well Configuration: Overlapping, 5-spot patterns, 40 acres each pattern</p> <p>Well Depths: 5,000 to 6,300 feet bgs</p> <p>Well Construction Areas: 0.5 to 2.0 acres per well site</p> <p>Well Operational Areas: 0.01 to 0.5 acres per well site</p> <p>CO₂ Recycle Facility Area: 250 feet by 250 feet (1.5 acres)</p>
CO₂ Monitoring Program	<p>Location: Each monitoring well would be located within approximately 1,500 to 3,000 feet of an injection well. Existing wells would be used to the extent practicable to minimize the number of new wells needed.</p> <p>Quantity: Approximately 10 to 13 monitoring wells (i.e., one monitoring well for each 10 to 15 injection wells), including some wells monitoring above the injection zones and some monitoring within the injection zones.</p>	<p>Well Depths: 1,500 to 6,300 feet bgs</p> <p>Well Construction Areas: 0.5 to 2.0 acres per well site</p> <p>Well Operational Areas: 0.01 to 0.5 acres per well site</p>

Table S-2. Proposed Parish PCCS Project Features

Project Component	Description	Characteristics (Approximate Dimensions)
<p>Access Roads</p>	<p>W.A. Parish Plant: As shown in Figure S-3, one road (approximately 1,000 feet long, included in 29-acre area discussed above) would be relocated.</p> <p>CO₂ Pipeline: Approximately 43 miles of existing roads would be used to access the construction ROW. Some roads may be upgraded (i.e., resurfaced and/or widened) to make them suitable for use by construction equipment.</p> <p>West Ranch oil field: Existing roads would be used to the extent practicable to access EOR and CO₂ monitoring areas. No new road construction is anticipated.</p>	<p>Construction Width: 30 feet</p> <p>Permanent Width: 20 feet</p>

bgs = below ground surface; CO₂= carbon dioxide; EOR = enhanced oil recovery; MLV = main line valve; MP = milepost; MW = megawatt; MWe = megawatt equivalent; ROW = right-of-way; tpy = tons per year; TCV = Texas Coastal Ventures LLC; UIC = Underground Injection Control



Figure S-3. Aerial Photo of W.A. Parish Plant Showing Areas Related to CO₂ Capture Facility Construction and Operations
CO₂ = carbon dioxide; HDD = horizontal directional drill; kV = kilovolt

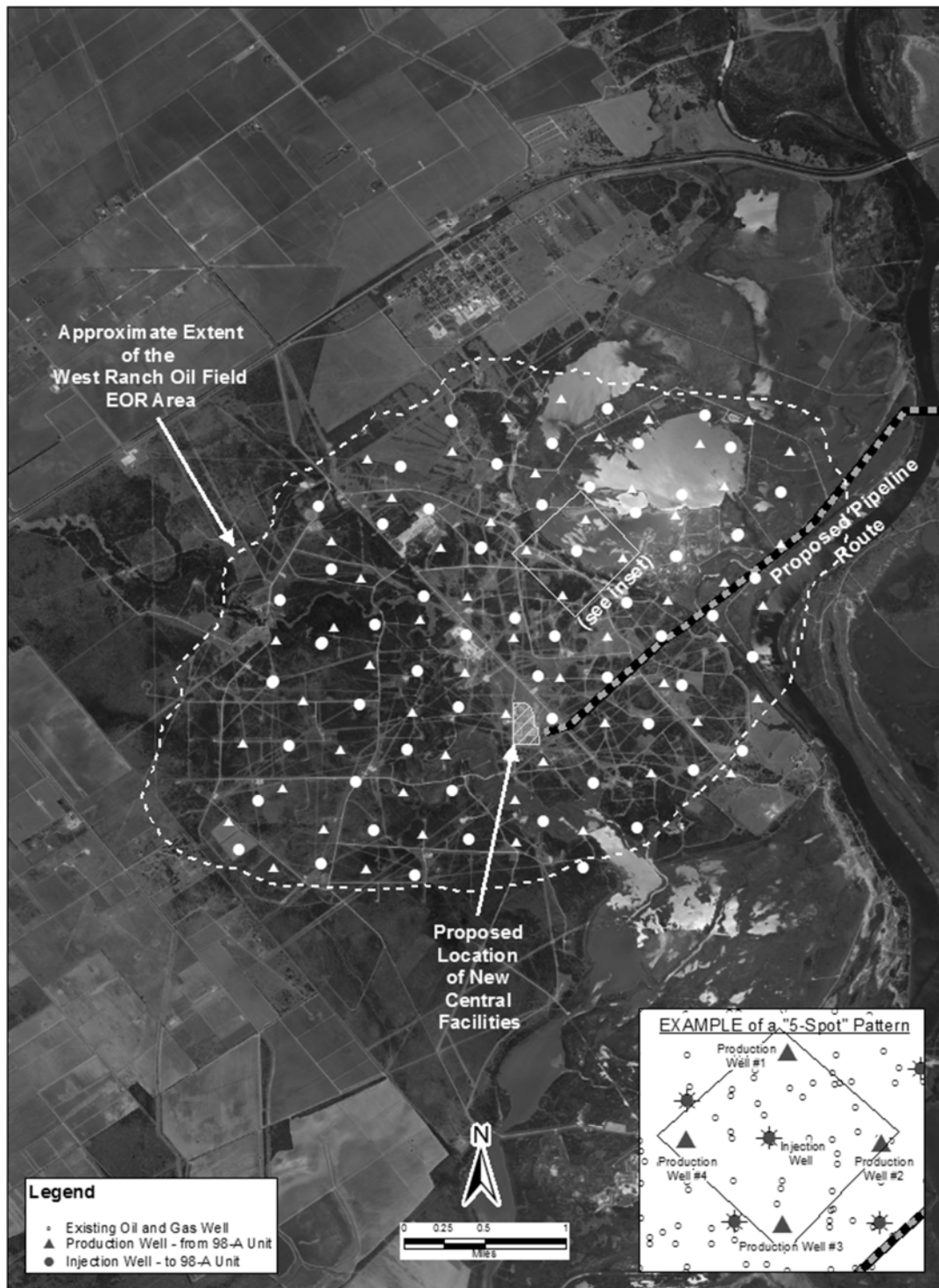


Figure S-4. Map of West Ranch Oil Field Showing Conceptual Arrangement of Injection and Production Wells for Proposed CO₂ Flood

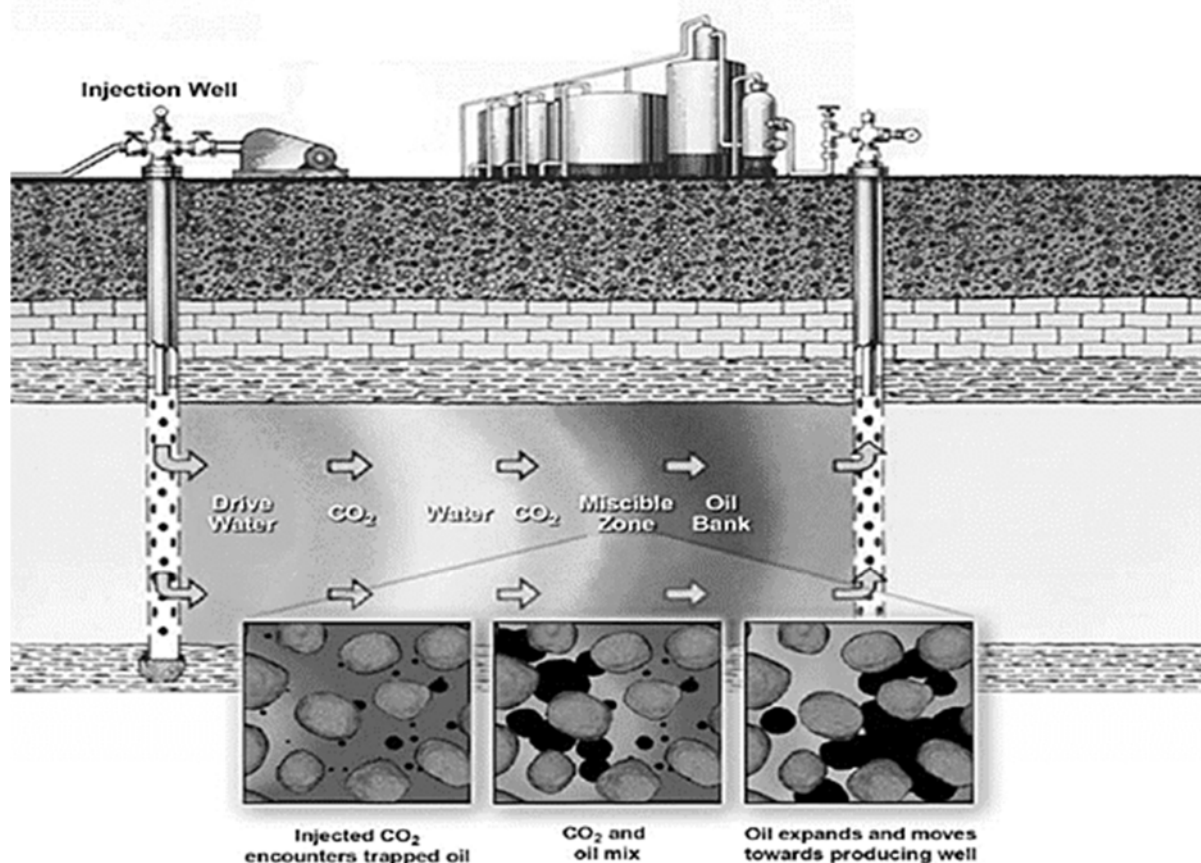


Figure S-5. Enhanced Oil Recovery Schematic

Source: NETL 2010.

The demonstration phase of the proposed project is currently scheduled to last for 35 months, according to the terms and conditions of the cooperative agreement between DOE and NRG. NRG would ultimately determine how long to continue running the CO₂ capture system following the demonstration phase based on a variety of factors, including potential future CO₂ legislation and regulations, process performance, and overall economics. For the purposes of this EIS, DOE assumes the CO₂ capture system would continue to operate for 20 years.

CO₂ capture facility construction is planned to start in **mid-2013**, at the earliest, and take approximately 24 months to complete. Construction would be followed by a three- to six-month commissioning and start-up period to verify that all process systems function properly and achieve project requirements. The phases of construction would include site grading and preparation, the erection of administrative facilities, installation of piles and foundations, assembly of structural steel and building enclosures, and installation of mechanical and electrical systems. The number of construction workers would vary during the two-year construction period, ranging from 250 to 600 persons during the various phases of construction and averaging approximately **300** personnel. The largest demand for construction workers would likely occur approximately six months after the start of construction, when approximately 600 construction workers would be on site to construct the mechanical and electrical systems. Construction materials and equipment would be delivered by trucks and rail; however, construction-related rail traffic would be minimized to reduce the potential for disruption of coal deliveries. To operate the systems installed as part

of the Parish PCCS Project, the W.A. Parish Plant would require approximately 15 additional full-time personnel.

Construction of the proposed CO₂ pipeline would take place over approximately six months beginning in **July 2014**. Construction techniques may include excavated trenching, boring, tunneling, and horizontal directional drilling (HDD). During pipeline construction, materials would be staged adjacent to the pipeline ROW or trucked in as necessary. The phases of construction would include clearing the ROW of trees and brush; grading the ROW; trenching or drilling, as applicable; pipe welding; pipe inspection; application of coating to welded areas; placing pipe; hydrostatic testing; backfilling; and site restoration. The pipeline would be covered by a minimum of three feet of compacted soil, but would be buried deeper (e.g., minimum of four feet in cultivated areas) or would be encased in reinforced concrete when needed to accommodate planned surface activities. During trenching in agricultural areas and wetlands, topsoil would be temporarily stored separately from other excavated material and would be replaced as the upper-most soil layer following pipeline construction. NRG's current project design would use HDD construction techniques in **six** sections of the proposed pipeline corridor, including **the section between the CO₂ capture facility and the CenterPoint ROW, and** five large water body crossings (i.e., Big Creek, San Bernard River, Colorado River **and** Jones Creek [**as one HDD**], Lavaca River, **and Menefee Bayou**). NRG's current design also includes conventional bores for most road crossings to minimize traffic disruption. The pipeline construction workforce would average **250** workers and reach a peak of 500 workers over the six-month construction period. Construction activities would generally be conducted 10 hours per day and six days per week. Approximately two full-time personnel would be required for pipeline operations.

The proposed pipeline would deliver CO₂ to the West Ranch oil field at a central CO₂ recycle facility, which would be constructed in an area previously occupied by an oil field gas processing facility. The CO₂ recycle facility would likely be constructed using skid-mounted equipment on gravel pads and would require a work force of approximately 12 workers during the three-month construction period. TCV estimates that approximately 9 injection wells and 16 production wells would be used initially. The number of injection and production wells would increase over the duration of the project to as many as 130 injection wells and 130 production wells. TCV plans to use existing wells (i.e., refurbished or deepened as needed) to the extent practicable for the proposed project. New injection wells would be drilled if the existing wells cannot be reworked for injection. All new injection wells would require UIC permits and TCV would install the new injection wells in accordance with the design standards specified by the RRC UIC Program. New wells would be installed on existing well pads to the extent practicable. Because some EOR operations would be automated, TCV anticipates that no additional operations personnel would be required for the EOR operations. TCV and the BEG are in the process of developing a CO₂ Monitoring Plan, scheduled for completion in early 2013, to define the particular activities that would be conducted as part of the CO₂ monitoring program for the West Ranch oil field. TCV and the BEG would conduct a variety of monitoring and modeling activities as part of this program to monitor the injection and migration of CO₂ within the geologic formations at the EOR site. As discussed in Chapter 2 of this EIS (Proposed Action and Alternatives), these monitoring and modeling activities may include preparing static and dynamic reservoir models of the proposed EOR area; conducting well integrity reviews and inspections; performing borehole seismic surveys and/or gravity surveys; performing gas tracer tests; and conducting groundwater and soil gas monitoring around the proposed EOR area. Approximately three full-time personnel would be required to implement the CO₂ monitoring program.

Table S-3 summarizes some of the key requirements and characteristics of the Parish PCCS Project.

Table S-3. Project Requirements and Characteristics Summary

Requirement/ Characteristic	Description	Source/Provider
Potable Water	<p>W.A. Parish Plant: <i>Construction:</i> Approx. 10,800 gpd; <i>Operations:</i> Approx. 450 gpd</p> <p>Pipeline: <i>Construction:</i> Approx. 12,750 gpd</p> <p>West Ranch: Negligible additional water</p>	<p>W.A. Parish Plant: <i>Construction:</i> W.A. Parish Plant and other local sources; <i>Operations:</i> Existing W.A. Parish Plant groundwater wells</p> <p>Pipeline: <i>Construction:</i> local sources</p> <p>West Ranch: On-site groundwater wells</p>
Industrial Water	<p>W.A. Parish Plant: <i>Construction:</i> Approx. 12,000 gpd over 24-month construction phase for dust control and general washdown and Approx. 3.5 million gallons for hydrotesting and system startup; <i>Operations:</i> Approx. 4 to 5 mgd (approx. 3.6 to 4.9 mgd for cooling tower make-up water, 0.1 mgd for the CT/HRSG, and 0.1 mgd for CO₂ capture system)</p> <p>Pipeline: <i>Construction:</i> Approx. 1.75 million gallons</p> <p>West Ranch: Negligible additional water needed; produced water would be used for anticipated industrial purposes</p>	<p>W.A. Parish Plant: Smithers Lake (new intake point) and existing W.A. Parish Plant groundwater wells</p> <p>Pipeline: <i>Construction:</i> trucked in or obtained from surface water</p> <p>West Ranch: On-site groundwater wells</p>
Electricity Required during Operations	<p>W.A. Parish Plant: <i>Operations:</i> Approx. 50 MW (full-load)</p> <p>Pipeline: <i>Operations:</i> To be determined during detailed design (for meter station)</p> <p>West Ranch: <i>Operations:</i> Approx. 36 MW for CO₂ compressor.</p>	<p>W.A. Parish Plant: proposed 80-MW cogeneration plant</p> <p>Pipeline: Drop line from existing retail power provider</p> <p>West Ranch: Purchase from existing retail power supplier</p>
Sanitary Wastewater	<p>W.A. Parish Plant: <i>Construction:</i> Approx. 5,625 to 11,250 gpd; <i>Operations:</i> Approx. 225 to 450 gpd</p> <p>Pipeline: <i>Construction:</i> Approx. 4,500 to 9,000 gpd; <i>Operations:</i> Negligible</p> <p>West Ranch: Negligible additional wastewater</p>	<p>W.A. Parish Plant: <i>Construction:</i> portable restroom trailers and local WWTP(s); <i>Operations:</i> W.A. Parish Plant WWTP</p> <p>Pipeline: <i>Construction:</i> portable restroom trailers and local WWTP(s);</p> <p>West Ranch: On-site septic system</p>
Industrial Wastewater	<p>W.A. Parish Plant: <i>Construction:</i> Approx. 3.5 million gallons (from hydrotesting and system startup); <i>Operations:</i> Approx. 7,200 to 36,000 gpd</p> <p>Pipeline: <i>Construction:</i> Approx. 1.75 million gallons</p> <p>West Ranch: Negligible additional water</p>	<p>W.A. Parish Plant: W.A. Parish Plant WWTP</p> <p>Pipeline: Disposed to ground or surface waterbodies per RRC and EPA regulations</p> <p>West Ranch: On-site injection well</p>

Table S-3. Project Requirements and Characteristics Summary

Requirement/ Characteristic	Description	Source/Provider																		
Hazardous Waste Generation	<p>W.A. Parish Plant: Reclaimer effluent would be generated by the CO₂ capture system at a rate of approx. 2,712 lbs per day; Approx. 24 truck shipments per year of reclaimer effluent would be removed from the W.A. Parish Plant.</p> <p>Pipeline: None</p> <p>West Ranch: None</p>	<p>W.A. Parish Plant: Licensed and approved off-site TSDF</p>																		
Solid Waste Generation	<p>W.A. Parish Plant: Rate of waste generation and number of shipments to be determined during detailed design</p> <p>Pipeline: Rate of waste generation and number of shipments to be determined during detailed design</p> <p>West Ranch: Rate of waste generation and number of shipments to be determined during detailed design</p>	<p>W.A. Parish Plant: WMI Coastal Plains or WMI Conroe</p> <p>Pipeline: Organic debris to be burned under controlled conditions within ROW; other waste to nearby landfill</p> <p>West Ranch: Recycled or landfarmed on-site or disposed of at VI Wolf, Inland Environmental, or other nearby landfill</p>																		
Material Transport during Operations	<p>W.A. Parish Plant: Approx. number of truck shipments per year for process materials required for CO₂ capture facility operation:</p> <table border="1" data-bbox="446 1039 974 1543"> <thead> <tr> <th data-bbox="540 1039 649 1066">Materials</th> <th data-bbox="771 1039 966 1066">Truck Shipments</th> </tr> </thead> <tbody> <tr> <td data-bbox="446 1102 682 1129">Amine-Based Solvent</td> <td data-bbox="771 1066 885 1094">24 per year</td> </tr> <tr> <td data-bbox="446 1161 673 1188">10% carbonylhydrazide</td> <td data-bbox="771 1129 868 1157">2 per year</td> </tr> <tr> <td data-bbox="446 1199 714 1226">Ferric chloride coagulant</td> <td data-bbox="771 1188 885 1215">20 per year</td> </tr> <tr> <td data-bbox="446 1257 544 1285">Polymer</td> <td data-bbox="771 1247 868 1274">2 per year</td> </tr> <tr> <td data-bbox="446 1316 527 1344">Caustic</td> <td data-bbox="771 1299 868 1327">2 per year</td> </tr> <tr> <td data-bbox="446 1375 584 1402">Sulfuric Acid</td> <td data-bbox="771 1344 885 1371">50 per year</td> </tr> <tr> <td data-bbox="446 1413 584 1440">Hypochlorite</td> <td data-bbox="771 1375 885 1402">50 per year</td> </tr> <tr> <td data-bbox="446 1451 625 1478">Sodium bisulfate</td> <td data-bbox="771 1407 868 1434">2 per year</td> </tr> </tbody> </table> <p>Pipeline: None</p> <p>West Ranch: To be determined during detailed design</p>	Materials	Truck Shipments	Amine-Based Solvent	24 per year	10% carbonylhydrazide	2 per year	Ferric chloride coagulant	20 per year	Polymer	2 per year	Caustic	2 per year	Sulfuric Acid	50 per year	Hypochlorite	50 per year	Sodium bisulfate	2 per year	<p>W.A. Parish Plant: Commercial vendors, shipped by commercial carriers</p>
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Sodium bisulfate	2 per year																			

Table S-3. Project Requirements and Characteristics Summary

Requirement/ Characteristic	Description					Source/Provider	
Construction and Operational Emissions	Construction Emissions (tons):					Construction emissions are from material handling (e.g. dirt moving) and emissions from combustion of fuel (i.e., gasoline and diesel) in mobile sources, which are mainly non-road construction equipment.	
	Compound Emitted	Pipeline (2013)	CO₂ Capture Facility (2013)	CO₂ Capture Facility (2014)	Total		Operational emissions related to the CO ₂ capture facility are from the CO ₂ capture system, the CT/HRSG, the cooling tower, the emergency generator, and fugitive sources. Operational emissions from the CO ₂ recycle facility are estimated based on reported emissions for the CO ₂ recycle facility located at the West Hastings oil field in Alvin, Texas.
	CO	8.73	5.59	5.27	19.6		
	NO _x	22.2	17.4	13.3	53.0		
	PM ₁₀	1.60	1.37	1.15	4.12		
	SO ₂	124.1	119.4	92.8	336.3		
	VOC	1.62	1.44	1.27	4.33		
	Operational Emissions (tpy):						
	Compound Emitted	CO₂ Capture Facility	CO₂ Recycle Facility	Total			
	CO	102.1	9.6	111.7			
	NO _x	37.6	10.3	47.9			
	PM ₁₀	75.1	0.7	75.8			
	PM _{2.5}	71.7	0.7	72.4			
	SO ₂	6.9	0.1	7.0			
	VOC	65.1	14.6	79.7			
VOC and NO _x emissions from the CO ₂ capture facility exceed major source thresholds; therefore, NRG must obtain and retire VOC emission reduction credits (ERCs) and NO _x Mass Emission Cap & Trade (MECT) allowances to reduce the total net project increases of these ozone precursors (i.e., NO _x and VOC) within the Houston Galveston Brazoria Metropolitan Statistical Area (HGB MSA). NRG would be required to purchase and retire 1.3 tons of credits or allowances, as applicable, for each ton of emission increase related to the Parish PCCS project.							

Table S-3. Project Requirements and Characteristics Summary

Requirement/ Characteristic	Description	Source/Provider																																																																																
Flue Gas Inlet and Outlet Characteristics	<p>W.A. Parish Plant: General characteristics of the flue gas feed to CO₂ capture system, the treated flue gas vent to atmosphere, and the compressed CO₂ product stream are as follows (NRG 2012g):</p> <table border="1" data-bbox="402 436 1024 1642"> <thead> <tr> <th data-bbox="402 436 602 489">Stream Description</th> <th data-bbox="602 436 748 489">Flue Gas Feed</th> <th data-bbox="748 436 894 489">Treated Flue Gas</th> <th data-bbox="894 436 1024 489">CO₂ Product</th> </tr> </thead> <tbody> <tr> <td colspan="4" data-bbox="402 520 1024 552"><i>Component Concentrations</i></td> </tr> <tr> <td data-bbox="402 552 602 583">H₂O</td> <td data-bbox="602 552 748 583">18.0%</td> <td data-bbox="748 552 894 583">9.8%</td> <td data-bbox="894 552 1024 583">100 ppmv</td> </tr> <tr> <td data-bbox="402 583 602 615">CO₂</td> <td data-bbox="602 583 748 615">11.5%</td> <td data-bbox="748 583 894 615">1.4%</td> <td data-bbox="894 583 1024 615">>99.96%</td> </tr> <tr> <td data-bbox="402 615 602 646">N₂</td> <td data-bbox="602 615 748 646">65.4%</td> <td data-bbox="748 615 894 646">82.3%</td> <td data-bbox="894 615 1024 646">226 ppmv</td> </tr> <tr> <td data-bbox="402 646 602 678">Ar</td> <td data-bbox="602 646 748 678">0.8%</td> <td data-bbox="748 646 894 678">1.0%</td> <td data-bbox="894 646 1024 678">5 ppmv</td> </tr> <tr> <td data-bbox="402 678 602 709">O₂</td> <td data-bbox="602 678 748 709">4.3%</td> <td data-bbox="748 678 894 709">5.5%</td> <td data-bbox="894 678 1024 709"><10 ppmv</td> </tr> <tr> <td data-bbox="402 709 602 741">SO₂</td> <td data-bbox="602 709 748 741">60.6 ppmv</td> <td data-bbox="748 709 894 741">0.0 ppmv</td> <td data-bbox="894 709 1024 741">0.0%</td> </tr> <tr> <td data-bbox="402 741 602 772">SO₃</td> <td data-bbox="602 741 748 772">1.2 ppmv</td> <td data-bbox="748 741 894 772">1.5 ppmv</td> <td data-bbox="894 741 1024 772">0.0%</td> </tr> <tr> <td data-bbox="402 772 602 804">NO</td> <td data-bbox="602 772 748 804">26.0 ppmv</td> <td data-bbox="748 772 894 804">32.7 ppmv</td> <td data-bbox="894 772 1024 804">0.0%</td> </tr> <tr> <td data-bbox="402 804 602 835">NO₂</td> <td data-bbox="602 804 748 835">1.4 ppmv</td> <td data-bbox="748 804 894 835">0.1 ppmv</td> <td data-bbox="894 804 1024 835">0.0%</td> </tr> <tr> <td data-bbox="402 835 602 867">HCl</td> <td data-bbox="602 835 748 867">2.2 ppmv</td> <td data-bbox="748 835 894 867">0.0 ppmv</td> <td data-bbox="894 835 1024 867">0.0%</td> </tr> <tr> <td data-bbox="402 867 602 898">HF</td> <td data-bbox="602 867 748 898">0.6 ppmv</td> <td data-bbox="748 867 894 898">0.0 ppmv</td> <td data-bbox="894 867 1024 898">0.0%</td> </tr> <tr> <td data-bbox="402 898 602 930">NH₃</td> <td data-bbox="602 898 748 930">1.3 ppmv</td> <td data-bbox="748 898 894 930"><1 ppmv</td> <td data-bbox="894 898 1024 930">0.0%</td> </tr> <tr> <td data-bbox="402 930 602 961">Amine-Based Solvent</td> <td data-bbox="602 930 748 961">0.0 ppmv</td> <td data-bbox="748 930 894 961"><1 ppmv</td> <td data-bbox="894 930 1024 961">0.0%</td> </tr> <tr> <td data-bbox="402 961 602 993">Acetaldehyde</td> <td data-bbox="602 961 748 993">0.0 ppmv</td> <td data-bbox="748 961 894 993">2.1 ppmv</td> <td data-bbox="894 961 1024 993">0.0%</td> </tr> <tr> <td colspan="4" data-bbox="402 1014 1024 1045"><i>Other Characteristics</i></td> </tr> <tr> <td data-bbox="402 1045 602 1077">Temperature, °F</td> <td data-bbox="602 1045 748 1077">165</td> <td data-bbox="748 1045 894 1077">114</td> <td data-bbox="894 1045 1024 1077">102</td> </tr> <tr> <td data-bbox="402 1077 602 1108">Pressure, psia</td> <td data-bbox="602 1077 748 1108">14.6</td> <td data-bbox="748 1077 894 1108">14.7</td> <td data-bbox="894 1077 1024 1108">2,115</td> </tr> <tr> <td data-bbox="402 1108 602 1140">Total Flow, lb/hr</td> <td data-bbox="602 1108 748 1140">2,723,940</td> <td data-bbox="748 1108 894 1140">2,108,470</td> <td data-bbox="894 1108 1024 1140">438,780</td> </tr> </tbody> </table>	Stream Description	Flue Gas Feed	Treated Flue Gas	CO ₂ Product	<i>Component Concentrations</i>				H ₂ O	18.0%	9.8%	100 ppmv	CO ₂	11.5%	1.4%	>99.96%	N ₂	65.4%	82.3%	226 ppmv	Ar	0.8%	1.0%	5 ppmv	O ₂	4.3%	5.5%	<10 ppmv	SO ₂	60.6 ppmv	0.0 ppmv	0.0%	SO ₃	1.2 ppmv	1.5 ppmv	0.0%	NO	26.0 ppmv	32.7 ppmv	0.0%	NO ₂	1.4 ppmv	0.1 ppmv	0.0%	HCl	2.2 ppmv	0.0 ppmv	0.0%	HF	0.6 ppmv	0.0 ppmv	0.0%	NH ₃	1.3 ppmv	<1 ppmv	0.0%	Amine-Based Solvent	0.0 ppmv	<1 ppmv	0.0%	Acetaldehyde	0.0 ppmv	2.1 ppmv	0.0%	<i>Other Characteristics</i>				Temperature, °F	165	114	102	Pressure, psia	14.6	14.7	2,115	Total Flow, lb/hr	2,723,940	2,108,470	438,780	<p>Flue gas obtained from 250-MWe flue gas slipstream of combustion exhaust gases from existing 650-MW coal-fired Unit 8</p> <p>Treated flue gas vented from a new stack (i.e., the CO₂ scrubber vent).in the CO₂ capture facility;</p> <p>CO₂ product is pumped to the CO₂ pipeline</p>
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% = percent; °F = degrees Fahrenheit; Approx. = Approximately; Ar = argon; CO = carbon monoxide; CO₂ = carbon dioxide; CT/HRSG = combustion turbine/heat recovery steam generator; ERC = emission reduction credit; gpd = gallons per day; H₂O = water; HCl = hydrochloric acid; HF = hydrofluoric acid; lbs = pounds; lb/hr = pounds per hour; MECT = Mass Emission Cap & Trade; mgd = million gallons per day; MW = megawatt; MWe = megawatt equivalent; N₂ = nitrogen; NH₃ = ammonia; NO = nitrogen oxide; NO₂ = nitrogen dioxide; NO_x = nitrogen oxides; O₂ = oxygen; ppmv = parts per million by volume (1 ppmv = 0.0001%); PM_{2.5} = particulate matter with a diameter of 2.5 microns or less; PM₁₀ = particulate matter with a diameter of 10 microns or less; psia = pounds per square inch absolute; SO₂ = sulfur dioxide; SO₃ = sulfur trioxide; tpy = tons per year; TSDF = treatment, storage, and disposal facility; WWTP = wastewater treatment plant; VOC = volatile organic compounds

ALTERNATIVES CONSIDERED BY NRG

NRG considered a number of design alternatives for the various components of the Parish PCCS Project while preparing its response to the FOA and during the preliminary design phase that followed DOE selection. As discussed below, these alternatives included locations for the CO₂ capture facility, methods of CO₂ capture, locations for the EOR field, and pipeline routes to the selected EOR site.

During preparation of its proposal, NRG reviewed the many power plants that it owns or operates as candidates for a large, integrated PCCS project. The primary criteria for selection were for a plant to have a sufficiently large coal-fired unit and for the plant to be located in proximity to oil fields suitable for tertiary recovery. NRG's W.A. Parish, Big Cajun II, and Limestone Plants met these criteria. NRG selected the W.A. Parish Plant because more oil fields that are suitable for tertiary recovery occur in the area.

NRG's project and technology selection process for the CO₂ capture facility focused on the set of commercially available post-combustion CO₂ capture technologies. Among the technologies currently available, only a few chemical absorption processes using ammonia or aqueous amines were determined to be sufficiently proven for a commercial-scale application. For this reason, and because an ammonia absorption project had already been selected as a demonstration project by the DOE CCPI program, NRG elected to scale up a comparatively proven advanced amine technology.

Prior to selection of the EOR site for this project, NRG approached the owners of several oil fields in the vicinity of the W.A. Parish Plant that NRG believed would be suitable for tertiary recovery using EOR. During this selection process, NRG determined that, of the prospective teaming partners who own or operate fields suitable for EOR along the Texas Gulf Coast, HEC was the candidate most aligned with the proposed project objectives. As a result, affiliates of NRG and HEC entered into a joint venture (i.e. TCV) and collectively determined that the West Ranch oil field was the most suitable candidate for the CO₂ injection and EOR component of this project.

After selecting the West Ranch oil field as the EOR site for this project, NRG considered several potential pipeline routes to convey CO₂ from the W.A. Parish Plant to the West Ranch oil field. The seven primary route alternatives considered by NRG, as described in the EIS, included:

- alternatives for routing the CO₂ pipeline through the W.A. Parish Plant from the compressor station at the CO₂ capture facility to the adjacent CenterPoint ROW;
- five alternate routes collocated with other utility or railroad ROWs from the W.A. Parish Plant to the West Ranch oil field; and
- two options for the approach to the West Ranch oil field from the adjacent South Texas Electric Cooperative (STEC) ROW.

NRG selected the pipeline route shown in Figure S-1 because it would minimize the length of the pipeline to approximately **81** miles and would be collocated along or within existing mowed and maintained utility ROWs for approximately **75%** of its length, which would minimize potential environmental impacts by allowing NRG to use existing maintained ROW during construction. Additionally, this route avoids several riparian corridors and population centers that would have been crossed by more southerly routes, but it is not so far north as to impact development around the U.S. Highway 59 corridor. **Appendix D-4 includes a set of maps showing the revised pipeline alignment in more detail and minor realignments made to its proposed route to accommodate landowner concerns or to allow for better access for directional drilling.**

CHARACTERISTICS OF THE AFFECTED ENVIRONMENT

The affected environment, also referred to as the region of influence (ROI), for the project was defined for each of 18 environmental resource areas depending on the extent of potential impacts resulting from plant and infrastructure construction and operation. The ROI includes, at a minimum, the proposed CO₂ capture facility areas at the W.A. Parish Plant, the proposed CO₂ pipeline corridor, and the proposed EOR area at the West Ranch oil field. However, the size of the ROI varies by resource depending on the extent of potential impacts on respective resources. Table S-4 summarizes the affected environment for each of the 18 resource areas. The affected environment for each of these resources is described in greater detail in Chapter 3 of the EIS.

Table S-4. Affected Environment of the Parish PCCS Project

Resource	Existing Conditions
Air Quality and Climate	<p>With the exception of ozone in Fort Bend County, the National Ambient Air Quality Standards (NAAQS) promulgated by the EPA are being attained in the three counties in which components of the proposed project would be located (i.e., Fort Bend, Wharton, and Jackson Counties). Fort Bend County, in which the CO₂ capture facility and related infrastructure, along with a portion of the pipeline corridor, would be constructed and operated, has been classified as a severe nonattainment area for ozone.</p>
Greenhouse Gases	<p>In 2009, estimated U.S. CO₂ emissions totaled 5,426 million metric tons, including 2,160 million metric tons of CO₂ from generation of electricity. Emissions of CO₂ in Texas accounted for approximately 11% of total U.S. CO₂ emissions (i.e., 605.5 million metric tons) in 2009. Currently, there are no Texas regulations limiting greenhouse gas (GHG) emissions, including emissions of CO₂.</p>
Geology	<p>The Frio Formation is made up of several massive sand units that have created a number of highly prolific oil and gas reservoirs, including the West Ranch oil field. At the West Ranch oil field, the Frio Formation is approximately 5,000 to 7,200 feet below ground surface (bgs) and is capped by the Anahuac Formation, consisting of over 400 feet of low permeability calcareous shale with some occasional interlaminated sand lenses. A study near Beaumont, Texas, estimated the average permeability (to liquid) of the Anahuac Formation is approximately 5.2×10^{-6} millidarcies (mD). At the West Ranch oil field, the Frio Formation has held large quantities of buoyant fluids (i.e., oil and gas) over geologic time, indicating that very little migration occurs, if any, through the overlying Anahuac Formation.</p> <p>The Catahoula Sandstone is a very coarse-grained, homogenous sandstone unit found at a depth of approximately 4,250 to 4,500 feet bgs into which excess produced water is currently reinjected at the West Ranch oil field. The Burkeville confining system, which overlies the Catahoula Sandstone, consists primarily of silt and clay with a typical thickness ranging from approximately 300 to 500 feet.</p> <p>Southeastern Texas exhibits low seismicity and there are no major mapped faults within or near the proposed project areas. The risk of seismic events (i.e., earthquakes) occurring within the proposed project area is therefore very low. The BEG conducted a geophysical-log-based evaluation of regional structural features in the vicinity of the West Ranch oil field, which identified two growth faults in the deep subsurface to the northwest and southeast of the West Ranch oil field. The shallowest expression of the two faults is approximately 2,500 feet below mean sea level (msl) and both faults extend through the Greta, Glasscock, 41-A, and 98-A sand units of the Frio Formation. An approximately 200-foot offset of geologic strata on either side of the fault to the northwest of the oilfield reveals the simple domal structure that is</p>

Table S-4. Affected Environment of the Parish PCCS Project

Resource	Existing Conditions
	<p>responsible for hydrocarbon trapping in the West Ranch oil field. Neither of these faults extends upward to land surface nor do they lie within the boundaries of the West Ranch oil field (Appendix I, Figures 4 through 8). There are no obvious or large-scale faults within the West Ranch oil field itself.</p>
<p>Physiography and Soils</p>	<p>The project area is located in the Gulf Coastal plain, which is a low-lying area that has a gradual rise from sea level (at the Gulf of Mexico) in the south and east up to an elevation of about 900 feet above msl to the north and the west. The physiography originated from the deposition of sediments around the margins of the Gulf of Mexico in fluvial-deltaic to shallow-marine environments. In the vicinity of the project, most of the land is nearly flat (< 1% slope) with very small areas of slightly sloping land (< 8%, mostly < 3%). Approximately 819 acres in the construction ROW and access roads is classified as Prime Farmland and approximately 43 acres classified as more than slightly erodible (i.e., moderately to severely erodible).</p>
<p>Groundwater</p>	<p>The major aquifer beneath the proposed project area is the Gulf Coast Aquifer, which is divided into four hydrostratigraphic units: the Chicot Aquifer, Evangeline Aquifer, Jasper Aquifer, and the Catahoula Confining System (aka, the Catahoula Restricted Aquifer). The Catahoula Confining System is composed of (in descending order) the Catahoula Sandstone, the Anahuac Formation, and the Frio Formation. The Chicot and Evangeline Aquifers are the primary underground sources of drinking water (USDWs) in the area. The only minor aquifer in the proposed project area is the Brazos River Alluvium Aquifer, which terminates north of the project area, but is hydraulically connected to the Brazos River, which supplies water to Smithers Lake for use by the W.A. Parish Plant.</p>
<p>Surface Water</p>	<p>The W.A. Parish Plant is located within the Brazos River Basin, immediately south of Smithers Lake, which is a 2,430-acre man-made lake with a capacity of about 18,000 acre-feet (AF) of water. The W.A. Parish Plant uses approximately 34 to 50 mgd (38,000 to 56,000 AF per year) of surface water from Smithers Lake, which receives water from the Brazos River, and discharges stormwater and treated wastewater to the lake through permitted outfalls.</p> <p>The pipeline corridor would traverse several Texas coastal river basins. Surface water bodies drain these basins from the northwest to the southeast across the generally low topographic relief of coastal Texas towards the Gulf of Mexico. The pipeline would cross 211 waterbodies (26 perennial streams/streams, 34 intermittent or ephemeral streams/streams, 3 ponds, and 148 canals/ditches), three of which are major rivers (i.e., the San Bernard, Colorado, and Lavaca Rivers). The proposed pipeline would cross six waterbodies designated as Ecologically Significant Stream Segments (i.e., Big Creek, the San Bernard River, Cedar Lake Creek [aka Caney Creek], the Colorado River, West Carancahua Creek, and the Lavaca River) and two waterbodies designated by the State of Texas as impaired (i.e., the San Bernard River, which is listed for bacteria, and Caney Creek, which is listed for bacteria and low dissolved oxygen).</p> <p>The West Ranch oil field is located near the juncture of the Lavaca, Lavaca-Guadalupe, and Colorado-Lavaca River Basins. Waterbodies within the oil field ROI include the Lavaca River, the Navidad River, Venado Creek, Garcitas Creek, the Menefee Lakes, Redfish Lake, and the Venado Lakes. The Lavaca Bay/Chocolate Bay Estuary and associated tributaries, including Garcitas Creek are designated by the State of Texas as impaired for low dissolved oxygen. Additionally, the nearby oyster waters of Lavaca Bay and Chocolate Bay are designated as impaired because of bacteria.</p>

Table S-4. Affected Environment of the Parish PCCS Project

Resource	Existing Conditions
<p>Wetlands and Floodplains</p>	<p>There are no wetlands located within the area proposed for the CO₂ capture facility, but some project infrastructure may be located within approximately 50 to 200 feet of a wetland (i.e., Smithers Lake and associated canals). Approximately 96 acres of wetlands are located within the proposed pipeline construction ROW and access roads, including the following types: 79 acres of palustrine emergent, 2 acres of palustrine scrub-shrub, less than 1 acre of palustrine forested, 9 acres of riverine, and 6 acres of drainage ditches. These 96 acres of wetlands include several large fallow rice fields, which are categorized as palustrine emergent wetland areas, and a large gulf cordgrass (<i>Spartina spartinae</i>) marsh between the Lavaca River and the West Ranch oil field. The northern portion of the EOR area at the West Ranch oil field includes a wetland near Menefee Lake, classified as estuarine and marine wetland/deepwater by the National Wetland Inventory (NWI). Venado Creek, which crosses the EOR area at the West Ranch oil field, is classified by the NWI as estuarine and marine wetland and fresh water emergent wetland. The NWI also identifies several small fresh water ponds and a small estuarine and marine deepwater habitat within the area. There are no wetlands located within the area proposed for the CO₂ recycle facility.</p> <p>The area proposed for the CO₂ capture facility is located outside of the 100-year and 500-year floodplains identified by FEMA, but some project infrastructure may be located within approximately 50 to 200 feet of a floodplain (i.e., Smithers Lake and associated canals). The proposed pipeline corridor crosses FEMA 100-year and 500-year floodplains in 25 locations including areas adjacent to the following waterbodies: Colorado River, Lavaca River, Blue Creek, Juanita Creek, San Bernard River, and Tres Palacios River. The EOR area at the West Ranch oil field includes the FEMA 100-year and 500-year floodplains of Venado Creek, the Lavaca River, Menefee Lake, and Menefee Bayou. The land area proposed for the CO₂ recycle facility is located outside of the FEMA 100-year and 500-year floodplains.</p>
<p>Biological Resources</p>	<p>The CO₂ capture facility ROI has been previously disturbed (i.e., cleared and graded) and provides poor habitat quality for most wildlife species. Most of the proposed pipeline corridor consists of previously cleared utility ROW, which is maintained a minimum of once every four years, and agricultural land. Approximately 11% of the proposed pipeline construction ROW is classified as natural systems. The dominant land cover types in the West Ranch oil field EOR area, which is currently used for oil and gas production and cattle pasture, are pasture/hay/grassland/herbaceous, shrub/scrub, developed (open space/low density), emergent herbaceous wetlands, and woody wetlands.</p> <p>Three federally listed endangered species (Whooping crane, West Indian manatee, and Texas prairie dawn-flower) potentially occur in the three-county ROI (i.e., Fort Bend, Jackson, or Wharton Counties), which is located within the Western Gulf Coastal Plain EPA Level III Ecoregion. The West Indian manatee is a marine species and its occurrence in the ROI is very unlikely. The Lavaca River may provide suitable habitat, but there are no documented sightings of a West Indian manatee in the ROI and none were observed during field surveys. The ROI includes no suitable habitat (i.e., pimple mounds) for the Texas prairie dawn and no designated critical habitat for the whooping crane. A large wetland habitat is present within the proposed pipeline route between the West Ranch oil field and the Lavaca River which has the potential to provide habitat for the whooping crane. However, this area is adjacent to an active oil field, which would make it less attractive for use by whooping cranes than other wetland habitats in the vicinity. No whooping cranes were observed during field surveys.</p> <p>The State of Texas has identified five previously used nesting areas within the ROI that are no longer in use, including a previously used colonial waterbird rookery near the W.A. Parish Plant, two previously used bald eagle nests near the W.A. Parish Plant in Fort Bend County, a</p>

Table S-4. Affected Environment of the Parish PCCS Project

Resource	Existing Conditions
	<p>previously used bald eagle nest along the boundary of Fort Bend and Wharton Counties, and a previously used bald eagle nest in Jackson County. An active bald eagle nest was observed in Wharton County near Jones Creek. The bald eagle is afforded federal protection under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act and is a protected species in the State of Texas. A state-listed threatened and federal candidate mussel species (smooth pimpleback) was identified at the proposed crossing location of the Colorado River.</p>
<p>Cultural Resources</p>	<p>No State Archeological Landmarks, Texas Historic Landmarks, National Register historic buildings, or historic structures are located within the ROI. Three previously identified prehistoric lithic artifact scatters are situated within the ROI of the W.A. Parish Plant (along the southern shore of Smithers Lake and/or Dry Creek/Rabbs Bayou), but none were considered eligible by the Texas Historical Commission (THC) for listing in the National Register of Historic Places (NRHP).</p> <p>No known historic buildings, features, or above-ground properties listed, or eligible for listing, on the NRHP are recorded within the ROI for the proposed pipeline. Only one previously identified archaeological site is located within the ROI. This site is a prehistoric period lithic site located along the Lavaca River in Jackson County that has not been assessed for its eligibility to be listed in the NRHP. During the Phase I inventory study of the proposed pipeline construction ROW, four archaeological sites (1 prehistoric and 3 from historic periods) were identified within the pipeline construction ROW and a total of nine buildings (6 in Fort Bend County and 3 in Wharton County) greater than 45 years of age were identified within 164 feet (50 meters) of the pipeline construction ROW or associated access roads. The nine buildings were predominantly National-style structures (4 structures), but also included one structure of undetermined design (due to inaccessibility) and single examples of a barn, a Spanish Eclectic structure, a railroad bridge, and an I-house. Most of the structures were built between ca. 1930 and the 1950s, with single examples noted from the 1890s to 1900s and 1920s to 1930s.</p> <p>No State Archeological Landmarks, Texas Historic Landmarks, National Register historic buildings or historic structures have been identified within the ROI of the West Ranch oil field. Nine previously identified archaeological sites have been identified within the ROI. Most of these sites are located along the boundaries of Venado Creek, with a single site by Menefee Lake. All of these sites are identified as prehistoric lithic scatters, except for one site which also contained prehistoric ceramics. Information regarding eligibility for listing on the NRHP is not available.</p> <p>The THC identified the following Native American Tribes that may have an interest in activities in the proposed project area: the Alabama-Coushatta Tribe of Texas, the Apache Tribe of Oklahoma, the Comanche Nation of Oklahoma, the Coushatta Tribe of Louisiana, the Kiowa Indian Tribe of Oklahoma, the Mescalero Apache Tribe of the Mescalero Reservation, the Tonkawa Tribe of Indians of Oklahoma, and the Tunica-Biloxi Indian Tribe of Louisiana. DOE sent letters to these tribes but has received no responses to date.</p>

Table S-4. Affected Environment of the Parish PCCS Project

Resource	Existing Conditions
<p>Land Use and Aesthetics</p>	<p>The proposed CO₂ capture facility would be constructed in Fort Bend County in areas within the existing W.A. Parish Plant that are currently in industrial use. The proposed CO₂ pipeline would cross lands used for utility (HVTL and pipeline) ROWs, livestock grazing, cultivated agriculture, and open space in Fort Bend, Wharton, and Jackson Counties. Approximately 75% of the pipeline corridor would be collocated with existing utility ROWs. The proposed EOR area would be constructed within the West Ranch oil field in an area used for oil and gas production and cattle pasture. Fort Bend, Wharton, and Jackson Counties have no land use plans, zoning, or development standards that would apply to the proposed project.</p>
<p>Traffic and Transportation</p>	<p>Access from Highway 59 to the W.A. Parish Plant is via Farm-to-Market Road (FM) 762 and Smithers Lake Road to the west side of the plant and via FM 2759, North Thompson Road, and Y U Jones Road to the east side of the plant. The proposed pipeline crosses several public roadways, all of which have two lanes and operate in a free-flowing manner with little congestion. Highway access to the West Ranch oil field is via State Highway 87 to FM 616 from the west or via FM 234 South to FM 616 from the east.</p> <p>The W.A. Parish Plant uses its rail facilities primarily for coal delivery. On average, the plant unloads two to three trainloads of coal each day, with each train averaging approximately 128 rail cars.</p>
<p>Noise</p>	<p>Dominant noise sources in the vicinity of the proposed CO₂ capture facility include power plant operation, coal train traffic and unloading, and use of heavy industrial vehicles. The nearest sensitive receptors to the proposed CO₂ capture facility are the rural residential communities near the perimeter of the W.A. Parish property (i.e., approximately 0.5 miles east, 1.5 miles to the southwest of the project site, 3 miles to the east, and 3 miles to the northwest) and a church located approximately 2.5 miles northeast of the proposed project site.</p> <p>The proposed pipeline would traverse primarily agricultural and rural residential areas, in which typical ambient noise levels are estimated to range between 28 and 38 dBA in calm weather conditions. Average noise levels are expected to be higher near roadways due to vehicle traffic.</p> <p>The existing noise at the West Ranch oil field comes from a number of sources, including truck traffic, drilling and associated activities, and well pumps and compressors. The nearest residential community is the town of Vanderbilt, located approximately 0.5 miles north of the northern perimeter of the West Ranch oil field and 2.3 miles north of the proposed location of the central CO₂ recycle facility. The nearest non-residential sensitive receptors include the Industrial Independent School District Junior and Senior High Schools, the Vanderbilt Baptist Church, and the Saint John Bosco Catholic Church in the town of Vanderbilt.</p>
<p>Materials and Waste Management</p>	<p>The W.A. Parish Plant and the West Ranch oil field have current suppliers for the types of construction and operational materials that would be needed for the proposed project, including preferred providers for management of solid and hazardous wastes. The West Ranch oil field also operates injection wells permitted for the disposal of excess produced water. The W.A. Parish Plant is currently a conditionally exempt small quantity generator, but conforms to the requirements of a large quantity generator for consistency with other NRG facilities.</p>

Table S-4. Affected Environment of the Parish PCCS Project

Resource	Existing Conditions
<p>Human Health and Safety</p>	<p>Of the three counties in the ROI, Fort Bend County has the best overall health ranking (i.e., #9 of 221 Texas counties). Health rankings for Wharton and Jackson Counties are generally not as good as Fort Bend County for most indicators but neither county is consistently better than the other. Wharton County is ranked #61 of 221 Texas counties in overall health and Jackson County is ranked #57. All three counties in the ROI have better overall health rankings than over half of the counties in the state of Texas. Wharton and Jackson Counties had higher incidences of cancer deaths when compared to the average cancer rate for Texas, while Fort Bend County had a lower incidence of cancer deaths.</p> <p>Occupational injury data from 2008 for industries related to the proposed project (i.e., utility, pipeline, and non-residential construction; oil and gas extraction; and electric power generation) reflect total recordable incident rates of between 1.4 and 4.4 cases per 100 workers per year, including between 0.4 and 1.5 lost work day cases per 100 workers per year and between 0.7 and 2.3 days away from work, job transfer, or restriction cases per 100 workers per year. The fatality rate for the utility; construction; oil & gas extraction; and installation, repair, and maintenance industries in 2008 were between 3.9 and 23.9 fatalities per 100,000 workers.</p> <p>The population density in a small area east of the W.A. Parish Plant and a larger area southwest of the plant is 100 to 500 people per square mile. The population density west of the plant is 26 to 50 people per square mile and the areas north and south of the plant are mostly unpopulated. The majority of the pipeline traverses areas with population densities of five or less people per square mile, with certain segments that have a population density as high as 100 to 500 people per square mile. The population densities are higher within 15 miles of the W.A. Parish Plant than along the remainder of the pipeline corridor. The areas surrounding the West Ranch oil field are primarily unoccupied, except for the town of Vanderbilt, north of the oil field, which has a population density of 25 to 50 people per square mile. Areas to the southwest and northeast of the oil field have population densities of 5 to 25 people per square mile. The winds in the ROI are predominately from the direction of the Gulf of Mexico (i.e., from the south and southeast).</p>
<p>Utilities</p>	<p>The W.A. Parish Plant generates its own electricity (3,865 MW total); operates its own WWTP, treating approximately 4,000 gpd of sanitary wastewater; obtains potable water from existing groundwater wells; and obtains water for industrial use from Smithers Lake and existing groundwater wells. The combined units at the W.A. Parish Plant use a maximum of approximately 27,500 million cubic feet of natural gas per hour. The West Ranch oil field has utility service in place for potable water, produced water management, electricity, and natural gas. Crude oil produced at the West Ranch oil field is currently transported off site by truck. Existing pipelines are in place to receive crude oil shipments from the West Ranch oil field. Wastewater produced at the West Ranch oil field is primarily disposed of by underground injection along with excess produced water.</p>

Table S-4. Affected Environment of the Parish PCCS Project

Resource	Existing Conditions
<p>Community Services</p>	<p>The combined number of law enforcement officers in the project area (Fort Bend, Wharton, and Jackson Counties) is between 1.6 and 2.35 officers per 1,000 residents, as compared to the State of Texas average of 2.2 officers per 1,000 residents. The average crime rate in the three-county area is 1,680 crimes per 100,000 residents as compared to the State of Texas average of 4,239 crimes per 100,000 residents. The W.A. Parish Plant's Emergency Response Team includes Environmental, Safety, and Health (ES&H) professionals; firefighters, emergency medical technicians (EMTs); and hazardous material (HAZMAT) response personnel. Emergency response services (i.e., fire, ambulance, and HAZMAT response) within the project area are also provided by the Richmond Fire Department and several volunteer fire departments (i.e., Thompsons, Wharton County, Edna, and Vanderbilt). There are 12 hospitals in the three-county area with a total of 1,139 hospital beds (i.e., 1.78 beds per 1,000 people). The schools in the three-county area have an average of 15.08 students per teacher, as compared to the maximum of 20 students per teacher specified in the Texas Education Code.</p>
<p>Socioeconomics</p>	<p>Of the five counties in the ROI, Fort Bend County was the most populous at 585,375 persons and Jackson County was the least populous at 14,075 persons, according to the 2010 Census. Fort Bend County also had the highest population density (679.5 persons per square mile), while Jackson County had the lowest population density (17.0 persons per square mile). Fort Bend County is expected to more than triple its population to 1,917,470 persons by 2040, while Matagorda County is anticipated to shrink in population by 9% (i.e., a reduction of nearly 3,300 persons) by 2040. Brazoria County is expected to more than double its population to 664,503 persons by 2040. Jackson and Wharton Counties are anticipated to experience modest growth (6.9% and 3.7%, respectively).</p> <p>There are 357,884 housing units in the ROI of which 14.5% are vacant. Additionally, there are 150 hotel/motel facilities within the five county ROI.</p> <p>Within the ROI, the residents of Brazoria, Fort Bend, and Jackson Counties had higher average per capita incomes than the State of Texas, which was \$23,863 in 2010, while Matagorda and Wharton County residents had slightly lower average per capita incomes than the State of Texas.</p> <p>The county with the highest unemployment rate in 2010 was Matagorda County at 6.4%. The unemployment rates for the other four counties were between 3.4% and 4.0% unemployed, all of which were lower than the unemployment rate for Texas, which was 5.7% in 2010.</p> <p>Within the five counties in ROI, there would be beneficial impacts to populations, employment, and sales tax revenue in the short-term during the construction phase of the proposed project. The total estimated wages paid during construction is nearly \$75 million, with local wages at nearly \$30 million. Additionally, beneficial impacts to sales/property tax revenue during the operations phase of the proposed project would be realized. The total estimated sales taxes would provide an estimated \$512,000 in revenues. Property tax revenues are estimated to total approximately \$24 million per year, once the proposed project is complete.</p>

Table S-4. Affected Environment of the Parish PCCS Project

Resource	Existing Conditions
<p>Environmental Justice</p>	<p>According to the U.S. Census Bureau, ethnicity data is collected by two main population categories, race and Hispanic/Latino origin. There are two ways to assess the U.S. Census Bureau ethnicity data to determine the existence of environmental justice areas of concern: (1) minority populations that are meaningfully greater than the corresponding county/state or (2) if the population is more than 50% minority. Each methodology can produce different results. Using the meaningfully greater threshold, none of the nine census tracts in the ROI that were analyzed exhibited minority populations that were meaningfully greater than the corresponding county. Additionally, none of the three counties in the ROI exhibited minority populations that were meaningfully greater than the minority population of the state of Texas. However, using the secondary threshold, three census tracts in the ROI that were analyzed exhibited minority populations that are more than 50% minority (Fort Bend County – Census Tract 157675500 and Wharton County – Census Tracts 481740700 and 481741000). Therefore, Executive Order 12898 directs DOE to determine whether the proposed project could subject these populations to disproportionate adverse impacts.</p> <p>There are two options for defining low-income populations to determine the existence of environmental justice areas of concern: (1) a percentage of persons below the respective state/county poverty level (based on U.S. Census Bureau data) or (2) poverty status (based on the U.S. Department of Health and Human Services Poverty Guidelines). None of the nine census tracts in the ROI that were examined exhibited low-income populations that were meaningfully greater than the corresponding county (i.e., no census tract had a low-income population percentage that was greater than two times the low-income population percentage of the corresponding county). Additionally, none of the three counties in the ROI exhibited low-income populations that were meaningfully greater than the low-income population of the state of Texas. Furthermore, none of the census tracts or counties in the ROI had a 2010 median household income that was less than \$22,050.</p>

AF = acre-feet; BEG = Texas Bureau of Economic Geology; bgs=below ground surface; ca. = circa; CO₂ = carbon dioxide; dBA = decibel, A-weighted; EMT = emergency medical technician; EOR = enhanced oil recovery; EPA = U.S. Environmental Protection Agency; ES&H = environmental safety and health; FEMA = Federal Emergency Management Agency; FM = Farm-to-Market Road; GHG=greenhouse gas; gpd = gallons per day; HAZMAT = hazardous material; HVTL = high-voltage transmission line; mD = millidarcies; mgd = million gallons per day; msl = mean sea level; NAAQS = National Ambient Air Quality Standards; NRHP = National Register of Historic Places; NWI = National Wetland Inventory; PCCS = W.A. Parish Post-Combustion CO₂ Capture and Sequestration Project; ROI = region of influence; ROW = right of way; USDWs = underground sources of drinking water

ENVIRONMENTAL IMPACTS

DOE evaluated the potential impacts of the Proposed Action and the No-Action Alternative in relation to the baseline conditions described in Chapter 3 and summarized above. **The impact analysis has been updated to reflect the minor changes to the proposed pipeline route. As these proposed pipeline changes are minor, increasing the overall pipeline length by approximately 1%, and were implemented to address concerns of land owners located in the areas of these changes, the results and conclusions of the impact analysis presented in the Final EIS are consistent with those presented in the Draft EIS. In addition, the impact analysis presented in the Draft EIS was developed conservatively, providing adequate bounding to encompass these minor changes.** More detailed discussions of potential impacts are provided in Chapter 3. Table S-5 summarizes the potential impacts for each of the 18 resource areas for the No-Action Alternative and the Proposed Action.

The EIS uses the following descriptors to qualitatively characterize impacts on respective resources:

- **Beneficial** – Impacts would improve or enhance the resource.
- **Negligible** – No apparent or measurable impacts would be expected; may also be described as “no impact” if appropriate.
- **Minor** – Barely noticeable but measurable adverse impacts on the resource. Mitigation measures may be considered for these impacts.
- **Moderate** – Noticeable and measurable adverse impacts on the resource. Mitigation measures would usually be considered for these impacts.
- **Substantial** – Obvious and extensive adverse effects, and potentially significant impacts on a resource. Mitigation measures would be sought to reduce these impacts.

Table S-5. Summary of Environmental Impacts

No-Action Alternative	Proposed Action
Air Quality and Climate	
<p>Negligible to minor adverse impacts.</p> <p>The pipeline corridor and EOR area at the West Ranch oil field would remain in their current conditions. NRG plans to proceed with construction and operation of a natural gas-fired cogeneration plant at the W.A. Parish Plant. This plant would begin operation in 2013, and would be a new source with emissions of criteria pollutants. The criteria pollutant emissions associated with the cogeneration plant are: 102.1 tpy of CO, 37.6 tpy of NO_x, 75.1 tpy of PM₁₀, 71.7 tpy of PM_{2.5}, 6.9 tpy of SO₂, and 12.88 tpy of VOC. These potential emission increases were evaluated by TCEQ, and are authorized in the TCEQ permit that was issued on December 21, 2012.</p>	<p>Negligible to minor adverse impacts with some beneficial impacts.</p> <p>Construction of the CO₂ capture facility, CO₂ pipeline, and EOR/CO₂ monitoring infrastructure would result in short-term, localized increased tailpipe and fugitive dust emissions. Emission rates for criteria pollutants would be less than 1% of the total emissions in the ROI, except PM₁₀ emissions during 2013, which would account for 3.1% of total ROI emissions. Emission rates for ozone precursors (i.e., VOC and NO_x) during the construction phase of the project would be lower than thresholds documented in the EPA rules for General Conformity (40 CFR 94.153).</p> <p>Operational emissions from the pipeline corridor would be negligible. Operational emissions of criteria pollutants from the CO₂ capture facility and related infrastructure (e.g., CT/HSRG) and the CO₂ recycle facility would be less than 1% of the total emissions in the ROI. Operational emissions of NO_x and VOC would exceed the thresholds documented in the Conformity Rules. However, as part of the NNSR permitting process, NRG must retire NO_x emission reduction credits (ERCs and/or DERCs) and NO_x MECT allowances to reduce the total net project increases of these ozone precursors (i.e., NO_x and VOC) within the HGB MSA. VOC ERCs are generated when the holder of an existing air permit reduces existing emissions and registers the emissions reduction with the TCEQ. MECT allowances were granted by the TCEQ to regulate the emissions of NO_x in the HGB MSA. NRG is required to obtain and retire 1.3 tons of credits or allowances, as applicable, for each ton of NO_x and VOC emissions increase related to the proposed project. NRG owns and has assigned the appropriate amount of NO_x emission credits approved for use in the HGB MSA to the PCCS project.</p> <p>In order to offset the VOC emission increases, NRG has petitioned TCEQ and EPA to use NO_x DERCs to satisfy the VOC emission reduction requirements. TCEQ rule 30 TAC 101.372(a) (Emission Banking And Trading, Discreet Emission Credit Banking And Trading General Provisions) provides for interprecursor trading, whereby one pollutant reduction is used to satisfy the reduction requirements of another pollutant. In a September 27, 2012 request NRG petitioned EPA and TCEQ to invoke this interprecursor trading and allow NO_x DERCs to be used to satisfy the VOC emission reduction requirements at</p>

Table S-5. Summary of Environmental Impacts

No-Action Alternative	Proposed Action
	<p>a 1 to 1 (1:1) ratio of NO_x emission reductions to VOC emission reductions. In an October 12, 2012 letter to NRG, the EPA stated “we find the use of NO_x DERCs for VOC emission increases is supported through the EPA-approved SIP.” In an October 26, 2012 letter TCEQ approved the interprecursor trading stating “we approve the use of NO_x DERCs to offset VOC emission increases for this project at a ratio of 1:1...” Based on these approvals NRG would obtain 1.3 tons of NO_x emission reductions for every 1 ton on VOC emission increases that are a result of this project.</p> <p>Due to the 1.3 to 1 retirement ratio of emission credits and allowances, the proposed project will result in no net adverse impact on air quality in the HGB MSA with regard to ozone. Additionally, NRG is required to identify and assign emission credits for use before the permit is issued; therefore, the current project demonstrates conformity with the Texas SIP for the HGB MSA (TCEQ 2007). NRG submitted a permit application to the TCEQ on September 16, 2012. Public notice of TCEQ's preliminary determination occurred on November 4, 2012. TCEQ issued the permit on December 21, 2012.</p> <p>Credits and allowances can either be obtained from a broker maintaining a “bank” of emissions credits and allowances generated by previously completed emissions reduction projects, or can be obtained directly from another company. In either case, the credits and allowances must be registered with the TCEQ to qualify as offsets for a new project, such as the proposed Parish PCCS Project. Also, NRG would be required to purchase and retire 1.3 tons of credits or allowances, as applicable, for each ton of emission increase related to the proposed project. Due to the 1.3 to 1 retirement ratio of ERCs and allowances, the proposed project would result in no net adverse impact on air quality in the HGB MSA with regard to ozone. Therefore, adverse impacts to air quality in the ROI due to operational emissions from the proposed project would be considered negligible to minor with some beneficial impacts in the form of elimination of SO₂ emissions from the Unit 8 flue gas slipstream, as well as reduced emissions of HCl, HF, and NH₃.</p> <p>As part of the state air permit application process, NRG would be required to finalize a detailed air quality analysis that includes dispersion modeling to compare predicted ambient air quality concentrations to the NAAQS. The detailed air quality analysis is not yet available. However, the TCEQ would not be able to issue the permit unless the modeling shows that NAAQS are met.</p>
Greenhouse Gases	
<p>Loss of potential beneficial impact.</p> <p>The pipeline corridor and EOR area at the West Ranch oil field would remain in their current conditions. NRG plans to proceed with construction and operation of a natural gas-fired cogeneration plant at the W.A. Parish Plant. This plant would begin operation in 2013, and would be a new source with emissions of</p>	<p>Beneficial impacts.</p> <p>Construction of the CO₂ capture facility, CO₂ pipeline, and EOR/ CO₂ monitoring infrastructure would generate up to approximately 4,900 tpy (4,400 metric tons per annum [MTA]) of CO₂ emissions over the two-year construction period. Operation of the CO₂ capture facility and CO₂ recycle facility would result in approximately 785,000 tpy (0.71 MMTA) of new CO₂ emissions. However, the proposed project would result in the capture approximately 1.6 million tpy (1.5 MMTA) of existing CO₂ emissions, resulting in a net reduction of approximately 815,000 tpy (0.74 MMTA) of CO₂ emissions during operations.</p> <p>The capture and geological storage of existing GHG emissions by the project would produce a minor beneficial cumulative effect on a national and global scale. The reduction in CO₂ emissions resulting from the Parish PCCS Project would</p>

Table S-5. Summary of Environmental Impacts

No-Action Alternative	Proposed Action
<p>GHG. The GHG emissions associated with the cogeneration plant are: 582,328 tpy of CO₂, 2.44 tpy of H₂SO₄, and 34.2 tpy of NH₃. Since there will be no emission reductions to offset the emission increases from the cogeneration plant; there would be an increase in GHG emissions. These GHG emission increases would have to be authorized under a PSD permit from the EPA. There would also be no commercial-scale demonstration of advanced coal-based power generation technologies to capture CO₂ for EOR and ultimate sequestration.</p>	<p>incrementally reduce the rate of GHG accumulation in the atmosphere and help to incrementally mitigate climate change related to atmospheric concentrations of GHGs.</p>
Geology	
<p>No impacts.</p> <p>The W.A. Parish Plant, pipeline corridor, and EOR area at the West Ranch oil field would remain in their current conditions. No changes to geologic resources would occur.</p>	<p>Negligible to minor adverse impacts with some beneficial impacts.</p> <p>Construction of the CO₂ capture facility, pipeline, and CO₂ recycle facility would result in negligible impacts to geologic resources. New well construction in the EOR area would result in removal of geologic media through the drilling process. This process would not be unique to the area and would not affect the availability of local geologic resources. Existing wells used by the project would be reworked, resulting in a potential beneficial impact to geologic resources by reducing the risk of leakage.</p> <p>Operation of the CO₂ capture facility and pipeline would not affect geologic resources. In the EOR area, the potential for CO₂ migration upward through the caprock seal is considered unlikely; however, leakage from one or more previously plugged and abandoned wells, oil-producing wells, injection wells, or observation wells might occur if any casing and/or cement placed in or around a well were to leak. To mitigate the potential for impacts related to casing or annular seal issues associated with wells in the proposed injection area, TCV and BEG conducted a well integrity testing program prior to EOR operations, and TCV would correct deficiencies prior to the use of such wells. These improvements to existing wells would result in a potential beneficial impact to geological resources by reducing the chance of leakage due to improperly sealed wells.</p> <p>Preliminary reservoir modeling indicates that injected CO₂ and associated zones of increased pressure would not be expected to migrate laterally outside the area at the West Ranch oil field that is leased and operated by TCV. As part of the proposed CO₂ monitoring program, TCV and BEG would conduct studies to detect migration of injected or displaced fluids, should migration occur, so that potential long term impacts to geologic resources may be minimized or avoided. No known major faults exist within the West Ranch oil field or within the area of maximum predicted EOR-induced impacts to geologic formations. Therefore, the potential for the proposed project to increase seismic activity or for seismic activity to impact proposed project</p>

Table S-5. Summary of Environmental Impacts

No-Action Alternative	Proposed Action
	<p>activities or facilities is low.</p> <p>The addition of CO₂ to a geologic unit (i.e., a target geologic unit or an overlying unit, if leakage were to occur) could make the fluids within the unit more acidic. The creation of potentially more corrosive conditions could result in increased costs for later oil and gas development. However, DOE expects the injection of CO₂ to beneficially impact oil and gas resources at the West Ranch oil field by increasing production from the target geologic units. Furthermore, the presence of infrastructure for CO₂ floods may make oil production from other geologic units at the West Ranch oil field more feasible, which could result in an indirect beneficial impact.</p>
Physiography and Soils	
<p>No impacts.</p> <p>The W.A. Parish Plant, pipeline corridor, and EOR area at the West Ranch oil field would remain in their current conditions. No changes to physiography and soils would occur.</p>	<p>Negligible to minor adverse impacts.</p> <p>In general, potential minor impacts to physiography and soils during construction would include disturbance of soils from grading, soil excavation activities, earthwork compaction, installation of impermeable surfaces over soils at some locations, and increased soil erosion. At the CO₂ capture facility, up to 29 acres of soil within the W.A. Parish Plant boundary would be disturbed or lost. Soil in these areas is classified as Prime Farmland, but they have been previously impacted and would not be utilized for agricultural purposes. For the proposed pipeline development, up to 1,197 acres of soils would be disturbed; however, the disturbed land areas would be restored following construction and overall land use impacts would be minimized through use of existing ROW for most of its length. Approximately 819 acres in the construction ROW is classified as Prime Farmland and approximately 43 acres classified as more than slightly erodible (i.e., moderately to severely erodible). In agricultural areas, impacts to soil would be minimized by segregating topsoil from underlying soil and placing the topsoil back as the top layer when trench is filled. For the EOR area, construction and operational activities would be conducted in existing operational areas; therefore, impacts to soils would be similar to existing impacts. Potential soil impacts in all construction areas would be avoided or mitigated as described in a project-specific stormwater pollution prevention plan (SWPPP).</p> <p>Operational activities associated with the CO₂ capture facility, CO₂ pipeline, and EOR/CO₂ monitoring infrastructure would be anticipated to result in negligible impacts to soil resources, primarily due to disturbance of soils from vehicle traffic and an increased potential for erosion.</p>
Groundwater	
<p>No impacts.</p> <p>The W.A. Parish Plant, pipeline corridor, and EOR area at the West Ranch oil field would remain in their current conditions. No changes to groundwater resources would occur.</p>	<p>Negligible to minor adverse impacts with some beneficial impacts.</p> <p>The potential for groundwater contamination during construction is considered low as potential spills and unintentional releases of wastes or petroleum-based materials to groundwater would be avoided or mitigated as described in a project-specific SWPPP.</p> <p>Operation of the CO₂ capture facility would require an additional 0.2 to 0.3 mgd of groundwater from existing onsite wells (an approximately 13% increase as compared to current groundwater usage rates). The existing wells at the W.A. Parish Plant have capacity to supply the CO₂ capture facility with potential minor impacts to on-site groundwater supplies, such as a reduction in groundwater volumes in underlying aquifers, water level declines, and potential subsidence. There are currently no plans</p>

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No-Action Alternative	Proposed Action
	<p>to withdraw groundwater or to discharge directly to groundwater during construction of the proposed pipeline. Water supply wells near the West Ranch oil field are not anticipated to be affected by injected or displaced fluids due to the relatively shallow depths of existing groundwater supply wells as compared to the depths of the proposed CO₂ injection wells in the Frio Formation (approximately 5,000 to 6,200 feet bgs) and the existing produced water injection wells in the Catahoula Sandstone (approximately 4,250 to 4,500 feet bgs); the presence of the approximately 400-foot-thick, low-permeability confining caprock formation (i.e., the Anahuac Formation) and the approximately 2,000-foot-thick low-permeability Burkeville confining system; and the absence of known faults in the EOR area.</p> <p>Although it is considered unlikely that CO₂ would leak from the injection zone, the possibility exists, in theory, for impacts to occur to shallower geologic units if leakage of CO₂ from the injection reservoir units were to occur. Increased groundwater acidity could result under such a hypothetical leakage scenario, potentially resulting in leaching of minerals and development of preferential flow pathways for migration of injected or displaced fluids. However, based on preliminary reservoir modeling results (Appendix H to this EIS), the probability of injected or displaced fluids migrating from the target injection zone into overlying aquifers is considered to be low. As part of the proposed CO₂ monitoring program, TCV and BEG would conduct studies to detect migration of injected or displaced fluids, should migration occur, so that potential long term impacts to groundwater resources may be minimized or avoided.</p> <p>In the EOR area, the potential for CO₂ to migrate upward through fractures in the caprock seal is considered unlikely; however, leakage from one or more wells (e.g., plugged and abandoned, oil-producing, injection, or observation wells) might occur if any casing and/or cement placed in or around a well were to leak. To mitigate the potential for impacts related to casing or annular seal issues associated with wells in the proposed EOR area, TCV and BEG would conduct well integrity testing prior to EOR operations and TCV would correct deficiencies prior to use of such wells. Additionally, existing wells used by the project would be reworked. Improvements to existing wells would result in a potential beneficial impact to groundwater resources by reducing the chance of leakage due to improperly sealed wells.</p>
Surface Water	
<p>No impacts.</p> <p>The W.A. Parish Plant, pipeline corridor, and EOR area at the West Ranch oil field would remain in their current conditions. No changes to surface waters would occur.</p>	<p>Negligible to moderate adverse impacts.</p> <p>Construction of project-related facilities has the potential to cause increased sedimentation and turbidity in adjacent waterbodies and increase the potential for surface water contamination from material spills. A SWPPP would be developed and implemented to avoid or minimize potential impacts to surface waters during construction activities.</p> <p>Negligible impacts to the surface water supply at W.A. Parish Plant would be expected due to the approximately 12,000 gpd required during construction for dust suppression, vehicle wash down, and other construction-related uses. Operation of the CO₂ capture facility (including supporting infrastructure and facilities, such as the CT/HRSG and cooling water tower), would require approximately 3.5 to 4.9 mgd more surface water from Smithers Lake than is currently used by the W.A. Parish Plant. Including this approximately 10% increase in surface water usage, the W.A. Parish Plant would use a total of 38 to 55 mgd of surface water. This usage rate would be approximately 3% to 6% of the average Brazos River flow rate and approximately 8% to 13% of the Brazos River's critical low-flow rate. The portion of</p>

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No-Action Alternative	Proposed Action
	<p>this water that would be related to the proposed project would account for approximately 0.5% of the average Brazos River flow rate and approximately 1% of the Brazos River's critical low-flow rate. Therefore, minor impacts on surface water supplies would be expected. NRG's projected surface water usage would also be well below NRG's current 99 mgd of surface water rights (i.e., 74 mgd from a surface water contract with the Brazos River Authority and 25 mgd of diverted Brazos River water that may be stored in Smithers Lake).</p> <p>During construction of the proposed pipeline, approximately 1.75 million gallons of water would be trucked in from outside sources or obtained from nearby surface water. NRG plans to discharge spent hydrotest water to upland areas according to RRC and EPA discharge permits and guidelines, as applicable. Construction would require 211 waterbody crossings. Three major rivers (i.e., the San Bernard River, the Colorado River, and the Lavaca River) and three other waterbodies (i.e., Menefee Bayou, Big Creek and Jones Creek) would be crossed by HDD. Additional mitigation measures (i.e., best management practices [BMPs], which would be specified in the project-specific SWPPP) would be employed for Ecologically Significant Stream Segments that are not crossed using HDD construction techniques (i.e., Cedar Lake Creek and West Carancahua Creek). Crossings of the San Bernard River and Caney Creek are not expected to exacerbate existing water quality impairments for these waterbodies. Construction-related impacts are expected to be negligible (i.e., for HDDs) to moderate (i.e., for open cuts) and temporary. Normal pipeline operations are not expected to impact surface waters.</p> <p>Negligible to minor impacts to surface water features in the West Ranch oil field ROI would be expected to occur as a result of construction activities within the proposed EOR area. During operations, the potential exists for a CO₂ well blow-out to occur, with some injected material being ejected and deposited into nearby surface waters. If that were to occur, such effects would be highly localized, minor, and readily remediated.</p>
Wetlands and Floodplains	
<p>No impacts.</p> <p>The W.A. Parish Plant, pipeline corridor, and EOR area at the West Ranch oil field would remain in their current conditions. No changes to wetlands and floodplains would occur.</p>	<p>Negligible to minor adverse impacts.</p> <p>There are no wetlands or floodplains located within the area proposed for the CO₂ capture facility at the W.A. Parish Plant or within the area proposed for the CO₂ recycle facility at the West Ranch oil field. However, construction of project-related facilities has the potential to cause increased sedimentation and turbidity in adjacent wetlands and increase the potential for contamination from materials spills. A SWPPP and SPCC would be developed and implemented to avoid or minimize potential impacts to wetland and floodplain areas during construction activities, resulting in negligible to minor impacts.</p> <p>Approximately 81 acres of wetlands would be temporarily impacted during pipeline construction and approximately 4 acres of wetlands may be permanently impacted. Topsoil in wetland areas would be segregated from other excavated material during trenching and returned to the surface to promote revegetation of disturbed areas and to restore preexisting soil conditions. NRG would reduce the width of the construction ROW in wetland areas from 100 feet to 75 feet and/or use of timber mats or low ground pressure equipment to minimize wetland impacts, as appropriate. Impacts to large riverine features and any adjacent wetlands would be avoided through the use of HDDs. Overall, the proposed project would result in minor, direct short-term impacts to wetlands. Based on the current project design and field survey data</p>

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No-Action Alternative	Proposed Action
	<p>collected to date, compensatory mitigation would not be required for NRG's proposed project by the U.S. Army Corps of Engineers (USACE) or the state of Texas.</p> <p>The pipeline route would cross FEMA 100-year and 500-year floodplains in 25 locations. The temporary presence of construction equipment and spoil piles would cause a minor temporary impact within the floodplain that could redirect flood flows in the event a flood occurred during construction in a floodplain. It is not expected that this impact would reach a level of endangering human health or property or conflict with any state, local, or federal floodplain ordinances as equipment and soil piles would be contained within the construction ROW and would represent relatively small, short-term obstructions as compared to the overall area of the floodplain. Following pipeline installation, the construction ROW would be returned to the original topography to the extent practicable. Five main line valves would be constructed within the FEMA 100-year floodplain in Wharton County. Changes to the flood elevation or the flow of water in the floodplain as a result of these valves would be negligible. No other aboveground facilities are planned within floodplain areas.</p> <p>BMPs (as specified in the site-specific SWPPP) would be implemented to avoid or minimize potential impacts to wetland and floodplain areas during construction activities, resulting in negligible to minor impacts.</p> <p>During operations, a 30-foot permanent ROW would be mowed and maintained along the pipeline route for pipeline inspection and maintenance activities, which could result in minor long-term impacts due to changed wetland functions in the approximately 31 acres of wetlands located within the proposed permanent ROW. Impacts to floodplains would be minor during pipeline operations.</p>
Biological Resources	
<p>No impacts.</p> <p>The W.A. Parish Plant, pipeline corridor, and EOR area at the West Ranch oil field would remain in their current conditions. No changes to biological resources would occur.</p>	<p>Negligible to moderate adverse impacts.</p> <p>The CO₂ capture facility and EOR area would be expected to have negligible impacts to biological resources as affected habitats have been previously disturbed for industrial and oil production uses. Impacts to wildlife from construction of the pipeline corridor would be negligible to minor. Approximately 75% of the proposed pipeline corridor would be constructed within or immediately adjacent to existing mowed and maintained utility corridors. Also, approximately 60% of the pipeline corridor is currently in agricultural use, which is of limited use to wildlife. The pipeline route was chosen to minimize the overall effect to wildlife and fragmentation of wildlife habitat. Construction activities, including land clearing, would cause a negligible loss of wildlife habitat. The potential would exist for invasive species to colonize newly disturbed areas following construction, which could result in long-term moderate adverse impacts to biological resources. Except in cultivated fields, unless requested by the landowner, NRG would plant areas of disturbed soil along the pipeline construction ROW following construction with an appropriate mix of seeds for perennial grasses and forbs native to the area or with a seed mixture requested by the landowner to reduce the potential for establishment of invasive plant species. Depending on the season in which construction is completed, NRG may also seed with a cold-weather annual grass species, such as Gulf Coast ryegrass (<i>Lolium multiflorum</i>), to establish a temporary vegetative cover until conditions become favorable for growth of perennial grasses and forbs.</p> <p>One active bald eagle nest and one state-listed threatened mussel species (smooth pimpleback) were observed during field surveys in the ROI. No other</p>

Table S-5. Summary of Environmental Impacts

No-Action Alternative	Proposed Action
	<p>state-listed or federally-listed species were identified during field surveys. The pipeline route would be located approximately one mile from the bald eagle nest, thus avoiding any impact. Impacts to the state-listed mussel species habitat would be avoided by HDD. Therefore, no impacts to protected species would be expected. NRG would limit land-clearing activities in previously undisturbed areas to periods outside of the nesting season, to the extent practicable, to minimize the potential for impacts to migratory birds. If clearing vegetation during the nesting season or whooping crane migration period is unavoidable, previously undisturbed areas within the construction area would be surveyed prior to construction to verify that whooping cranes or nests with eggs or young would not be disturbed by construction activities. The pipeline corridor crosses a whooping crane migratory path, and any areas being temporarily used by whooping cranes during their migration at the time of construction would be avoided until the cranes have left the area.</p>
Cultural Resources	
<p>No impacts.</p> <p>The W.A. Parish Plant, pipeline corridor, and EOR area at the West Ranch oil field would remain in their current conditions. No changes to cultural resources would occur.</p>	<p>Negligible adverse impacts.</p> <p>DOE determined, and the THC has concurred, that no impacts to historic properties listed, or eligible for listing, in the NRHP would be expected from construction or operational activities for the CO₂ capture facility or EOR/CO₂ monitoring areas. Additionally, based on cultural resources survey data collected to date, the DOE has determined that no historic properties listed, or eligible for listing, in the NRHP would be impacted by the construction and operation of the proposed pipeline. Additional investigation activities (i.e., mechanized trenching) found no deeply buried archaeological deposits at HDD entry and exit locations near several river crossings. DOE has submitted its findings regarding pipeline corridor surveys to the THC for review and consultation with the THC is ongoing.</p>
Land Use and Aesthetics	
<p>No impacts.</p> <p>The W.A. Parish Plant, pipeline corridor, and EOR area at the West Ranch oil field would remain in their current conditions. No changes to land use and aesthetic resources would occur.</p>	<p>Negligible to moderate adverse impacts.</p> <p>The proposed construction and operation of the CO₂ capture facility at the W.A. Parish Plant and EOR and CO₂ monitoring infrastructure at the West Ranch oil field is consistent with existing land use and would result in negligible to minor impacts. Construction of the proposed CO₂ pipeline would temporarily impact approximately 386 acres of agricultural lands, but no permanent loss of agricultural lands would occur. Less than 0.3 acres would be converted for aboveground pipeline facilities (one meter station and 12 main line valves).</p> <p>Impacts to aesthetic values would be negligible at the CO₂ capture facility and EOR field as the existing aesthetic character would generally remain unchanged. Along the proposed CO₂ pipeline route, minor to moderate aesthetic impacts to adjacent property owners would occur in some locations due to construction noise, truck traffic, fugitive dust emissions, and vegetation clearing. Operational aesthetic impacts would be negligible to minor and would be related to placement of pipeline markers, periodic vegetation clearing, and other maintenance activities.</p> <p>The impact of lighting during construction would be temporary and minor. The impact of lighting for operations at the proposed CO₂ capture facility, the EOR/CO₂ monitoring facilities, and the pipeline meter station would be negligible to minor as</p>

Table S-5. Summary of Environmental Impacts

No-Action Alternative	Proposed Action
	lighting would be consistent with existing operations. Lighting along the pipeline would be limited to the meter station. Meter station lighting would be down shielded to avoid interference with wildlife, which would result in minor impacts.
Traffic and Transportation	
<p>Negligible to minor adverse impacts.</p> <p>The pipeline corridor and EOR area at the West Ranch oil field would remain in their current conditions. Construction of the cogeneration plant at the W.A. Parish Plant would temporarily increase traffic during construction (up to 100 workers), but would be easily accommodated by the existing road systems with only minor temporary disruptions.</p>	<p>Negligible to minor adverse impacts.</p> <p>The introduction of a temporary increase in traffic during construction (up to 1,100 workers) would be easily accommodated by the existing road systems with only minor temporary disruptions. Continuing operation of the W.A. Parish Plant, the pipeline, and the West Ranch oil field would have negligible effects as a relatively small number of commuting employees (10 to 15) would be added as well as a relatively small amount of additional material deliveries.</p>
Noise	
<p>No impacts.</p> <p>The W.A. Parish Plant, pipeline corridor, and EOR area at the West Ranch oil field would remain in their current conditions. No changes to the noise environment would occur.</p>	<p>Negligible to moderate adverse impacts.</p> <p>Construction of the CO₂ capture facility would result an estimated 0.3 dB increase over existing noise levels for nearby receptors (i.e., nearby residential areas), which is below the threshold of human perception. Increased truck traffic during daytime hours may result in minor, short-term noise impacts along transportation corridors. Residences within 500 to 1,000 feet of pipeline construction would experience a short-term increase in ambient noise and vibrations from construction activity. Receptors near HDD locations could experience elevated temporary ambient noise levels as high as 78 dBA. Overall, noise and vibrations would result in minor to moderate impacts to receptors, depending on the distance from the receptor to the construction area. Construction and operations at the West Ranch oil field would result in an estimated 0.8 dB increase over existing noise levels for nearby receptors (i.e., in Vanderbilt), which is below the threshold of human perception, resulting in negligible to minor impacts to receptors.</p>
Materials and Waste Management	
<p>No impacts.</p> <p>The W.A. Parish Plant, pipeline corridor, and EOR area at the West Ranch oil field would remain in their current conditions. Conditions related to material use and waste generation would remain</p>	<p>Negligible to moderate adverse impacts.</p> <p>The W.A. Parish Plant is currently a conditionally exempt small quantity generator and generates approximately 200 pounds of hazardous waste per year. Due to the generation of approximately 2,712 pounds per day of reclaimer effluent, a hazardous material, the W.A. Parish Plant would become a large quantity generator of hazardous waste. Approximately 24 shipments of reclaimer effluent would be sent to a permitted TSDF per year. The amounts sent for disposal would not substantially</p>

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No-Action Alternative	Proposed Action
<p>unchanged.</p>	<p>affect the capacities of the TSDF.</p> <p>Adequate waste disposal capacity exists within the ROI. Based on over 20 million tons of capacity available in waste disposal facilities that have been identified to date and the relatively low volumes of solid waste that would be generated by the proposed project (e.g., up to approximately 60 tons per year from the CO₂ capture facility), adequate capacity exists along the Texas Gulf Coast for solid waste disposal with negligible impacts to waste management service providers.</p> <p>Construction materials, equipment and supplies are readily available within the ROI and quantities required to support the proposed project are expected to be well within the capacity of material suppliers. Some specialized equipment may be required from outside the ROI; however, it is expected that this equipment would also be within existing supplier capacities. As a result, impacts to regional and national construction material resources and special equipment suppliers would be negligible.</p>
Human Health and Safety	
<p>No impacts.</p> <p>The W.A. Parish Plant, pipeline corridor, and EOR area at the West Ranch oil field would remain in their current conditions. Conditions related to human health and safety would remain unchanged.</p>	<p>Minor adverse impacts.</p> <p>The potential for worker injuries and fatalities would be present during the construction of the proposed CO₂ capture facility, CO₂ pipeline, and EOR/CO₂ monitoring infrastructure. Based on historical records for related industries, no worker fatalities would be expected. During facility operation, workers could be subject to physical and chemical hazards, which would be typical of those associated with similar power plant, pipeline, and oil field operations. An estimated nine to 12 OSHA recordable incidents would be anticipated during project construction based on national incidence rates for comparable industries.</p> <p>The potential for CO₂ pipeline ruptures or punctures is considered to be unlikely (i.e., the potential to occur between once in 100 years and once in 10,000 years). The upper bound impact from a pipeline release of CO₂ would be transient and reversible effects for up to 12 people. More severe impacts would affect less than one person for all other pipeline release scenarios. If a release were to occur with workers present, the workers would likely experience the physical effects of an accident (physical trauma, asphyxiation [i.e., displacement of oxygen in a small confined place], or frostbite from the rapid expansion of CO₂) or a higher concentration exposure to CO₂ than the surrounding population. Potential exposure would be limited because the pipeline would be buried underground. Additionally, NRG plans to install 12 main line valves to stop the release of CO₂ should a puncture or rupture occur. These valves, along with pipeline pressure monitoring equipment, would be linked to the CO₂ capture system operations control room, which would be staffed at all times when the CO₂ capture system is in operation. In the event of a pressure drop indicating a pipeline rupture, the control room operator would shut down the CO₂ capture system and remotely activate the main line valves to prevent further damage to the pipeline and minimize impacts to people in the surrounding area and the environment.</p> <p>The potential for release of CO₂ from the EOR area is considered to range from unlikely (i.e., the potential to occur between once in 100 years and once in 10,000 years) to Incredible: (i.e., the potential to occur less than one time in 1 million years) with less than one person affected for all release scenarios. In the extremely unlikely occurrence of an injection well blowout (i.e., a sudden loss of CO₂ from failure of an injection well during operation), the main adverse outcome would be the potential for</p>

Table S-5. Summary of Environmental Impacts

No-Action Alternative	Proposed Action
	<p>ejection of CO₂, possibly as dry ice particles, and formation fluids from the wellhead. Effects would be expected to be localized to the area around the affected wellhead and events of this type would be avoided or minimized by incorporating high pressure piping, overpressure protection (i.e., relief valves, and blowout preventers into the design of the injection wells. A leak of amine-based solvent from a storage tank was evaluated. Such a release would be unlikely (i.e., with the potential to occur between once in 100 years and once in 10,000 years) and effects would be confined to the W.A. Parish Plant property. In this scenario, no nearby residents or the general public in the vicinity of the plant would be affected; however, plant workers would need to take appropriate response actions, since life-threatening concentrations of the solvent in air could occur within the plant site to a distance of 0.3 miles from the release. No nearby residents or general public in the vicinity of the plant would be affected beyond mild irritation if an amine-based solvent tank release occurred, although an odor may be detectable depending on the wind conditions.</p>
Utilities	
<p>Negligible to minor adverse impacts with some beneficial impacts.</p> <p>The pipeline corridor and EOR area at the West Ranch oil field would remain in their current conditions. The construction and operations phases of the cogeneration plant at the W.A. Parish Plant would increase demand for potable and industrial water; and wastewater treatment services. Construction-related impacts to water supplies would be short term and negligible to minor. Construction-related impacts to wastewater treatment would be negligible. Operations impacts to water supplies would be negligible. Operations of the cogeneration plant would result in negligible impacts to the natural gas supply as compared to existing use (i.e., much less than 1% of the current maximum usage). The cogeneration plant would supply electricity that would be available for commercial sale through the power grid, and would be a beneficial impact.</p>	<p>Negligible to minor adverse impacts with some beneficial impacts.</p> <p>The construction and operations phases of the proposed project would increase demand for potable and industrial water; and wastewater treatment services. Construction-related impacts to water supplies would be short term and negligible to minor. Construction-related impacts to wastewater treatment would be negligible. Operations impacts to water supplies would be negligible. Operations of the CO₂ capture facility would result in negligible impacts to the natural gas supply as compared to existing use (i.e., much less than 1% of the current maximum usage).</p> <p>EOR operations may require additional natural gas supply and electricity, which may result in minor impacts to the local utility infrastructure. Beneficial impacts to oil supplies would be provided in the long term as a result of increased production of oil in the ROI as a result of EOR operations.</p>

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No-Action Alternative	Proposed Action
Community Services	
<p>No impacts.</p> <p>The W.A. Parish Plant, pipeline corridor, and EOR area at the West Ranch oil field would remain in their current conditions. No changes to community services would occur.</p>	<p>Negligible adverse impacts.</p> <p>A temporary workforce of up to 1,100 workers would be required for construction of the proposed project. Long-term operation of the project would require up to 20 new employees. Many of these workers are expected to be employed from within the ROI. Negligible impacts on community services would be expected due to a relatively small population increase that would be related to the construction and operations phases of the Parish PCCS Project. Existing community services (i.e., law enforcement, emergency response, hospitals, and education) are expected to be adequate to address the needs of the population in the ROI, including project personnel.</p>
Socioeconomics	
<p>Beneficial impacts.</p> <p>The pipeline corridor and EOR area at the West Ranch oil field would remain in their current conditions. Construction of the cogeneration plant would result in minor short-term beneficial impacts by consumption of goods and services by the up to 100 construction persons. Construction of the cogeneration plant would likely result in a moderate, beneficial impact to taxes and revenue within the ROI.</p>	<p>Beneficial impacts.</p> <p>The project (with approximately 1,100 construction-related jobs and up to 20 new jobs for operations) would be expected to contribute minor, long-term, beneficial impacts on the local economy and employment activities, as well as taxes and revenue through increased employment opportunities and expenditures in the local economy. Housing demand may increase slightly during construction if a portion of the 1,100 construction workers temporarily relocate to the area; however, this would be a negligible, short-term effect. The State of Texas offers many legislatively enacted production tax structures. Under the State's tax code, oil produced using methods involving the injection of CO₂ into an oil-bearing formation falls into two categories of tax rate - using CO₂ for EOR and using anthropogenic CO₂ for EOR. The Parish PCCS project would fall into both categories, which would result in an effective oil production tax rate of 1.15% (Texas Comptroller 2012c). The legislative record indicates the intent of these tax structures is to increase oil production in a manner that likewise increases tax revenue to the State. Consistent with the legislative intent, and as Section 2.3.4 of this EIS indicates, the Parish PCCS project is expected to increase the rate of oil production from the West Ranch oil. TCV's portion of the West Ranch oil field currently has approximately two million barrels of conventional proven oil reserves. TCV estimates that using CO₂ floods (i.e., EOR), the West Ranch oil field could produce an additional 55 to 75 million barrels of oil. This projected increase in oil production is expected to translate directly into additional revenues for the State of Texas, even after taking into account the tax exemptions related to use of CO₂ for EOR and use of CO₂ from anthropogenic sources.</p>
Environmental Justice	
<p>No impacts.</p> <p>The W.A. Parish Plant, pipeline corridor, and EOR area at the West Ranch oil field would remain in their current conditions. No environmental justice impacts would occur.</p>	<p>Negligible adverse impacts with some beneficial impacts.</p> <p>Three census tracts in the ROI qualify as a minority environmental justice areas of concern using the threshold of 50% minority in the corresponding county. However, the proposed project is not expected to have disproportionately high and adverse human health or environmental impacts on minority populations. The overall impacts of the proposed project would be negligible or minor, depending on the resource area evaluated, and would not</p>

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No-Action Alternative	Proposed Action
	<p>be directed at any particular minority group(s). Significant and/or adverse impacts on potential environmental justice areas of concern would not occur. In addition, the proposed project is expected to create economic benefits for local communities, regardless of race, by generating employment opportunities, local expenditures by workers, and compensation for proposed project-related easements to local landowners. Mitigation measures for resource areas impacted have been identified to further reduce environmental impacts and adhere to policies and regulations for the protection of the environment and local public health. Therefore, the proposed project would not create a disproportionately high and adverse human health or environmental effect on minority populations during construction or operation.</p> <p>Because there is no low-income population in the ROI to be affected, there would be no adverse environmental justice impacts associated with the proposed project. However, DOE expects the proposed project to create economic benefits for local communities during construction and operation.</p>

BEG = Texas Bureau of Economic Geology; BMPs = best management practices; CFR = Code of Federal Regulations; CO₂ = carbon dioxide; CT/HRSG = combustion turbine/heat recovery steam generator; EOR = enhanced oil recovery; EPA = U.S. Environmental Protection Agency; ERC = emission reduction credit; FEMA = Federal Emergency Management Agency; FM = Farm-to-Market Road; GHG=greenhouse gas; gpd = gallons per day; HCl = hydrochloric acid; HDD = horizontal directional drilling; HF = hydrofluoric acid; HGB MSA = Houston Galveston Brazoria Metropolitan Statistical Area; MECT = Mass Emission Cap & Trade; mgd = million gallons per day; MLV = main line valve; MMTA = million metric tons per annum; MTA = metric tons per annum; MW = megawatts; NAAQS = National Ambient Air Quality Standards; NH₃ = ammonia; NNSR = Nonattainment New Source Review; NO_x = nitrogen oxides; NRHP = National Register of Historic Places; PCCS = Post-Combustion CO₂ Capture and Sequestration; PM₁₀ = particulate matter with a diameter of 10 microns or less; ROI = region of influence; ROW = right of way; RRC = Railroad Commission of Texas; SWPPP = stormwater pollution prevention plan; TCEQ = Texas Commission on Environmental Quality; TCV = Texas Coastal Ventures LLC; **THC = Texas Historical Commission**; tpy = tons per year; TSDF = treatment, storage, and disposal facility; UIC = Underground Injection Control; VOC = volatile organic compounds; **WWTP = Wastewater Treatment Plant**

POTENTIAL CUMULATIVE IMPACTS

DOE addressed the impacts of the Parish PCCS Project incrementally when added to the reasonably foreseeable impacts of other significant known or proposed projects within the geographic area in accordance with the cumulative impact requirements of NEPA (40 CFR 1508.7). As a result of the cumulative impacts analysis, DOE concluded that the Parish PCCS Project, in combination with other reasonably foreseeable future actions may result in cumulative impacts on the following resource areas:

- **Air Quality and Climate:** Emissions from the proposed project and other power or oil and gas projects in the same airsheds as the proposed project (e.g., the Colorado Bend Energy Center, Deer Park Energy Center Expansion, King Power Station, White Stallion Energy Center, and the Flag City Natural Gas Processing Plant) may have a cumulative impact on air quality. Due to emission limits imposed by the TCEQ as part of the Texas air permitting process, in conformity with the Texas SIP, significant adverse cumulative effects on air quality are not expected.
- **Greenhouse Gases:** The proposed project would be expected to contribute minor beneficial impacts by reducing CO₂ emissions. Other projects in the ROI that would include combustion of additional fossil fuels or other GHG emissions (e.g., Colorado Bend Energy Center, Deer Park Energy Center Expansion, King Power Station, White Stallion Energy Center, and the Flag City Natural Gas Processing Plant) would be expected to cumulatively emit additional amounts of GHGs within the ROI.
- **Physiography and Soils:** Each of the reasonably foreseeable future actions would cause some degree of soil disturbance, loss, and/or erosion, which may result in minor cumulative impacts.

- **Groundwater and Surface Water:** Each of the reasonably foreseeable future actions may require some amount of water for construction and/or operation. Minor cumulative impacts in terms of increased demand on groundwater and/or surface water, and the potential for contamination of water resources may occur in the ROI.
- **Wetlands and Floodplains:** The ETP NGL pipeline could interact with construction of the proposed CO₂ pipeline and cumulatively reduce wetland acreage by expanding the width of the mowed and maintained ROW in the existing utility corridor and/or increase the duration of temporary impacts (i.e., for wetland restoration). Cumulative impacts associated with these projects would be minor, however, as both projects would be required to avoid, minimize, and mitigate wetland impacts according to USACE permit requirements.
- **Biological Resources:** Each of the reasonably foreseeable future projects may result in some degree of wildlife habitat losses. The impacts to wildlife habitat resulting from the proposed project combined with other reasonably foreseeable future projects would be minor because comparable habitat is available throughout the region.
- **Cultural Resources:** Each of the reasonably foreseeable future actions may cause some degree of cultural resource disturbance. Thus, minor cumulative impacts would be expected on cultural resources.
- **Land Use and Aesthetics:** The ETP NGL pipeline could interact with construction of the proposed CO₂ pipeline and cumulatively make land unavailable for other uses temporarily, resulting in minor cumulative impacts on land use.
- **Transportation and Traffic, and Noise and Vibration:** Should construction of the proposed CO₂ pipeline coincide with construction of the ETP NGL pipeline and/or the bridge replacement in Fairchilds, construction-related, temporary cumulative impacts of increased traffic may occur. Additionally, minor to moderate, short-term cumulative effects of increased sound levels and perceptible vibrations may occur during project construction. However, current information suggests that the construction timeframes would be unlikely to overlap.
- **Materials and Waste Management:** Each of the foreseeable future actions would require construction materials and/or operational materials, which may result in minor cumulative adverse impacts on availability of materials and waste disposal facility capacity.
- **Utilities:** Minor beneficial cumulative impacts would be expected in terms of oil supplies. Minor cumulative adverse impacts on utility providers' supply and distribution capacities would be expected; however, the existing utility capacities within the ROI would be adequate to support the increased demand.
- **Community Services:** The planned new subdivision in Greatwood would contribute to population growth near the W.A. Parish Plant. Overall, minor impacts on community services in the Greatwood area may occur, though the contribution of the proposed project would be negligible.
- **Socioeconomics:** Construction projects could compete for skilled and unskilled labor and lodging in the short-term. However, beneficial short-term and long-term impacts result from increased employment opportunities, local spending, and related tax revenue.

The Parish PCCS Project would not contribute to adverse GHG impacts in the ROI. The estimated GHG reduction attributable to the proposed project would result in overall beneficial impacts. Cumulative impacts are also not expected for the geology, human health and safety, or environmental justice resources areas because the Parish PCCS Project is not expected to interact with other reasonably foreseeable future actions with regard to these resource areas.

CONCLUSIONS

As with the development of any large industrial project, the construction and operation of the proposed Parish PCCS Project, including the CO₂ capture facility and related infrastructure, the approximately 81-mile CO₂ pipeline, and EOR and related CO₂ monitoring activities at the West Ranch oil field, would impact the surrounding environment. Analyses included in this EIS indicate that the project could result in:

- potential beneficial impacts, primarily related to regional socioeconomics and the reduction of greenhouse gas emissions, but also related to some aspects of air quality, geology, groundwater, and utilities;
- potential moderate adverse impacts to surface water, biological resources, land use and aesthetics, noise, and materials and waste management;
- potential negligible to minor adverse impacts to air quality, geology, physiography and soils, groundwater, surface water, wetlands and floodplains, cultural resources, traffic and transportation, human health and safety, utilities, and community services; and
- no environmental justice impacts.

DOE's Proposed Action would support the CCPI Program in demonstrating an advanced coal-based technology at a commercial scale that would capture, put to beneficial use, and geologically sequester CO₂ emissions. The Proposed Action would satisfy the responsibility Congress imposed on DOE to demonstrate advanced coal-based technologies that can generate clean, reliable, and affordable electricity in the U.S. The CCPI Program selects projects with the best chance of achieving the program's objectives as established by Congress: commercialization of clean coal technologies that advance efficiency, environmental performance, and cost competitiveness well beyond the level of technologies currently in commercial service. Accelerated commercial use of these new or improved technologies will help to sustain economic growth, yield environmental benefits, and produce a more stable and secure energy supply.

DOE also recognizes the controversies surrounding the continued dependence on coal by the power industry and the need to address the associated environmental and climate change challenges related to the continued use of coal. However, as the most abundant fossil fuel resource in the U.S., coal will continue to play an important role in the nation's energy supply. The proposed Parish PCCS Project would capture for EOR and ultimately sequester approximately 1.6 million tons per year of CO₂ that is currently emitted by the W.A. Parish Plant to the atmosphere. DOE considers the technological advancement and commercialization of carbon capture and storage, and beneficial use of CO₂, as important components of maintaining energy supplies while minimizing environmental impacts associated with using fossil fuel resources.

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