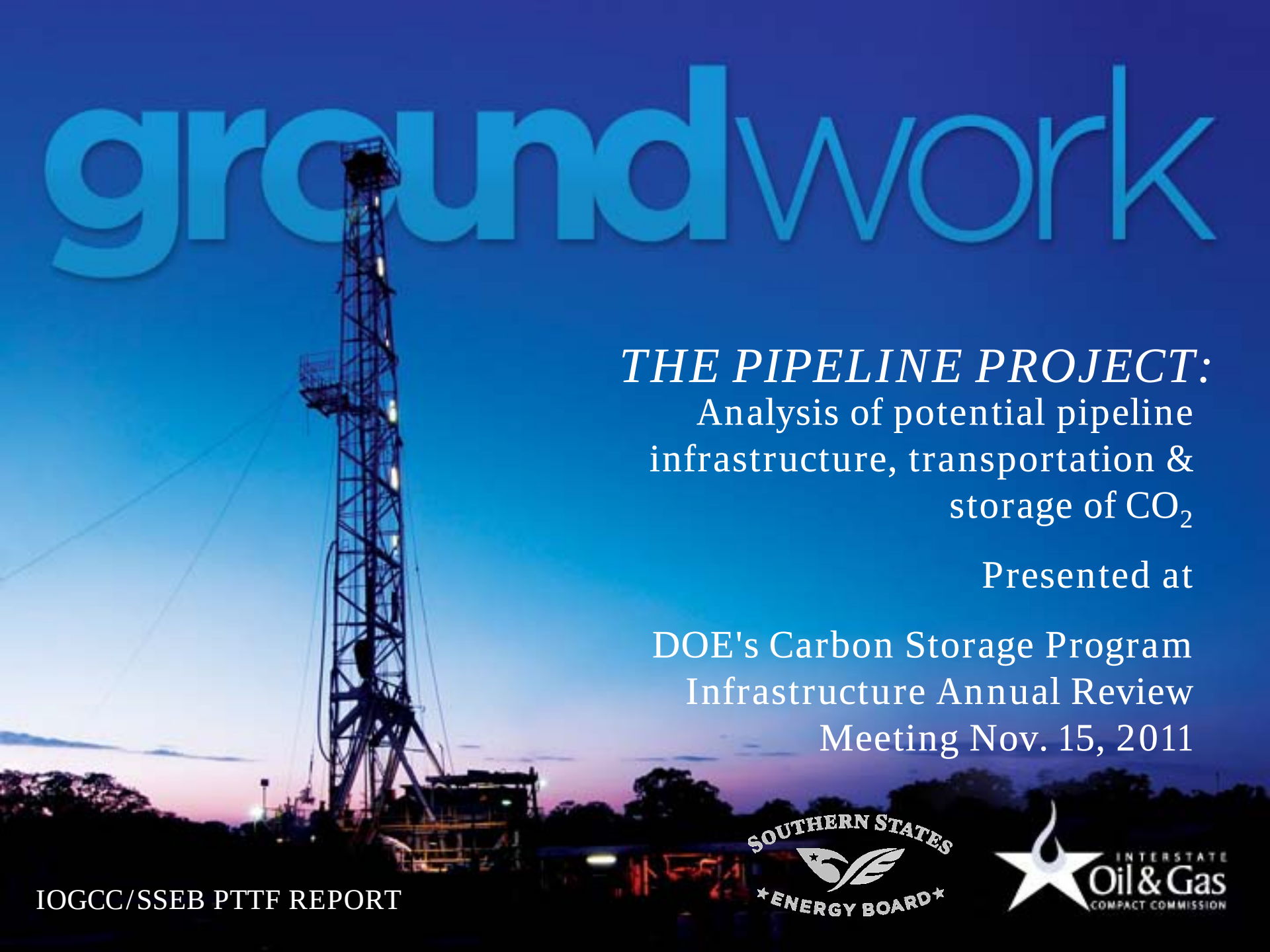

THE PIPELINE PROJECT:

Analysis of potential pipeline infrastructure, transportation & storage of CO_2

Presented at

DOE's Carbon Storage Program
Infrastructure Annual Review
Meeting Nov. 15, 2011

IOGCC/SSEB PTTF REPORT

SOUTHERN STATES ENERGY BOARD

INTERSTATE Oil & Gas COMPACT COMMISSION

Acknowledgement

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The Report

Four sections:

1. Overview
2. Background
3. Analysis
4. Recommendations

PART 1: OVERVIEW

- Pipeline Transportation Task Force
- Collaborative Work Group Model
- Task Force Objectives

IOGCC-SSEB CO_2 Pipeline Transportation Task Force (PTTF)

- Offshoot of IOGCC's Carbon Capture and Geologic Storage Task Force
- Southeast Regional Carbon Sequestration Partnership Focus Area
- Collaboration:

Task Force Composition

- Interstate Organizations
  - IOGCC
  - SSEB
- Federal Regulators
  - FERC
  - US DOE
  - US EPA
  - US DOI
- Industry Representatives
- Environmental Representatives
- Scientists
- Legal Experts

IOGCC's Collaborative Work Group Model

- Peer-led
- Research conducted by members
- Facilitated by IOGCC project managers and contracted specialists
- Consensus-driven

Task Force Objectives

- Examine current legal and regulatory environment
- Identify barriers and opportunities for wide-scale construction of CO_2 pipelines
- Issue recommendations

Policy
Legal
Regulatory
Perspective

PART 2. BACKGROUND

I. Carbon Capture

II. Geologic Storage

III. Transportation

Carbon Capture and Storage

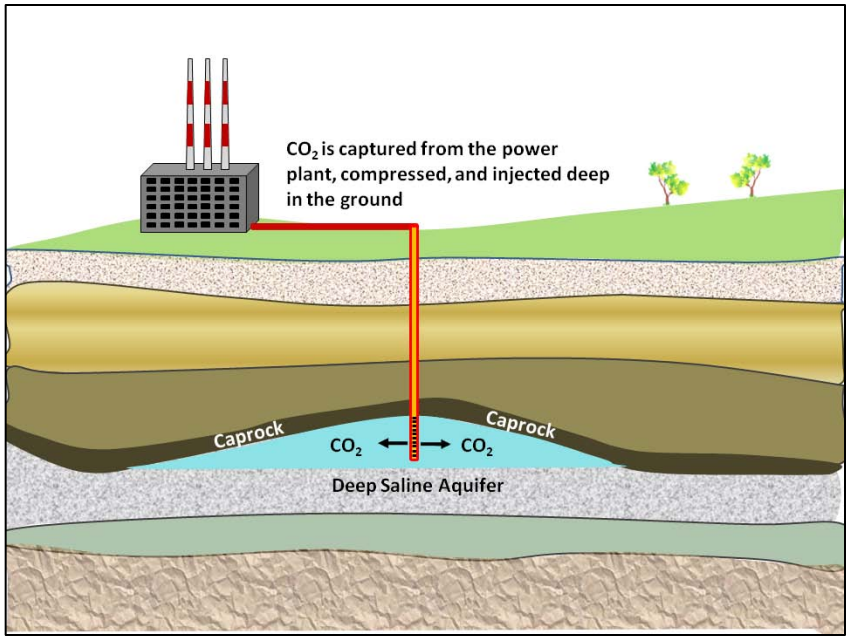
- CO_2 is separated, pressurized, transported and stored in geological formations
- One of 4 commonly discussed GHG reduction strategies
  - Energy conservation and efficiency
  - Use of renewables, nuclear and fuel switching
  - Terrestrial sequestration
  - Carbon Capture and Storage

I. Carbon Capture

- Only feasible at large point sources:
  - Power plants
  - Large industrial sources
- Pre and post – combustion systems can capture 80% to 90% of CO_2 emissions
- Facility equipped with CCS currently requires 10% to 40% more energy

II. Geologic Storage

- Depleted oil and gas fields
- Deep saline formations
- Coal-bed storage



Geological formations are used to capture / store CO_2

III. Transportation

- Current infrastructure developed to support enhanced oil recovery (EOR)
- Approximately 4000 miles of CO_2 pipelines in place
- Future infrastructure needs could range from 15,000 to 66,000 miles of CO_2 pipelines –
  - from IEA Blue Map Scenario
  - And Interstate Natural Gas Association study

Enhanced Oil Recovery

- CO_2 is injected into underground formations to produce additional oil following primary and secondary recovery methods
- EOR has been used successfully to increase oil recovery in exhausted oil reservoirs
- Approximately 4000 miles of CO_2 pipeline infrastructure services the EOR industry
- In Texas alone there are 183 active EOR projects

PART 3: ANALYSIS

I. Existing Physical and Regulatory Structure in the US

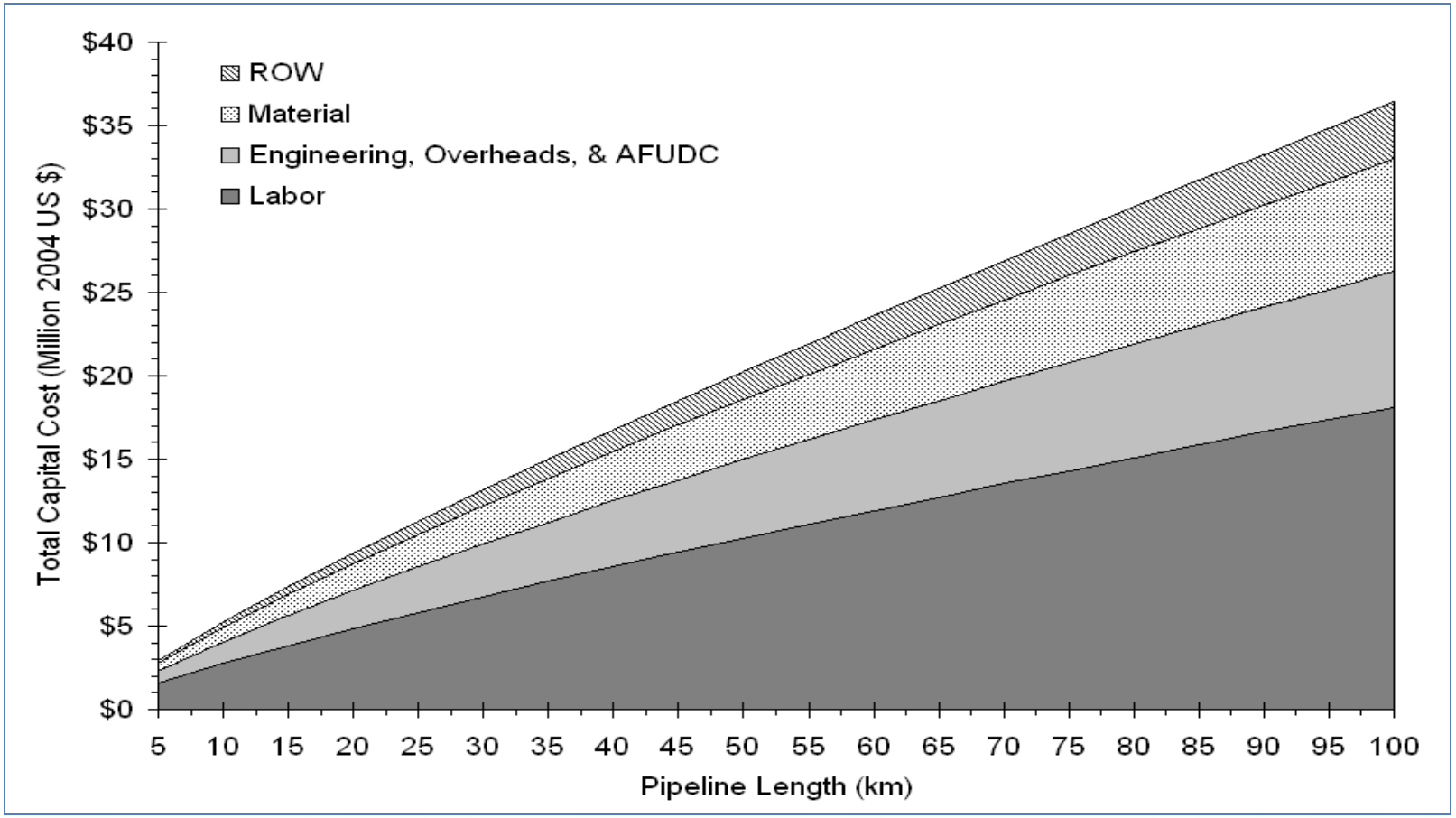
- Pipeline Infrastructure
- Regulatory Structure
- Resource Management Paradigm
- Future Pipeline Build-Out Scenarios

Physical Infrastructure

- Design is similar to natural gas pipelines
  - CO_2 pipelines must withstand higher pressure (1200 to 2700 psi) than Natural Gas (NG) pipelines (200 to 1500 psi)
  - Because CO_2 is typically transported in a supercritical state, pumps are used to move the product (rather than compressors)
- Costs
  - Increases in carbon steel has resulted in higher pipeline costs
- Quality Specifications
  - Today there are no CO_2 compositional standards; composition is determined by contract
  - Common contractual specifications
    - Nitrous Oxide (N_20) and Methane (CH_4) < 10% in aggregate
    - Oxygen < 10 to 20 ppm
    - Water (H_20) 20-30 lbs./MMcf allowed

Pipeline Costs

Cost of a 16-inch CO_2 Pipeline of Various Lengths in the Midwest



Regulatory Structure

- Safety regulation of CO_2 pipelines
- Regulatory Status under the Interstate Commerce Act and the Natural Gas Act
- Jurisdiction under the Mineral Leasing Act of 1920
- CO_2 pipeline regulation under State Law
- Resource Management Paradigm

Safety regulation of CO_2 pipelines

- Intrastate pipelines regulated by
  - State applying applicable federal standards under the Pipeline Safety Reauthorization Act;
  - If State has not adopted federal standards, then by the Pipeline Hazardous Materials Safety Administration (PHMSA) within DOT
- Interstate pipelines regulated by PHMSA
- OPS sets standards for:
  - Design, construction, pressure testing
  - Used pipe, new pipe, metals, etc.
  - Operation and maintenance

Federal Regulatory Status

- **Interstate Commerce Act** – under the ICA, the Surface Transportation Board (STB) regulates oil pipelines; however in 1980 a predecessor agency (ICC) declared that "it lacked jurisdiction over interstate transportation of CO_2 by pipeline"
- **Natural Gas Act (NGA)** – in 1978, FERC found that gas that was not 98% methane was not "natural gas" and therefore not subject to regulation under the NGA
- **Pipelines Crossing Federal Lands**
  - Mineral Leasing Act – if Rights-Of-Way issued by BLM then "common carrier" obligations are imposed
  - Federal Land Policy Management Act – imposes no "common carrier" obligation

CO_2 Pipeline Regulation under State Law Examples

State	Regulatory Status	Condemnation Authority
Mississippi	Private carrier	Yes, limited to EOR use
Texas	Private/common carrier option	Yes, for common carrier
Louisiana	Private carrier	Yes, limited to EOR use

Resource Management Paradigm

Regulation that seeks to manage, maintain, and advance the beneficial uses of a commodity while regulating and controlling harmful or deleterious effects of the commodity.

II. Prospective Business Models and State and Federal Regulatory Options

- Leading Business Models
- State and federal regulatory systems
- Potential impact of regulatory systems

Leading Business Models

- Intrastate Dedicated Pipeline Model
  - Dedicated pipelines
  - Private or contract carriage
  - Limited third party access
  - Typically condemnation authority not available
- Intrastate Open Access Model
  - Provide transportation to multiple users
  - Third party access available
  - Condemnation authority available

Leading Business Models Cont'd

- Interstate Dedicated Pipeline Model
  - Does not involve access to federal lands
  - Similar to Intrastate Dedicated Pipeline Model
- Interstate Open Access Model
  - May involve access to federal lands
  - Possibly regulated as "common carriers"
  - Similar to Intrastate Open Model
- Government/Public Option Model
  - Public financing and/or ownership of facilities

Regulatory Options

Option	Siting Authority (eminent domain powers)	Rate Regulation	Access	Entry/Exit	Safety
Current CO_2 Pipeline regulatory framework	States	Contractual agreement	Generally by contractual agreement, except where pipeline crosses federal land	States	OPS State option
Oil Pipeline Model	States	FERC	FERC – common carriage where proration or apportionment is required		OPS State option
Natural Gas Model	FERC - § 717f grants eminent domain authority	FERC	Not common carriers; no apportionment; open season required	FERC	OPS State Option
E.g., Energy Policy Act 2005 "backstop" Option (electric facilities)	States; if state fails to act, FERC may issue permit with associated eminent domain authority				OPS State option
"Opt-in" Model	States or new pipeline developers may access federal siting authority	FERC or other federal regulatory authority	FERC or other federal regulatory authority	FERC or other federal regulatory authority	OPS State option
Multi-State Compact	Intrastate → States Interstate → Compact	Compact	Compact		OPS State option

The Impact of Regulatory Scenarios on Business Models

- Regulatory considerations must Balance
  - Competition vs. Compliance
  - Centralized vs. Decentralized
  - Small vs. Large
- Status Quo compatible with all Business Models
- Multi-state Compact option compatible
- Natural Gas Pipeline Model compatible
- Oil Pipeline Model not compatible with some of the models (apportionment/proration)
  - Could leave CO2 stranded
  - w/o firm off-take capacity
  - Can’t meet compliance obligations

III. Economic Issues

- Financing
  - Project finance and debt financing used to finance existing CO_2 pipelines
  - Government support may be necessary in the future
- Infrastructure Costs




III. Economic Issues Cont'd.

- Cost Forecasting of CO_2 pipelines
  - $50,000 per inch X per mile (estimate)
- Commercial Transactions Involving CO_2 Pipelines
  - Sale and purchase agreements
  - Off-take agreements




III. Economic Issues Cont'd.

- Regulatory Compliance Costs
- State Incentives
- Federal Incentives
  - Financial, tax credits, loan guarantees, allowing MLPs etc.
- Treatment under the Uniform Commercial Code
  - Minimizes uncertainty regarding applicable law
  - Disputes resolved under UCC rather than state contract law

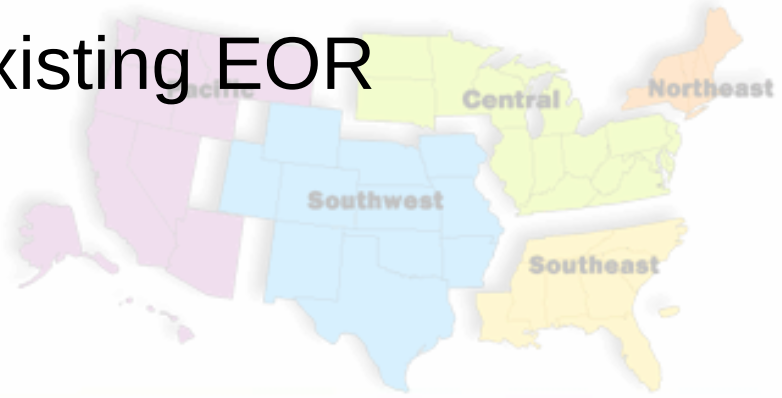
PART 4: RECOMMENDATIONS

General Recommendations

- No federal oversight required
- Begin with EOR-driven storage
- Allocate public resources for infrastructure should Non-EOR storage be mandated

State Recommendations

- Avoid a one-size-fits-all approach
- Promote market based solutions
- Implement statutes and regulations
- Consider creating separate pipeline authorities, i.e Wyoming
- Share information about existing EOR structure



Federal Recommendations

- Retain the status quo of safety regulations, leaving siting and rate regulation to the states
- If role expanded, closely follow natural gas model, which provides dedicated capacity to assure transport for sources to meet potential compliance obligations
- Encourage private sector build-out for EOR activities

Offshore Storage Task Force

- Objective

  Evaluate the potential for CO_2 Sequestration in Sub-Seabed Geological Structures (CS-SSGS)

  - In the Gulf of Mexico
  - Other coastal areas

Offshore Storage Report

Aerial view of the Sleipner production platform of the North Sea shelf, which hosts the first commercial geologic CO_2 sequestration project (Source: Statoil)

Offshore Storage Task Force

- Task force formed April 2010
  - State Regulators
  - Federal Agencies – Interior & Energy
  - Researchers
    - Geological Survey of Alabama
    - UT Bureau of Economic Geology
  - Industry representatives

* observers

Offshore Storage Task Force

- Focus: U.S. Outer Continental Shelf
- Evaluate CS-SSGS storage potential
  - 1 trillion tons of offshore storage capacity
- Evaluate current legal and regulatory framework
  - State
  - Federal

Research Topics

- Geological/Technical Topics
  - Capacity assessment
    - Geological Survey of Alabama
    - UT Bureau of Economic Geology
  - Identify existing infrastructure
    - penetrations and
    - possible re-use
  - Discuss MVA options

Research Topics

- Regulatory requirements
  - State Seabed
  - Federal Seabed
  - Water Column
- Legal/regulatory challenges and opportunities
  - Uniform governmental control
  - Long-term liability/stewardship

Questions?

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