

DOE Carbon Sequestration Program

Overview and Summary

Charles E. Schmidt

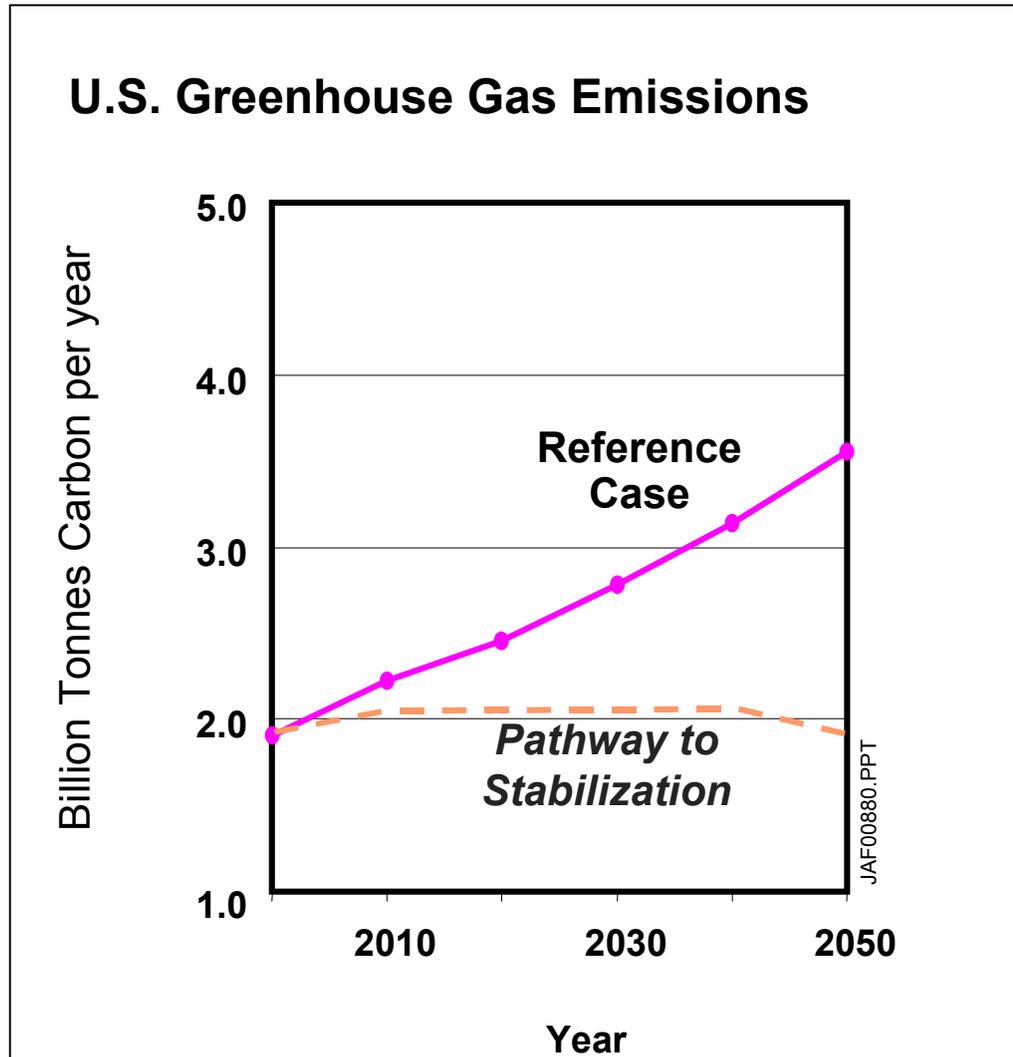
**Carbon Sequestration Product Manager
National Energy Technology Laboratory**



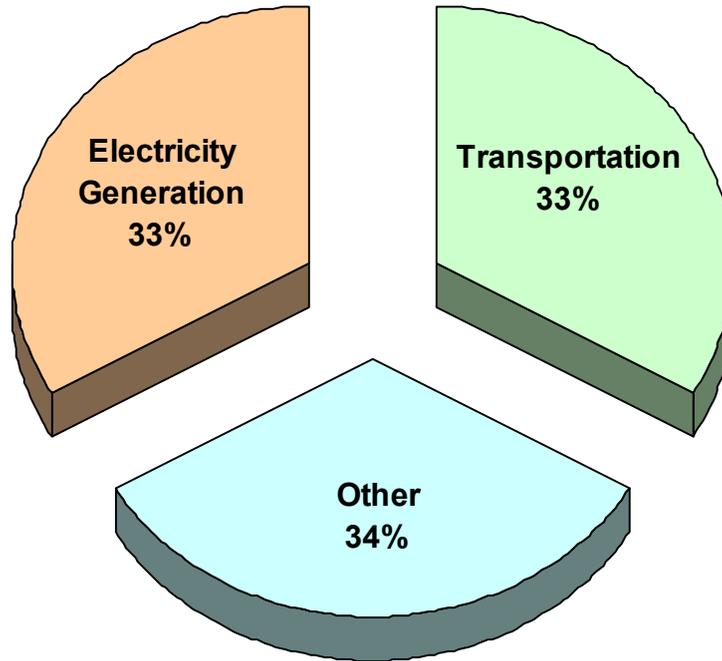
The Third Option



Closing the “gap”



Carbon Sequestration Addresses All Carbon Emissions

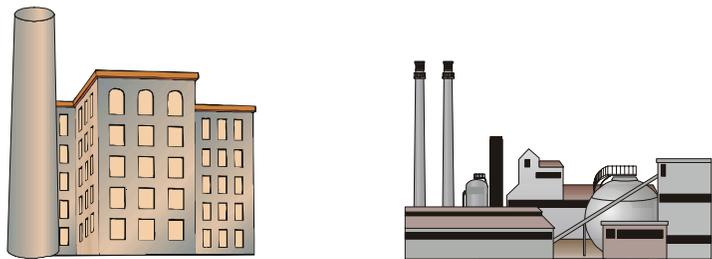


Direct Carbon Sequestration

Indirect Carbon Sequestration

Capture and store CO ₂ from large point sources	Decarbonize fuels, capture and store CO ₂	Offset emissions by removing CO ₂ from the atmosphere
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Direct Carbon Sequestration



Capture and storage

Oil & Gas Reservoirs

Unmineable Coal Seams

Saline Formations

Oceans

Indirect Carbon Sequestration



Remove CO₂ from the atmosphere

Forestation

Agricultural Practices

Mineralization

Ocean Fertilization

Advanced Concepts

Convert CO₂

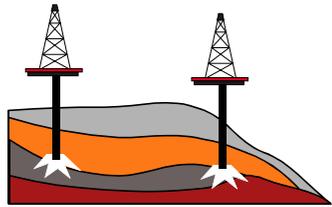
Stable Benign Solids

Useful Products

Hydrocarbon Fuels



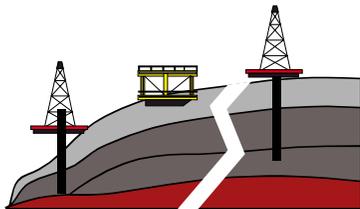
Sequestration Sinks



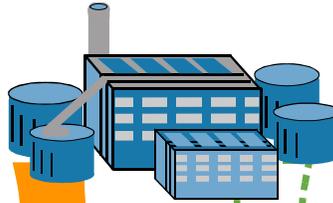
Unmineable Coal Seams



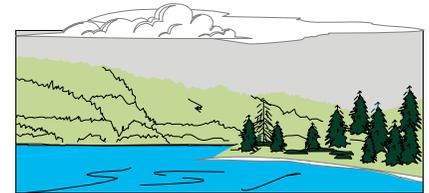
Ocean Storage



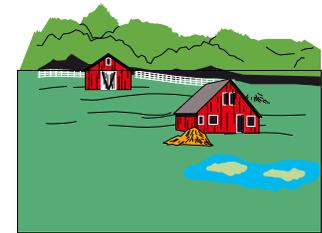
Depleted Oil/Gas Wells;
Saline Aquifers



Enhanced
Natural
Sinks



Forestation



Enhanced Photosynthesis;
Biomimetics



Sequestration Program Goals

- **Provide economically competitive and environmentally safe options to offset all projected growth in baseline emissions of greenhouse gases by the U.S. after 2010, with offsets starting in 2015**
- **The long- term cost goal is in the range of \$10/ ton of carbon avoided sequestration net costs**



Key Research Areas

- **CO₂ separation and capture**
- **Sequestration in geological structures**
- **Ocean sequestration**
- **Integration of energy production systems with terrestrial sinks**
- **Advanced chemical and biological concepts**
- **Modeling and assessments (crosscutting)**



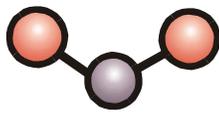
CO₂ Capture

Assessment



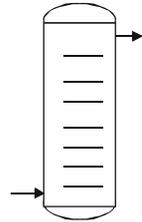
Retrofit Analysis

Research

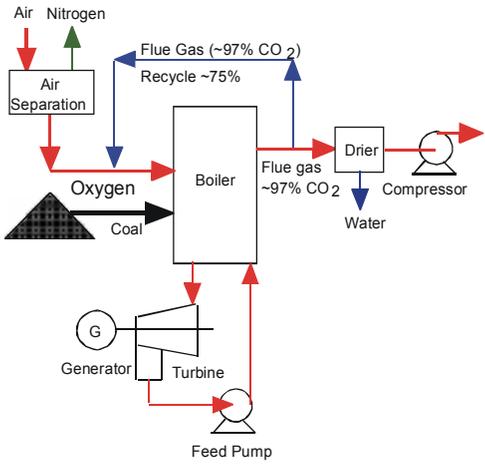


CO₂ Sorbents

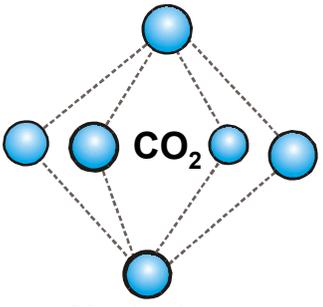
Development



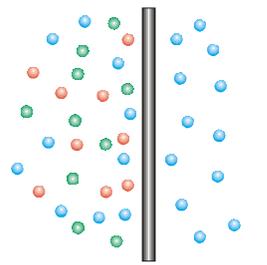
Scrubbers



Power Generation Models



Hydrates



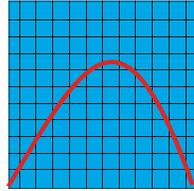
Membranes



Novel Concepts



Geologic Sequestration



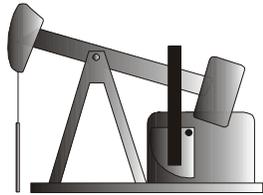
Understand the process,
optimize performance



Identify suitable sites



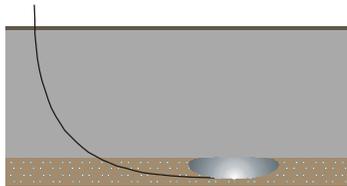
Verify environmental
acceptability



Oil Reservoirs



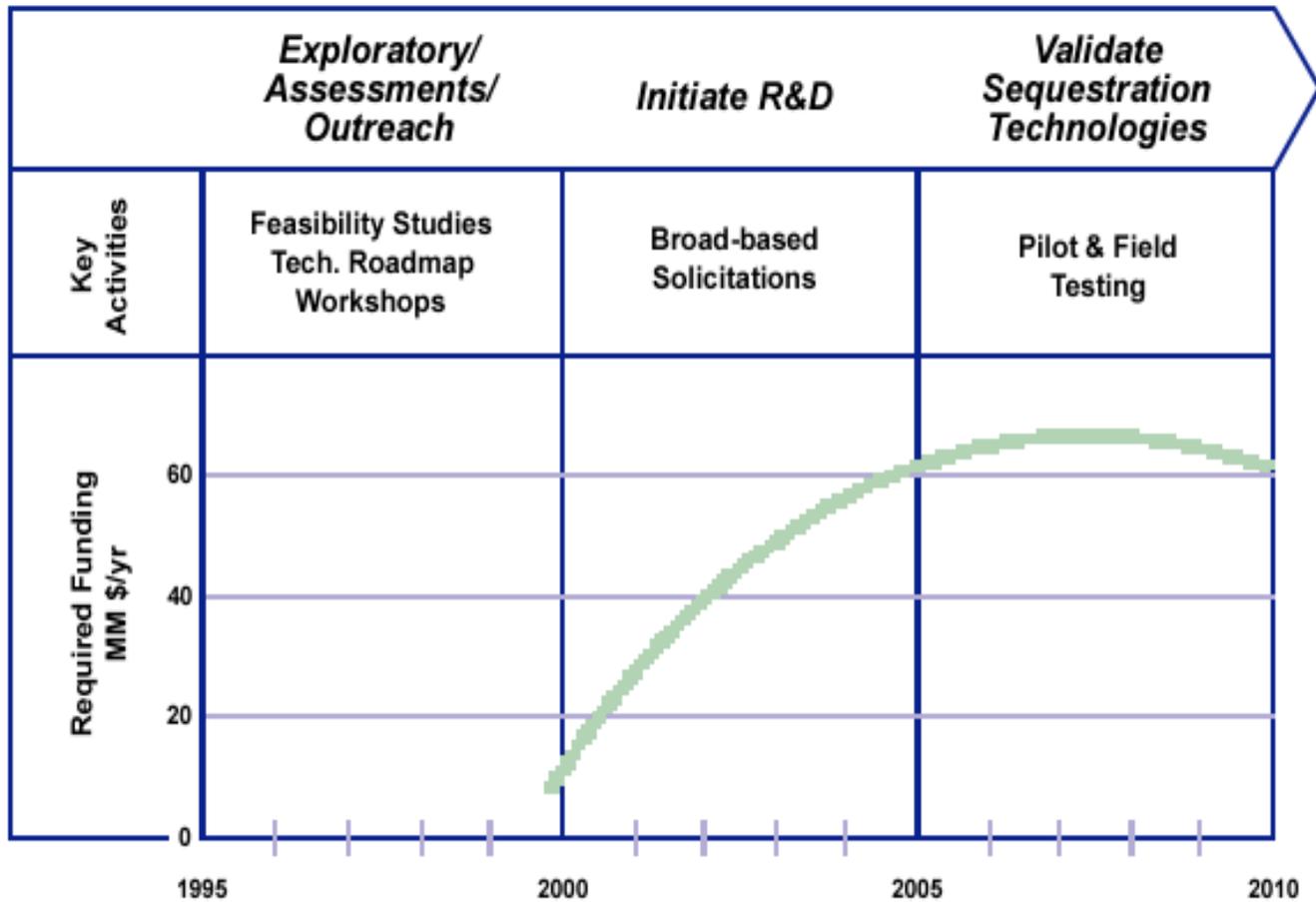
Coal Seams



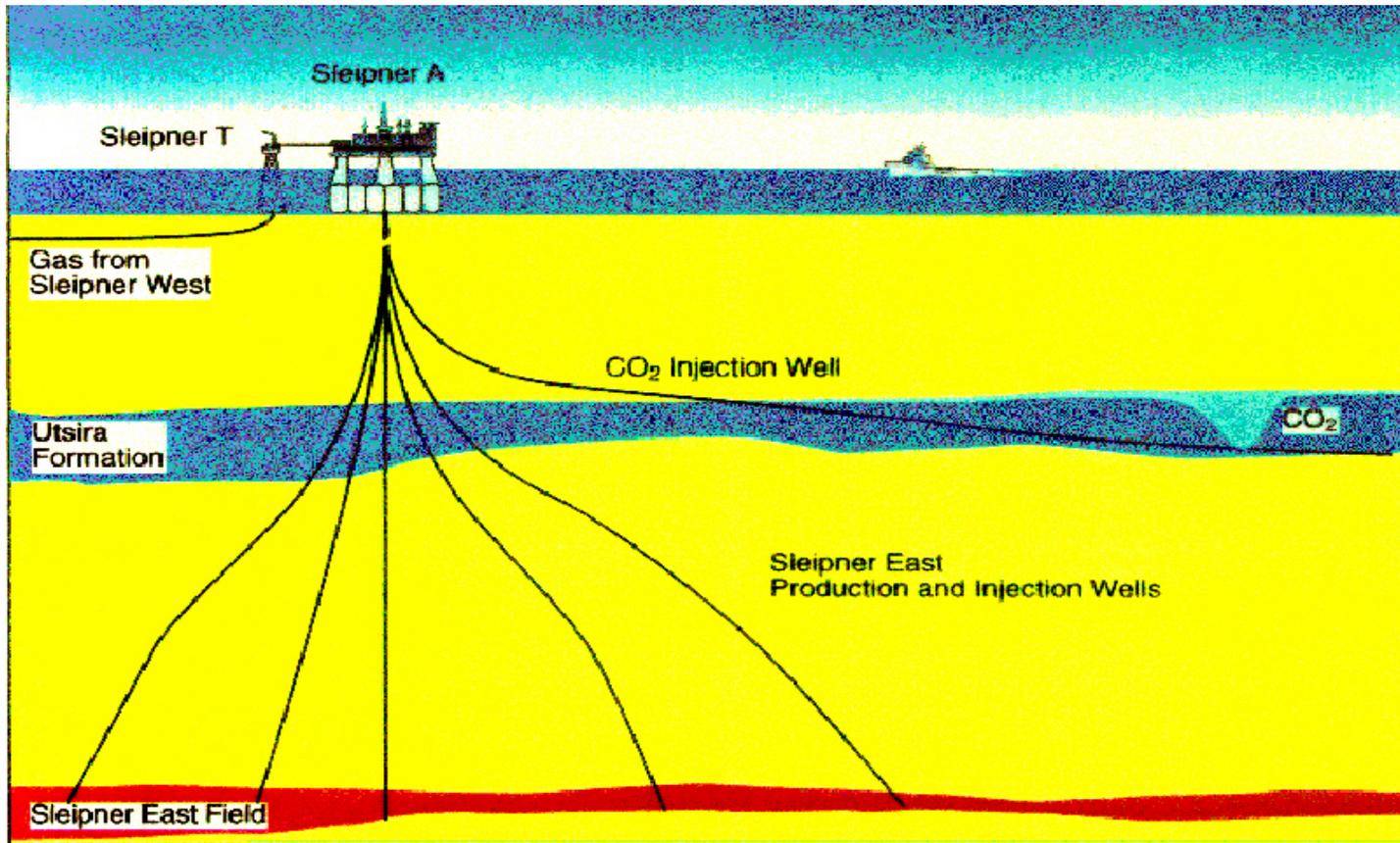
CO₂ Injection into
a Saline Formation

2004	2006	2008
2006	2008	2010
2008	2012	2015

Program Phases & Proposed Budgets



Sleipner CO₂ Injection Project



CO₂ sequestration equivalent to 140 MW power plant

