

# **Developing a Commercial System for CCS in Indiana**

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**Clean Air Task Force**

**Indiana Carbon Capture and Sequestration Summit**

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CLEAN AIR TASK FORCE



# Clean Air Task Force (CATF )

- **CATF is a nonprofit environmental organization that addresses air quality and atmospheric protection issues.**
- **CATF's Coal Transition Project works with project developers and technology vendors to advance environmentally sound coal gasification projects.**
  - **Increasingly, these projects seek to incorporate some level of carbon capture and geologic sequestration often through enhanced oil recovery.**
- **CATF employs twenty professionals with backgrounds in science, engineering, law, economics and public outreach.**
- **Headquartered in Boston, Massachusetts but operating throughout the United States with additional efforts in China and India.**



# Topics

- **CO<sub>2</sub> Storage options for Indiana**
  - **Location of sinks, potential capacity**
- **Pipelines for EOR**
- **'Costs' of Transport of CO<sub>2</sub>**
- **Comparative Carbon Mitigation Strategies**
  
- **Suggest a framework for addressing CCS in Indiana**
- **Suggestions for creating that framework**

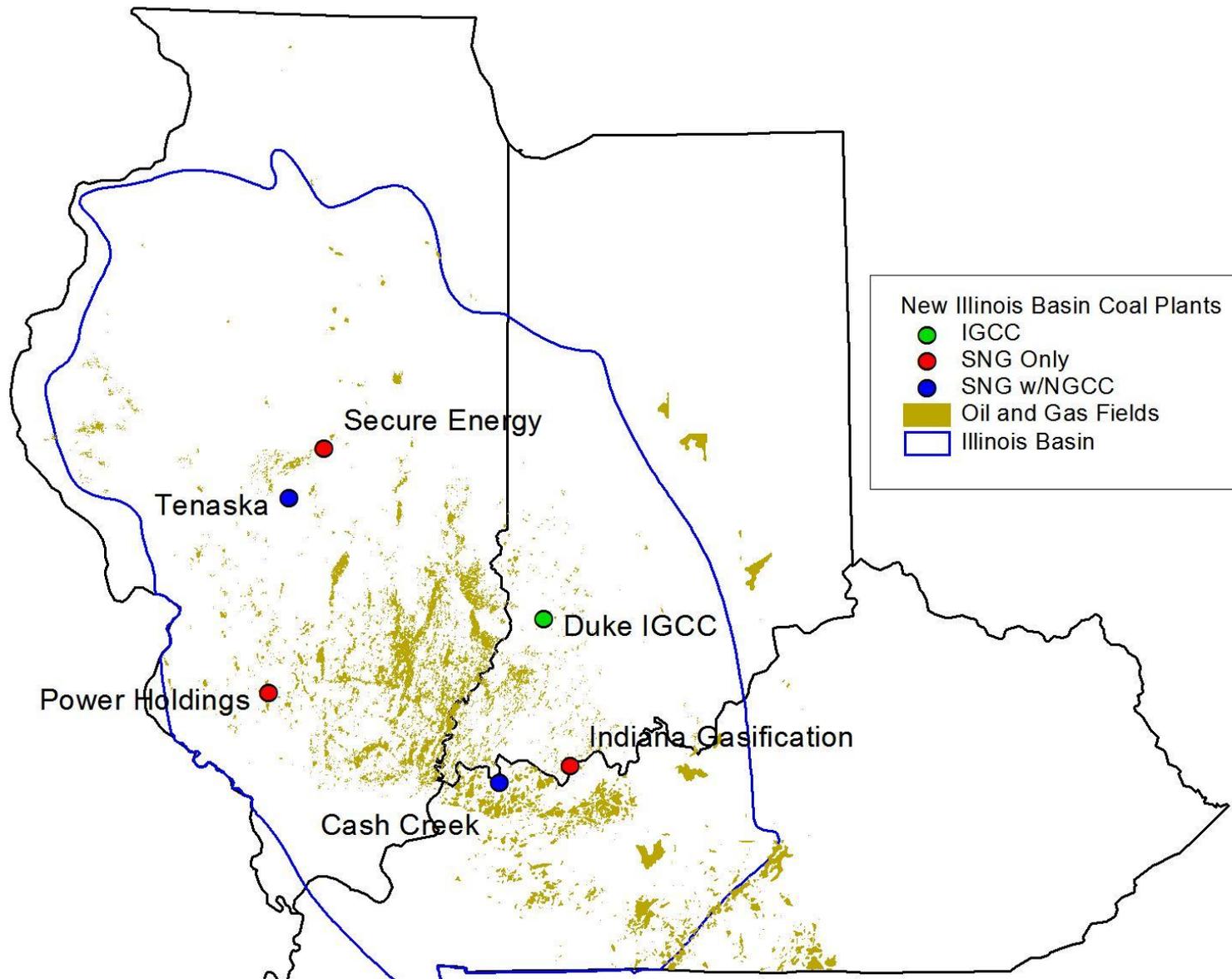


# Rebuttable CCS Presumptions

- **Commercial deployment of carbon storage is inextricably linked to coal.**
  - **Today's US economic reality:**
    - Hard to finance a coal plant without a clear CO<sub>2</sub> solution.
  - **Chicken-Egg Problem:**
    - Need CO<sub>2</sub> sinks for advanced coal plants, but need advanced coal plants to develop the sinks and pipelines needed for commercial scale efforts
  
- **Yes, we need more than projects... but what we really need to make progress is a *commercial system*.**
  - **Proven CO<sub>2</sub> sinks**
  - **CO<sub>2</sub> pipelines**
  - **New technology**
  - **Corporate experience and know-how**
  - **Enabling regulations**
  - **Economic drivers and an ability to finance projects**
  
- **This Summit must lay the foundation for this commercial system in Indiana and the Midwest.**



# What's Happening Around Us?



# CO<sub>2</sub> Emissions in Indiana

Emission sources	CO <sub>2</sub> emissions (tons/year)
Coal-burning electric power plants	130 million
Major coal-burning industrial and institutional plants	4.5 million
Natural gas industrial generators	110 million
Wood-burning industries	.5 million
Oil-burning industries	.3 million
<b>TOTAL</b>	<b>242 million</b>

Source: Indiana  
Geologic  
Survey

# Indiana CO<sub>2</sub> Storage Options

- **Indiana Geologic Survey identifies four types of reservoir for sequestration:**
  - **Mature or depleted oil and natural gas reservoirs**
  - **Deep, saline formations**
  - **Organic-rich shales**
  - **Unmineable coal seams**

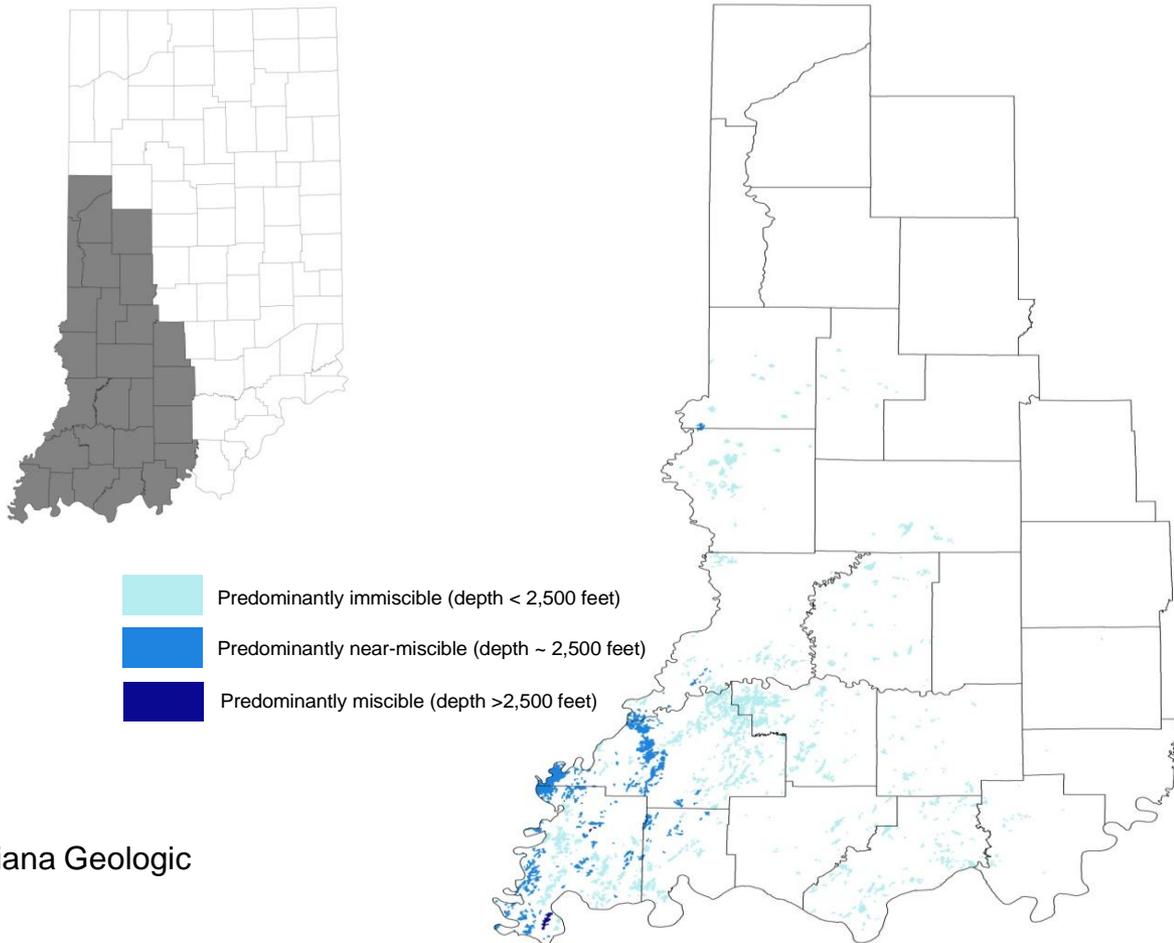


# Preliminary Capacity Estimate for Indiana Storage Options

	<b>Estimated Capacity (tons CO<sub>2</sub>)</b>
<b>Mature Oil and Gas Fields</b>	<b>30 million</b>
<b>Mt Simon Saline Aquifer</b>	<b>38 billion</b>
<b>New Albany Shale</b>	<b>8 billion</b>
<b>Unmineable Coal Seam</b>	<b>200 million</b>

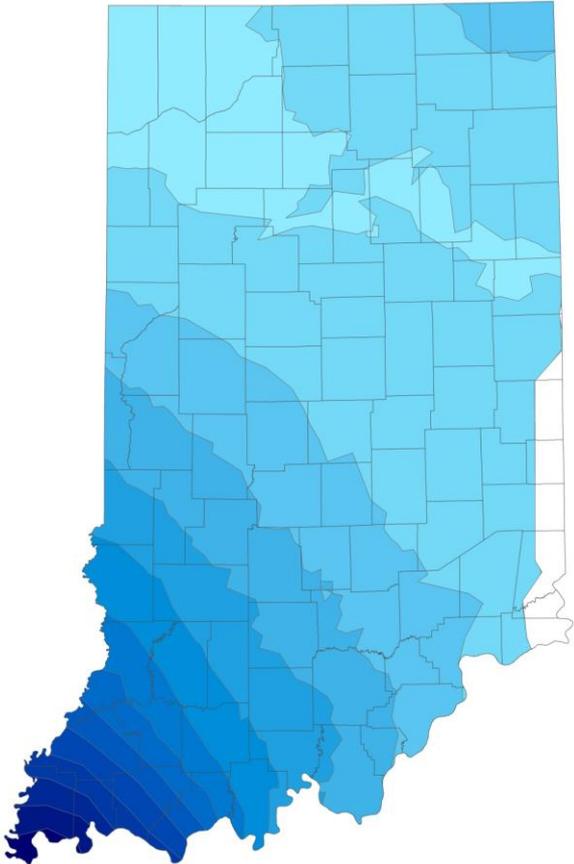
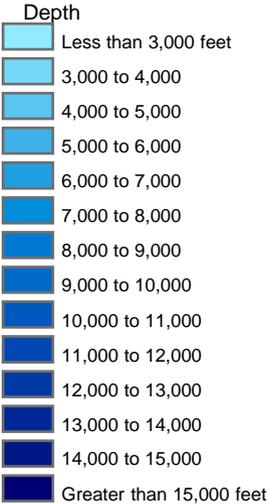


# Mature Oil and Gas Fields



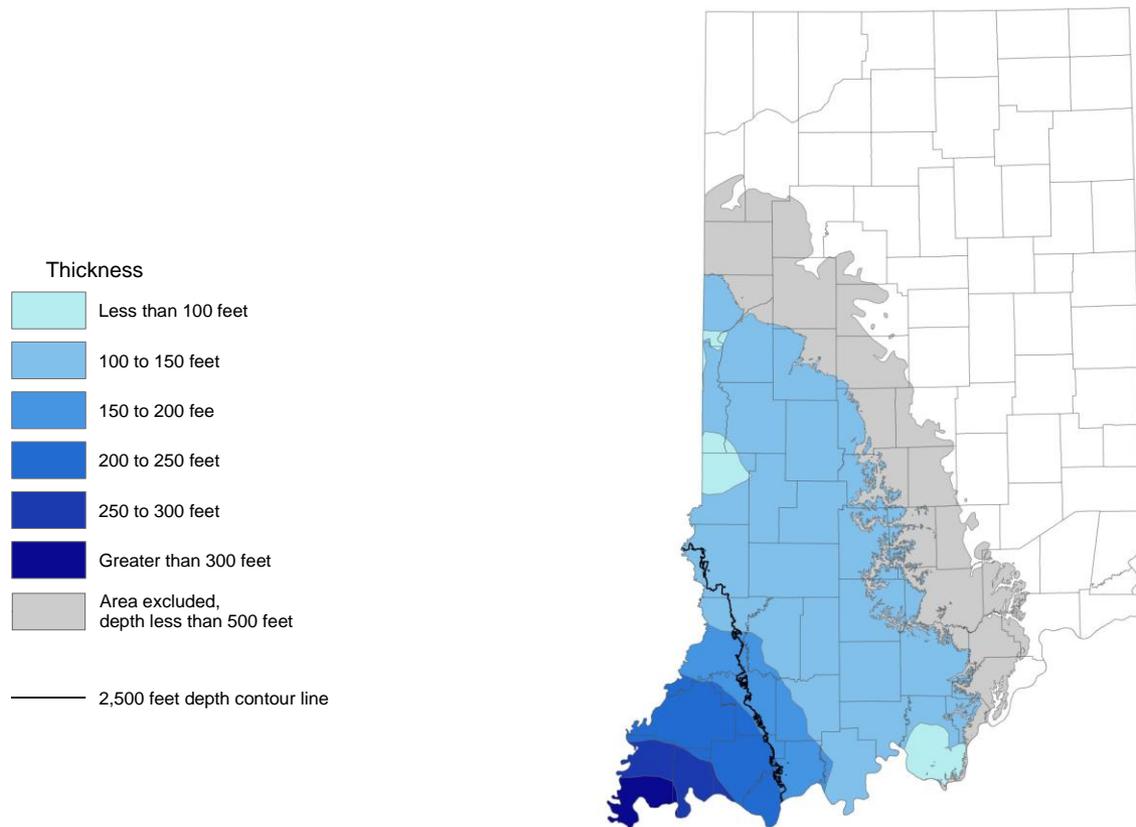
Source: Indiana Geologic Survey

# Saline Aquifer - Mt Simon Sandstone



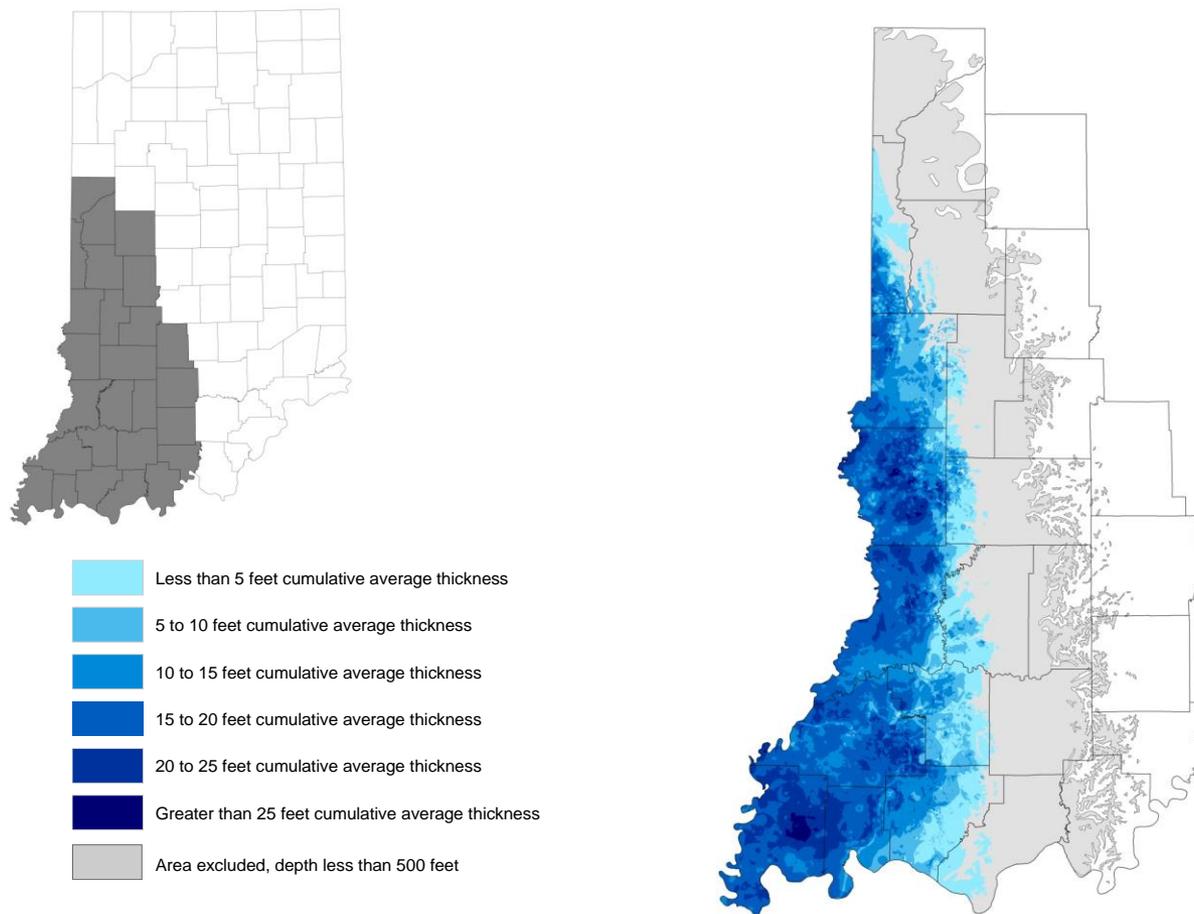
Source: Indiana  
Geologic Survey

# New Albany Shale



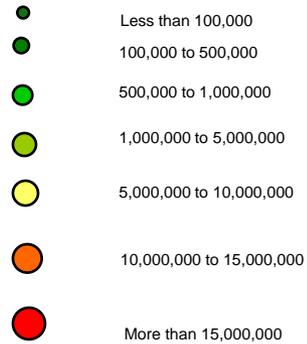
Source: Indiana  
Geologic Survey

# Unmineable Coal Seams

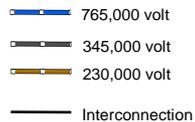


Source: Indiana  
Geologic Survey

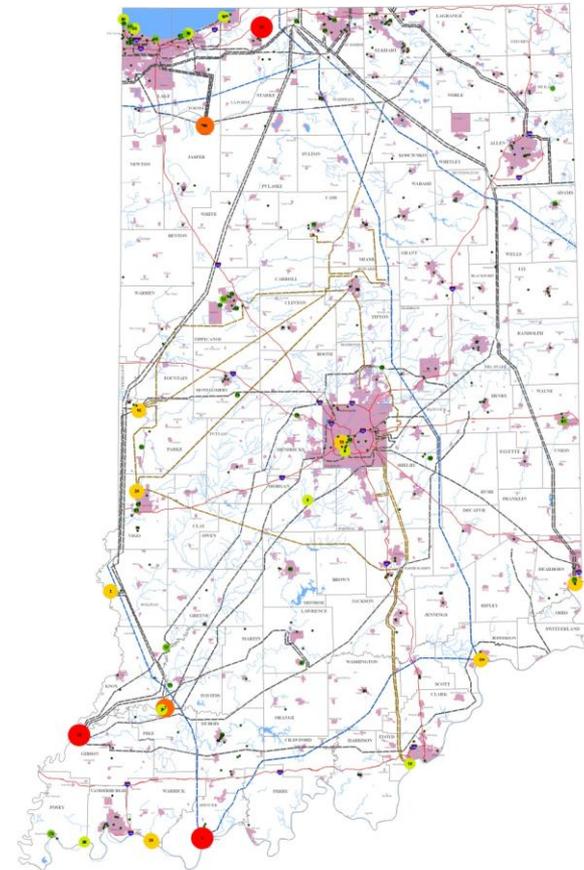
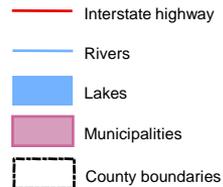
# Indiana CO<sub>2</sub> Sources



## Transmission line capacity



## Other



Source: Indiana  
Geologic  
Survey

# CO<sub>2</sub> Pipelines

- **Cost depends upon size and distance:**
- **Illustration:**
  - **60 mile (12”), 100 MMcf/d**
    - \$75 million construction costs
    - \$1 million/yr operating costs
  - **450 mile (24”) with 5 pump stations, 800 MMcf/d**
    - \$800 million construction costs
    - \$37.5 million/year operating costs
- **In terms of CO<sub>2</sub> costs**
  - **60 miles: \$3-\$6 per ton of CO<sub>2</sub>**
  - **300 miles: \$10/ton**
  - **500 - 800 miles: \$10- \$20/ton**



# New Technologies

- **Substitute Natural Gas (SNG) with storage**
- **IGCC with partial or full-capture carbon capture**
- **Post-combustion capture:**
  - **Pulverized coal**
  - **Natural gas**
- **Underground coal gasification**
- **Advanced surface gasifiers**
- **Hydrogen turbines**
- **Fuel cells**
- **Advanced compression**



# Indiana Experience and Know-How

- **Corporate**
- **Academic**
- **Government**



# Three Counterintuitive Ideas to Create the Commercial System

**#1**

**To become an incubator of new coal technologies, Indiana should partner with China.**



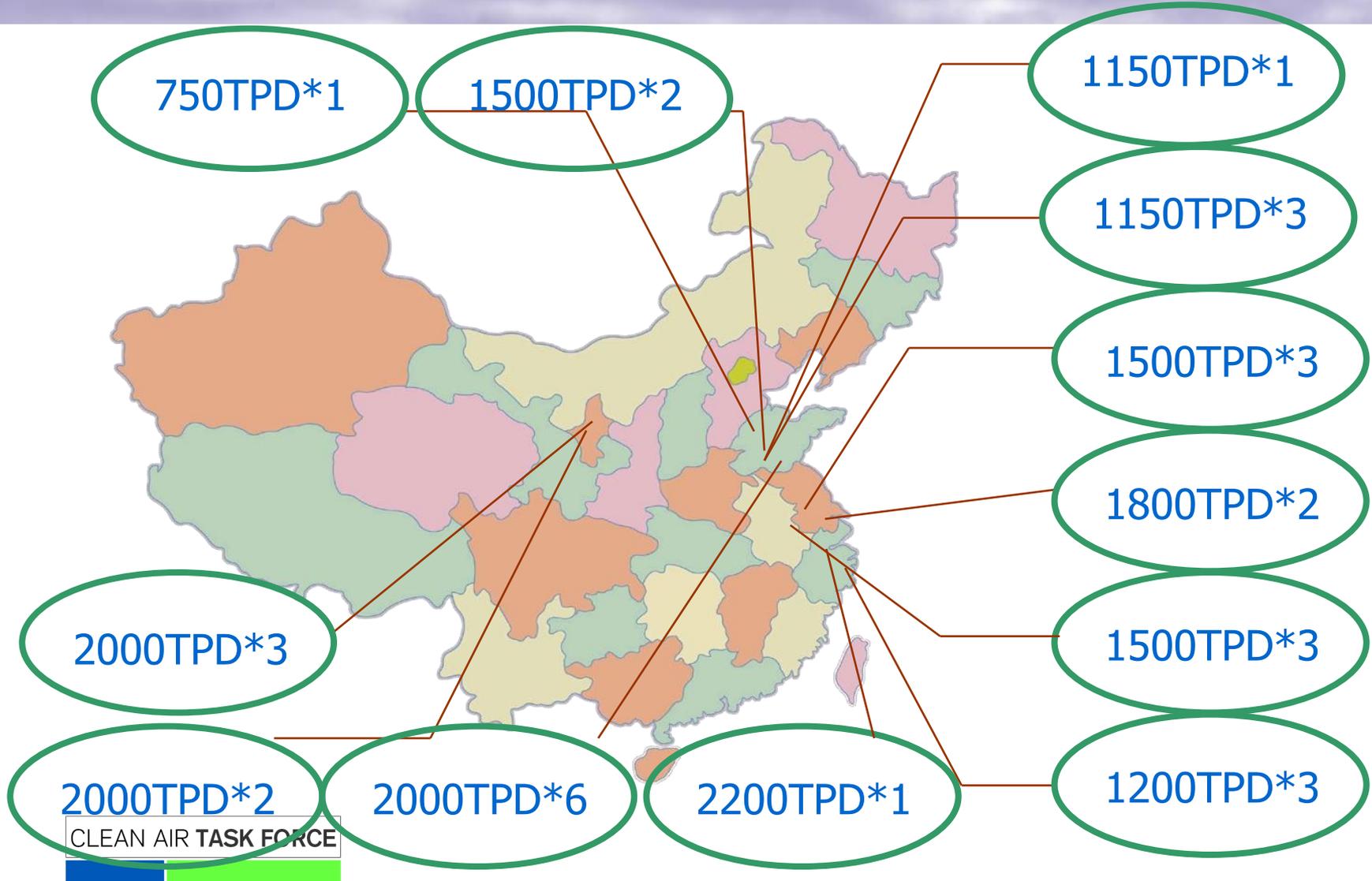
# Gasification Plants

	<b>China</b>	<b>United States</b>
<b>Gasifiers Placed in Service 2004-2008</b>	<b>Over 30</b>	<b>Zero</b>
<b>Gasifiers Expected to Be in Service 2004-2012</b>	<b>Over 70</b>	<b>Edwardsport</b>



# East China University OMB Gasifiers

## 12 Projects - 30 Gasifiers



# “China Speed”

## ➤ **How about Indiana Speed?**

- **Pass needed legislation to establish the CCS commercial system**
- **Get the proposed coal plants across the finish line**



# Counterintuitive Ideas to Create the Commercial System (Cont'd)

## #2

To speed EOR and saline storage in Indiana, build an EOR pipeline to Gulf States or some other established EOR region.



# Why a Pipeline Outside Region?

- **New SNG and probably IGCC plants, need immediate CO<sub>2</sub> solution for financing and or public support.**
  - **Existing EOR outside of region provides certainty**
  - **Use a portion of the new plants CO<sub>2</sub> to develop local storage options over time**



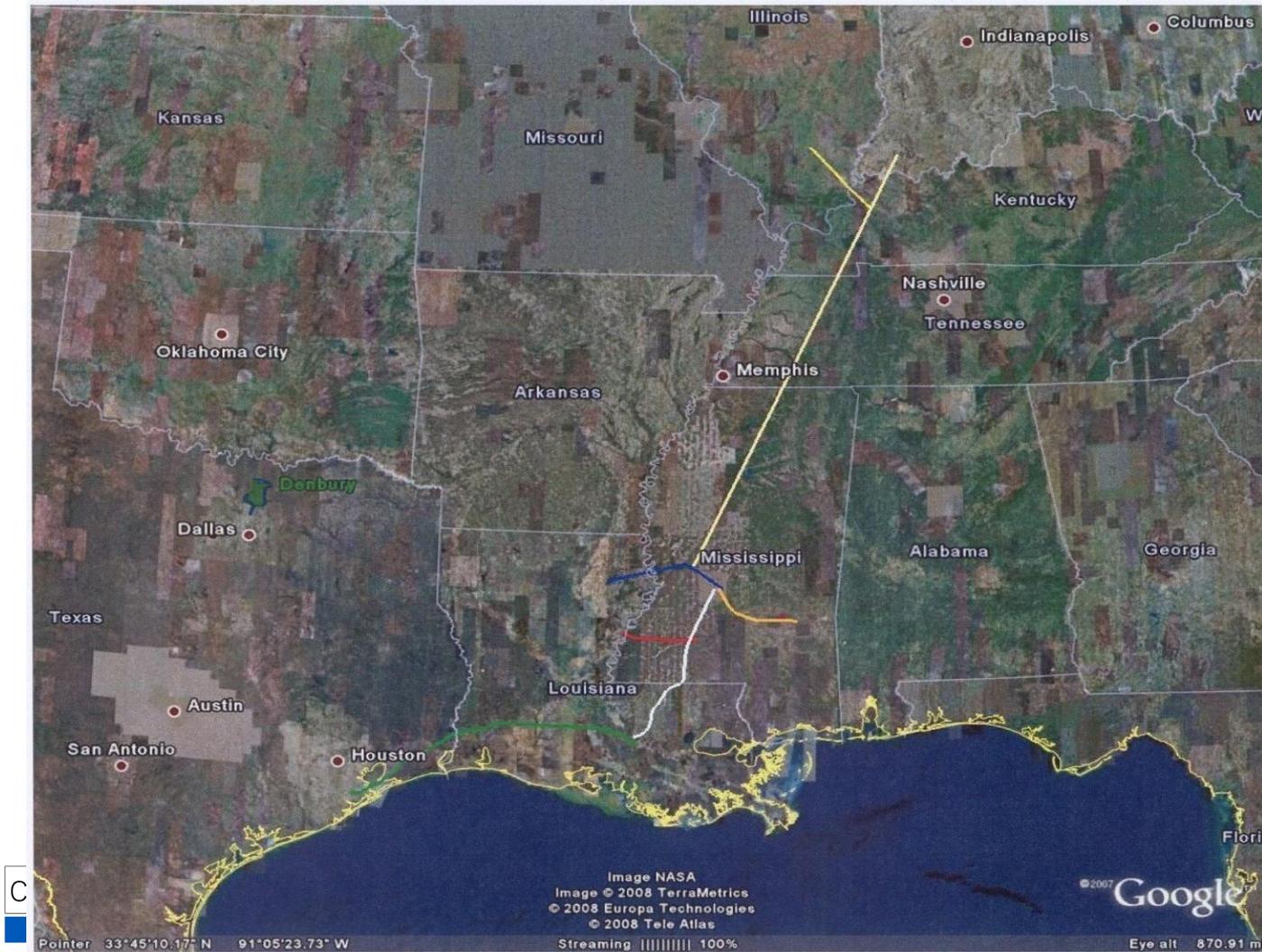
# Example of Proposed EOR Pipeline- Denbury

- **The Pipeline will begin in Illinois and Indiana and proceed south along the east side of the Mississippi River, terminating at Tinsley, Mississippi.**
- **Constructing a 24" CO<sub>2</sub> Pipeline**
- **The prospected length is approximately 565 miles.**
- **It will transport 14 million tons/year of CO<sub>2</sub>**
- **Project completion date of 2012**

Source: Denbury



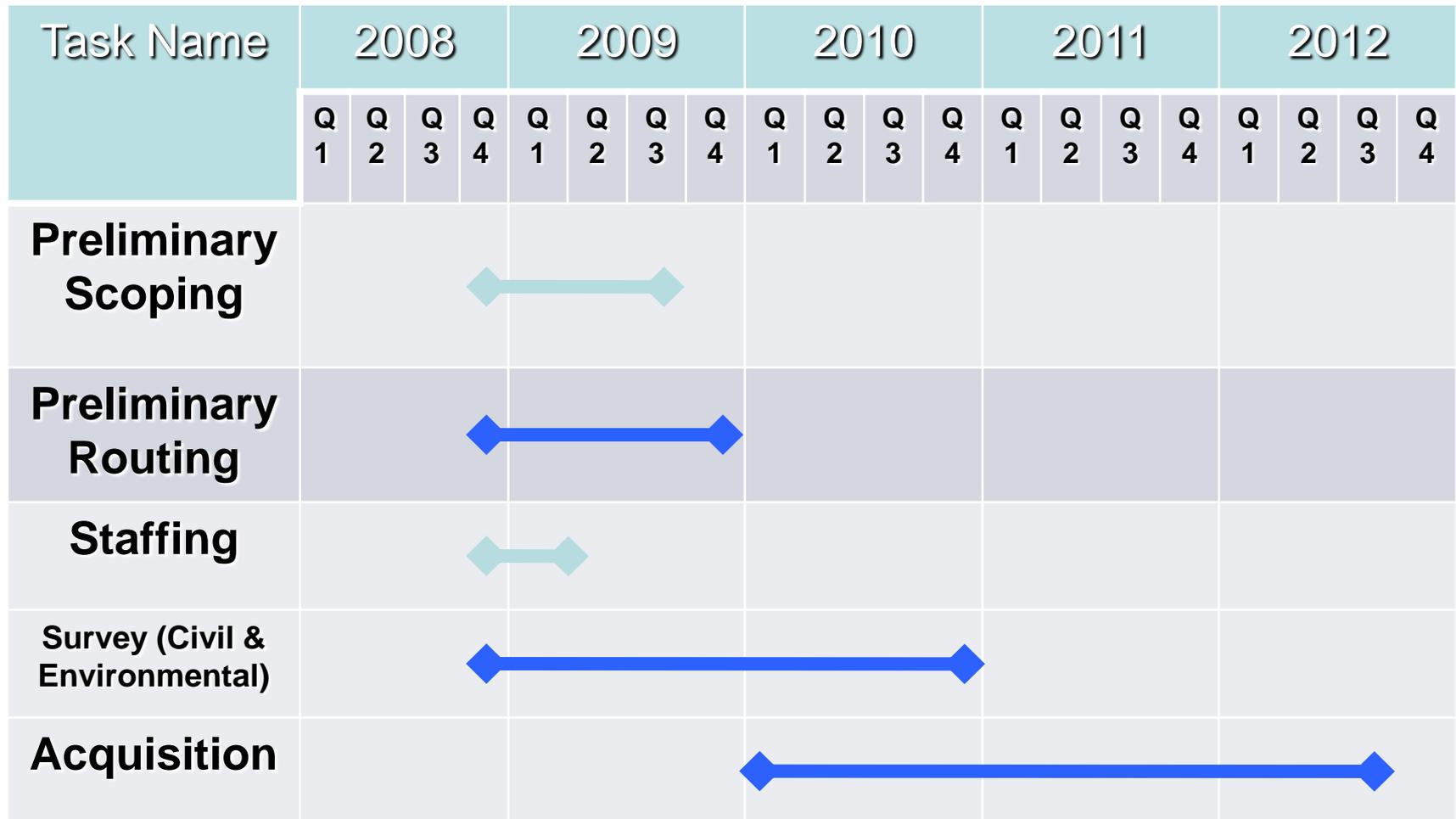
# Denbury's CO<sub>2</sub> Pipelines Present and Proposed



Source: Denbury

# Denbury Timeline

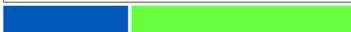
Source: Denbury



# Counterintuitive Ideas to Create the Commercial System (Cont'd)

**#3**

**To solve global warming, start building  
new coal plants (with CCS)**



# Suggestions for a Commercial System

- **Move with “Indiana Speed”**
- **Must Haves**
  - **CO<sub>2</sub> cost recovery**
  - **CO<sub>2</sub> pipeline eminent domain**
  - **Address risk issues**
  - **Fund in-region storage development**
- **About Future Incentives**
  - **Align with specific Indiana objectives**
  - **Reward accomplishment, not simply proposing**
  - **Make them self-activating**
- **Collaborate with others**
  - **Illinois, Kentucky, Ohio**
  - **Midwest Governors Association**

