

Harvard Electricity Policy Group

Ample Opportunity, Ample Risks:

**The Dilemma of Generating Companies
Trying to Make Prudent Needed
Investment in the Context of Climate
Change Uncertainty**

**A Coal Producer View By
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Outline

- **Future of the coal industry**
- **Uncertain greenhouse gas policy impacts**
- **Risk assessment and mitigation**
- **What is needed from a coal perspective**
- **How we work with customers to mitigate risk**



Is the future of the coal industry at risk?

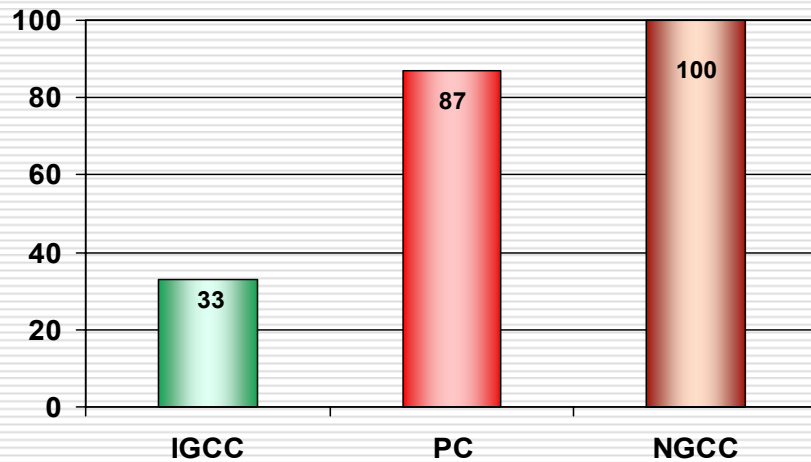
- **GHG legislation will affect, but not destroy, the coal industry**
- **Coal plants produce 49+% of US generation**
 - **Existing 316,000 MW of coal capacity cannot be easily replaced**
- **Coal plants will likely remain competitive**
 - **Timing of GHG technology development, demonstration and implementation is key to remaining competitive**
- **Relevant question is the impact on the US economy**
 - **More dependence on foreign fuel supplies (e.g., LNG)**
 - **Rapid rise in power costs**
 - **Restrains economic growth**



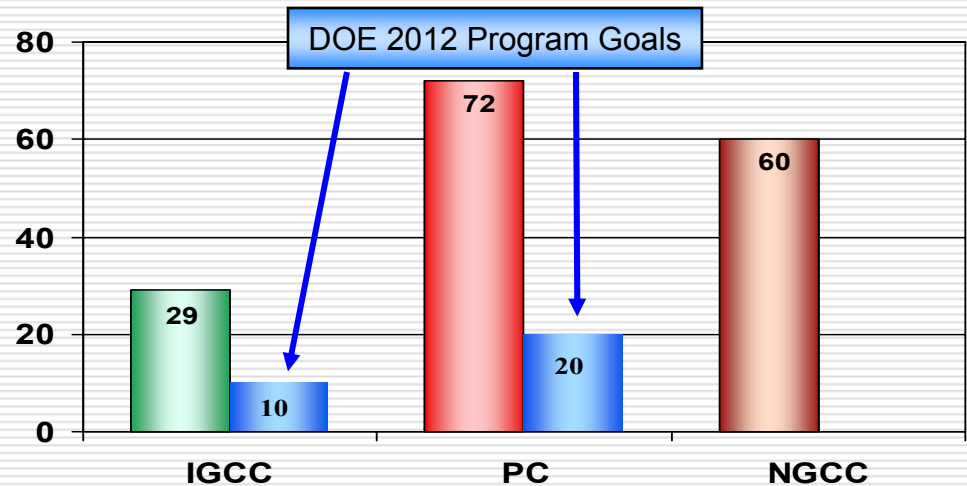
Current "Best Case" Capture Technologies Costly

- 5–30% parasitic energy loss
- 30–100% increase in capital cost
- 29–72% increase in cost of electricity

Effect of CO₂ Capture on Capital Cost
(% Increase Resulting From CO₂ Capture)



Effect of CO₂ Capture on Cost of Electricity
(% Increase Resulting From CO₂ Capture)



Source: DOE National Energy Technology Laboratory



Uncertain greenhouse gas policy impacts

- **CONSOL near term prospects remain bright**
 - **Vast majority of CONSOL coal market is existing generation**
 - **CAIR/CAMR requirements expand CONSOL's opportunities**
 - **Ownership in CNX Gas provides a hedge against impacts**
- **CONSOL is still signing long-term coal supply agreements**
- **Growth in new plant demand expected to slow in near term**
 - **New generation capacity must be CCS capable**
 - **Foresee new coal plant delays until CCS technology proven**



Uncertain greenhouse gas policy impacts (continued)

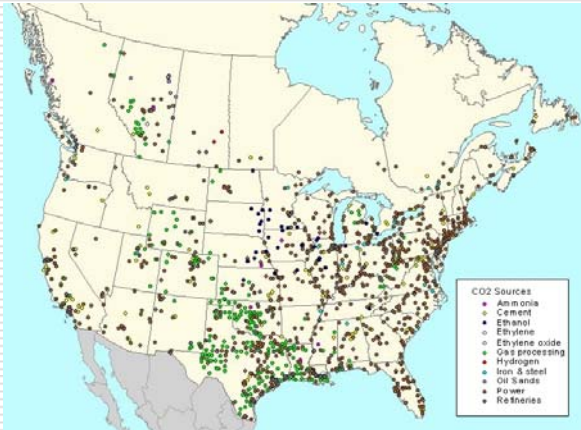
- **Short-term focus on utilizing existing capacity and conservation**
- **Short-term gas-fired plants provide new capacity (NGCC)**
 - **Shorter lead times and lower capital costs**
 - **Significant fuel security and price risks**
 - **CO₂ and CCS are still an issue**
- **Generators hesitant to make long-term investments**
 - **Delaying capital intensive projects**
 - **Foresee new coal plant delays until GHG legislation passed**
 - **Electric demand growth leads to lower reserve margins**
 - **Renewable projects will continue but they are small scale**
 - **Interest in nuclear expected to increase but significant addition of nuclear capacity will not materialize due to siting, permitting, security and waste disposal issues**

Risk assessment and mitigation

- **Difficult to quantify risks absent legislation**
- **Renewables play a role, but as energy *not* as capacity**
- **Coal must demonstrate CO₂ can be captured and safely stored**
- **For coal, CCS technology *is* the path forward**
 - **Clear direction forward to commercialize CCS**
 - **Prove various options for CO₂ capture and sequestration**
 - **Need more research, development and demonstration**
 - **Need to resolve carbon sequestration indemnification issue**



U.S. Sequestration Capacity *Adequate Capacity in U.S.*



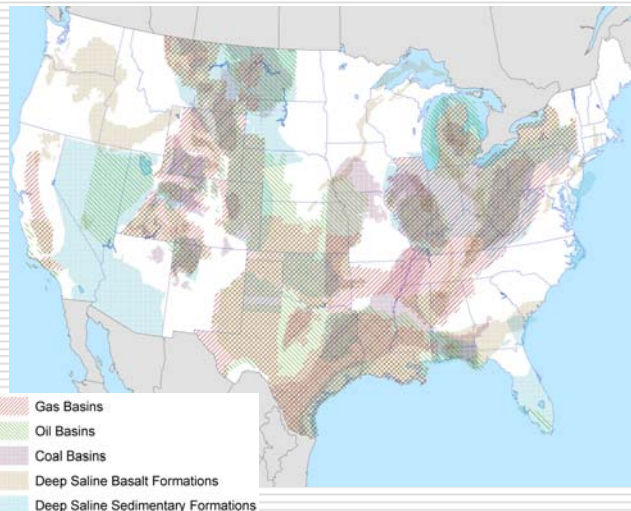
**2,082 Large Sources (100+ ktCO₂/yr)
with Total Annual Emissions = 3.8 GtCO₂/yr**

- 1,185 electric power plants
- 447 natural gas processing facilities
- 154 petroleum refineries
- 53 iron & steel foundries
- 124 cement kilns
- 43 ethylene plants
- 9 oil sands production areas
- 40 hydrogen production
- 25 ammonia refineries
- 47 ethanol production plants
- 8 ethylene oxide plants

~ 1000 Years

3,800+ GtCO₂ Capacity within 330 US and Canadian Candidate Geologic CO₂ Storage Reservoirs

- **3,730 GtCO₂ in deep saline formations (DSF)**
- 65 GtCO₂ in deep unmineable coal seams with potential for enhanced coalbed methane (ECBM) recovery
- 40 GtCO₂ in depleted gas fields
- **13 GtCO₂ in depleted oil fields with potential for enhanced oil recovery (EOR)**



Risk assessment and mitigation (continued)

- **CONSOL leads coal industry in GHG technology development**
 - **Charter member of FutureGen Industrial Alliance**
 - **Participate in DOE regional partnerships**
 - **Technologies to mitigate coal mine methane emissions**
 - **Generation with carbon capture (PFBC/SARGAS)**
 - **CO₂ sequestration in unminable coal seams**
- **CONSOL actively engaged in seeking solutions**
 - **Working with CBGS and NMA to Quantify Risks**
 - **Internal team to analyze legislative options**
 - **Routinely review other analyses and technology research**
 - **Funding technology demonstration (e.g., FutureGen)**
 - **Largest privately held coal R&D group with active program on GHG mitigation**
 - **Exploring solutions with customers**



What is needed from a coal perspective

- **A comprehensive national energy policy that:**
 - **Establishes energy independence as a national goal**
 - **Addresses environmental issues, conservation and efficiency improvements**
 - **Streamlines power generation siting and permitting processes**
 - **Supports conventional and non-conventional energy technology development and demonstration**
 - **Supports transportation and transmission infrastructure improvements**
 - **Provides for adequate reserve margins**
- **Energy legislation that recognizes:**
 - **Coal is the most abundant domestic fuel**
 - **Coal plants can be built with near-zero emissions**
 - **Federal funding needed for coal utilization technologies**
 - ✓ **Manhattan project parallel**
 - **CCS indemnification is needed for commercial application**



How we work with customers to mitigate risk

- **Will consider Bi-lateral CO₂ credit trades**
- **Will customize coal supply agreements**
- **Will assist in plant siting and permitting**
- **Will assist in plant operation performance improvements**
- **Will consider funding emission equipment capital investments (lease-back with coal supply agreement)**
- **Will consider coal plant equity participation**
- **Will consider linking coal supply and power agreements**
- **Use our R&D capabilities to assist customers**
 - **Coal utilization and emission technology development**

