FutureGen™ ALLIANCE

Clean Energy for a Secure Future

FutureGen
The Right Project at the Right Time

AAAS Annual Meeting
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www.FutureGenAlliance.org

Political Recognition of "The Solution"

"The U.S. needs a 'Manhattan Project' for clean coal technology."

- Sen. Barbara Boxer (D-CA); Head of the Environment and Public Works Committee, May 10, 2007

"I hope to move as aggressively as we can to persuade Congress to [promote carbon capture and storage technology]."

- Sen. Jeff Bingaman (D-NM)

"The continued use of the Nation's abundant coal reserves must be a part of our climate change strategy... In order to meet growing demand for electricity without causing economic harm, a substantial investment in [CCS] technology will be required… need for the federal government to provide funding totaling approximately $11 billion over the next 15 years."

- Reps. John Dingell (D-MI) and Rick Boucher (D-VA), March 30, 2007 Update to Speaker Pelosi

"The U.S., in partnership with its government steering group member countries and the private sector, will build FutureGen, the United States first near-zero emission fossil fuel plant, by 2012."

- 2007 EU-US Summit on Energy Security, Efficiency, and Climate Change

FutureGen

Right Partners

- **Industry**
  - **Thirteen leading companies with operations on six continents**
  - **Investing $400M in project with no expectation of financial return**
- **Governments**
  - **United States, China, India, South Korea, and Japan**

Uniquely positioned to build global acceptance of near-zero emission coal technology

Support services from Battelle Memorial Institute, a global science and technology enterprise

*1Q 2004$

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Importance of the Government Role

- Public benefit project
  - Could help fundamentally transform the global energy system and address the public's climate change concerns
  - Will lay the technical foundation for monitoring CO_2 sequestration, its long term effects, and permanency
  - Industry's participation is on a non-profit basis

- Research on a first-of-a-kind technology
  - No IGCC plants currently with carbon capture and sequestration in the world.
  - Widely recognized that governments have an important cost-sharing role in pre-competitive research

- Global applicability of the technology is critical
  - Governments are uniquely positioned to build international partnerships that will strengthen acceptance of near-zero emission coal technology

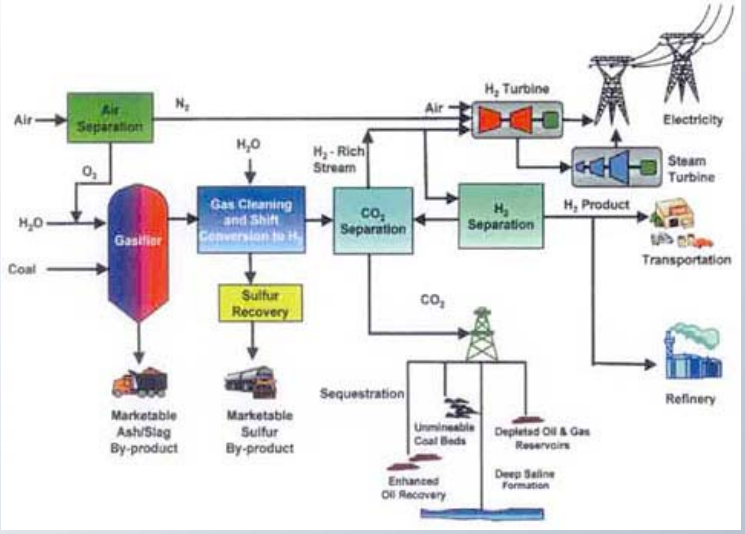
Project Overview - Right Objectives

- **Design, build, and operate a near-zero emission coal-fueled power plant including:**
  - **Capturing and sequestering more than one million metric tons of CO2 per year in a deep saline geologic formation**
  - **Near-zero levels of NOx, SOx, PM, and Hg**
- **Facility on-line by 2012**
- **Advance near-zero emission technology so that future plants will be cost-effective**
- **Build stakeholder acceptance**

FutureGen Technology

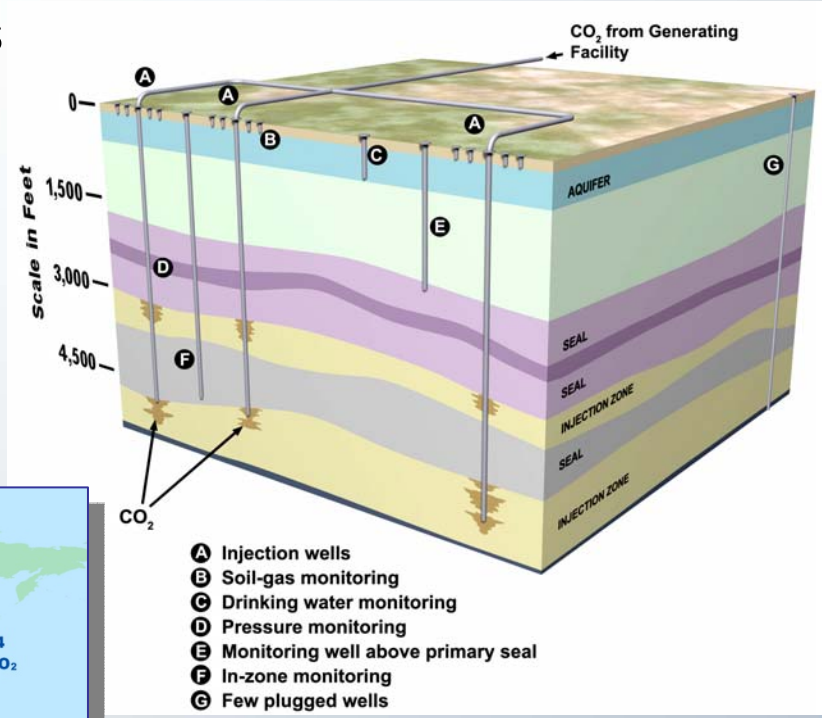
Advances IGCC Technology

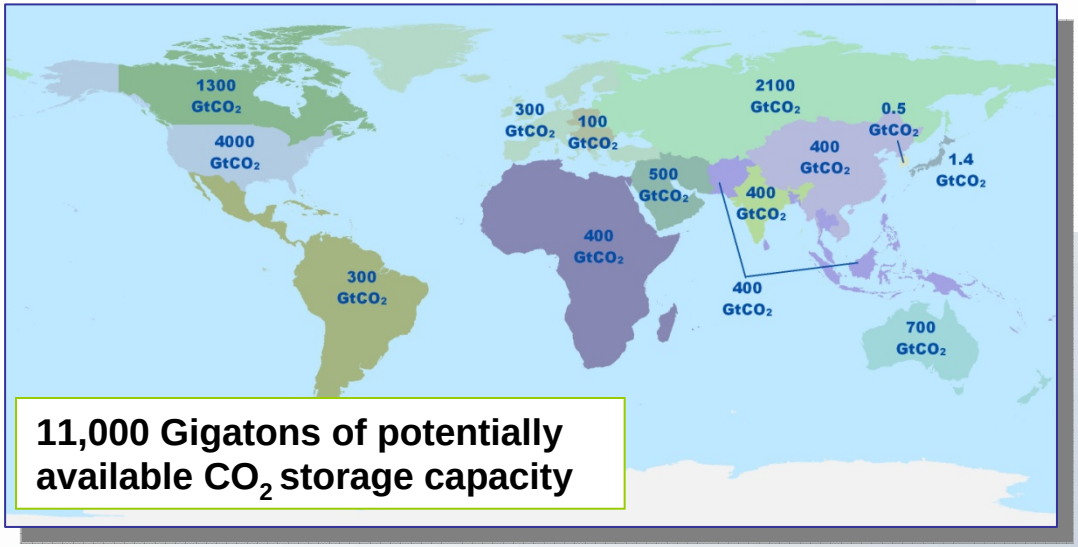
- Designed to gasify eastern and western U.S. coals, and test other coals, which expands the global applicability of environmentally-friendly IGCC technology
- Advances gasification, hydrogen turbine, and other clean-coal technologies
- Integrates CO_2 capture at a commercially-relevant scale into a IGCC power plant
- Tests plant operation with integrated CO_2 capture, transport, and sequestration



Technology - Advances Sequestration Technology

- Focused on deep geologic formations that are globally available
- Extensive modeling and monitoring program planned to verify the safety and permanence of CO_2 storage.





11,000 Gigatons of potentially available CO_2 storage capacity

CCS Issues – Technology Readiness

Stages of FutureGen's Carbon Sequestration Project

Preliminary Site Characterization

Detailed Site Characterization

Injection System Design, Permitting, & Construction

Operations & Monitoring

Post-injection Monitoring

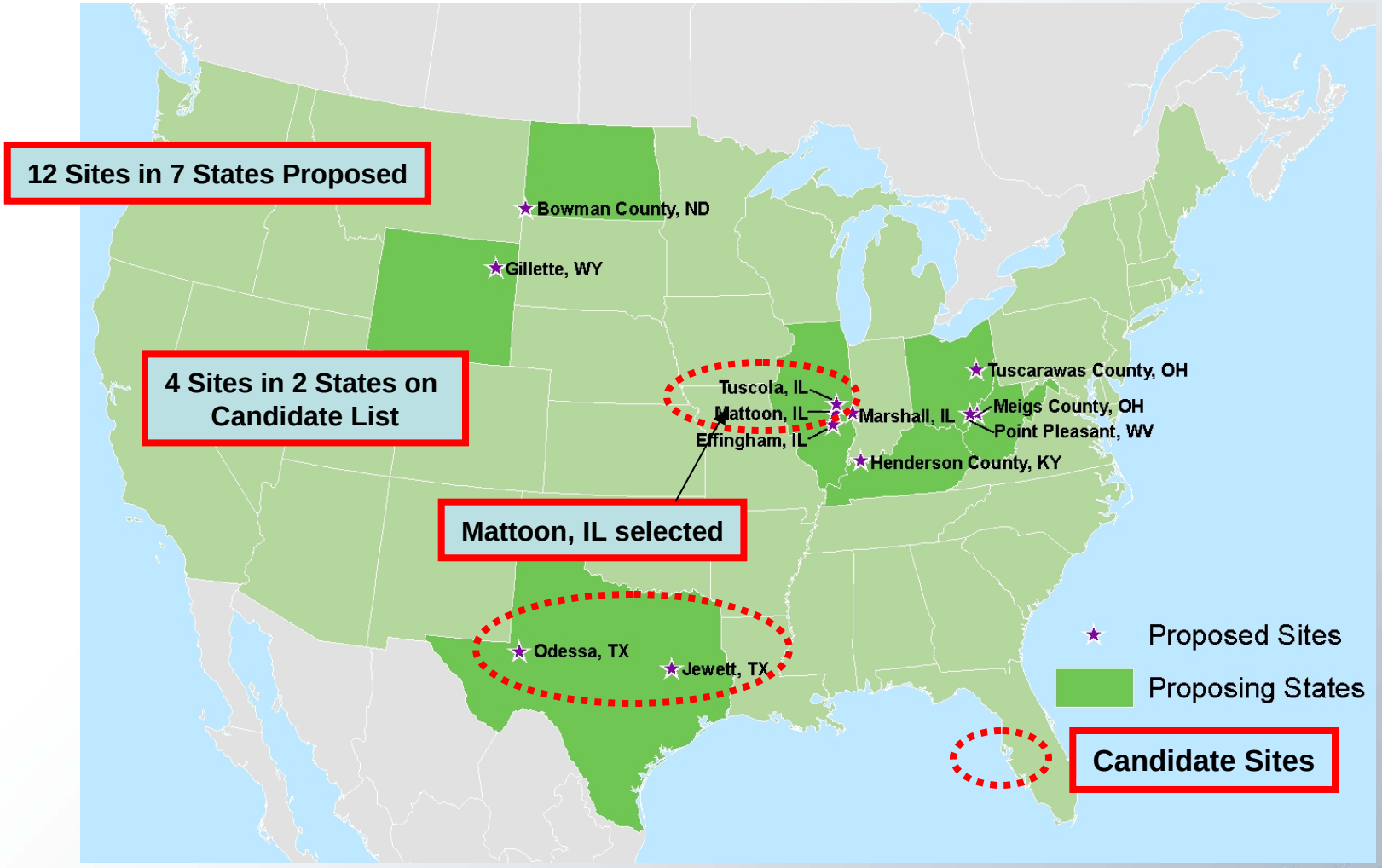
Closure

We are Here.
2008

2018

It is not likely that CCS using deep geological formations would be commercialized before these tasks are completed

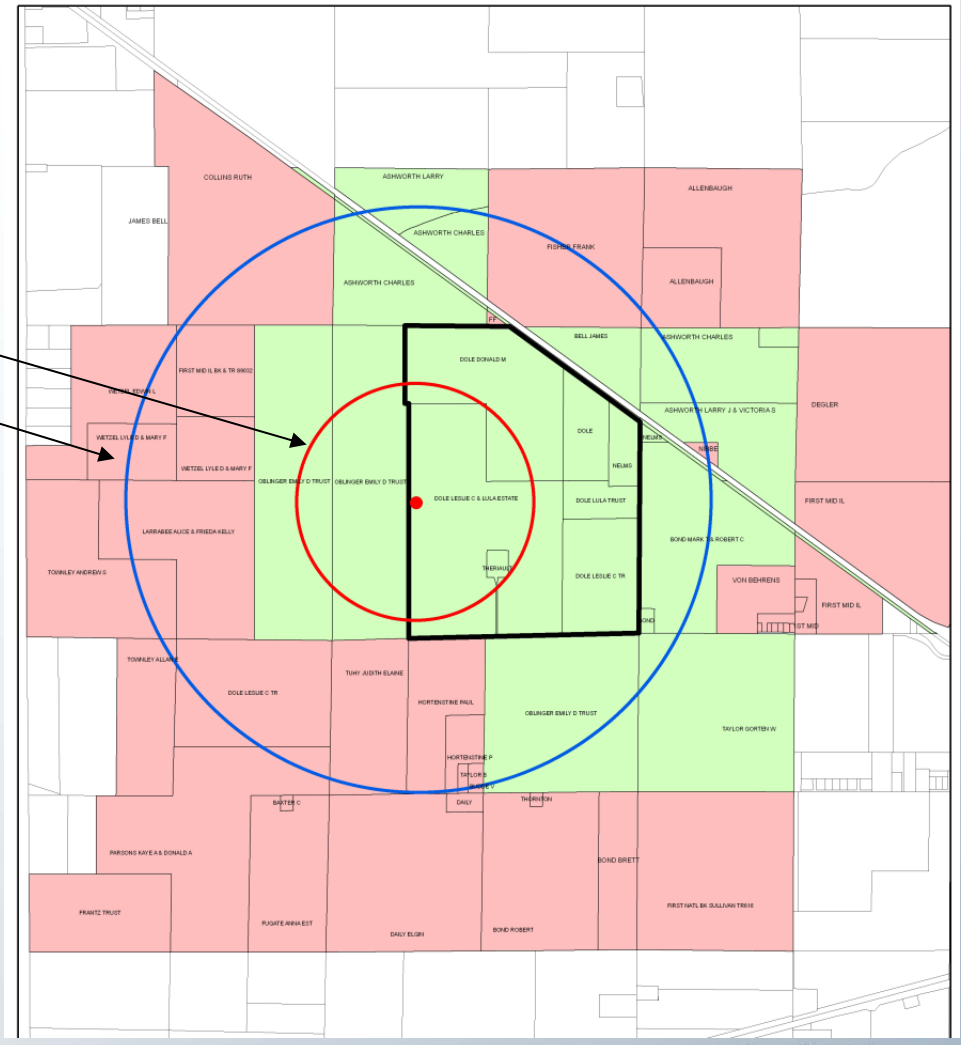
FutureGen
Site Selection



Siting – Legal Considerations

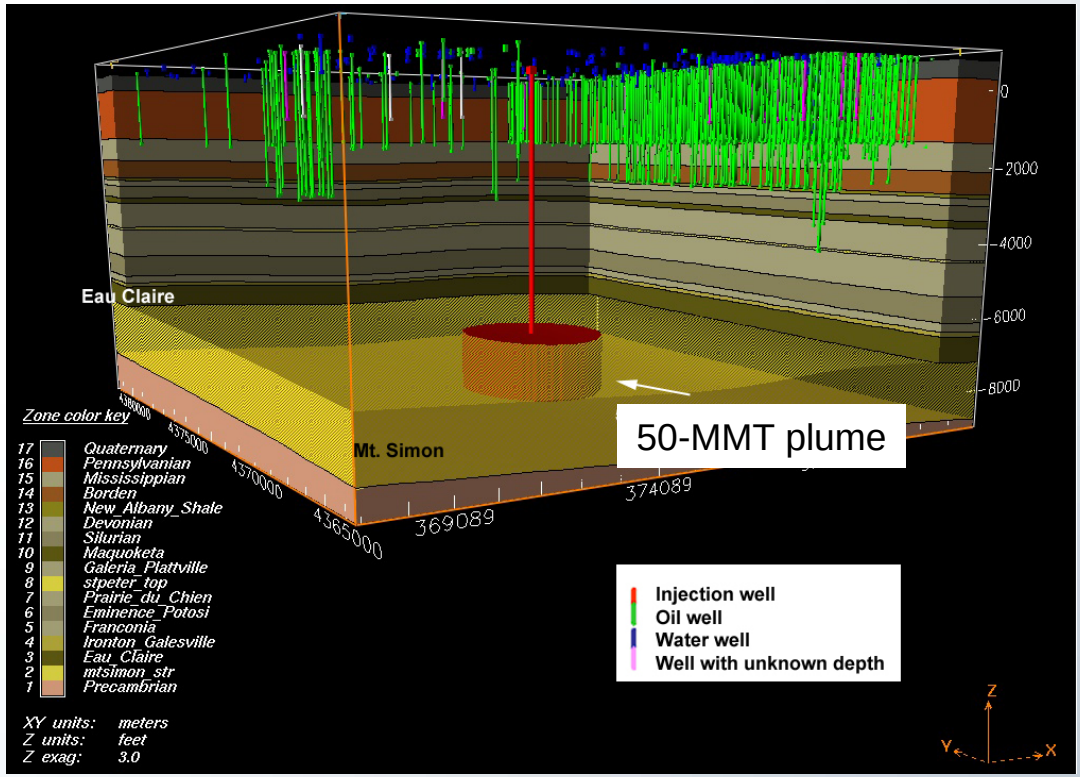
- Projected plume radii
  - 6-year
  - 50-MMT

- Land Parcels Shown



Reservoir Modeling

- Analysis of pre-existing well penetrations

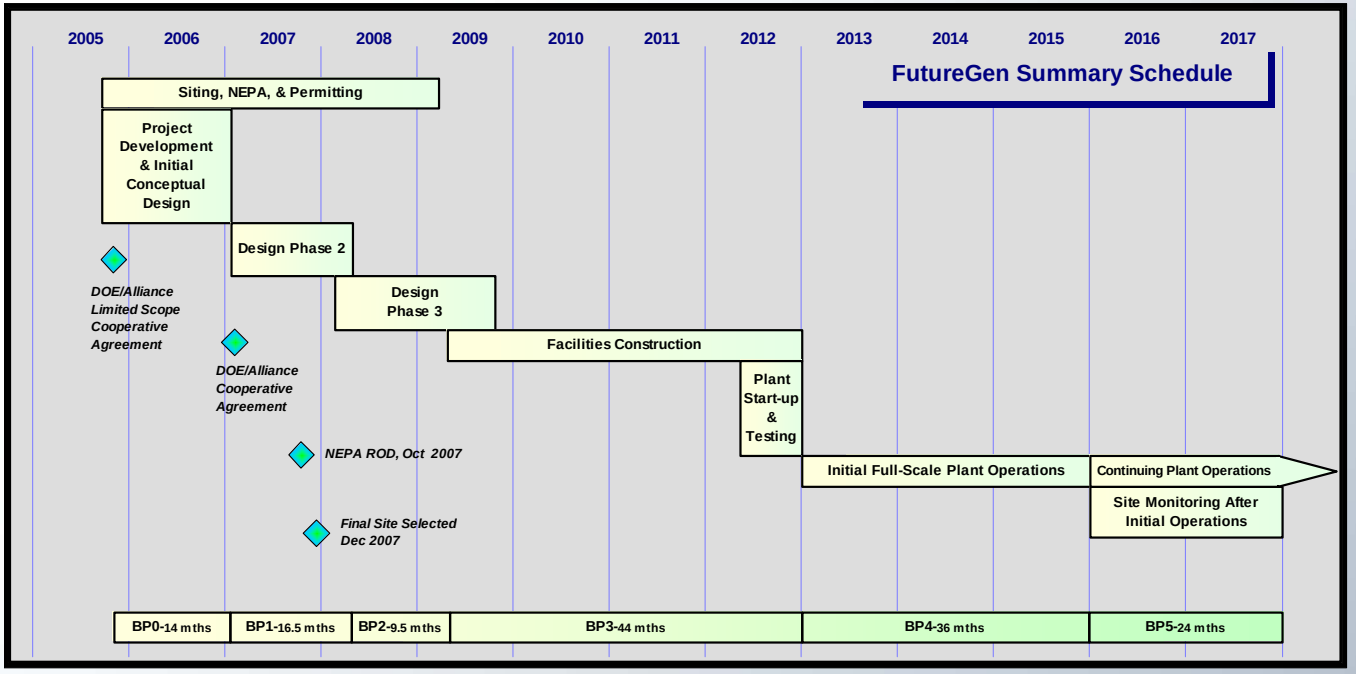


FutureGen Progress

Project Cost and Schedule

Total Net Project Cost: $1.5B

Federal Cost Share	**74%**	**$1,105M**
Alliance Cost Share	**26%**	**$379M**



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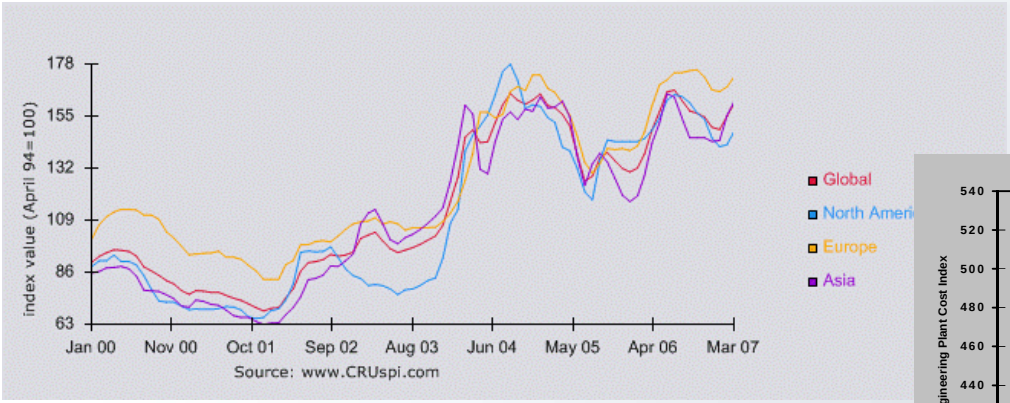
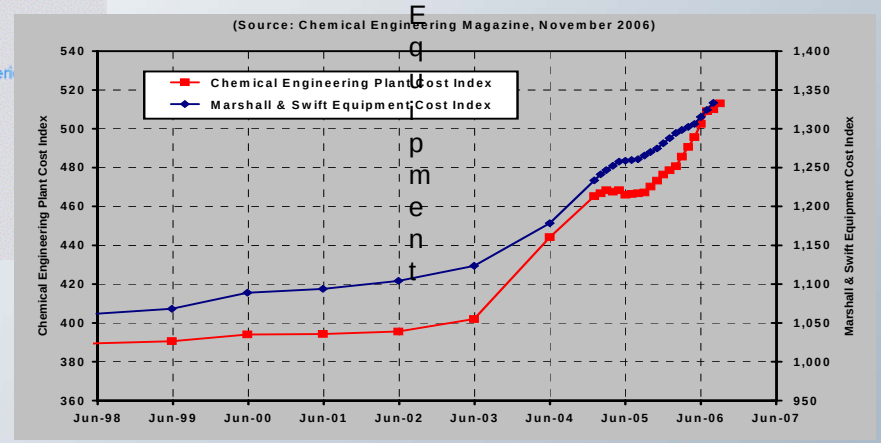
The Realities of Power Plant Inflation

- Since DOE completed its original cost estimate in 1Q FY04, the Bureau of Labor and standards reports:
  - well drilling, which applies to sequestration site, up ~250%
  - heavy construction, which applies to power plants, up ~30%

London Exchange Steel Price Indices



Equipment Cost and Process Plant Costs



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Some Insights from Progress to Date

- Marketplace is tight
  - Labor, major equipment, even pipeline
  - Vendor engagement, “getting in line”, creative contracting strategies are critical
  - Vendors are charging significantly higher up-front payments
- Learning by doing
  - Operational strategy development: implications of commitment to avoid CO_2 venting and near-zero emissions
  - Legal, permitting, and regulatory issues
  - Integration challenges
- Indirect costs can be significant
  - Closure bonding, rights-of-way acquisition, land access for MMV
  - Legal cost and time to obtain necessary land and mineral rights for carbon injection
- Outreach and Stakeholder Engagement is critical
  - Cost escalations and climate policy debate underline need for well developed outreach and communications strategy
  - Educating congressional and administration officials
  - Informing the media
  - Engagement of key stakeholder groups

FutureGen

Current Challenge with the DOE

- On January 30, the Department of Energy announced that they intended to “restructure” the FutureGen Program
- DOE intends to start with an entirely new solicitation to cost share in CCS systems in commercial power plants
- The FutureGen Alliance continues to believe that the FutureGen Program at Mattoon is in the public interest and remains the world’s premier leading project to advance near-zero emissions coal plants in the shortest possible time.
- The Alliance intends to work with the Administration, Congress, and Illinois stakeholders to advance the project

FutureGen

Current Challenge with the DOE

- Key Considerations for why FutureGen at Mattoon is too important not to go forward
  - It is the most advanced CCS project in the world
    - Four years and over $50M ahead of any other project
    - Environmental Impact Statement (typically 3-4 year effort) completed
  - FutureGen Alliance is a 501 c 3 organization
    - Not constrained by commercial requirements
    - Intends to maximize sharing information in the public domain
  - FutureGen Alliance has international participation, unlike a commercial domestic project
  - FutureGen will capture 90% of the CO_2
    - Commercial plants will likely not be able to achieve that level until it has been proven at FutureGen

FutureGen

Current Challenge with the DOE

- The “Smart” Approach
  - First Continue with FutureGen
    - Blaze the Trail with a program that addresses first-of-a-kind technology integration, carbon sequestration, advanced gasifcation, legal issues, and regulatory issues
  - Then Demonstrate and Deploy CCS Technology
    - Once proven through FutureGen, use Government incentives similar to the CCT and CCPI Programs to deploy CCS technologies into the commercial marketplace

FutureGen
Summary

- Supports a *technology-based climate change strategy*
  - Mitigates the financial risks of carbon dioxide emissions

- *Validates the cost and performance* of an integrated near-zero emission coal-fueled power plant
  - Advances IGCC technology
  - Advances carbon capture, sequestration, and hydrogen-production technologies
  - Sets groundwork for CO2 sequestration siting and licensing

- Creates the technical basis to *retain coal* in U.S. and global energy mix with a long-term goal of *zero emissions*.

- Enables the public and private sector to *share the cost and risk* of advanced technology demonstration.
  - Platform for emerging technology demonstration.

Technology Deployment does not occur immediately

What it the potential timing for the widespread implementation of CCS in the US and worldwide?

- 2009 Break Ground for FutureGen (no warranties and very high costs)
- 2011 CCS Plant#2 is ordered with CCPI funding (some warranties and high costs)
- 2012 FutureGen begins operation
- 2013 CCS Plant #3 is ordered with CCPI funding (some warranties and high costs)
- 2016 FutureGen test period completed
- 2017 Plant #2 starts up
- 2018 Plant #3 starts up
- 2019 CCS plants are offered with competitive costs and warranties

Could this theoretical scenario really happen this quickly?

Perhaps, but definitely not without FutureGen