

FutureGen

The Energy Plant of the Future



CSLF – Barriers to CCS Deployment Workshop

FutureGen Overview

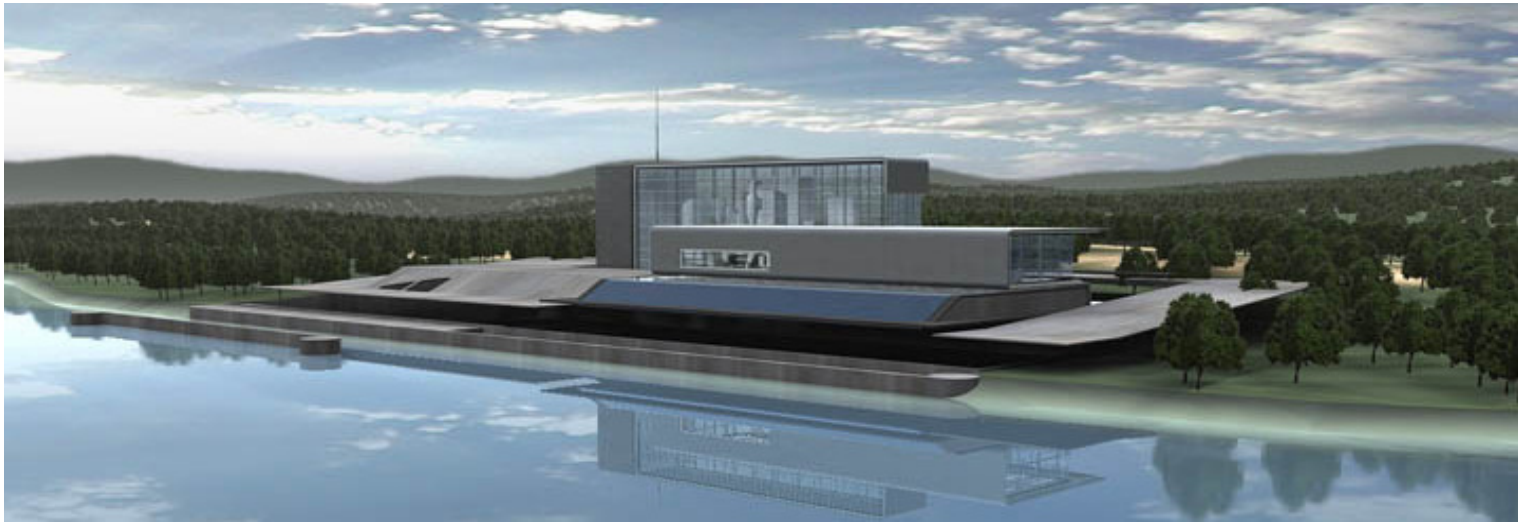
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Tomorrow's Energy Plant



Through a government-industry partnership, the FutureGen research project has as its goal the establishment of the technical feasibility, economic viability and broad acceptance of co-producing electricity and hydrogen from coal with essentially zero emissions, including carbon (sequestration). Industry will lead since it will ultimately deploy the technology in the energy market.

FutureGen Goals

- Design, construct and operate a 275 MW prototype gasification plant that produces electricity and hydrogen fuel, while sequestering CO₂ at an annual rate of 1-2 million metric tons to adequately stress the geologic formation with CO₂ injection.
- Sequester 90 percent of CO₂ initially and up to near 100 percent sequestered eventually
- Prove the effectiveness, safety, and permanence of CO₂ sequestration through validating the technology at large scale under real world conditions.
- Establish technology standards and protocols for CO₂ measuring, monitoring, and verification
- Validate engineering, economic, and environmental viability of advanced coal-based, zero emission technologies for commercial readiness in the 2020 timeframe

FutureGen: the Focus of the R&D Program



Fuel Cells



FutureGen



Carbon Sequestration



Gasification with Cleanup Separation



H₂ Production

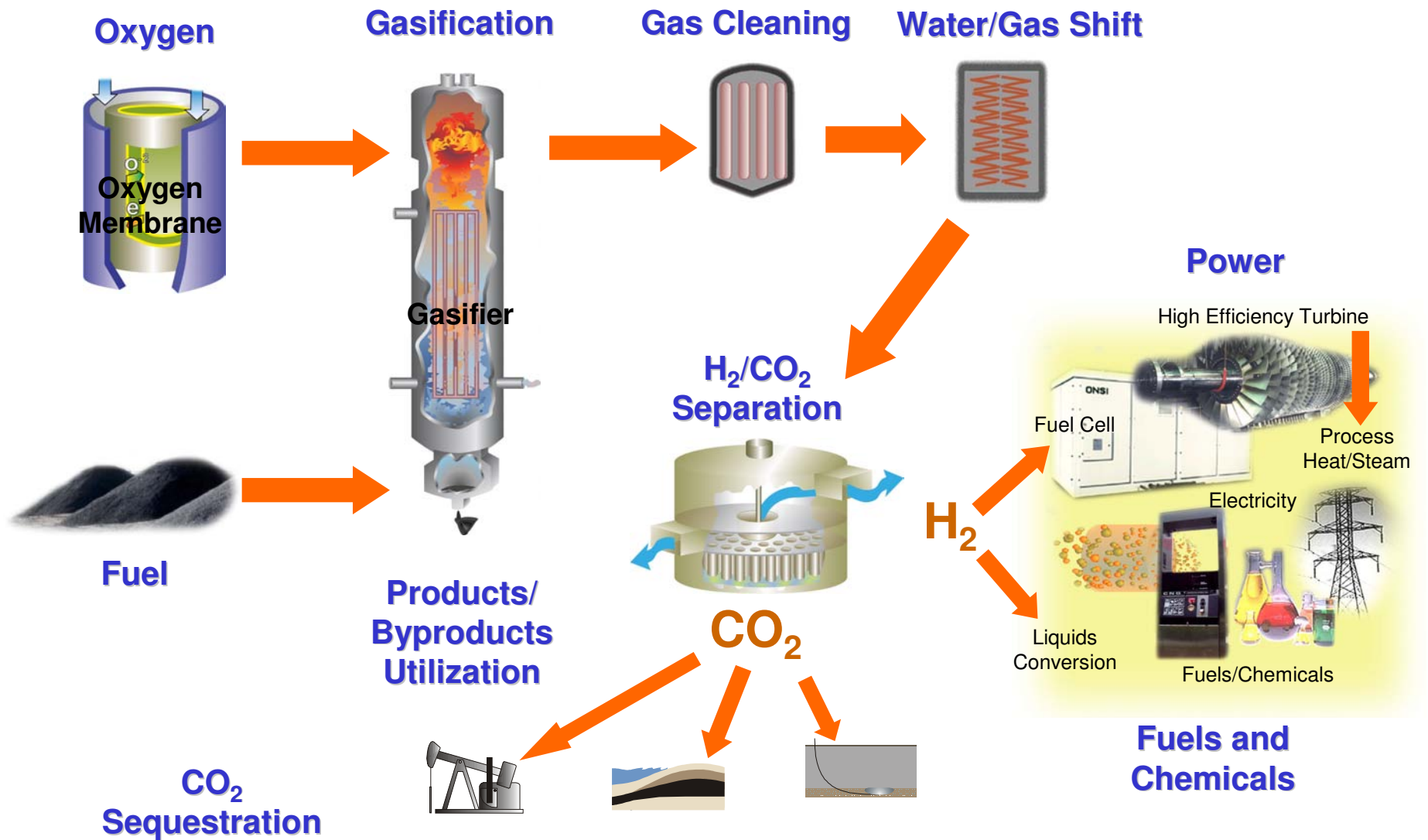


Optimized H₂-Turbines



System Integration

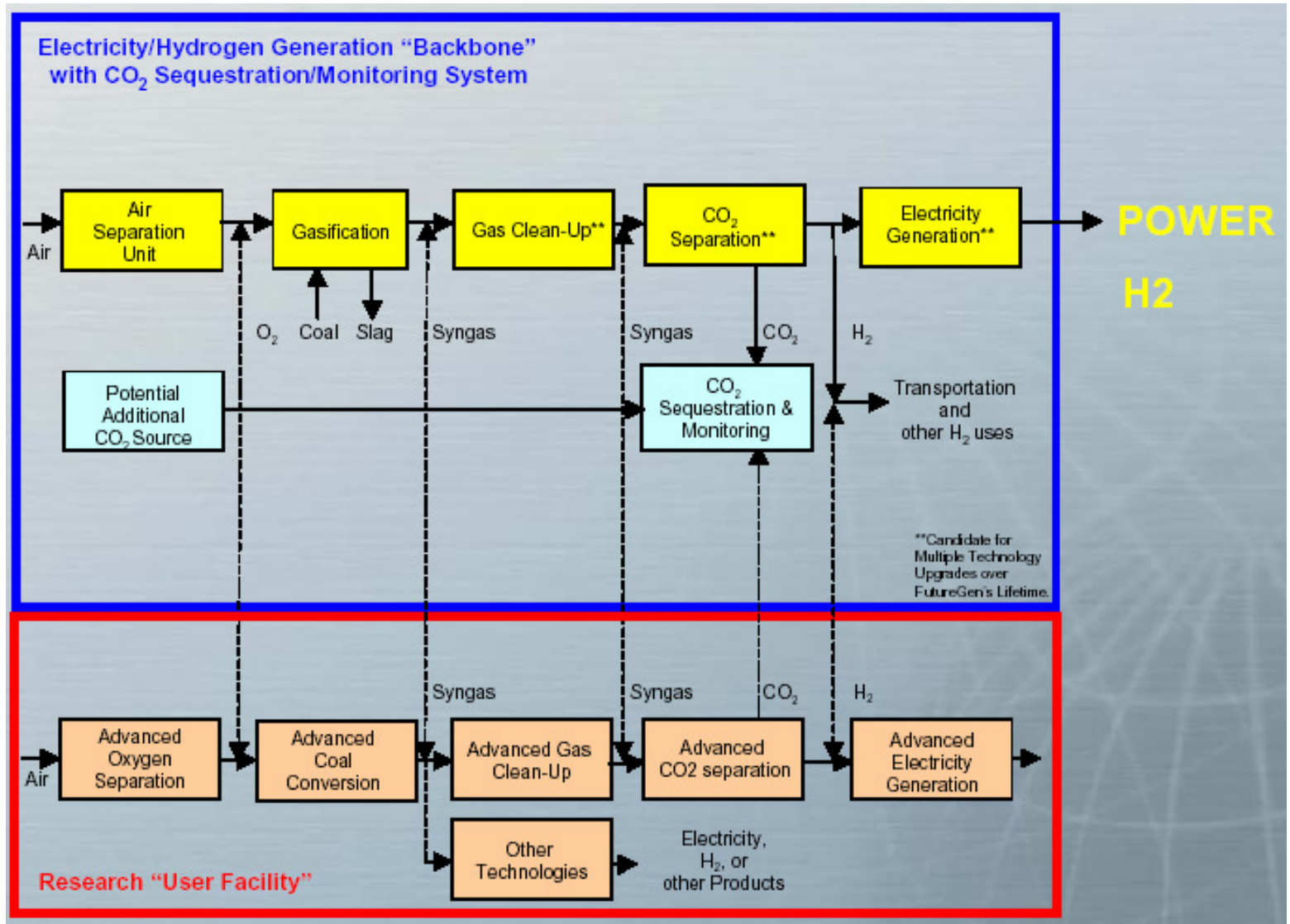
FutureGen Systems



Industry's View of the Facility

“State-of-the-Art
Gasification
Technology”

“Sequestration”



RD&D to Meet Technology Challenge

Traditional Advanced Technology

Cryogenic Separation

Amine Scrubbers

Gas Stream Clean-Up

Syngas Turbine

Fuel Cell (\$4,000/kW)

EOR based

Existing Gasifier

System Integration

Plant Controls

Research Inventions

O₂ Membranes

H₂ Membranes, “Clathrate” CO₂
Separation or Advanced Selexol

Raw Gas Shift Reactor

Ultra-low NO_x Hydrogen Turbine

SECA Fuel Cell (\$400/kW design)

Sequestration Technology

(including in-situ CO₂ monitoring)

Advanced Transport Reactor

“First of a Kind” System Integration

“Smart” Dynamic Plant Controls &
CO₂ Management Systems

The FutureGen “Alliance”

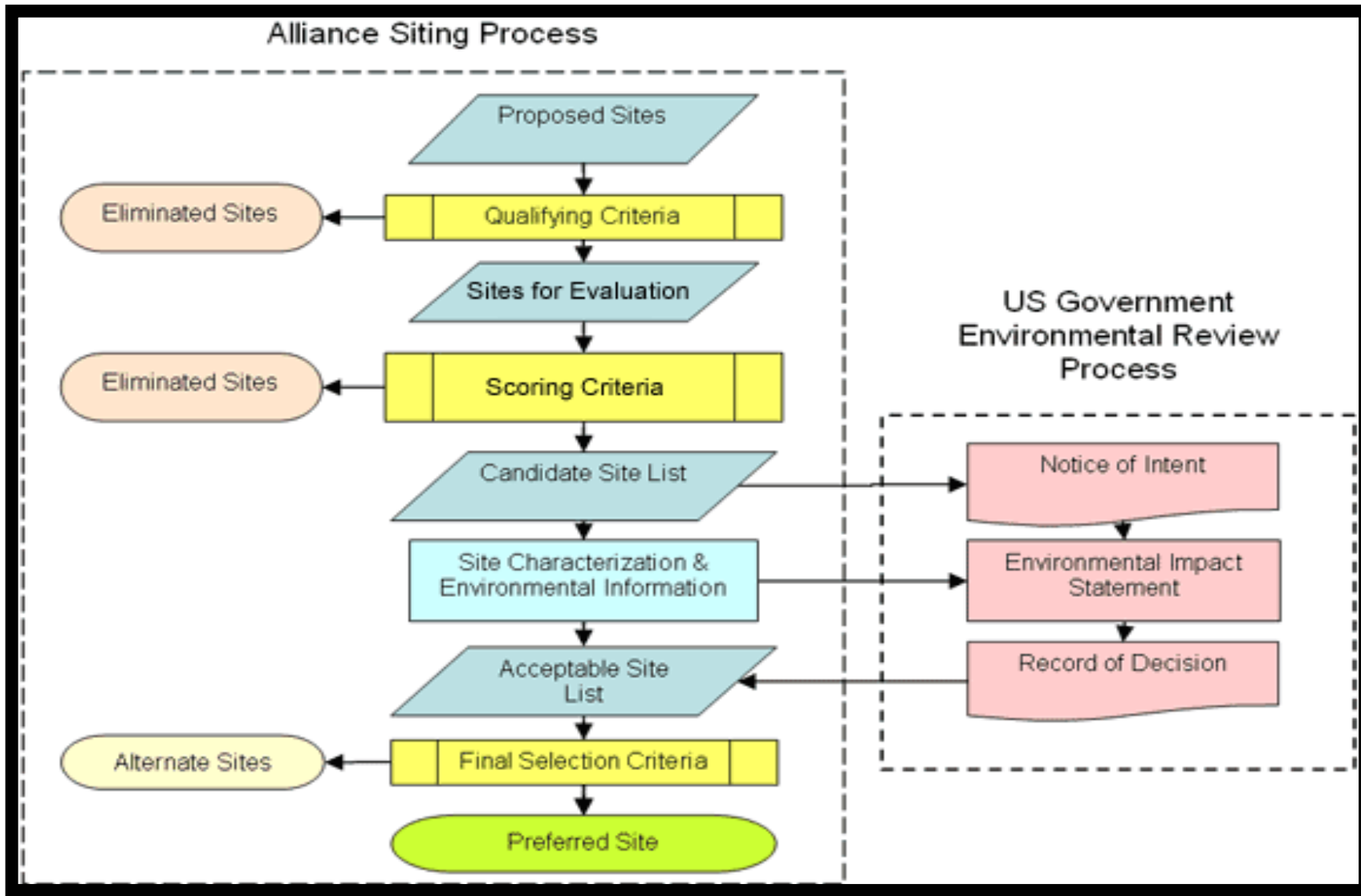


•The Alliance presently consists of 12 organizations some of which represent approximately 20% of the U.S. coal-fired electricity generation and over 40% of the U.S. coal production.

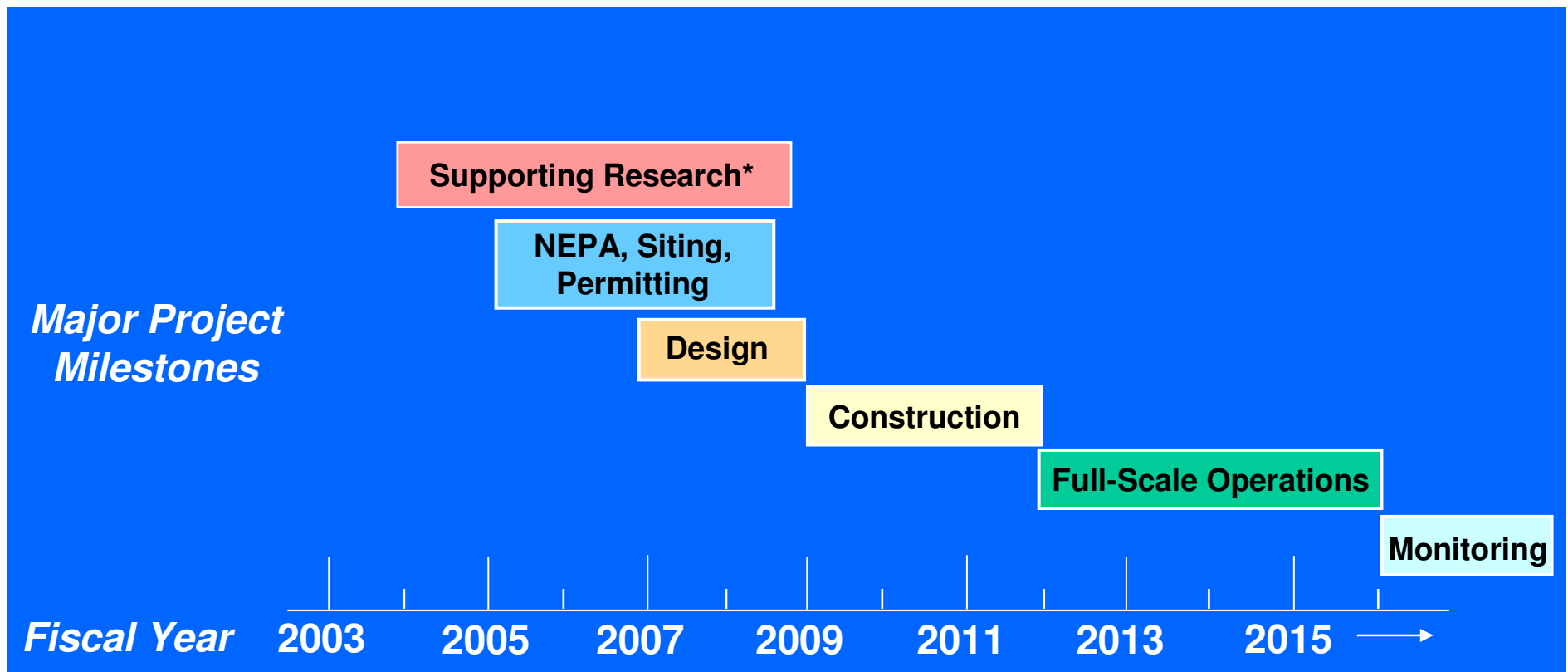
•As an open consortium (both domestically and internationally) the Alliance is geographically diverse, currently including both eastern and western domestic coal producers and coal-fueled electricity generators. The Alliance includes producers and users of a full range of coal types.

- American Electric Power
- Anglo American Ilc
- BHP Billiton
- China Huaneng Group
- CONSOL Energy Inc.
- E.ON US
- Foundation Coal
- Peabody Energy
- PPL Corporation
- Rio Tinto Energy America
- Southern Company
- Xstrata Coal

Alliance Siting Process

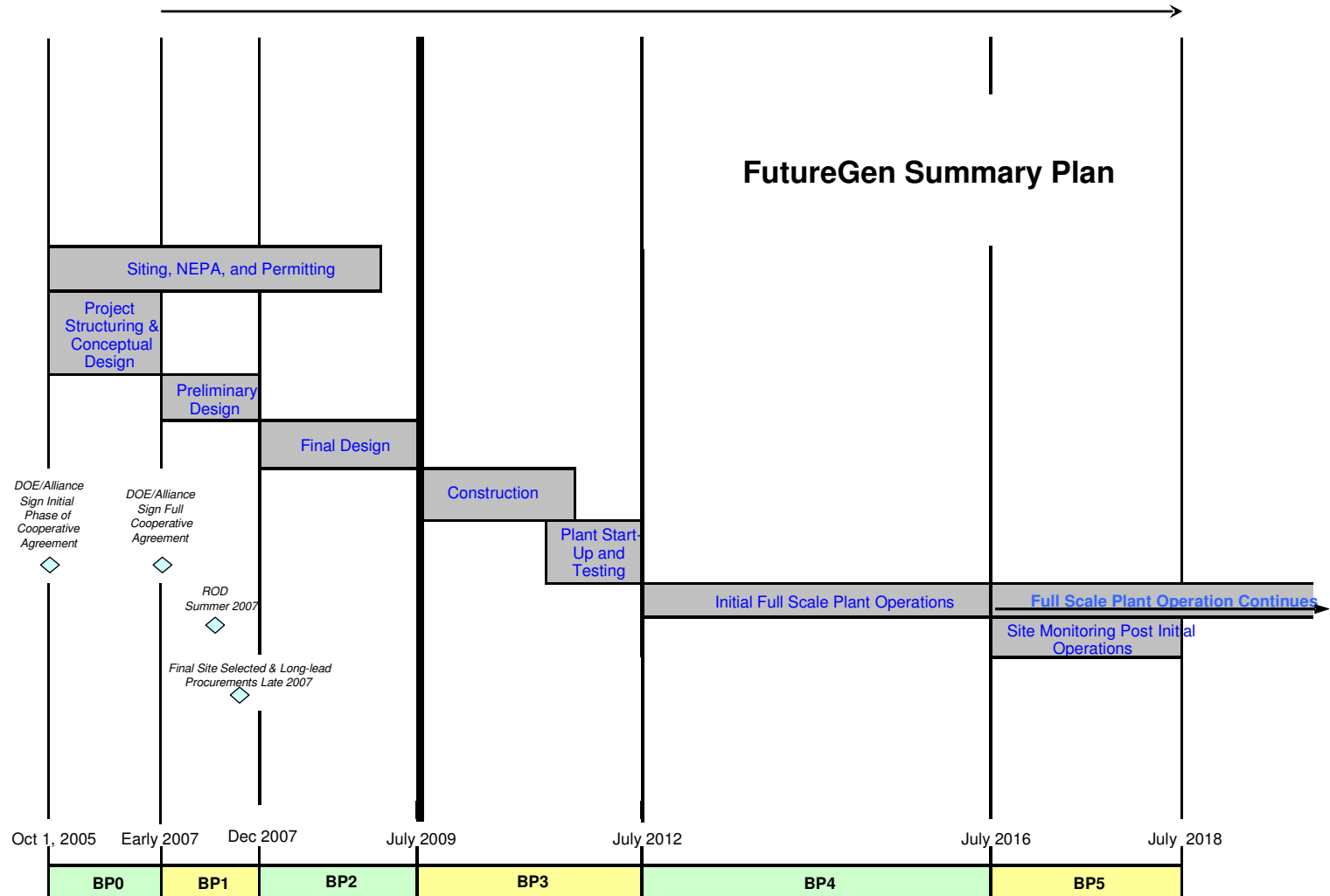


Project Schedule - Key Events



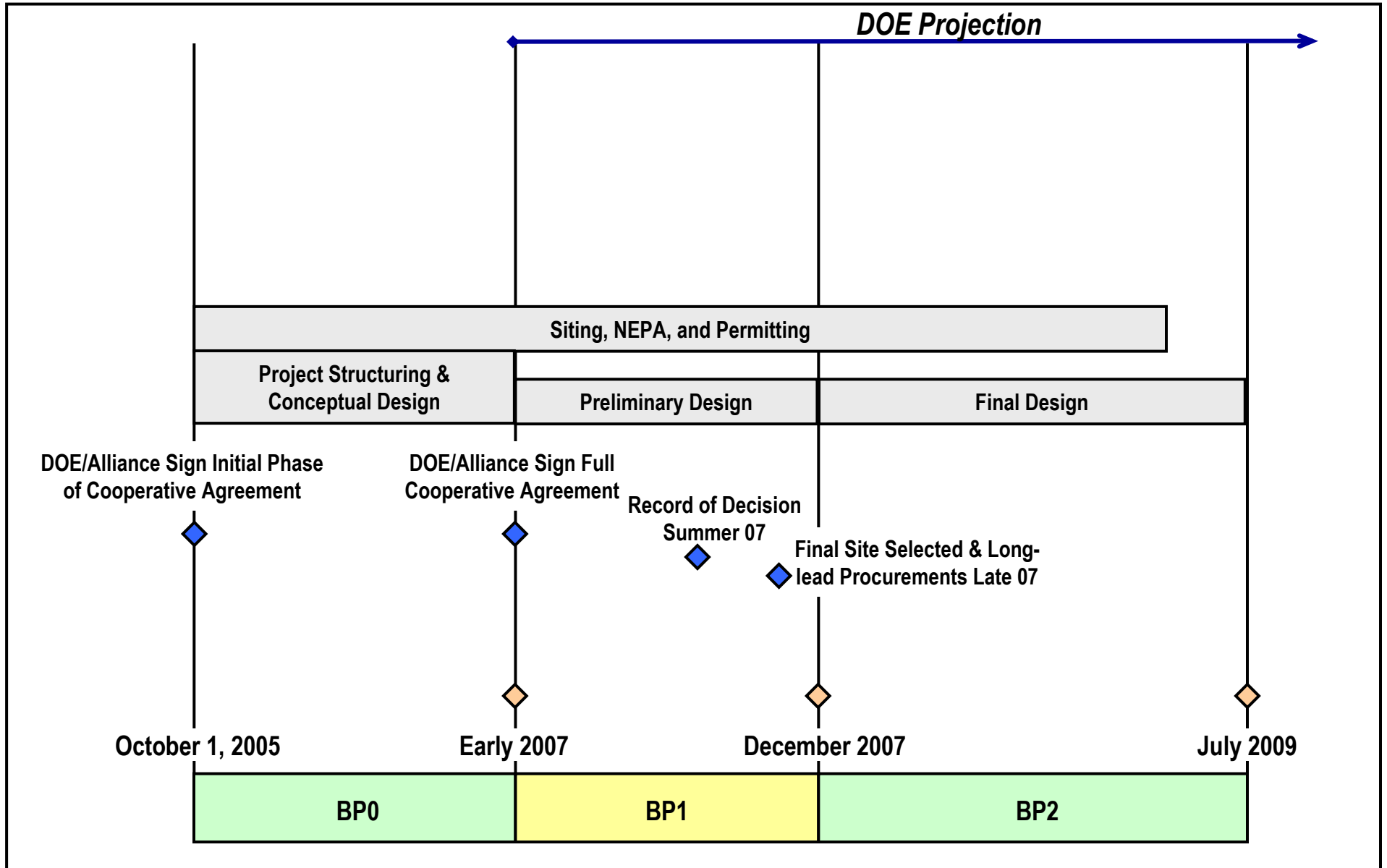
* Supporting research includes research embedded in the FutureGen project and additional research in FE's carbon sequestration, IGCC, turbines, and fuel cell R&D programs.

Project Schedule



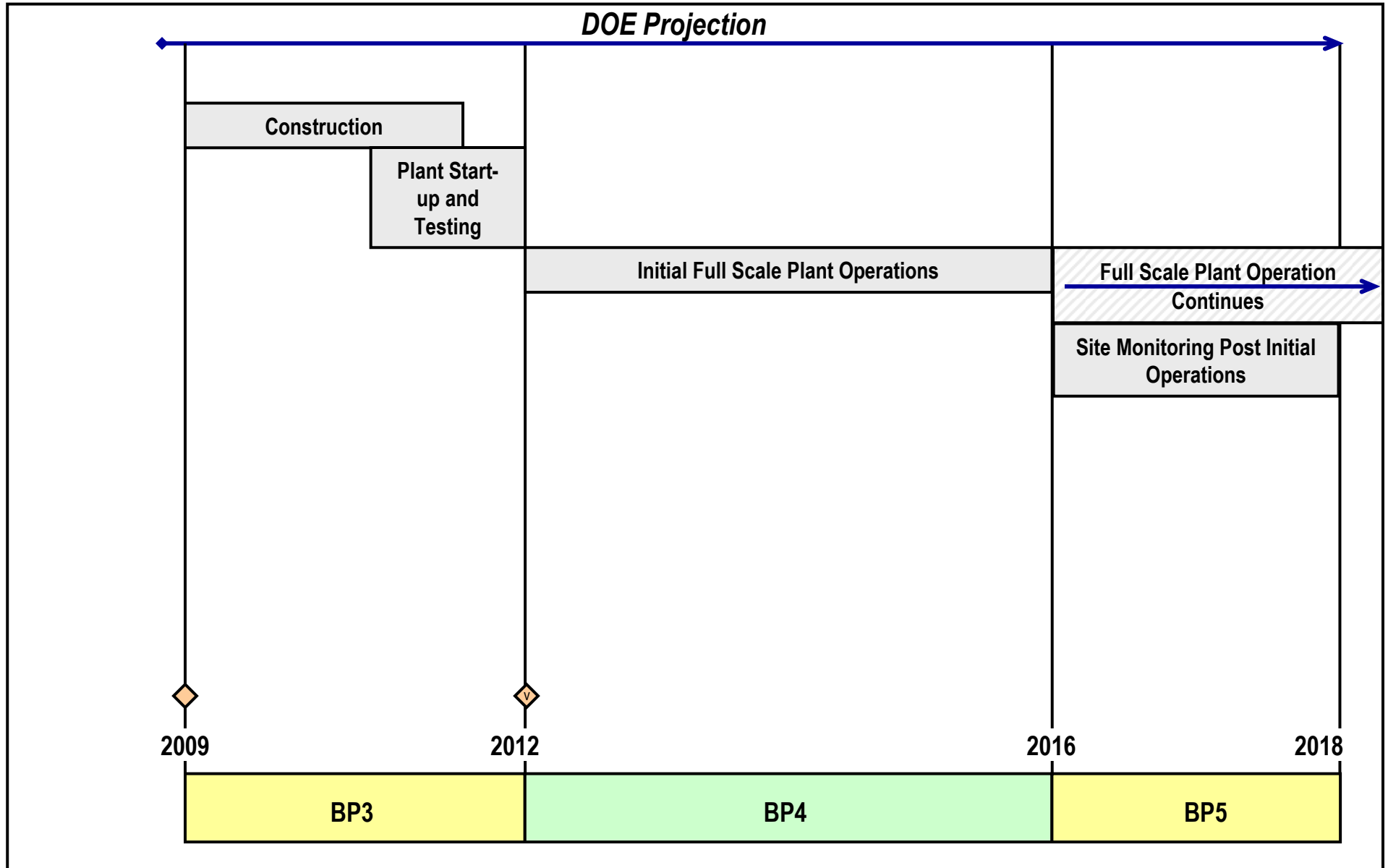
FutureGen

Project Schedule (BP0-BP2)



FutureGen

Project Schedule (BP3-BP5)



Status Update- Progress to Date

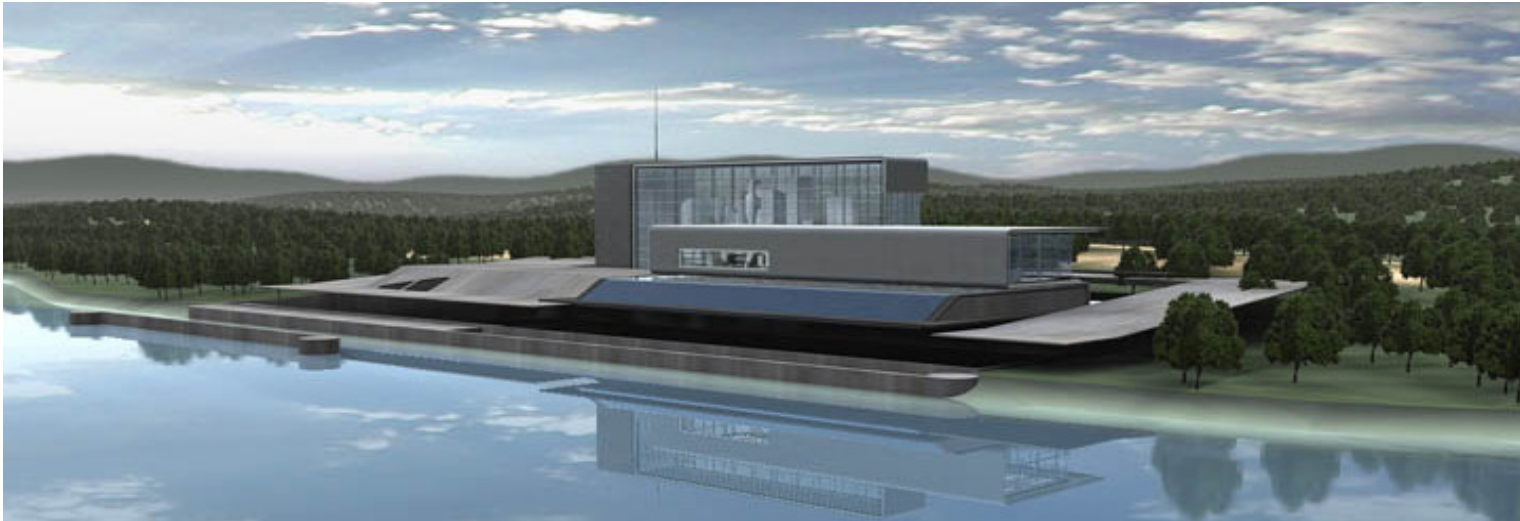
Recent Progress

- The Alliance issued a competitive Site Solicitation and has announced its short list of 4 candidate sites to host the project: Mattoon, IL, Tuscola, IL, Heart of Brazos near Jewett, TX, Odessa, TX
- On July 28th, 2006, the DOE began the formal environmental compliance process by issuing a Notice of Intent for an Environmental Impact Statement for FutureGen
- Meetings were held near the 4 candidate sites to engage public participation
- Conceptual designs on several plant configurations and associated preliminary cost estimations have been completed.
- Initiated preliminary planning activities for permitting process
- Initial phase project definition completed
- Two countries have joined the Government Steering Committee (India, South Korea), and other countries have been invited to join also.

Moving Forward- Next Steps

- **Initiate next phase of project for site selection and design**
- **Conduct design activities for FutureGen**
- **Decide on cutting-edge technology “step-outs” for inclusion in FutureGen**
- **Develop test scope for validating FutureGen goal**
- **Conduct planning activities for permitting process (some preliminary work has already begun)**
- **Continue formal environmental compliance process and work on Environmental Impact Statement (EIS) for all four candidate sites. Continue work on environmental information data gathering in support of an EIS.**
- **Finalize FutureGen International Agreement with prospective government participants and establish the Government Steering Committee operations.**
- **Encourage additional international participation – both on government and industry side.**
- **Continue outreach to garner public acceptance and to bring additional participants into the project both domestically and internationally (coordinated team effort of DOE, Alliance and international partners)**

Summary Remarks



- **FutureGen is a key research step towards proving the feasibility of a zero-emission coal option.**
- **Project is currently on track – all necessary funding has been provided to date as scheduled and the evaluation of candidate sites is currently underway.**
- **Expect site selection by Alliance in late 2007 upon completion of the formal environmental compliance process (EIS)**
- **The cooperation and support of all international stakeholders (government, industry, environmental) are necessary for the success and broad acceptance of the FutureGen zero emission concept. Therefore, global participation is invited.**
- **The potential benefits of a zero-emission coal option are enormous with respect to energy, environmental and economic security.**

Additional Information

- **MAIN FUTUREGEN WEBSITES**

<http://fossil.energy.gov/programs/powersystems/futuregen/>

<http://www.netl.doe.gov/technologies/coalpower/futuregen/index.html>

<http://www.futuregenalliance.org/>

- **GENERAL**

www.netl.doe.gov

www.eia.doe.gov

www.epa.gov

www.climate-science.gov

