



FutureGen

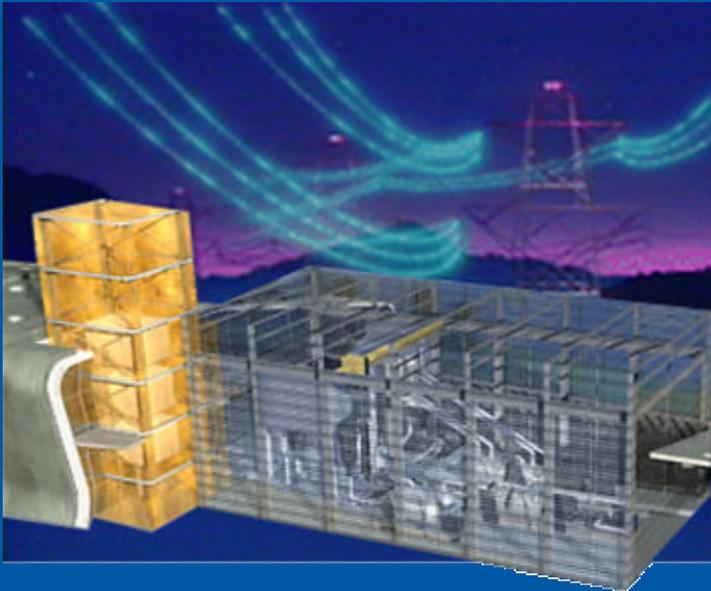
The Energy Plant of the Future

Energy Independence through
Carbon Sequestration and Hydrogen



FutureGen

What is the *FutureGen* prototype?



The world's first zero emission power plant to

- ☐ Pioneer advanced hydrogen production from coal**
- ☐ Emit virtually no air pollutants**
- ☐ Capture and permanently sequester carbon dioxide**

Objective: *FutureGen* will be an international test facility for breakthrough technologies that addresses three key Presidential initiatives: (1) Hydrogen, (2) Clear Skies, (3) Climate Change Technology

FutureGen

A \$1 Billion, 10-Year Global Partnership Effort



-  **DOE to share project cost with private sector**
-  **Other nations to be invited to join at first meeting of Carbon Sequestration Leadership Forum**

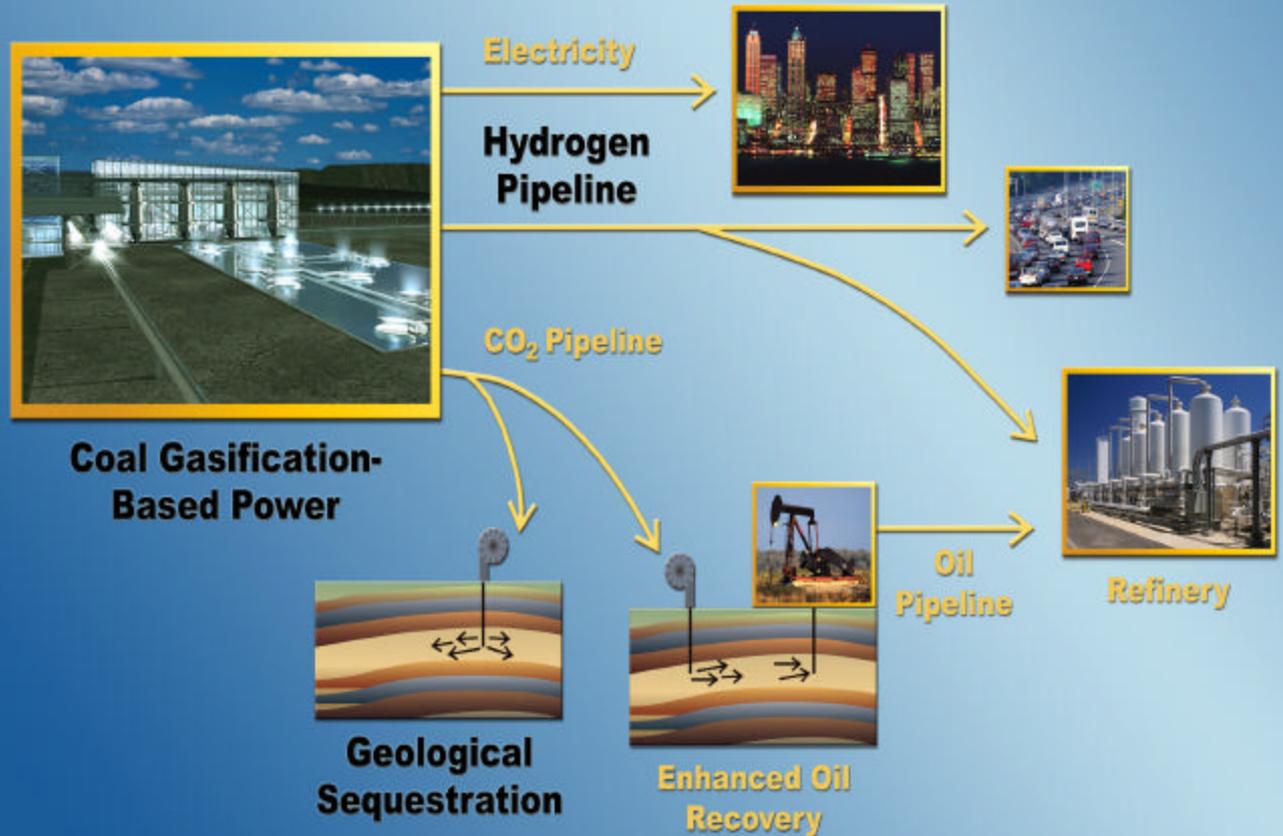
Goal: A U.S.-led global effort to pioneer coal-to-hydrogen and carbon management technologies for coal

FutureGen

A “Zero Emissions” Plant

 **FutureGen** will test new technologies to capture CO₂ at the power plant

 **FutureGen** will test large-scale injection into oil fields or into deep geologic formations for permanent storage



Tomorrow's Hydrogen

Why is Hydrogen from Coal Important?



- 95% of U.S. hydrogen comes from natural gas
- Future “Hydrogen Economy” must have more diversified sources
- Over longer term, hydrogen will likely come from renewables, nuclear power, fusion, etc.

But coal can also be a major feedstock

- Most abundant U.S. fossil fuel (250-yr supply); if transportation fuel today was hydrogen, potential for additional 1.3 billion tons coal per year; by 2025 that addition could grow to 2.4 billion tons
- Can be environmentally clean source of hydrogen

Climate Change

Why is Sequestration Important?

Carbon Management Paths

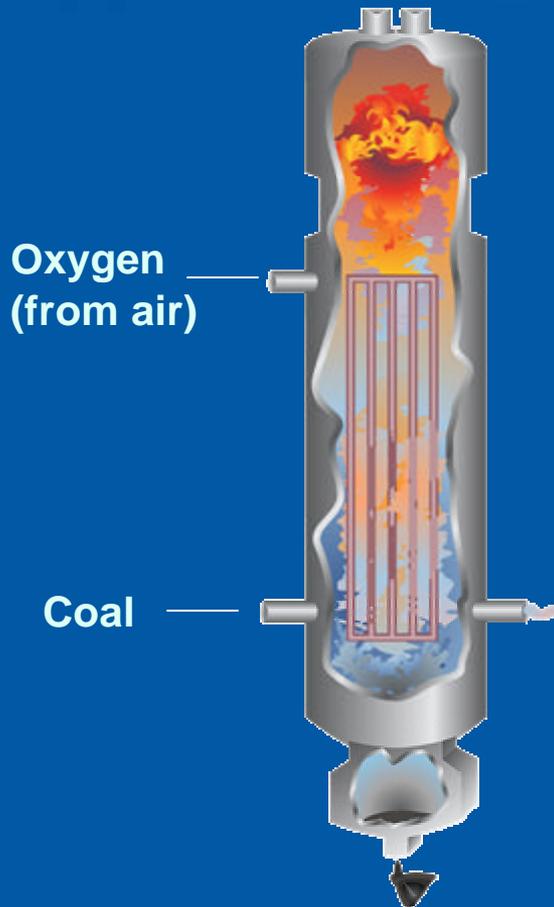
- Switch to low- & no-carbon fuels
Renewables, Nuclear, Natural Gas
- Increase energy efficiency
Demand-Side & Supply Side
- Sequester carbon

- May be only option that removes enough carbon to stabilize CO₂ concentrations in atmosphere
- Only approach that doesn't require countries to overhaul energy infrastructures
- May prove to be lowest cost carbon management option

The *FutureGen* plant will be a first-of-its-kind project by the U.S. electric power industry to prove that large-scale sequestration is safe and practicable.

FutureGen

Converting Coal into Gas is Key



- 99%+ of Clear Skies pollutants (sulfur/nitrogen/mercury) can be cleaned from gasified coal
- Hydrogen is a primary product
- Carbon gases are in concentrated form for easier capture and sequestration

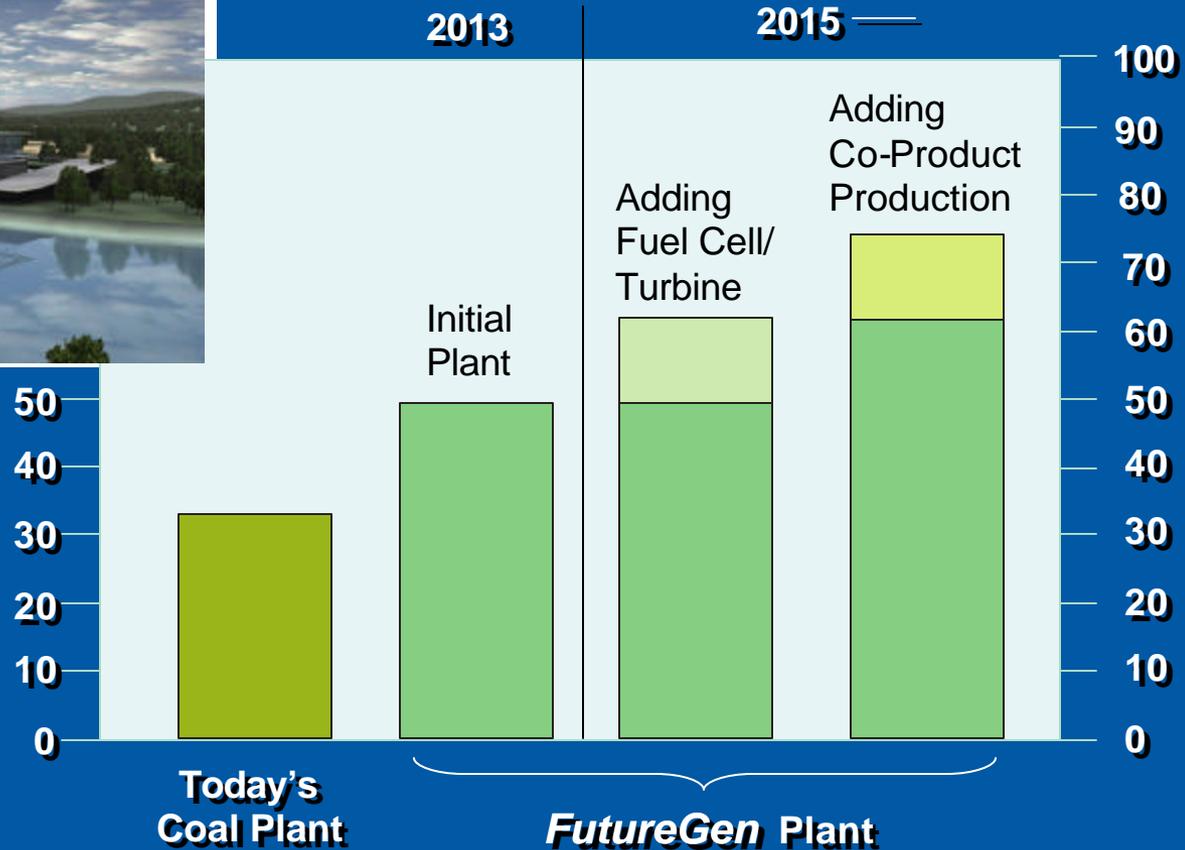
No coal-to-gas plant in the world today is configured to optimize hydrogen production or to capture carbon. The *FutureGen* prototype plant would be the world's first.

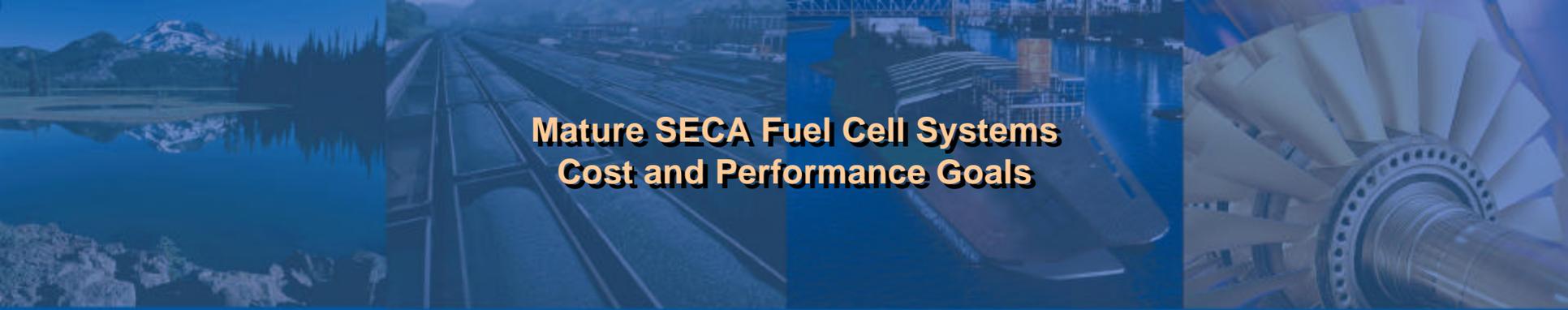
FutureGen

The World's Most Energy-Efficient Power Plant



Boosting power plant efficiencies is first step toward reducing greenhouse gases

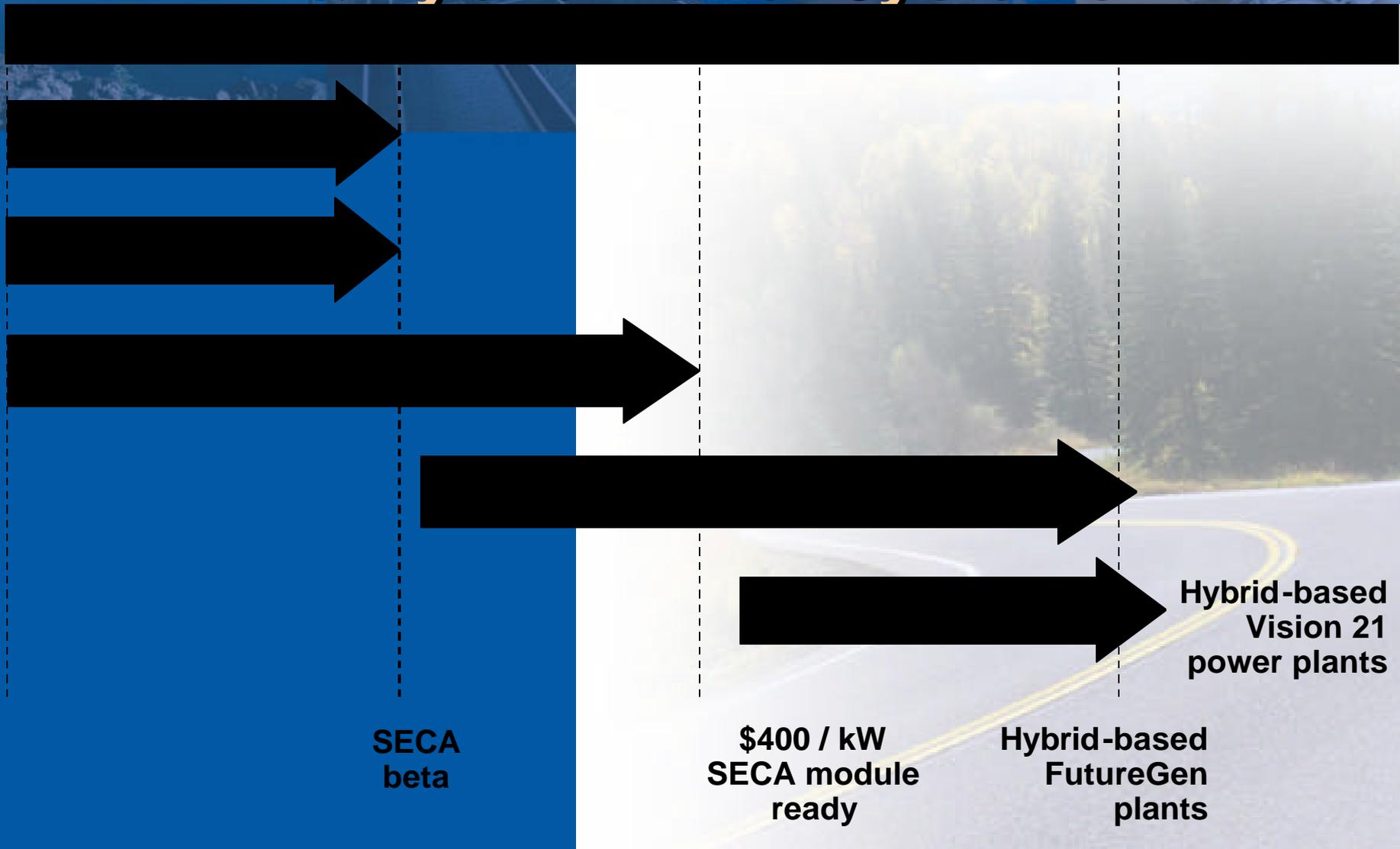




Mature SECA Fuel Cell Systems Cost and Performance Goals

	Fuel Cell System	Fuel Cell Turbine Hybrid System
Capital Costs	<\$400/kW	<\$400/kW (includes turbine)
Maintenance Interval	3000 hrs.	3000 hrs.
Full Load Electrical Efficiency (LHV)	50% APU 60% stationary	60-70% adaptable to coal gas
Design Life	5000 hrs. APU 40,000 hrs. stationary	40,000 hrs.
Emissions of criteria pollutants	Near zero	Near zero

Technology Road Map for SECA & Hybrid Power Systems





Role of SECA in Zero Emissions Plants

- **SECA low-cost fuel cells are key to achieving the ultra high efficiencies needed to make integrated zero emissions plants competitive on cost of electricity.**
- **Fuel Flexibility challenge: Compatibility of SECA fuel cells with coal gas as a fuel.**
- **Important steps:**
 - **Planned SECA fuel cell test on coal gas in the Power Systems Development Facility (PSDF) at Wilsonville, Alabama. SECA unit being built by Delphi and scheduled for installation this summer.**
 - **FutureGen offers the opportunity to test SECA solid oxide fuel cells at a full-scale integrated research prototype.**



FutureGen

DOE Announcement on Proposed Path Forward for Implementing FutureGen

- **Federal Register Notice (April 21, 2003): Request for Information (RFI) on FutureGen: The world's first coal based, zero-emissions power system for electricity and hydrogen.**
- **Seeking public comment on its plans for implementing FutureGen**
- **U.S. Department of Energy plans a non-competitive cooperative agreement with a Consortium led by the coal-fired electric power industry and coal production industry.**
- **Comments requested back by June 16, 2003 from**
 - **Those interested in establishing a Consortium**
 - **Stakeholders or other interested parties**



FutureGen

Proposed FutureGen Implementation

- **Government establishes the requirements for the FutureGen project**
- **Expectation of industry to cost share at least 20% of the \$1 billion, 10-year research project.**
- **Consortium members collectively must own and produce at least 1/3 of coal and 1/5 coal-fueled electricity in the U.S.**
- **Consortium to be geographically diverse (both East and West) and representing full range of coal producers and electricity coal generators.**
- **A Government Steering Committee to provide guidance to industry Consortium**
- **Consortium is encouraged to be inclusive and seek additional domestic and foreign industrial coal producers and coal- fueled electricity generators.**
- **U.S. DOE to require open and fair competition by Consortium in site selection and procurement of equipment and services for FutureGen**

Role of *FutureGen*

In the Coal Research Program

R&D for:

- Clear Skies
- Climate Change / Efficiency
- Hydrogen
- Sequestration

Clean Coal Power Initiative Demos

Adv
Tech
Modules

Next
Gen
Tech

Adv
Gen
Tech

Pre
V-21
Tech

Increasing efficiency and Decreasing emissions

FutureGen Project
Integrated H₂ and Sequestration
Research Prototype

High Efficiency
Zero Emissions
Vision 21

For More Information

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