

FutureGen - A Sequestration and Hydrogen Research Initiative

The Integrated Sequestration and Hydrogen Research Initiative is a \$1 billion government/industry partnership to design, build and operate a nearly emission-free, coal-fired electric and hydrogen production plant. The 275-megawatt prototype plant will serve as a large scale engineering laboratory for testing new clean power, carbon capture, and coal-to-hydrogen technologies. It will be the cleanest fossil fuel-fired power plant in the world.

Responding to the President's Initiatives

The project is a direct response to the President's Climate Change and Hydrogen Fuels Initiatives. President Bush emphasized the importance of technology in stabilizing greenhouse gas concentrations in the atmosphere with two major policy announcements: the National Climate Change Technology Initiative on June 11, 2001, and the Global Climate Change Initiative on February 14, 2002. Carbon capture and sequestration technologies likely will be essential to meeting the President's goals. Without them, it will be virtually impossible to limit global carbon emissions.

"Technology offers great promise to significantly reduce greenhouse gas emissions, especially carbon capture, storage, and sequestration technologies."

President George W. Bush
Announcing the National Climate
Change Technology Initiative
June 11, 2001

The President's Hydrogen Fuel Initiative, announced on January 28, 2003, envisions the ultimate transformation of the nation's transportation fleet from a reliance on petroleum to the use of clean-burning hydrogen. Today, most hydrogen in the United States and about half of the world's hydrogen supply, is produced from natural gas. The new technologies to be integrated into the prototype plant will expand the options for producing hydrogen from coal, providing a more diversified and secure source of feedstocks for the President's initiative.

The Technology

Virtually every aspect of the prototype plant will employ cutting-edge technology. Rather than using traditional coal combustion technology, the plant will be based on coal gasification which produces a synthesis gas in which the coal's carbon is converted to a "synthesis gas" made up primarily of hydrogen and carbon monoxide.

Advanced technology will be used to react the synthesis gas with steam to produce additional hydrogen and a concentrated stream of CO₂. Initially the hydrogen will be used as a clean fuel for electric power generation either in turbines, fuel cells or hybrid combinations of these technologies. The hydrogen could also be supplied as a feedstock for refineries. In the future, as hydrogen-powered automobiles and trucks are developed as part of President Bush's Hydrogen Fuels Initiative, the plant could be a source of transportation-grade hydrogen fuel.

The captured CO₂ will be separated from the hydrogen perhaps by novel membranes currently under development. It would then be permanently sequestered in a geologic formation. Candidate reservoir(s) could include depleted oil and gas reservoirs, unmineable coal seams, deep saline aquifers, and basalt formations – all common in the United States. The reservoir(s) will be intensively monitored to verify the permanence of CO₂ storage.



Goals

- Design, construct, and operate a nominal 275-megawatt (net equivalent output) prototype plant that produces electricity and hydrogen with near-zero emissions. The size of the plant is driven by the need for producing commercially-relevant data, including the requirement for producing one million metric tons per year of CO₂ to adequately validate the integrated operation of the gasification plant and the receiving geologic formation.
- Sequester at least 90 percent of CO₂ emissions from the plant with the future potential to capture and sequester nearly 100 percent.
- Prove the effectiveness, safety, and permanence of CO₂ sequestration.
- Establish standardized technologies and protocols for CO₂ measuring, monitoring, and verification.
- Validate the engineering, economic, and environmental viability of advanced coal-based, near-zero emission technologies that by 2020 will: (1) produce electricity with less than a 10% increase in cost compared to non-sequestered systems; (2) produce hydrogen at \$4.00 per million Btus (wholesale), equivalent to \$0.48/gallon of gasoline, or \$0.22/gallon less than today's wholesale price of gasoline.

Timelines, Components and Estimated Costs

