

P R O J E C T facts

DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
FEDERAL ENERGY TECHNOLOGY CENTER

ADVANCED CLEAN/EFFICIENT
POWER systems

PS017.0697

DEVELOPING A CLEAN, HIGH-PERFORMANCE POWER SYSTEM

Project Description

A team led by Foster Wheeler Development Corporation is developing a power plant concept for the 21st century that promises clean, highly efficient electricity from the Nation's most abundant energy resource, coal.

The High Performance Power System (HIPPS) being developed by Foster Wheeler is a coal-fired combined-cycle system that links a high-efficiency gas turbine cycle with a more conventional steam turbine cycle. In the HIPPS design, coal is partially gasified, producing a low-Btu gas and a solid char. Char from the gasifier is burned in a combustor to generate steam to drive a steam turbine generator and to preheat high pressure air for the gas turbine/generator. The low-Btu gas from the gasifier is cleaned with conventional techniques and burned to bring the temperature of the high-pressure preheated air stream to the gas turbine inlet temperature. This HIPPS arrangement allows power to be generated simultaneously by two complementary thermodynamic cycles, resulting in maximum power-generation effectiveness.

Such a high-performance power system could reach efficiencies of 47% or more (today's plants are 33%–35% efficient). Higher efficiencies mean that less fuel is needed, which translates into lower levels of pollutant emissions and lower electricity costs for consumers. Emissions are held to a tenth of today's standards—and no wastes are produced.

During Phase I, which has been completed, the team produced a conceptual design after analyzing various alternatives to determine technical risk and economic feasibility. Key activities in Phase II will be to generate experimental data, conduct engineering and economic analyses, and design the prototype plant. Foster Wheeler is heading one of two teams preparing the initial designs for a High Performance Power System. At the end of Phase II, one of the teams will be selected to proceed to Phase III, construction and operation of a prototype plant.

Program Goal

Coal represents 94% of proven U.S. fossil fuel reserves, but burning coal for power generation produces harmful emissions. It is in the Nation's interest to maximize the use of this abundant resource while reducing its adverse environmental impact as much as possible. By achieving significant increases in the thermodynamic efficiency of coal-fired electric power generation, the HIPPS project will sharply reduce all airborne emissions, including carbon dioxide. HIPPS will also yield environmental benefits throughout the entire fuel cycle, including coal mining and transportation, reducing solid waste, water requirements, and thermal loadings to bodies of water.

PRIMARY PROJECT PARTNERS

**Foster Wheeler
Development Corporation**
Livingston, NJ

MAIN SITE

Livingston, NJ

TOTAL ESTIMATED COST

\$47,520,000

COST SHARING

DOE \$39,225,000

Non-DOE \$8,295,000

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Project Benefits

The High Performance Power System (HIPPS) is expected to meet the combined goals of (1) higher power-generating efficiencies, (2) extremely clean environmental performance, and (3) affordable electricity.

Coal is projected to remain a dominant source of fuel for electric power generation, both domestically and globally, well into the 21st century. Coal currently supplies more than 56% of U.S. electric-power needs.

In the early part of the next decade, U.S. power generators will select the next generation of baseload power plants. In an era of tight environmental standards, new plants will have to meet very stringent air-quality requirements. Coal is expected to remain a fuel of choice for many of these plants, and HIPPS could provide an important option for a power company that must meet these air-quality standards while producing the most affordable electricity possible for its consumers.

HIPPS will be able to:

- Increase electric-generating efficiency to 47% or more.
- Lower emissions of sulfur and nitrogen pollutants to less than a tenth of current U.S. new-plant standards, an environmental performance that meets or exceeds the strictest world standards for coal-fired power plants.
- Reduce greenhouse gas emissions, specifically carbon dioxide, by as much as 30% in the first commercial plants and, as technology matures, by more than 35% overall.
- Produce electricity at costs at least 10% below those of today's plants.
- Repower existing coal-fired plants, producing a significant gain in operating efficiency.

CONTACT POINTS

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Project Partners

ALLIED SIGNAL

Los Angeles, CA
(component development)

BECHTEL CORPORATION

San Francisco, CA
(architect/engineering services)

INSTITUTE OF GAS TECHNOLOGY

Chicago, IL
(component testing)

WESTINGHOUSE ELECTRIC CORPORATION

Orlando, FL
(turbine integration)

UNIVERSITY OF TENNESSEE

SPACE INSTITUTE
Tullahoma, TN
(system design, component testing)

FOSTER WHEELER ENERGY CORPORATION

Clinton, NJ
(combustion system)

Cost Profile

(Dollars in Millions)

	Prior Investment	FY95	FY96	FY97	Future Fund (Phase II)
Department of Energy*	\$6.1	\$3.6	\$4.9	\$3.8	\$20.8
Private Sector Partners	\$—	\$0.9	\$1.2	\$1.0	\$5.1

* Appropriated Funding

Key Milestones

FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04
Design		Construction		Testing and Design		Build and Operate Prototype Plant (Phase III)			
Design subsystems		Construct subsystems		Test subsystems Integrated testing Design prototype plant					
Produce preliminary conceptual design									