

# Proposed clean-coal boiler would meet today's, tomorrow's needs

Purdue is seeking approval from the State of Indiana for financing and constructing a \$53 million clean coal technology boiler at the West Lafayette campus's Wade Utility Plant.

Physical Facilities is proposing a circulating fluidized bed (CFB) boiler, to be named Boiler 6, that is rated at up to 300,000 pounds of steam per hour.

On the growing campus, the utility system produces and supplies almost all of the University's energy — steam for heating, chilled water for cooling buildings, compressed air, water, and on average 50 percent of electrical requirements. The balance of electricity is purchased from the local electric utility.

A significant increase in building space has pressed the plant's current coal boiler system to capacity for about four years. On an ongoing basis, plant personnel monitor systems very carefully, adjust temperature controls across campus, and encourage energy conservation efforts, but these efforts have not been enough to keep pace with growing demands from campus.

More than 4 million square feet of building space have been added to the campus since Boiler 5 was installed in 1990, and it was a replacement for the old North Power Plant, which was retired at the same time. Since the last significant increase in boiler capacity in 1973, the campus has grown by 6.8 million square feet of building space, or an increase of more than 50 percent.

## Current boilers

When enough steam cannot be generated with the plant's current boiler fleet, due to extreme temperatures or unforeseen boiler failure of one of two aged coal-burning stokers (boilers 1 & 2), only a gas/oil boiler (Boiler 3) is available to stabilize the load. Boiler 3 is an expensive boiler to operate, costing six times as much

to produce the same amount of steam or electricity as the plant's newer Boiler 5. Boiler 4 was retired from the plant in 1989.

As Purdue's utility plant is the only source for heating campus, adequate steam supply is critical for utility reliability on campus.

"Boiler 6 is necessary to ensure a reliable source of heat for all of the new facilities constructed in the last decade," says Joe Mikesell, interim vice president for physical facilities. "It will allow the steam plant to remain in compliance with environmental regulations at higher loads and will do so in the most economical manner."

The newest boiler in the utility plant's base load boiler fleet is a 16-year-old clean coal technology boiler, Boiler 5. Like the proposed Boiler 6, Boiler 5 combusts fuel using circulating fluidized bed (CFB) technology.

Almost 99 percent of the plant's energy production comes from coal as a fuel source produced solely by Indiana mines. A CFB boiler eliminates more than 90 percent of the sulfur and mercury, and much of the nitrogen oxide compounds. The CFB's ability to burn coal with limestone at a low temperature creates chemical reactions that capture airborne pollutants efficiently and effectively.

In addition to the "scrubbing" of pollutants with limestone, the CFB boiler is equipped with a "baghouse," a fabric filter that collects much of the particulate matter (or "soot") and acts as a "sponge" to absorb mercury and acid gas emissions. The result is a coal-fired boiler that burns high-sulfur Indiana coal efficiently and cleanly.

"The coal-fueled steam production from the Wade Utility makes a lot of sense economically to us and to the state of Indiana," says Erick Van Meter, director of utilities.

and the Office of the Provost.

Miller's humorous, high-energy presentation shows how personal accountability helps to boost morale, enhance communications, encourage problem solving, foster creativity and build effective teams. Miller is the best-selling author of "QBQ! The Question Behind the Question" and "Flipping the Switch: Unleash the Power of Personal Accountability."

This lecture is open to all Purdue employees free of charge and will last 90 minutes. More information is available at APSAC's Web site, [www.purdue.edu/apsac](http://www.purdue.edu/apsac).



PHOTO BY GAIL RIESE, PHYSICAL FACILITIES

Sustainability is a prominent planning consideration as Physical Facilities officials work to meet immediate and long-range needs. Here, with Indiana-grown switchgrass — a biomass fuel option — delivered near Wade Utility Plant, are (from left) Jim Lefeld, Duke Energy; Klein Ileleji, assistant professor and extension engineer in Agricultural and biological engineering; Pat More, Duke Energy; Mark Nethercutt, utility engineering group manager; Erick Van Meter, director of utilities; Robin Ridgway, environmental regulatory consultant in REM; and Ron Steuterman, managing director of the Energy Center in Discovery Park. The banner on the tarp says, "Biomass Co-fire Project" and shows the names of these cooperating units.

## Environmental benefit

Operationally, the new Boiler 6 will not only help keep pace with the needs of the campus community, requiring ever-increasing heating and cooling capacity, but also will provide the University with newer, cleaner steam-generation technology, allowing Purdue to continue to address its responsibility to the environment.

"Purdue works closely with the federal Environmental Protection Agency (EPA) and Indiana's Department of Environmental Management (IDEM), providing accurate performance data and analysis, as well as collaborating on forward-looking rule development that satisfies and goes beyond regulatory requirements for Clean Air Act Amendments," says Robin Mills Ridgway, environmental regulatory consultant in Radiological and Environmental Management and Utilities.

"Regulatory certainty is key to long-term planning for Purdue utilities, allowing us to design beyond the bare minimum

requirements while at the same time making best use of the state's capital. Our cooperative relationship is a three-way win for us, the regulators, and the environment."

## MACT compliance

The addition of Boiler 6 follows on the heels of a significant project already under way at Wade to prepare the coal-fired boilers for compliance with an air toxics rule called the National Emission Standard for Hazardous Air Pollutants or "Boiler MACT." The Boiler MACT project upgrades the existing pollution control equipment on the older boilers to substantially enhance collection of airborne particulate matter and mercury emissions.

Ridgway says, "The project could have proceeded in several different ways, but Purdue chose the path that offered the most potential for expansion if needed in the future. This puts us in a better position to respond to possible new requirements in the future instead of having to rework the entire multi-million-dollar

project."

Under original plans, the new MACT equipment was to be on line in the fall of 2007, but due to delays in equipment procurement, the new date is September 2008.

This cooperative effort with the EPA, along with the benefits derived from a new CFB boiler, adds steam generating capacity to the plant while actually decreasing the University's overall utility plant emissions, helping to improve local and regional air quality.

With the addition of Boiler 6 and the completion of the Boiler MACT project, plant-wide emissions relative to 2004 will remain unchanged for SO<sub>2</sub> and NO<sub>x</sub> while particulate matter and mercury levels will be reduced significantly — all are pollutants of primary concern in coal-fired boiler emissions.

Purdue's choice to go beyond the regulatory requirements by capping selected emissions and greatly reducing others reduces the environmental impact of Purdue's energy production while meeting expanding campus demands for heating and cooling.

Adding to the environmental benefits of the Boiler MACT and Boiler 6 projects, the new boiler will save the University several million dollars per year in operating costs simply by generating steam more efficiently.

## Sustainability benefit

Though emissions and project economics have always been the primary drivers of technology selection, the CFB boilers allow Purdue to consider an added dimension in the impact of energy production: sustainability. The fuel-flexible CFB technology of boilers 5 and 6 is well-suited for the use of solid fuels other than coal for the boilers.

Specifically, carbon-neutral sustainability-friendly biomass-derived fuels are becoming more available and more appealing in environmental stewardship efforts. Possible biomass fuel sources include switchgrass (grown as a fuel crop), by-products from ethanol and corn syrup production, and clean wood waste generated locally. These materials can be easily co-fired with coal in either Boiler 5 or the proposed Boiler 6.

Physical Facilities anticipates hiring Burns & McDonnell, a firm in Kansas City, Mo., to conduct preliminary engineering for the new boiler. Burns & McDonnell supports sustainable design and is a member of the U.S. Green Building Council, the sponsors of the Leadership in Energy and Environmental Design (LEED) program.

Physical Facilities is also engaged in the permitting process with the expectation of having Boiler 6 operational by 2011.

## Professional development speaker to discuss personal accountability

Well-known author John G. Miller will discuss how to eliminate blame, complaining and procrastination in the workplace in a professional development lecture this month.



Miller

Miller will present "Personal Accountability and the QBQ" at 10:15 a.m. Oct. 17 in Loeb

Playhouse, Stewart Center.

The lecture is being sponsored by the Administrative and Professional Staff Advisory Committee (APSAC), Purdue Extension Services, Human Resource Services,