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# super boiler

The U.S. manufacturing sector uses more energy for steam generation than for any other single purpose. In 2002, steam accounted for 31 percent of total U.S. manufacturing energy consumption. This high energy demand in part reflects the reliance on an aging U.S. industrial boiler population employing designs that conceptually vary little from those used at the end of the 19th century. As such, new developments are limited and have offered only incremental gains in operational efficiency.

The U.S. manufacturing sector utilizes more than 33,000 boilers. Of these, more than 80 percent were purchased prior to 1978, with the largest share purchased in the 1960s. However, an important window of opportunity to reduce steam generation energy use will open to U.S. manufacturers as they begin to replace their aging stock of existing industrial boilers nearing retirement.

As part of a new Super Boiler program, which includes a host of industry partners from the Department of Energy to various utilities to Cleaver-Brooks, researchers are working to develop new, breakthrough steam generation technologies that could potentially save U.S. industry billions of dollars per year in operating costs and substantially lower associated environmental impacts.

Key innovations include a transport membrane condenser (TMC) and compact humidifying air heater (HAH) to extract sensible and latent heat from the flue gas for increased energy efficiency; compact convective zones with intensive heat transfer; and a staged/intercooled combustion system for ultra-low emissions. The first generation Super Boiler is being designed and developed for field demonstration under this project.

By utilizing a unique boiler geometry incorporating a two-stage firetube design and heat recovery system that are both compact and highly efficient (94 percent HHV efficiency), first generation Super Boilers will offer up to 25 percent increases in steam generation efficiency and occupy substantially reduced footprints relative to their conventional counterparts. Efficiency gains alone could result in total U.S. manufacturing energy cost savings of approximately $15 billion per year. Reduced footprints enable new opportunities for boiler modularization.

The Super Boiler has been installed at several beta sites around the country, and the equipment is expected to be available to the public in 2008 or 2009. ■

**TOP:** End users in commercial applications are interested in high-efficiency heating products, such as the Benchmark boilers shown here, primarily due to the rising cost of energy. **ABOVE:** The Super Boiler has been installed at several beta sites around the country, including Specification Rubber. Shown here with the Super Boiler are Bob Spiegel, research and development technician – Cleaver-Brooks, Tony Fischer, plant operations – Specification Rubber, and Tom Nyman, application and special engineering – Cleaver-Brooks. See sidebar story.