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## Super Boiler technology is closer to commercialization

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The U.S. industrial sector accounts for more than 32 percent of the nation's energy use, according to the U.S. Department of Energy. But several companies and organizations are working together to reduce that impact.

In 2000, several energy industry partners came together with the idea of creating a boiler that would achieve high efficiency rates, produce fewer emissions than conventional boiler technologies, reduce U.S. industrial steam system operating costs by more than \$10 billion a year and save 185 trillion Btus by 2020.

Seven years later, in November 2007, the Super Boiler and its developers celebrated a year of successful testing at Specification Rubber Products Inc. in Alabaster, Ala., where the boiler resides.

In July 2006, Cleaver-Brooks and the Gas Technology Institute installed the 300-horsepower, high-pressure steam Super Boiler. Since then, the boiler has been operating 24 hours a day, five days a week. And the results have been astounding:

- Over more than 6,000 hours of operation, fuel-to-steam efficiency has been consistently 93 percent to 94 percent — far better than traditional boilers that provide less than 80 percent efficiency.
- Fuel savings have averaged around 13 percent on a fuel bill that was \$800,000 annually.
- The Super Boiler has been producing less than 9 parts per million by volume (ppmv) NOx.

### ***What Makes this Boiler Super?***

The combination of controls in a highly efficient steam-generation system, heat transfer and recovery, vessel engineering and innovations in combustion make the Super Boiler one of the most cutting-edge boilers in the United States.

Controlling the Super Boiler is Cleaver-Brooks' CB Hawk ICS, an integrated control system embodying precise boiler/burner management and safety with logic-based ancillary devices and functions.

The CB Hawk ICS provides the ability to actively monitor efficiency trends and helps systems operators to recognize when performance problems occur and correct them — before heat and energy loss becomes an issue and increased fuel costs are incurred.

The boiler boasts extended heat transfer service with cutting-edge Alufer tubes, which provide five times the heat transfer rate as bare tubes. This allows the boiler to be much smaller (30 percent smaller footprint, 50 percent less weight) than traditional boilers, all in a two pass design, which has the same efficiency as existing four pass design.

For optimal heat recovery, the Super Boiler incorporates dual economizers but also has two new devices: a transport membrane condenser (TMC) and a compact humidifying air heater (HAH). The TMC extract sensible and latent heat from the flue gas for increased energy efficiency, while dehumidifying the boiler exhaust gases. The HAH preheats and humidifies the combustion air thereby increasing system efficiency.

With all this equipment, the Super Boiler is equipped to achieve efficiency rates up to 95 percent.

### ***New Boiler Technology Now Available***

There are approximately 80,000 boilers over 30 years old in U.S. facilities today. Of those boilers, Cleaver-Brooks hopes to replace at least 25 percent with newer boilers that are more reliable and more efficient.

Due to the advanced technology in continuous research and development, the full Super Boiler is not currently available to the market. However, many of the individual technologies used in the Super Boiler can be retrofitted to boilers and provide efficiency levels of at least 90 percent. Cleaver-Brooks is currently marketing

the First Generation Super Boiler (FGS), which is made up of those pieces of equipment that are currently marketable, while specifying space considerations for additional pieces of equipment as they become marketable.

Retrofit options to reduce fuel costs include standard economizers, condensing economizers, controls such as the CB Hawk ICS, high turndown burners, blow down separators, and oxygen trim systems.

### ***Super Boiler Testing Continues***

Two additional Super Boiler test sites are expected to go live in 2008. The system at Clement Pappas & Company Inc., a food processor in Ontario, Calif., is expected to be operational in January 2008. Box and packaging manufacturer Third Dimension Inc. of West Jordan, Utah, has received a state-of-the-art Cleaver-Brooks boiler with an economizer and they will add a TMC in spring 2008. The intent is to have five operational Super Boiler test sites by the end of 2008.

### ***Commercialization***

The Super Boiler could be ready for commercialization by mid-2009, pending further test results. Developers are working to reduce manufacturing costs in order to provide customers with a faster return on their investment.

### **About the Super Boiler Project**

The Super Boiler is the culmination of DOE-sponsored research and development by Gas Technology Institute, Des Plaines, Ill.; and its partner, Cleaver-Brooks Inc., Milwaukee. Additional support came from Utilization Technology Development, Des Plaines, Ill.; the Southern California Gas Company, Los Angeles; the South Coast Air Quality Management District, Diamond Bar, Calif.; the California Energy Commission, Sacramento, Calif.; and the California Air Resource Board, Sacramento.

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