



## Fact Sheet: Waste Heat Recovery using a Condensing Economizer

### Santa Clara Paperboard Mill

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### Resident Mill Manager: Richard Johnston

Graphic Packaging's Santa Clara, California paperboard mill produces more than 380 tons of clay coated paperboard daily using 100% recycled fiber. Clay-coated paperboard is used for high-end consumer packaging. The coating is an excellent substrate for printing and graphic artwork.

The mill completed its 50th year in operation in 2007, having recycled more than 4.8 million tons of fiber since 1957. Recent modifications to the mill's cogeneration plant have allowed the mill to further reduce its carbon footprint.

The mill replaced its steam boilers with a high efficiency combined-cycle cogeneration power plant in 1985, which produces steam, power for the mill and power sold to the electric grid.

- The cogeneration plant consists of a natural gas fueled combustion turbine, coupled with a duct-fired heat recovery steam generator (HRSG) and steam turbine.
- Exhaust gases from the combustion turbine are supplemented with the duct burners and used to produce high pressure, high temperature steam in the HRSG.
- Steam from the HRSG is expanded in the steam turbine to produce additional electric power and then used to heat the paper mill's process water and dryers.
- Flue gases from the HRSG were previously released to the atmosphere at more than 390 degrees Fahrenheit. By lowering the temperature, the mill's stood to increase its energy savings significantly.

Working with Lockheed Martin, who runs Pacific Gas and Electric's Heavy Industry Energy Efficiency Program, the mill reduced the stack gas temperature by upgrading the HRSG stack using a "condensing economizer".

- A condensing economizer (Condex) is a heat exchanger tube bundle inserted in the exhaust gas stream and used to heat water with the stack gases thereby reducing the stack gas temperature down below the acid dew point.
- The tube bundle is stainless steel and the housing and exhaust stack extension are fiberglass in order to withstand the corrosive nature of the resulting condensate.

Graphic Packaging is heating the mill's process water in the Condex, reducing the mill's steam demand by about 20%, thereby offsetting the amount of fuel formerly required to run the duct burners.

- Duct burner fuel consumption has been cut in half, or 50%, eliminating more than 15,700 tons of CO<sub>2</sub> emissions annually, equivalent to removing 2,198 cars from the road or powering over 5,000 homes each year.
- Final stack temperature is now on the order of 145 degrees Fahrenheit.

