



Energy Efficient Boiler Case Study

Schools



PG&E Helps Butte County Office of Education With Boiler Replacement

The Butte County Office of Education installs an energy efficient boiler system that is 93.7 to 95 percent efficient and reduces energy consumption and costs with help from Pacific Gas and Electric Company and the California Energy Commission's Bright Schools Technical Assistance program.



Warming to the Task in Oroville

Butte County, California (population 211,000) is located in the northern part of the state and encompasses 14 school districts in Chico, Oroville, Paradise and many smaller communities. The Butte County Office of Education in Oroville is responsible for implementation of programs, fiscal oversight, teacher credentialing and curriculum support for all high schools, intermediate and elementary schools in the county, as well as Special Education, Learning Community Charter Schools, Juvenile Court School, Regional Occupational Programs (ROP), Migrant Education and California Mini-Corps programs. The office also administers federal and state educational funding at all levels.

The physical location of the Butte County Office of Education, on Bird Street in the historic Old Town area of downtown Oroville, is a 60-year-old, three-story building that previously served as the Butte County Hall of Justice. For all those years, the building was heated by two 1950's-vintage, automobile-sized natural gas boilers that filled an equipment room in the basement. The ancient behemoths were only about 60 percent efficient, and the air balance in the building was further hampered by an imprecise air distribution system relying on fan coils in the ductwork and air blowers behind the radiators. Heat in the building was consistently inconsistent – hot in some areas, cold in others.

Despite the problems, the county would probably have continued to use the old boilers for budgetary reasons, but a retrofit became a necessity when, in late 2008, one of the boilers developed an internal leak and had to be shut down. The remaining boiler proved inadequate to the demands of heating the building

through the winter. At that point, BCOE facilities manager Rick Huston launched a boiler replacement project. He consulted with PG&E program manager Charles Maroon, one of PG&E's top experts in how school districts manage energy use, and account manager Rebekah Ahrendes to discuss alternatives and available rebate and incentive programs. The architect and planning engineer for the project were also involved from the outset.

A Big Assist from Bright Schools

PG&E helped the BCOE apply to the California Energy Commission's Bright Schools Technical Assistance Program, which helps publicly-funded and nonprofit K-12 school districts identify cost-effective efficiency measures that can reduce energy bills. Bright Schools offers no-cost energy audits (up to \$20,000 worth of consulting engineering time) to recommend retrofit measures that typically reduce annual utility costs by an average of 20 percent. Bright Schools also offers access to low-interest Energy Commission loans to implement the recommended projects.

BCOE engaged the Technical Assistance services of the Bright Schools program to identify additional efficiency improvements in the piping and air ducting systems associated with the boiler system. This free consulting resource proved invaluable in designing the new system.

Demolition and Replacement

In July of 2009, the cutting torches were applied to the old boilers and the piecemeal demolition process began. The laborious effort was further complicated by the fact that both boilers and the pipelines connecting them to the ducting

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**Rick Huston, Maintenance,
Operations and Facilities
Manager
Butte County Office of Education**

system were lined and insulated with asbestos, so asbestos abatement was a major element of the demolition.

Huston and his staff chose state-of-the-art condensing combustion boilers from Hamilton Engineering as the new equipment for the building. The highly efficient condensing technology recycles the products of combustion – steam and heat – back into the system instead of releasing them through exhaust vents to the atmosphere. The result is that condensing combustion boilers are more than 94 percent efficient, a huge improvement over the old boilers.

The BCOE's engineers installed a racked boiler system using four small boilers – a choice dictated as much by building logistics as by design preference. Access to the basement installation site was limited to a small, ancient elevator and two switchback stairwells, neither of which would permit the delivery of large boilers. These four modular units are the size of wine barrels, so they could be delivered and installed more easily.

Two high-efficiency pumps replaced the four that had previously circulated heat through the building, and the boilers and pumps are equipped with electronic digital controls to manage energy use. The boilers are synchronized and sequenced so that the heating demands of the building determine how many boilers are in operation at a specific time. When temperature sensors throughout the building determine that full heating capacity isn't necessary, some of the boilers are automatically cycled down to make operations more economical. The new pumps have been equipped with variable frequency drives that are likewise synchronized to the heating requirements at the moment. The entire automated system therefore cycles up or down as necessary. And, of course, the new system is insulated with fiberglass instead of asbestos.

In the next phase the plan is to replace the old electric thermostats throughout the building and replace them with direct digital controls (DDC). These microprocessor-based temperature sensors are more accurate and provide better calibration of temperature controls in the building, making the occupants

more comfortable. The DDC controls also require less energy, and they are a prerequisite to the building energy management system (EMS) that the BCOE intends to deploy in the future for zone-based climate control.

The total cost of the project, including the boilers, demolition and asbestos abatement, came to \$382,000. PG&E's "Energy Efficiency Rebates for Your Business" program provided rebates totaling \$2520, and applications for more rebates are in process.

“The single most critical aspect of a project like this is having all the parties at the table from the start, so everyone has a clear idea of our objective and all the costs can be held down to a minimum. Our PG&E representatives were on top of things from day one, and they worked with us on finding the best resources and solutions to get this done as quickly as possible. We've worked with them on past projects and we have more in the planning stages, and we make it a point to bring them in right from the inception, because they're all we could ask for in a partner.” – Rick Huston, Maintenance, Operations & Facilities Manager, Butte County Office of Education

Future Plans with PG&E

In addition to the aforementioned EMS, the BCOE is working with PG&E's Savings by Design program on a new school construction project, a six-classroom special education/charter school combination. While awaiting state funding to move forward, BCOE has made it a point to bring PG&E to the table immediately on the project to work with the design team to achieve maximum energy efficiency. The building is also being designed in cooperation with CHIPS, the Collaborative for High Performance Schools program, to emphasize green building principles like optimal daylighting and reduced water consumption.

Next Steps with PG&E

To learn how PG&E can help your school or school district manage energy consumption and reduce costs, contact your local PG&E representative or call our **Business Customer Service Center** at **1-800-468-4743**. More information is available at www.pge.com/schools.



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