Oregon Health & Science University

At a glance

Location

Portland, Oregon, USA

Commissioned

2006

Fuel

Natural gas

Technologies

- 5 C60 Capstone ICHP Microturbines used in a combined heat and power (CHP) application.

Results

- The building is 49% more energy-efficient than required by Oregon code.
- Annual carbon dioxide reduction of 1.26-million-pounds (630-tons), or 12%, when compared to a similar project that doesn't use microturbines.
- The reduction of CO_2 emissions from onsite microturbine power is equivalent to taking nearly 100 cars off the road or eliminating the emissions from about 400 average single-family homes.

When the project team sat down to plan a medical facility for Oregon Health & Science University, their goals didn't stop at standard.

The result is The Center for Health & Healing, a medical building that surpassed the credit total needed for the U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) Platinum Certification.

"The success of this building isn't just the structure itself, but also the process. Integrated design is changing the design professions," said Andy Frichtl, PE, Principal at Interface Engineering, the engineering firm for the project. "This building has shown that sustainable design doesn't need to cost more. It was designed to be the most resource-efficient, large-scale building in the region and one of the greenest anywhere."

A key component of this incredibly clean-and-green building is five Capstone C60 ICHP microturbines used in a CHP application.

"We set very high goals for every aspect of this project," Frichtl said. "Using Capstone microturbines helped us achieve and even surpass those goals."

Aiming to be the greenest building in the region was no small effort, given the greenness of the Portland area. By 2005, the city had more projects LEED-certified for high-performance buildings than any other city. However, at that time, Portland had never seen a local building achieve the highest LEED rating – Platinum.

Photo courtesy of Interface Engineering

The Center for Health & Healing is a mixed use facility for wellness, medical research, clinics, surgery, classrooms, and ground-floor retail. The 400,000-square-foot, 16-story building is located in the South Waterfront, a former industrial area along the Willamette River just south of Portland's downtown.

Powering Up

"We are moving into the creative economy where we have to find ways to do more with less," Frichtl said. "This can be accomplished by integrating building features to serve multiple purposes and using creative solutions that save energy and water with less upfront costs."

Frichtl and the rest of the project team realized the many advantages of having a building produce its own energy. The onsite microturbines eliminate the potential for power loss when electricity is produced at remote sites, and provide free thermal energy – a by-product of the natural-gas combustion process – that's recovered and used.

They also realized the many advantages of using Capstone microturbines, namely their ability to reduce energy costs and help preserve the environment with their near-zero emissions profile.

"Owing to their market maturity, technological simplicity, and much lower cost, we chose microturbines over fuel cells for this project," Frichtl said. "We calculated that by generating our own power onsite and using the waste heat efficiently, we were able to achieve about 78 percent efficiency of fuel conversion, as opposed to 32 percent in a typical electric power generating and transmission system."

Closing the Loop

The building has a continuous load of between 200kW and 400kW for running fans, pumps, motors, lighting, equipment, and computers. Its central utility plant wasn't designed to provide power to the grid. Instead, the five Capstone C60 ICHP microturbines are connected to three of the four electrical services in the building (a photovoltaic system is connected to the fourth) and regulates power output according to demand.

As for thermal output use, the building's central utility plant converts waste heat from the microturbine exhaust to create hot water and sends it to stratified storage tanks in the building's underground garage. The hot water is used to pre-heat the building's hot water supply and to meet the facility's heating needs. To heat the building, the hot water is circulated through air handling units, fin-tube units, and room-level terminal re-heat units. If all of these needs are satisfied, then any additional "cheap" heat is stored in the first floor concrete radiant thermo-active slab or the health-club swimming pool.

Five C60 ICHP microturbines used in a CHP application have reduced energy costs at this center for health and healing.

Proving Itself

Since opening its doors in 2006, the building has recorded 49 percent greater energy-efficiency than required by Oregon code.

By using Capstone microturbines for about one-third of the building's electrical energy needs, the Center eliminates nearly two-thirds of the losses of power incurred when electricity is purchased from a distant utility power plant.

"We calculate an annual reduction in carbon dioxide emissions of 1.26-million-pounds (630-tons), or 12 percent when compared to a similar project that doesn't use microturbines," Frichtl said. "That's about 20,000-tons over 30 years. Sulfur dioxide and nitrogen oxide emissions are reduced by about 38 percent."

The reduction of CO_2 emissions by generating onsite power with microturbines is equivalent to taking nearly 100 cars off the road or eliminating the emissions from about 400 average single-family homes. ■

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