What is Combined Heat and Power?

Combined heat and power (CHP) technologies combust fuel to simultaneously generate both heat and electricity. CHP is also referred to as cogeneration or co-gen. When power stations burn fuel to generate electricity, useful heat is wasted as it is sent up the chimney. CHP captures this wasted energy and puts it to use, for example providing a source for space heating. As a result, CHP is far more efficient than traditional offsite generation since more useful work is extracted from the same amount of fuel.

Compared to most commercial buildings, CHP systems are typically well suited for hospitals since their base load heating requirements are generally larger. However, a range of technologies including micro-turbines are now available and are scalable to various capacities.

The Benefits

- CHP meets the year-round heat demands of health care facilities
- CHP is a reliable source for emergency power in the case of grid outages
- Consuming in-house electricity generates cost savings that can be better spent on health care

Did you know.

Combined heat and power—also known as CHP or cogeneration—provides both electric power and thermal energy (heat) from a single fuel source.

CHP captures energy that would normally be lost in power generation and uses it to heat buildings.

On average, a CHP project can meet 70% of a hospital’s annual electricity consumption.

CHP captures energy that would normally be lost in power generation and uses it to provide heating and cooling.

Source: Adapted from Energy.gov
CASE STUDY: Kingston General Hospital, Kingston, Ontario

Kingston General Hospital (KGH) is a research hospital affiliated with Queen’s University. In 2006, the hospital jointly commissioned a 15 megawatt, $25 million cogeneration facility with Queen’s University. The two natural gas-fired jet engines can supply enough electricity for the hospital and a portion of the university’s campus. The waste heat is captured to produce steam, which heats buildings and water through an existing steam distribution system.

In addition to generating operational savings, a major benefit of this CHP system is its ability to supply power to the hospital independently of the electricity grid. The systems was put to the test in 2009, when a blackout caused over 6,000 homes and businesses in Kingston to lose power, resulting in widespread school and business closures. Kingston General Hospital “never skipped a beat.”

“The plant has provided the hospital with a reliable back-up power supply and savings from the project have offset operational costs. Co-gen allows KGH more assurance that patient care will not be impacted when electricity is not available for whatever reason – and we are able to do so in a more effective and energy efficient way.”

Chris Mackey, former Director of Facility Engineering and Maintenance, Kingston General Hospital

Opportunity – Fulfill Health Care Heating Needs and Save Electricity

CHP systems are particularly suited for health care facilities for several reasons:

• Year-round heating requirements in the health care sector for sterilization, laundry and dishwashing often represent about 50% of the peak heating demand. This means CHP equipment can generate savings in all seasons; a stark contrast to commercial buildings that typically have no summer heating needs.

• Reliable emergency back-up power is essential for health care facilities to ensure patient and resident care can continue during grid outages.

• Electricity bill savings are created by offsetting the facility’s electricity requirements with in-house electricity generation. The economics of CHP are particularly attractive at present given that natural gas has decreased in cost and electricity costs are anticipated to continue increasing for the next two decades.

Best Practices – Principles of Combined Heat and Power

The amount of usable heat produced per unit of electricity, known as the heat-to-power ratio, is an important design consideration for achieving maximum savings. Another essential design parameter is heat quality – high pressure steam is high quality, while hot water is low because it can only be used for low temperature applications. Follow best practices to help identify the most cost-effective system design for each facility:

• Match heat output to the facility’s thermal base load, so that system utilization is high,

• Maximise electricity production,

• Match the heat quality needed by heat users. For example, if steam pressure needs to be stepped down before use, energy and cost savings are lost because the system could have been generating lower pressure steam and more electricity,

• Work with your utility to ensure the design takes into consideration local grid considerations, such as transmission infrastructure.

Funding Support

The Ontario Power Authority offers incentives for combined heat and power projects through the Process and Systems Upgrade Initiative (PSUI) of the saveONenergy program. The PSUI program provides incentives of $200/MWh up to a maximum of 40% of total project costs.

How can HealthCare Energy Leaders Ontario Help?

This technology brief is brought to you by HealthCare Energy Leaders Ontario (HELO), a Canadian Coalition for Green Health Care initiative. Through education, training, and custom assistance, HELO is helping the sector reduce electrical consumption and start generating savings for care. Learn more about our free support services at www.greenhealthcare.ca/HELO or contact Kent Waddington, Communications Director for the Coalition, at kent@greenhealthcare.ca.