MICROTURBINES BOOST EFFICIENCY IN THE CHP MARKET

MICROTURBINES TURN GASEOUS AND LIQUID FUELS INTO USABLE ELECTRICITY WITHOUT THE NEED FOR EXHAUST AFTER-TREATMENT

DARREN JAMISON

The push to improve energy efficiency is growing on a global scale as organizations seek ways to reduce operating costs and carbon footprints. This trend is further reinforced by environmental regulations as both governments and private entities develop clean energy for commercial and industrial applications.

Numerous initiatives are being enacted around the world, such as the Energy Efficiency Accelerator Platform launched at the 2014 United Nations Climate Summit. More are under development to provide a platform for making improvements to energy infrastructure based on existing technologies.

Investments in combined heat and power (CHP) and combined cooling, heat and power (CCHP) projects using microturbines are gaining popularity as a way to increase energy efficiency. By combining the generation of heat and electricity from a single fuel source, such as low-cost natural gas, and displacing a site's current use of grid electricity, cogeneration systems burn less fuel per unit of useful energy output while producing lower emissions.

Low maintenance

Microturbines are basically small combustion turbines that turn gaseous and liquid fuels into usable electricity. They are a low-maintenance technology intended to run for long intervals without the need for exhaust after-treatment.

In addition to electrical generation, microturbines continuously produce clean exhaust heat, which can be recovered via a heat exchanger, and fed either to a thermal energy storage tank or to an onsite distribution system. This thermal energy can be used in a variety of ways, including the production of hot water, space heating and cooling, as well as for desiccant dehumidification equipment.

Cogeneration plant sizes range in scale according to the type of building and the energy load required. When referring to small-scale CHP, these are typically defined as systems that generate less than 200kW of electrical power. They can be found in various industries including manufacturing, hospitality and healthcare facilities.

Meanwhile, the adoption of small-scale CHP gains momentum as pressure rises in other industries such as multi-unit residen-

Figure 1: The Four Seasons installed three 65 kW microturbines from Capstone on its roof as part of a CHP project

tial buildings and retail facilities to be environmentally friendly. Virtually any commercial or industrial application that requires heat, cold air, or hot and cold water production is a candidate for microturbine-based CHP.

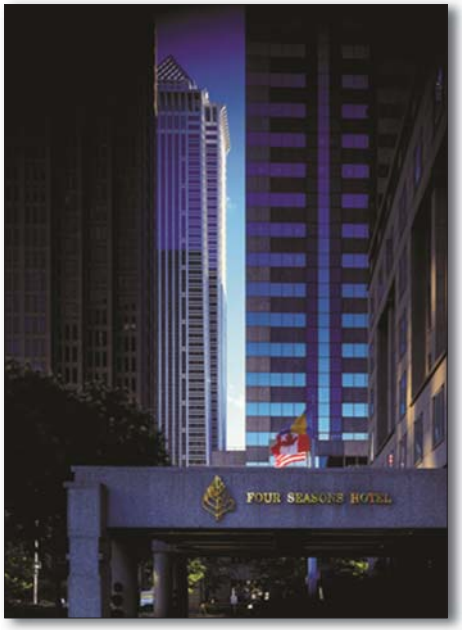

Figure 2: The Four Seasons Hotel in Philadelphia uses natural gas-based microturbines to generate its own electrical and thermal power while producing less than 9 ppmv NOx emissions at 15% O_2.

The Four Seasons Hotel in Philadelphia, Pennsylvania, for example, wanted to gain control of energy costs and reduce emissions. The 364-room facility installed three 65 kW microturbines fueled by natural gas for an integrated CHP application on the roof.

The plant allows the hotel to generate just under 200 kW of electrical power, which takes care of 30% of overall electricity needs. Exhaust heat from the microturbines is captured and used to provide 100% of the building's day-to-day domestic hot water and 15% of its heating needs for other hotel operations.

Prior to installing the microturbines, the hotel relied heavily on Philadelphia's steam loop and the local electric grid to meet its energy needs. The hotel reconfigured its hydronic heating loop into a system that captures heat from the microturbines and distributes it throughout the building.

As a result, the Four Seasons uses natural gas to generate its own electrical and thermal power while producing less than 9 ppmv NOx emissions at 15% O_2. In the first two months of operation, it saw a cost avoidance of over $80,000 by not dumping the rejected heat into the atmosphere (Figure 1 and 2).

In this example, the cost-benefit equation came out in favor of CHP. In general, there are multiple factors to consider when it comes to determining whether a microturbine CHP plant is worth the investment.

Those looking at CHP should understand their electrical and thermal loads, as well as any seasonal effects on those loads. Correctly sizing microturbine equipment based on the load is vital in sustaining project economics. As microturbines are scalable, accurate sizing is possible.

Since its initial development in the 1990s, the market for small-scale CHP has been growing, spurred on by increasing energy prices and air quality concerns. As governments move to ramp up energy efficiency programs and encourage distributed generation, microturbine-based CHP offers a way to reduce energy costs and minimize environmental impact.

Darren Jamison is President and CEO of Capstone Turbine Corporation, a producer of low-emission microturbine systems. For more information, visit www.capstoneturbine.com