BLUE MOUNTAIN RESORT GOES GREEN

By James Kennedy

Microturbines have transitioned from an interesting technology to a proven solution for many applications. Now we are finding niches where the turbine is part of an overall energy solution, such as combined heat and power (CHP).

We typically look at turbines to produce electricity - —which they do — and their contribution to distributed generation is significant. However, for microturbines to be economically viable, the largest part of their energy output — heat — must also be utilized. For example, a 30kW turbine puts out 90kW thermal energy (approximately 65kW is recoverable via a heat exchanger (HX)), equivalent to 310,000 BTU/hr based on 500-600˚F exhaust heat @ 0.68 lb/s.

Table 1: Key Microturbine Performance Statistics

Microturbine - electrical	Exhaust Output	Recoverable Output	Space Heating	Equivalent tons cooling*	Dehumidification
30kW	420,000BTU/hr. (530F @0.68lb/s)	310,000BTU/hr. 60kW	TBD	10-15	TBD
60kW	541,000BTU/hr. (580F @1.07lb/s)	392,000BTU/hr. 115kW	TBD	20-30	TBD

Notes: HX with 86% effectiveness

A recent installation of a 30kW turbine in a combined heat and power system for Blue Mountain, in Collingwood Ontario is yielding efficiencies of 85% by providing 30kW of electrical energy, and 55kW of heat energy, or 190,000 BTU/hr (see Table 1). Applications for microturbines range from domestic hot water (DHW), cooling, humidity control, or directly for greenhouses or industrial processes such as brick making, baking, plastic extrusion, etc. Again, their uses are only limited by one's imagination — for example, a microturbine/fuel cell hybrid system has been already been tested and operated.

Capstone MicroTurbine has distinguished itself as a leader in the microturbine market, due to its highly reliable design. There are few moving parts, as the main assembly spins on an air/foil bearing at 96,000 rpm. As a result, there are few maintenance requirements, limited primarily to air and gas filter changes annually, with major overhauls in the 5th to 10th year. Naturally, on the heels of all the good news are these words of caution — consider the installation and design issues.

Blue Mountain's installation provides a further look at the technology, economics, applications, design, installation and technical considerations as a view to understanding how this fits in the marketplace.

INTRAWEST - BLUE MOUNTAIN

The year-round ski and golf resort for vacationing and conferences has undergone major changes since being purchased by Intrawest, a resort operator with properties across North America, including Whistler Mountain and Mont-Tremblant.

The objective of installing a CHP system is to reduce operating costs across facilities, but equally important, fix and control their costs of operation as much as possible.

Blue Mountain represented a pilot project for Intrawest properties - the 1st stage utilized a 30kW turbine, a stand-alone HX, and electrical and mechanical infrastructure that could accommodate an additional 90kW turbine should the thermal requirements be sufficient. At present, the turbine supplies and offsets 30kW/hr electrical, and provides approximately 55kW of thermal energy heating the incoming water to feed hot water to 90 hotel rooms, laundry services and dishwashing, among other uses. Still not being fed from a turbine are the resorts hot tubs, and the swimming pool, as-yet-to-be-built features, i.e., additional pool, rooms, etc,. Based on data to date, whereupon an Aalto energy monitoring system logs gas consumption, electrical output, water flow rates and temperature in and out of the HX, another 60kW will be justifiable.

Tables 1 and 2 summarize data to date.

The 480V Wye output, 30kW turbine is a load following "Grid-Connect" unit. If grid power is lost, the turbine shuts down and re-starts 20 minutes after grid power is restored. A 480-600V step-up transformer was required to tie into the facility's switchgear. Two other versions of this model are 'Stand Alone', and 'Dual Mode'. The Blue Mountain system was less than 200kW, so the grid-connect model made the interconnection agreement relatively simple. Installation approvals are becoming easier and a greater number of US standard interconnection agreements are in place.

Full Circle Systems took on design-build responsibilities, having previously installed a 60kW CHP system at a Health Canada facility in Scarborough on behalf of the 'CanMet' division of NRC Canada. The photos and drawings outline some of the site specific issues that were overcome. Suffice to say that despite a few hiccups, the project has been a success for Blue Power Distribution, On Power Systems, Full Circle, Intrawest-Blue Mountain, Capstone, and the distributed generation/district energy sector.

Blue Mountain's installation was specific to the site and their situation, particularly given the expected changes and growth.

Table 2: Typical Microturbine Applications

Application	Fluid Temperatures	Fluid Types
Domestic Hot Water	60-70C (140-160F)	Potable water
Laundry	60-70C (140-160F)	Potable water
Swimming Pool / Spa	25-45C (75-115F)	Chlorinated water (intermediate HX)
Boiler Preheat	60-95C (140-200F)	Closed Loop Water
Building Space Heat	60-80C (140-180F)	Water or Glycol Mix
Hot Water Fired Chiller	85-95C (185-200F)	Water or Glycol Mix
Industrial Process	10-95C (50-200F)	Water or Glycol Mix

MICROTURBINE TECHNOLOGY AND ADVANTAGES

- Can be located close to thermal loads for maximum efficiency gains.
- The Capstone systems are small (75" x 28" x 53" for a 30kW turbine, and 83"x 30"x 77" for a 60kW turbine).
- Easy approval process relative to larger, MW based systems.
- Low emissions, ranges from 2-9ppmV NOx @ 15%O2 at full load.
- Reliability by design, and due to possibility of N+1 scenario.
- One moving part, no lubricants or coolants, thus low maintenance requirements.
- Up to 20 grid-independent microturbines can be arrayed without any external hardware for n+1, or upwards of 100 turbines can be paralleled.
- Approvals relatively simple
- Qualified for interconnection standards in U.S., load following, under 200kW.
- Fuel flexibility. The systems can use natural gas, propane, diesel, kerosene, oil field "flare-gas" and biogas from agriculture or wastewater, landfill sites with energy content as low as 350 BTU/cf.
- Applications across commercial, residential, industrial, medical, resource industry, utility, etc.
- Low emissions and oxygen rich, and hot exhaust make CCHP & CHP add options and flexibility.

SUMMARY

Are microturbines, at 30, 60, and soon to be 200kW, going to solve Ontario's power shortage? Not likely on the surface, however, as the old adage states, "one eats an elephant one bite at a time". Given that these systems are relatively easy to install, approve and purchase, fit many applications, have the lowest maintenance requirements, they may well make a dent on Ontario's energy market.

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