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Capstone Turbine Corp. has introduced its 1 MW, C1000 power package designed for power generation in oil and gas, hospital, industrial, municipal, retail, landfill and other applications. The package, based on a 30 ft. long ISO container, includes up to five C200 microturbines, each with a 200 kW output.

LESS “MICRO” FROM CAPSTONE

Capstone unveils 1 MW power package; new C1000 opens door for larger-scale projects

BY MIKE MERCER

For most of its history, Capstone Turbine Corp., Chatsworth, Calif., has been a pioneer in the development of microturbine technology for power generation and mobile application. Starting out with turbogenerators as small as 24 kW, the company gradually expanded the output of its product offering to 30, 60 and 200 kW.

Now Capstone has taken an even larger step up with the introduction of its first truly large-scale power package. The C1000 is rated 1000 kW (1 MW) and is designed to offer variable outputs of electrical power for applications in oil and gas, hospital, industrial, municipal, retail, landfill and other installations requiring electricity.

“This is another important technical achievement for Capstone as we will be able to effectively compete in megawatt-scale projects and therefore double our addressable market,” said Jim Crouse, Capstone Turbine Corp.’s executive vice president of sales and

marketing. “The new C1000 package is as clean as a fuel cell, priced like a reciprocating engine package and has the reliability of a gas turbine.

“In addition, the package is smaller and lighter when compared to a reciprocating engine package and compared to a fuel cell system in the same power range, it is smaller, lighter and much less expensive.”

According to Capstone, the C1000 platform is the first 1 MW power package available based on a microturbine prime mover. The package uses up to five of the company’s recently introduced 200 kW, C200 microturbines to produce power. As many as 20 C1000 packages can be placed together in a parallel arrangement for a total output of 20 MW, the company said.

“The C1000 platform applies the same dependable technology found in our proven 30 kW and 65 kW products,” said Darren Jamison, Capstone’s president and chief executive officer. “We believe the C1000 will be well

received in the United States and abroad, and reinforce our commitment to provide customers one of the most environmentally friendly distributed generation products available.”

Using multiple microturbines installed into one container, the company can flexibly configure the package into 600, 800 or 1000 kW systems using three, four or five C200 microturbines. The microturbines are packaged in a 30 ft. ISO container, which includes the power electronics in a standard configuration ready to install. All that is required are fuel and electrical connections. The package is also capable for use in CHP applications that would require additional system hookups, Capstone said.

In addition, the C1000 package includes Capstone’s remote monitoring and diagnostic capabilities with integrated utility synchronization and protection. The system also includes Capstone’s comprehensive factory protection service plan. Other bene-



A beta version of the new C200 microturbine is shown during test at the Capstone facility. The new turbine includes features from the company's C30 and C65 microturbines.

fits of the package, according to Capstone, are lower greenhouse gas emissions, patented air bearing technology, ease of installation and commissioning, minimal scheduled maintenance and downtime, low noise and vibration and a small modular system footprint.

The unit has an electrical performance under nominal full power performance at ISO conditions of 1 MW output at 400 to 480 Vac with a three-phase, four-wire electrical service. The package will be available in 50 and 60 Hz grid connect and 10 to 60 Hz stand-alone operation versions. The maximum output current is 1450 amps at 400 V or 1200 amps at 480 V in grid connect operation and 1550 amps stand-alone operation with a linear load. Electrical efficiency is 33% according to published numbers from Capstone.

The microturbine fuel requirements include natural or raw natural gas HHV 825 to 1275 Btu/scf with an inlet pressure using standard natural gas at 1000 Btu/scf of 75 psig. The fuel flow rate is 11,400,000 Btu/hr.

As for turbine exhaust characteristics, the NO_x emissions at 15% O₂ are less than 9 ppmvd for the stan-

dard turbine and less than 4 ppmvd for a CARB-certified version. The NO_x-to-electrical-output ratio is less than 0.17 g/bhp-hr for the standard configuration and less than 0.05 g/bhp-hr for a CARB-certified version, the company said. The exhaust gas flow is 14.7 lb./sec, while exhaust gas temperatures are stated to be 535°F at ISO conditions.

Dimensions for the package are 8 ft. wide by 30 ft. long by 9.5 ft. high with the grid connect model weighing 17,000 lb. and the dual mode model weighing 28,500 lb. — these are estimates and they may vary in production units according to Capstone.

Noise emissions at full load power under nominal full power performance at ISO conditions are 65 dB(A) nominal at 33 ft.

Capstone is planning certifications of the power electronics and engine assemblies to be recognized to UL 2200 and UL 1741 for natural gas operation. The systems will meet statewide utility interconnection requirements for California Rule 21 and New York State Public Service Commission, the company said, adding that models are also planned that bear the CE compliance marking.

According to Capstone, the C1000 package maintains the benefits of its current microturbines, such as the patented air bearing technology; minimal scheduled maintenance and downtime; low noise and vibration; a small, modular footprint; remote monitoring and diagnostic capabilities; and integrated utility synchronization and protection.

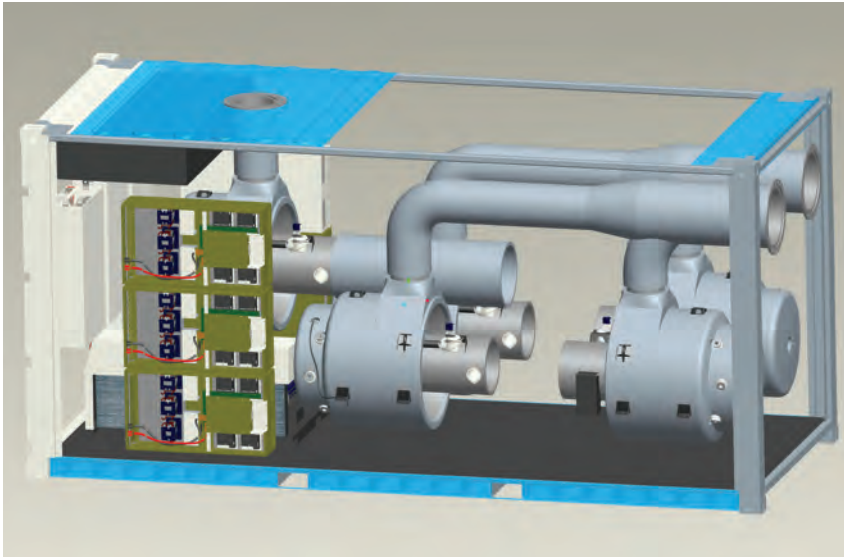
“One key part of the package is the Capstone power electronics system that is used to convert electricity into clean, reliable, useable electricity,” said Mark Gilbreth, executive vice president and chief technology officer of Capstone Turbine Corp. “These electronics convert the high frequency ac electricity into dc, step it down and then convert it back to ac for use on the power grid.

“In addition, service of the microturbine is very simple due to the minimal amount of parts and lack of such systems as lubrication and cooling. A service technician only needs four hours to swap out a complete microturbine module in the event that one needs to be replaced.”

Development of the C200 microturbine, the main component of the C1000 package, started in 2002. It has been tested in a number of climates for durability. In a beta fleet, the microturbine has logged over 8000 hours at multiple facilities across the United States, the company said.

As part of bringing the product to market, Capstone completed a \$12.8 million agreement with UTC Power (a United Technologies Corp. company) in September 2007. Under the terms of this agreement, UTC Power will help fund commercialization of the C200 and provide a sales channel to accelerate adoption of this new technology. This, according to Capstone, allowed it to double the product's addressable market.

“We were very pleased to announce that important business development with UTC Power,” said Jamison. “As one of the market leaders in on-site power solutions, UTC Power's continuing commitment to



A cutaway view of the C1000 package reveals the placement of the five C200 microturbines, as well as the power electronics within the container.

developing environmentally advanced products makes them an ideal strategic partner for Capstone.”

UTC Power and Capstone Turbine Corp. collaborated for several years in the development, marketing and sales

of UTC Power PureComfort low-emission combined cooling, heating and power systems. The systems are designed to generate between 195 and 390 kW of electricity and capture exhaust energy from the Capstone microturbines to power an absorption chiller, thereby producing seasonal cooling and heating within the same unit. When the PureComfort system is integrated with a facility's central heating or cooling system, the energy efficiencies can exceed 80%, according to UTC Power.

Late last year, Capstone received a \$3.8 million C200 order from Greenenvironment OY, its distributor in Finland and Germany. The first installation of the C200 will take place in the fourth quarter of this year.

Capstone is accepting orders for the C1000 and expects to ship its first systems for installation early in 2009. Packaging of the C1000 units will take place at Enercon in Peoria, Ill. **dp**

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