

Greenhouse Gas Technology News

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An Environmental Technology Verification (ETV) Organization
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Two Microturbine Systems Verified

Large- and medium-scale gas fired turbines have been used to generate electricity since the 1950s, but recent developments have enabled the introduction of much smaller turbines or microturbines, which produce about 30 to 200 kW of power. Microturbines are one of a new breed of technologies developed to serve the growing distributed electricity generation (DG) industry. DG technologies generally include power generation or storage equipment in the 5 to 1000 kW range, and provide electricity at a point closer to customers than central generation stations. According to the U.S. Department of Energy, DG could satisfy a significant fraction of new electricity demand. In some cases, DG can also significantly reduce emissions of greenhouse gases and other air pollutants.

The Parallon® 75 kW Turbogenerator, offered by Honeywell Power Systems, Inc., is one of several new compact natural gas-fired microturbines. It is designed to produce 75 kW of 3-phase electricity at voltages ranging from 208 to 600 volts alternating current (VAC) (with optional transformers). Performance verification of the Parallon 75 was just completed by the GHG Center on a unit that was installed at a 55,000 ft² office building to reduce grid electricity consumption. The building, *(continued on page 2, see Microturbines)*



**Honeywell Parallon® 75 kW Turbogenerator Test Site
in College Park, MD**

EPA Expresses Renewed Support for the GHG Center

The U.S. Environmental Protection Agency's Office of Research and Development operates the Environmental Technology Verification (ETV) program to further environmental protection by accelerating the acceptance of improved environmental technologies. Since 1997, the Greenhouse Gas Technology Center (GHG Center) has been one of 12 verification organizations operating as a pilot under ETV, and is the only known organization doing performance testing exclusively on GHG technologies. The GHG Center, managed by Southern Research Institute (SRI), locates promising GHG mitigation and monitoring technologies, subjects them to independent third-party testing, and provides performance data to the public free of charge.

The pilot period of the ETV program is nearing completion, and EPA has selected 6 pilots to continue as permanent Verification Centers. "We are thankful EPA decided to continue operation of the GHG Center," said Steve Piccot, GHG Center Director for SRI, "and we plan to build on the Center's sound reputation and technical contributions." Sixteen technology verifications

have been completed or are in process and, according to Piccot, "We expect to continue verifying technologies of interest to purchasers in our most successful areas, like natural gas production and distribution, municipal solid waste disposal, and distributed electrical power generation. We also hope to become more established

in new areas like refrigeration equipment, GHG monitoring, residential energy use, or other areas of interest to the GHG technology community." SRI has proposed an operational and strategic plan for the next 5 years, and is establishing a new Cooperative Agreement with EPA to operate the GHG Center through 2006.



New GHG Center Logo

Microturbines

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which serves as a test bed for the Building Combined Heat and Power (BCHP) program, is located on the campus of The University of Maryland, College Park, and is operated by the University's Center for Environmental Energy Engineering. Testing was conducted from December 2000 to April 2001, during which time the unit was synchronized with the electric grid, and provided 30 percent of the building's electricity requirement. Power performance, operational performance, and emissions performance were verified by the GHG Center. The results showed that in comparison to obtaining electricity from the local grid in Maryland, emissions of CO₂ and NO_x were significantly lower with the Parallon 75 microturbine.



Mariah Heat PlusPower™ System Test Site in Calgary, Alberta, Canada

Parameters Verified For The Mariah Heat PlusPower™ System

Power and Heat Production Performance

- Electrical power output and heat recovery rate at selected loads
- Electrical, thermal, and total system efficiency at selected loads
- Total electrical energy generated and used
- Total thermal energy recovered

Power Quality Performance

- Electrical frequency
- Voltage output and voltage transients
- Voltage and current total harmonic distortion
- Power factor

Emissions Performance

- NO_x concentration and emission rates at various loads
- CO concentration and emission rates at various loads
- VOC concentration and emission rates at various loads
- CO₂ and CH₄ concentration and emission rates at various loads
- Estimated GHG emission reductions tested for Mariah installation
- Estimated GHG emission reductions for model sites

Microturbines coupled with exhaust heat recovery systems for cogeneration represent a relatively new, and high-interest DG technology, so independent performance data for these systems are limited and in great demand. The GHG Center just completed verification of the Heat PlusPower™ System, offered by Mariah Energy Corporation of Calgary, Alberta, Canada. The system uses a Capstone MicroTurbine® for electricity generation. It also includes a waste heat recovery unit and building energy management system that recovers thermal energy from the microturbine exhaust and produces domestic hot water and comfort heating for the facility. Between April and May 2001, verification testing was conducted on a 30 kW Heat PlusPower system installed in the mechanical room of a new 12-unit work/live facility (Walker Court) in Calgary. The unit was designed to supply all of the needed electricity, and about 80 percent of the hot water and space heating required at Walker Court. Power performance,

operational performance, and emissions performance were verified using a peer reviewed verification strategy, but additional measurements determined the increase in efficiency associated with waste heat recovery (see list of parameters verified). Compared to the local grid in Alberta, the GHG Center found that emissions of CO₂ and NO_x were significantly lower for the Heat PlusPower, and that overall energy efficiency increased by a factor of almost three when heat recovery was used. Verification Reports for the Mariah Heat PlusPower™ System, and the Honeywell Parallon® 75 kW Turbogenerator are expected to be on the GHG Center's Web site by August or September 2001.

Policy Corner

Eastern States and Provinces Developing Climate Change Action Plan



In July 2000, the Conference of New England Governors and Eastern Canadian Premiers adopted a resolution on global warming. At that time, they resolved that global warming was a joint concern for which a regional approach to strategic action is required. The Conference directed the Committee on the Environment and the Northeast International (continued on page 6, see Policy-Climate)

GHG Policy in the U.S. Changes Rapidly And it's not over...

In early 2001, the U.S. announced plans to back away from the Kyoto Protocol and propose an alternative approach to address the climate change issue. The announcement surprised and angered many, encouraged some, and disappointed those with years invested in negotiating the Kyoto Protocol. The announcement caught many off guard, but since then, the pace at which climate change and energy policy have taken (continued on page 6, see Policy-Changes)

Users & Vendors of Commercial Greenhouse Gas Technologies Meet in NYC

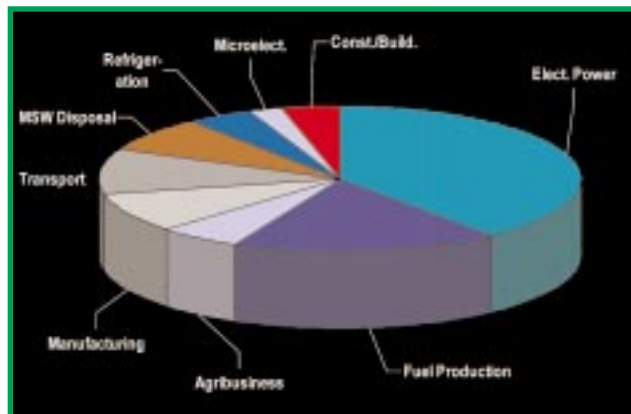


Opening Remarks from the Forum's Chairman, Stephen Piccot

On March 14-15, 2001, the GHG Center hosted an international forum, *Commercial Greenhouse Gas Technology Solutions*, in New York City, NY. The forum provided an open and unbiased venue for public debate and information exchange on a range of commercial-ready GHG technologies. Industry, government, and consulting organizations with active GHG mitigation programs showcased their skills, accomplishments, and future plans, while vendors of commercial and near-commercial GHG mitigation and monitoring technologies described and displayed their products. Updates were also provided on legislative actions and GHG trading, verification, and reporting initiatives.

About 150 attendees from 11 nations participated in the 2-day event. Attendees were from a wide range of different organizations, and represented many different industry and technology interests (see pie chart). A significant delegation of Canadian technical and policy experts attended the meeting, and the Government of Canada, as represented by Natural Resources Canada, was the forum's largest cosponsoring organization. Eleven additional cosponsoring organizations provided financial support to the forum. These include Consolidated Edison of New York, Southern Company, Gas Technology Institute, Super Blue Box Recycling Corp., First Environment, the State Agency of Energy and Energy Resources - Bulgaria, The EcoSmart Concrete Project, U.S. EPA Natural Gas STAR Program, Mariah Energy Corp., The IT Group, and the Industrial Center. U.S. EPA's ETV Program provided most of the financial, planning, and organizational support for the forum.

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Plenary Session

Two Plenary sessions were held, with the first focusing on efforts to mitigate GHG emissions by governments, private industry, and international bodies. The second included an international panel of experts on GHG trading, reporting, verification, and certification. Technology areas addressed included distributed electrical power generation (e.g., fuel cells and microturbines), oil and gas production and distribution, energy efficiency, municipal and other waste management, semiconductors, combined heat and power, transportation, horticulture, commercial buildings, construction, small-scale biomass, refrigeration, and large-scale electricity generation. The forum closed with an open session for all delegates, at which attendees' voting results for the

most promising technologies were revealed (see listing on page 6). This input will be used to direct the GHG Center's focus during the next five years. Following the forum, the GHG Center launched new performance verifications for several technologies of interest to participants, and companies made important business connections that will likely result in GHG technology demonstrations and new business collaborations.

(continued on page 6, see Forum)

Gas Transmission Station Installs Microturbine CHP

The GHG Center and TransCanada PipeLines Limited have agreed to conduct independent performance verification of the Integrated Microturbine Combined Heat and Power System (Microturbine CHP). The Microturbine CHP, recently installed at a natural gas transmission station, comprises three integrated Honeywell Power Systems' microturbines and two separate heat recovery units. It will be verified at one of TransCanada's natural gas transmission stations in Alberta, Canada. TransCanada hopes to use this installation as a springboard to guide future potential CHP installations at other TransCanada facilities. With the exception of the coldest months of winter, current plans call for all electrical power and heat requirements at the station to be met by the Microturbine CHP, which is being assembled, integrated, and skid mounted with the help of Mercury Electric.



*Typical Natural Gas Transmission Station
in the U.S.*

The verification will provide credible data for the following performance characteristics: power and heat production performance, power quality performance, and GHG and conventional air pollutant emission performance. These performance characteristics will be determined by the GHG Center, using recognized field measurement and data analysis procedures, and quality assurance oversight from U.S. EPA's Quality Assurance Team. Verification testing is scheduled to occur in the fall of 2001, over a 4 to 6 week period. "A verification strategy, similar to that used on the Mariah Energy microturbine CHP, is planned for use here," says Sushma Masemore, Verification Manager for the GHG Center. "Of course some improvements will be made, and there are differences to consider; this is an industrial site with a comparatively stable energy demand, the electrical and heat outputs will be many times higher, and integration of the turbines, heat exchangers, electrical systems, and existing plant systems will be complex."

Using measured GHG emission rates and energy efficiencies, baseline heating system data, and Alberta Power Pool data obtained and validated by the KEFI Exchange, GHG and NO_x emissions and emission reductions will be estimated.

Vendor Describes Experience with ETV

"ETV opened doors we didn't anticipate it would"

The Heat PlusPower™ system, offered by Mariah Energy Corporation of Calgary, Alberta, Canada, is a microturbine cogeneration system capable of supplying heat and electricity at small and medium sized commercial buildings. At the heart of the system is (1) the U.S.-based Capstone MicroTurbine®, which produces electricity from a gas-fired turbine generator, and (2) the waste heat recovery unit and energy management system integrated into the Capstone turbine by Mariah. The Greenhouse Gas Technology Center recently verified a 30 kW Heat PlusPower system (see related story), that was installed in the mechanical room of a new 12-unit work/live facility.

"We've worked hard to develop an efficient and affordable system", said Paul Liddy, President and CEO of Mariah Energy, "and we knew ETV verification could show the system's strong technical capabilities and environmental benefits". The GHG Center found that use of the Heat PlusPower system significantly reduced emissions of CO₂ and NO_x, and that energy efficiency is high, about 3 times higher than use of a microturbine without heat recovery. Liddy explains, "People are skeptical of new technology, which is why Mariah needed believable third-party verification. It may be years before we know the impact ETV has on our sales, but it's already an important factor in discussions we're having with new customers. ETV opened doors we didn't anticipate it would, for example, new partnering organizations are using ETV data to make decisions on investing in our technology. Also, new opportunities to conduct field demonstrations have occurred, and we've been invited to testify at a Senate hearing on clean, high performance energy technology."



ANNOUNCEMENT!

Greenhouse Gas Technology Center

A U.S. EPA Sponsored Environmental Technology Verification (ETV) Organization



The GHG Center intends to conduct independent field performance verification of combined heat and power and other distributed generation technologies.

Performance characteristics to be verified include:

- Electrical power quality
- Thermal and electrical energy efficiency
- Criteria pollutant emissions
- GHG emissions and emissions reductions

The GHG Center has just completed verifications of Honeywell, Capstone, and other DG technologies. Participating organizations are required to share in the cost of testing (50%). Interested vendors should contact the GHG Center before September 15, 2001, and submit an Application for Testing.

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Forum

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"This fulfilled a key goal I had for the forum", said Steve Piccot, Conference Chair, "and bolsters our intuition that the GHG technology industry needs an unbiased platform where technical people can learn and exchange ideas on commercial GHG technologies."

Additional information on the forum can be found on the GHG Center's Web site (www.sri-rtp.com).

High Interest GHG Technologies (Ranked) Identified by Forum Participants

- Distributed Electrical Generation
- Cogeneration
- Energy Conservation/Efficiency
- GHG and Other Monitoring
- CO₂ Sequestration/Capture
- Transportation
- Waste Management
- Oil and Natural Gas Processing
- Fuel Substitution (including Biomass)
- Buildings
- Large Industrial/Commercial Engines



*Delegates and Exhibitors Talk during
an Evening Reception*

Policy-Climate

(continued from page 2)

Committee on energy (NICE) to work toward drafting an Action Plan which identifies steps to address those aspects of global warming that are within the region's control to influence. Although the plan is still under development, it could ultimately include the coordinated establishment of GHG reduction goals and energy technology utilization strategies for the region. It could also include plans for adaptation of economic and physical infrastructures, and specifications for a coordinated public education and outreach effort. The GHG Center was asked to provide technology input into the process, particularly in the area of energy production, and did so during the first face-to-face meeting of the Committee on the Environment and NICE, held this June in Boston. The GHG Center will stay involved in the process, and ultimately could provide independent, third-party verification of technologies that have specific applicability to the Action Plan and this region of North America.

Policy-Changes

(continued from page 2)

center stage in Washington seems to have been equally unexpected.

In June, the White House was reported to be considering a proposal, developed by Jae Edmonds of the U.S. Department of Energy's Pacific Northwest Laboratory, which could lead to the elimination of "new" carbon dioxide emissions by 2025. The approach was favored because of its reliance on technology improvements, rather than hard and sometimes arbitrary caps. This is one of several options under active discussion by a special White House Task Force.

These policy discussions occurred against the backdrop of rapid and significant new developments. A new National Academy of Sciences study just released blames recent climate change on industrial and other human activities. The study, commissioned by the Bush Administration, supports the findings of recent IPCC Assessments, which to some in Washington and industry, have been viewed with a jaundiced eye. Also, the recent U.S. Senate majority shift, and subsequent turnover of the powerful Senate Environment and Public Works committee, will likely influence the discussions. Finally, at press time, Kyoto Protocol negotiators announced agreement had been reached in Bonn, in spite of the U.S. withdrawal, further complicating Bush administration policy efforts and again throwing into question what U.S. GHG policy may be.