

RIGHT NOW IN ENERGY

FALL 2005

EXPLORING TECHNOLOGY AND APPLICATIONS

Puttin' on, the Ritz

The Five-Star Ritz-Carlton
San Francisco Installs IES
for Energy Savings

Local Power Can Solve
Reliability, Recovery
Challenges

An Innovation 180
Years in the Making





4 **ON LOCATION** High Class, High Efficiency

The Five-Star Ritz-Carlton San Francisco Installs IES for Energy Savings

Host Marriott, with the support of the U.S. Department of Energy (DOE) through the National Accounts Energy Alliance (NAEA), has installed the first PureComfort™ 240M Integrated Energy System (IES) applied in an urban environment.



3 **PUBLISHER'S NOTE** You Can't Count on the Grid

7 **POWER ON DEMAND** Local Power Can Solve Reliability, Recovery Challenges

8 **TECHNOLOGY HORIZON** Micro-Combined Heat and Power Coming to the U.S.

9 An Innovation 180 Years in the Making

10 **ENERGY TRENDS** How to Spot the CHP Savings



On the Cover: A crane lifts the chiller module of the PureComfort 240M Integrated Energy System onto a section of roof at the Ritz-Carlton San Francisco.

You Can't Count on the Grid

The need for more durable and secure power never has been more evident. But few major power consumers and producers have formal energy plans or emergency strategies in place. What's worse, no single entity is responsible for ensuring that energy systems keep power flowing to critical facilities and functions (e.g. hospitals, shelters, nursing homes, water, communications, etc.) during disasters.

The extreme fragility of the U.S. power grid is well documented:

- 1995: Chicago's Great Heat Wave kills more than 700. Insufficient power to cool buildings causes many of the deaths.
- 2003: Northeast United States blackout leaves 50 million in dark.
- 2005: Hurricane Katrina-related deaths surpass 1,000. Critical services including communications, hospitals, emergency response, water treatment and cold storage facilities are left without power.

What can and should be done in the next 12 to 18 months to protect major facilities and U.S. citizens during a major loss of power? The answer lies in minimizing the risk associated with a central power supply.

For this purpose, diesel backup has proven unreliable. In the 2003 blackout, 50 percent of the New York hospitals, all

with diesel backup, were without power—forcing them to move patients around like checkers. Diesel systems were plagued with electrical and mechanical problems, and when they did start, their fuel supply ran out with no means to replenish fuel during a large-scale power outage.

What can and should be done in the next 12 to 18 months to protect major facilities and U.S. citizens during a major loss of power? The answer lies in minimizing the risk associated with a central power supply.

A better way: distributed power generation systems fueled by a variety of local resources can protect life-sustaining services from grid disruptions. Protecting critical facilities and functions requires a hybrid electric system design that leverages a number of advanced, small-scale power generation technologies.

A Helpful Resource

But where do you turn for help and more information about these systems? Take some time to read this issue of *Right Now in Energy* to find out.

Distributed energy technologies continue to improve. Now is the time to take a closer look at how they can be deployed within

your facilities to protect your employees and allow you to serve the community when everyone else is in the dark.

That's why the National Accounts Energy Alliance (NAEA), in cooperation with several of the largest commercial real estate owners in New York, spent the past three months developing distributed energy master plans. This included prioritizing the building stock, performing feasibility walkdowns and developing conceptual designs. NAEA will provide these commercial property owners with procurement specifications and assist with their first deployments of distributed energy systems. These local energy systems will allow peak energy cost reductions and provide reliable power in the event of a grid blackout.

NAEA will begin working with the hospitality sector in the fourth quarter of this year. Let us know if you are interested in pursuing a distributed energy plan for your facilities. Send me an e-mail at john.kelly@gastechnology.org

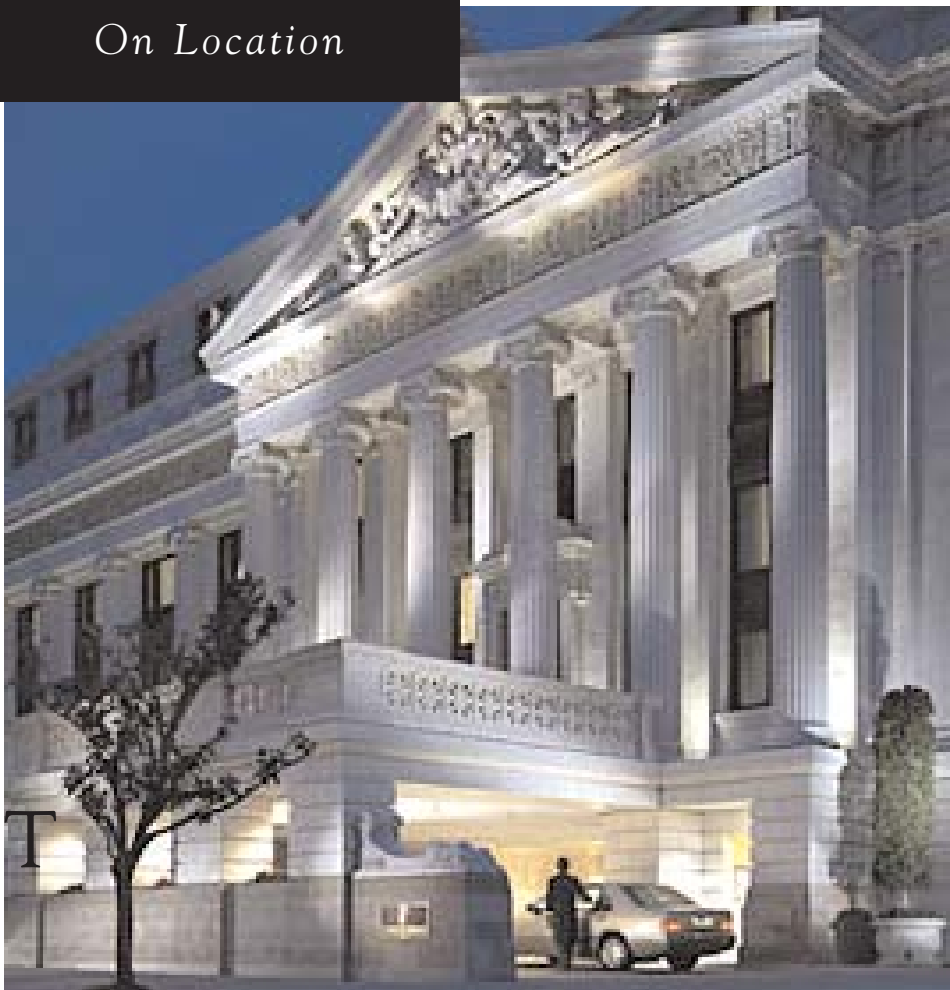
John Kelly
Executive Director,
GTI Distributed Energy Program

Right Now In Energy is designed for regional and national companies who strive to take advantage of energy markets technology. The National Accounts Energy Alliance leadership recognizes the power of fast implementation of reliable technology and approaches to saving energy, and seeks to share methods that are proven through applied science and field research, test and verification projects. *Right Now In Energy* is a quarterly publication developed in cooperation with the NAEA, the U.S. Department of Energy, the American Gas Association, the Southern Gas Association and the Gas Technology Institute. If you have any questions about NAEA, its partners or *Right Now In Energy* articles, please contact:

John Kelly, publisher:
john.kelly@gastechnology.org

gti®





Puttin' on the Ritz

The Five-Star Ritz-Carlton San Francisco Installs IES for Energy Savings

The Ritz-Carlton San Francisco (http://www.ritzcarlton.com/hotels/san_francisco/) is the city's only Mobil Five-Star, AAA Five Diamond hotel. The 336-room Nob Hill landmark is also the only hotel in North America to capture both Mobil's Five Stars and AAA's Five Diamonds for the hotel and its restaurant.

No wonder it's an uncommonly busy facility. While that's mostly good news for hotel owner Host Marriott Corporation (www.hostmarriott.com), a real estate investment trust (REIT), it also means high energy costs. The hotel consumes an average of 670 kWe of electrical power and 600 kWth of thermal energy. In a

high-energy-cost city such as San Francisco, that represents significant costs that cut into ROI for Host Marriott's investors.

That's why Host Marriott, with the support of the U.S. Department of Energy (DOE) through the National Accounts Energy Alliance (NAEA), has installed the first PureComfort™ 240M Integrated Energy System (IES) applied in an urban environment. Besides helping Host Marriott realize sizable energy cost savings, the results of the Field Scale Test and Verification (FSTV) of the IES will serve as an important baseline for further development of packaged distributed

energy systems retrofitted in urban centers.

Minaz Abji, Host Marriott Executive Vice President for asset management, said the installation fits well with the corporate strategy of value creation through aggressive asset management and disciplined capital allocation performance.

"We are proud to be the first hotel to install PureComfort integrated power technology," said Abji. "This product aligns with our corporate vision to protect the environment as well as to produce bottom-line energy cost savings. It also ensures we continue to lead our industry as the best in class."

The Ritz-Carlton San Francisco's significant energy demands can be effectively relieved by the PureComfort 240M from UTC Power (www.utcpower.com), a unit of United Technologies Inc. It's a packaged, pre-engineered system that includes four microturbines to produce electrical power, an exhaust heat-driven, double-effect absorption chiller and integrated controls to ensure that the package operates predictably, reliably and safely for both steady-state and transient loads.

On a hot day, the 240M can deliver 202 kW (net) and 120 RT of chilling. Consequently, after eliminating the 80 kWe previously required for the chilling that the 240M's exhaust-heat-driven chiller will deliver, the IES will supply about 40 percent of the average total electrical power consumed by the Ritz-Carlton. And, because the hotel requires more cooling than the 240M can provide, the system's high utilization should provide a rapid return on investment.

Integration Issues

The electric supply to the Ritz-Carlton comes from a network system, not from a typical radial feed (See “Understanding Radial and Network Electrical Systems,” page 6.) Network systems, which are generally found in metropolitan areas, require a more sophisticated interconnection design. In California, networks are in San Francisco, Oakland and Sacramento.

The Ritz-Carlton incorporates a PureComfort 240M with a current selling price of about \$500,000 per system.

Existing IEEE 1547 and state Interconnection Standards generally do not apply to networks. Safety protection and grid reliability coordination are core issues, and there’s not much experience nationwide with network interconnection. PG&E allows network interconnections, but requires an extensive utility review process and additional protection equipment.

The Ritz-Carlton has installed the 240M system to offset electrical power and air-conditioning loads. While the IES can deliver thermal energy for space cooling and heating, the demand at the hotel for air conditioning is sufficiently high all year, so the system was plumbed to meet only the cooling needs.

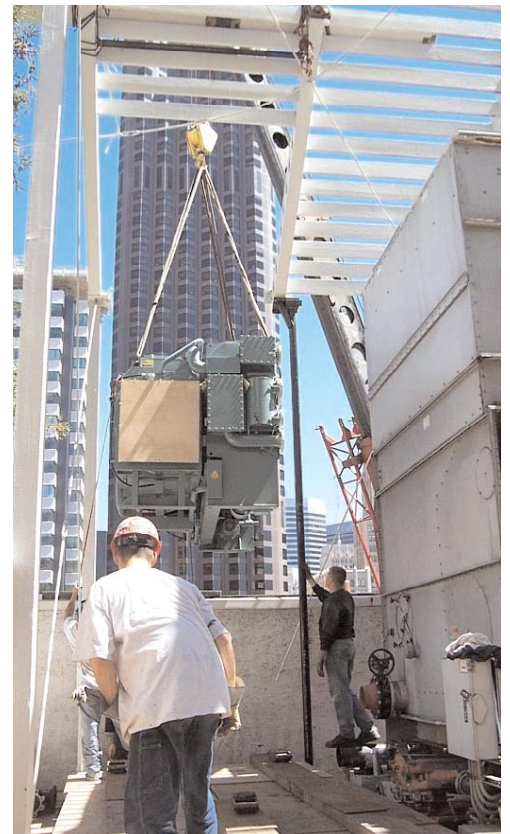
Taming the Urban Retrofit jungle

The FSTV at Ritz-Carlton San Francisco is also helping to identify optimal packaging for the 240M. So far, it has become clear that modularization is a key to economically delivering IES to urban areas. These lessons will be incorporated in the next-generation modular urban design.

However, optimized modularity depends just as much on retrofitting existing buildings such as the Ritz-Carlton. There, the microturbine array and the absorption chiller are mounted on the mechanical building’s roof in the rear of the hotel, and the pumps and tanks are mounted directly below, in the machine room.

Densely populated urban settings are always a challenge for large-scale installations, and the Ritz-Carlton was no exception. Raising the microturbines to the roof was not a problem, thanks to their relatively small size (6.25x2.5x6.42 feet) and light weight (1,671 pounds). The chiller was a different matter, however. The unit measures 12x6.62x6.83 feet and 19,731 pounds. It required lifting from a private parking area off the alley with a heavier crane and additional

city permits. Simplifying this lift process will reduce installation time and cost in congested center cities.



Working with PG&E, the interconnection at the Ritz was arranged to include:

- Under power relays that will immediately trip the microturbines if exporting power occurs.
- Network protectors with new protector relays that have adjustable time delays to coordinate time delay with the under power relay and permit microturbine generators to disconnect before any network protector would trip.
- A network protector controller (GE C 30 device) to monitor the network protectors, which trips the microturbines when only one network protector remains closed. That assures PG&E a minimum level of service to the site and prevents poor load- factor situations.

Understanding Radial and Network Electrical Systems

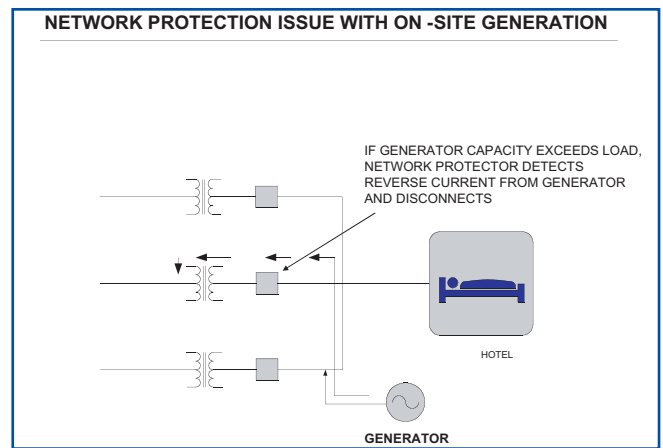
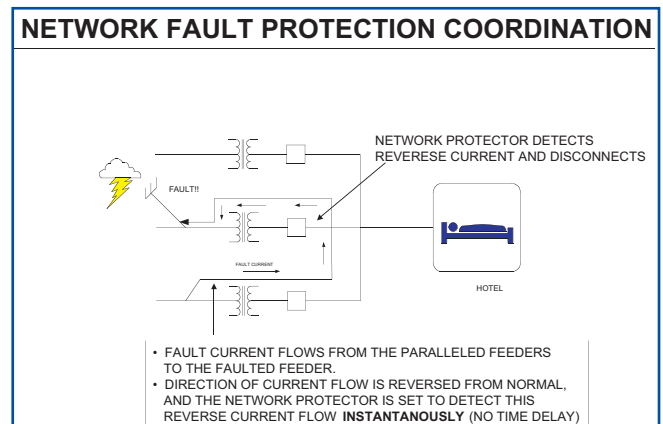
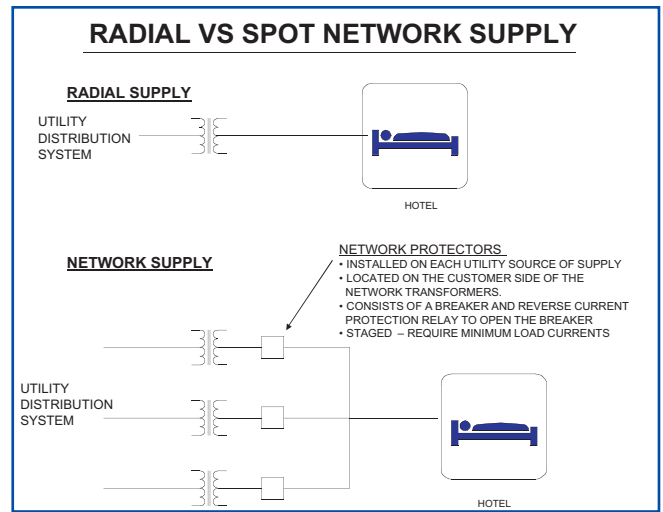
A radial feed (top) presents a single service to a transformer and then to the load. If the utility power goes down, the hotel also goes down unless it has back-up generation that is energized through a transfer switch.

The network feeding the hotel (bottom) has three feeds supplying three transformers, with each feed equipped with a network protector. Each network protector protects each feed from a fault on one of the other feeds.

A network system enhances the apparent grid reliability by providing redundant feeds to the customer. This feature can be seen in the middle figure, where the central circuit receives a lightning strike that shorts out that circuit. The network protector on the central circuit senses reverse current flow from one of the other feeds and immediately opens to prevent power flow back to the shorted circuit.

Like any electromechanical device, the electronic signal to open the protector initiates within approximately one cycle, while the actual opening of the contactor happens in 5 to 25 seconds. Network protectors are owned and maintained by the utility. Most often, these circuit protectors are manually reset in vaults only accessible by the utility.

When onsite power is installed on a building (load) that is network protected, it is important to understand the operational implications of such an installation. If the load—for any reason—momentarily falls below the generator output, the network protectors instantaneously sense it and begin to trip, rendering the site separated from the grid until such time (and cost) for the utility to reset the network protector. The bottom figure also shows the generator output exceeding the site load and tripping a network protector.



Local Power Can Solve Reliability, Recovery Challenges

Recent catastrophic events have exposed the vulnerability of our electric infrastructure. The extensive network of transmission and distribution lines is difficult to defend against a host of threats—natural disasters, operator error, maintenance flaws or terrorist attacks.

But if more of the electricity in the nation were dispersed locally, at the point of use, the adverse consequences of these threats would be diminished. And for businesses, on-site or local power offers additional benefits such as long-term energy savings.

In response to recent power-reliability problems, the National Association of Regulatory Utility Commissioners (NARUC) is encouraging states to develop recovery plans that allow for rapid recovery from disruptions in service. However, Hurricane Katrina showed us that recovery efforts must have access to electricity, heating and cooling capacity to be effective. Government officials' cellular phones ran out of power, fuel and water could not be pumped, lighting remained off and shelters were without heating or cooling capability.

If more of the electricity in the nation were dispersed locally, at the point of use, the adverse consequences of threats to power infrastructure would be diminished. And for businesses, on-site or local power offers additional benefits, such as long-term energy savings.

That's why local and on-site energy systems are uniquely positioned to provide power to key facilities and functions. The Department of Energy's Federal Energy Management Program (FEMP) has cited local energy as key to security solutions for federal facilities. But one of the lessons learned from the August 2003 blackout in the Northeast was that many emergency generators did not function when they were needed. Local energy can provide power to key community emergency management functions by strategic deployment in potentially impacted areas.

System designs can include multiple generators to divide the load and increase reliability in the event of a failure of one generator. Automatic load control must be included in the design to provide for the capability to match site loads with the energy system output in real time. Waste energy recovery, in the form of hot water, steam, and chilled water, can significantly improve energy savings.

INDUSTRY	AVERAGE COST OF DOWNTIME	SOURCE
Cellular Communications	\$41,000 per hour	Teleconnect Magazine
Telephone Ticket Sales	\$72,000 per hour	Contingency Planning Research
Airline Reservations	\$90,000 per hour	Contingency Planning Research
Credit Card Operations	\$2,580,000 per hour	Contingency Planning Research
Brokerage Operations	\$6,480,000 per hour	Contingency Planning Research

For businesses, specifying a local energy system should be a decision driven by an economic risk assessment that considers items such as lost production, revenues and data (see table). Owners can take advantage of utility demand reduction incentives or use these energy systems to avoid high peak energy prices. When considering on-site or local energy options, business owners should look beyond the minimum code requirements to determine the optimal configuration for their facilities.

There are software tools available, such as a Building Energy Analyzer™ from InterEnergy (www.interenergysoftware.com), to help determine the economics and the factors that impact the overall savings possible with various types of distributed generation (DG) equipment. The results of this assessment will allow an owner to determine how much to invest and what type of paybacks are possible by installing equipment to increase reliability.

Micro-Combined Heat and Power Coming to the United States

American Honda Motor Company has teamed with Massachusetts-based Climate Energy LLC to develop a new form of micro-combined heat and power (MCHP) technology to provide heat more efficiently and in smaller applications than ever before, with an additional benefit of producing a portion of a facility's electricity.

Honda is one of the world's dominant makers of engines for cars, motorcycles and power equipment, selling more than 19 million units in 2004. Climate Energy LLC was founded in 2000 to develop and market micro-combined heat and power for residential and light commercial customers.

Honda will provide the cogeneration unit to Climate Energy, which will integrate it with a furnace or boiler and market the entire system as an alternative to conventional systems. Climate Energy is working with state and local authorities as well as utilities to refine the system. Limited field-test installations are scheduled for late 2005. Widespread distribution is planned for fall 2006.

The Honda unit's compact design consists of a small natural-gas engine, modified specifically for this application, and a small electric generation system. The initial units will be able to generate up to 3 kW of heat and 1 kW of electricity per hour.

The complete system results in more than 85 percent efficiency in converting fuel energy into heat and power. Although the system is initially being targeted to residential homes, future plans will include small commercial applications. Consistent with Honda's environmentally conscious reputation, the system is expected to provide a 30 percent reduction in carbon dioxide emissions compared with conventional heating appliances and grid-supplied electricity. A similar version of the Honda system has been in use in Japan since 2003, with more than 15,000 units installed.



The complete MCHP system results in more than 85 percent efficiency in converting fuel energy into heat and power.

Visit www.hondanews.com or www.climate-energy.com for more information.



An Innovation 180 Years in the Making

STM Introduces 55 kW Stirling Engine Generator

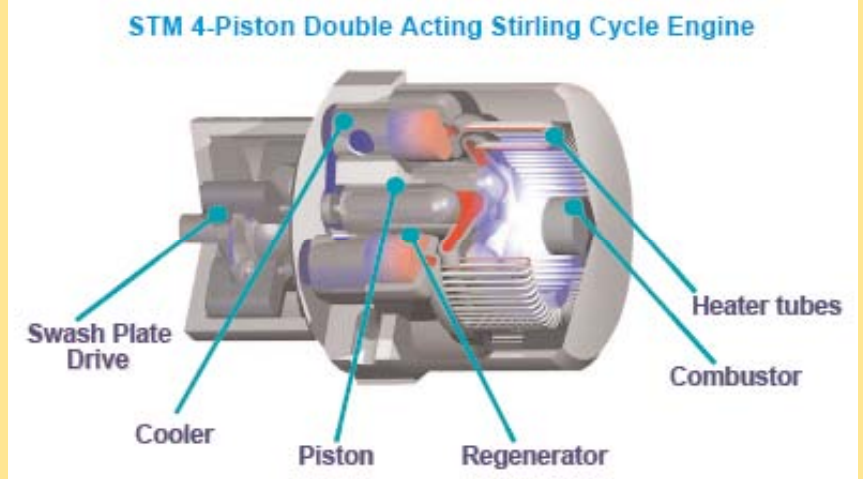
STM Power Inc. has launched a 55 kW generator set based on an external combustion (Stirling) engine. The launch culminates more than 180 years of effort to commercialize Scottish Minister Robert Stirling's follow-up to the steam engine—also an external combustion design. The new Stirling external-combustion engine improves the outlook for otherwise hard-to-use alternate fuels, with good efficiency and lower emissions.



The Stirling, like a steam engine, employs a fuel to heat an intermediate fluid (hydrogen) to drive pistons. The hydrogen then passes through heat exchangers and returns to be reheated in the area

where fuel is burned. Clean hydrogen is exposed only to the moving parts of the Stirling engine, which accounts for its low maintenance needs.

STM series production follows successful field testing of 80 Stirling powered generator sets, which accumulated over 70,000 operating hours. The Gas Technology Institute also has acquired an STM unit and will do performance testing at GTI's Energy Systems laboratory at its headquarters in Des Plaines, Ill. After the laboratory testing, GTI will install an STM



generator set at a swimming pool in Utah for a one-year field demonstration.

The STM combustion system inherently generates low levels of hydrocarbons, carbon monoxide and nitrogen oxide (NO_x) with continuous lean combustion. More specifically, the design does not generate the periodic high-temperature spikes that are the principal source of NO_x. This eliminates the exhaust after-treatment systems needed by internal combustion engines.

STM claims its Stirling engine demonstrates 31 percent electrical efficiency and up to 80 percent CHP (combined heat and power) efficiency with simple maintenance at 10,000-hour intervals. The STM units have less than half the number of parts of a typical internal combustion engine.

Stirling engine components later will be made by auto industry suppliers for assembly at STM's facility in Ann Arbor, Mich., which has an initial manufacturing capacity for 4,000 units annually. STM has established 20 distributors in the United States and plans to expand that to 50.

Visit www.stmpower.com for additional information on the new Stirling Gen set.

How to Spot the CHP Savings

According to the Energy Information Administration of the U.S. Department of Energy, 16 percent of the electricity generated in the United States in 2003 was provided from natural gas-fired facilities. This has caused many people to take a closer look at the relationship between gas and electricity prices and their impact on the potential for distributed generation systems.

The typical distributed generation application results in a reduction in electricity purchases and an increase in gas purchases. In order to have an economically viable DG application, the increased capital and gas purchases must be offset by the savings derived from the reduced electricity purchases. There is a concern that today's higher gas prices will negate the magnitude of electricity savings. This is a valid concern where gas and electricity prices are decoupled, but electricity markets are changing and are increasingly being linked to gas markets.

Historically regulated wholesale prices are based on the average cost of utility generation. The majority of electricity is generated by low-cost nuclear, coal and water assets. Restructured electrical wholesale prices are based on the marginal unit at each hour. These marginal units in many areas are gas-fired for much of the year, even where coal is the primary energy source. In cases such as these, gas and electricity prices are linked.

The parts of the country where gas-fired units are on the margin most of the time include:

- California/Northwest
- Texas
- Northeast

Increasingly, price caps are coming off in restructured markets and utilities are moving to market-based rates for large customers and electric prices will track gas prices.

So, although gas prices are higher than they have been historically, electricity prices will track gas prices in restructured markets.

While considering DG projects, you need to consider forward-looking, full cost of electricity prices in the evaluation. DG can be competitive in these markets because it has a greater value than the energy commodity price.



While considering DG projects, you need to consider forward-looking, full cost of electricity prices in the evaluation.

2006 National Accounts Conference and Exhibition

Strategies for a Volatile Energy Market

Retreat with us to beautiful Keystone, Colo., where we'll take in the mountain air and share ideas about how to address today's surging energy prices and tenuous supplies.

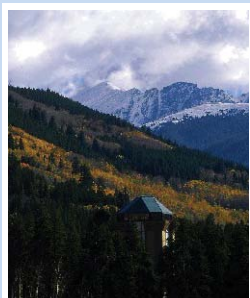
Organized By: Gas Technology Institute, American Gas Association, and U.S. Department of Energy

Dates: August 9-11, 2006

Location: Keystone, Colo. (<http://keystone.snow.com/keystoneconventions/>)

Past National Account Attendees:

AJS Associates KFC	Great Atlantic & Pacific Tea Company	Phoenix ESG/Comp USA
Best Buy	Harris Teeter, Inc	Sears Holding Corp
Blockbuster Inc	The Home Depot/Prenova	Sprint
Boston Market Corporation	Hyatt Hotels Corporation	Target Corporation
CKE Restaurants Inc.	Kohls Department Stores	Tharaldson Energy Group
Cox Enterprises	Linens 'n Things	UFPC
Darden Restaurants	McDonald's USA	Vornado Realty Trust
Equity Office Properties	O'Charley's Inc.	Walgreen
Family Dollar Stores, Inc	Outback Steakhouse	Walmart
Fisher-Nickel Inc	PETCO	WD Partners



Make Plans
Now for
Keystone,
Colorado.

Go to www.NAPartners.com for more info.

RIGHT NOW IN ENERGY
EXPLORING TECHNOLOGY AND APPLICATIONS