Volume III, Issue 4, July/August 2003


# DG MONITOR[SM]

## *Industrial Sector Offers Strong CHP Potential*

A newly published study, *Cooling, Heating, and Power for Industry: A Market Assessment*, was prepared by the Resource Dynamics Corporation for the U.S. Department of Energy (DOE) and Oak Ridge National Laboratory (ORNL). The study assesses the market for cooling, heating, and power applications in the industrial sector and determines the potential of these applications.

Combined heat and power (CHP) applications produce both electricity and byproduct thermal energy onsite, converting 80 percent or more of the input fuel into useable energy. CHP has the potential to dramatically reduce industrial sector carbon and air pollutant emissions and increase source energy efficiency. The industrial sector has used CHP applications for many years, typically using systems to generate hot water or steam from recovered DG waste heat and using it for process heating. However this waste heat also can be directed to an absorption chiller where it can provide process or space cooling. *(continued on page 6)*

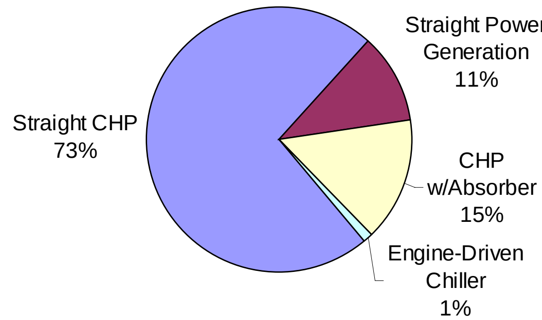


**Figure 1. 2002 U.S. Industrial Cooling, Heating and Power Market Potential (33 GW)**

## *DG Plays Critical Role in the Blackout of 2003*

Shortly after 4 p.m. on Thursday, August 14th, 2003, the power went out in New York City, parts of New England, the upper Midwest and parts of Canada. More than 20 million people were affected by the blackout, which served as a reminder of our economy's dependence on electricity, and the costs of electricity outages. DG backup generation helped many organization and companies get through the blackout with little or no disruption.

Key financial institutions remained functioning throughout the blackout and suffered no or minimal interruption with the aid of battery backup and generators. As reported by the Washington Post, generators at Goldman Sachs & Co. were able restore full power about 20 seconds *(continued on page 8)*

## *Interconnection Update*

*This update highlights the programs and events shaping DG interconnection.*

***IEEE 1547.*** On June 12, 2003, the IEEE Standard Board approved IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems. IEEE 1547 documents the mandatory, minimum functional technical requirements that are universally needed to help assure a technically sound interconnection. The Standard was published on July 28, 2003 and is available from the IEEE online catalog and store at http://shop.ieee.org/store/

***FERC ANOPR.*** On July 23rd, 2003, the Federal Energy Regulatory *(continued on page 5)*

**IN THIS ISSUE**



RESOURCE DYNAMICS CORPORATION

*To view earlier editions of the DG Monitor or to begin receiving the publication via email please visit:* www.distributed-generation.com.

**About the DG Monitor.** The DG Monitor is a bimonthly publication of the Resource Dynamics Corporation covering the many facets of the emerging Distributed Generation marketplace. Articles both report and interpret the most important items. In addition, the Monitor includes special series on DG technologies, applications, manufacturers, and other issues, providing the reader with a complete picture of these topics over several issues.

Comments or requests for additional information can be addressed to DGMonitor@rdcnet.com, through our website at www.distributed-generation.com, or by contacting Jean Connors at 703/356-1300 x 208.

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The **Resource Dynamics Corporation (RDC)** creates business solutions that empower clients to compete effectively in changing energy markets. Often, these involve evaluating the role of new technologies. All senior staff have both business and engineering backgrounds, with a distinct focus on strategy implementation. We combine these strengths to create innovative business solutions for energy technologies and markets. **RDC** utilizes an extensive set of tools including proprietary databases and models to develop these solutions.

**We develop business solutions in four areas:**

- **Distributed Generation**
- **Marketing for Energy Businesses**
- **Strategies for Power Suppliers**
- **Strategies for Energy Purchasers**

**RDC** has entered its 23rd year. Meeting our clients' needs has always been our top priority and we have consistently delivered outstanding consulting services that enable our clients to reach their goals. Clients include energy companies, consumers, financial institutions, law firms, equipment vendors, trade associations, research organizations, government agencies and international institutions.

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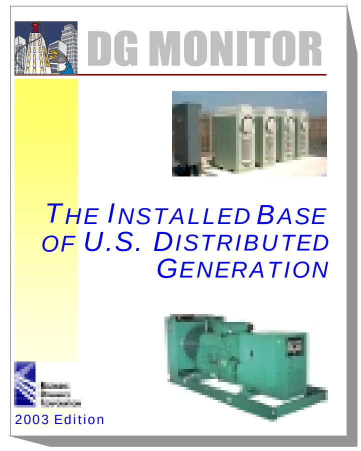



**How much DG is there in my state or region?**

**What is their aggregate capacity?**

**Where are these units located?**

***The Installed Base of U. S. Distributed Generation 2003 Edition*** helps decision makers at all levels answer these questions and make informed DG policy, regulatory and market decisions by providing detailed estimates of the total number of DG units installed in the U.S. as of 2001, and their capacity by 19 size ranges from less than 15 kW to 60 MW. Breakouts are made by technology, application, primary fuel consumed and year of installation. Additional regional and industrial breakouts are provided for a subset of the larger generators.

Additional reports are also available:

With the new IEEE 1547 DG Interconnection Standard likely to be released this year, the ***DG Monitor's Directory of Interconnection Technologies and Equipment*** helps decision-makers quickly develop a short list of potential interconnection solutions. This publication lists the equipment and technologies necessary to interconnect all kinds of DG applications, and provides contact information for manufacturers and distributors.

Evaluating DG technologies or markets? Check out the ***DG Monitor's 2002 DG Sourcebook!*** A compendium of information on virtually every aspect of distributed generation technologies, applications, and markets - right at your fingertips!

These reports are part of the DG Monitor™ publication series produced by the Resource Dynamics Corporation (RDC).

*To order this report or other DG publications, go to*

www.distributed-generation.com.

## *Unrealized DG Market Potential*

As previously reported in the *DG Monitor's The Installed Base of U.S. Distributed Generation: 2003 Edition*, about 35 GW of industrial and commercial peak shaving, baseload, and combined heat and power (CHP) DG applications are already installed in the U.S. (see page 9). This calculation does not include any of the millions of smaller units used for backup and emergency generation.

Looking to the future, DG economic market potential can be defined as situations where the all-in life-cycle economics of a DG unit would be superior to purchasing power from the grid. That is, in a head-on competition with conventional power purchases, DG can save the end user money.

Using this definition, and assuming DG technology and economic performance continues to improve as forecast by manufacturers and the DOE, there will be as much as 175 GW of industrial and commercial economically viable market potential by 2010. This measure considers peak shaving, baseload, CHP, and integrated energy systems where CHP may be used for cooling applications. The *DG Monitor* is currently preparing a new publication that details how this can be measured and what it means; the market potential will be provided for several breakouts including DG unit size, technology, application, and state. We will let you know when this study is available.

Obviously there is a huge gap between the currently installed 35 GW and the 175 GW of market potential. Why the gap? There are many reasons.

First, about 100 GW of the market potential only becomes economically viable once DG performance improves. The introduction of combined heat and power and cooling systems is part of this trend. It is this expectation for large growth that has been driving much of the publicity about DG in recent years.

Second, a knowledge barrier limits DG adoption even when it can be the economically preferable solution. This includes low levels of knowledge about DG, its siting, its operation, and the state and federal regulations that affect its use. Together this lack of information on the part of end users, architects, engineers, building inspectors, public utility commissions and policymakers has contributed to DG not even being considered an option for a particular new or retrofit building, or for an industrial electrotechnology.

Third, siting costs are relatively high compared with a small DG unit cost. Sometimes older regulations or utility policies have prevented DG from being considered on a level playing field with grid based power. For instance, non-standard utility interconnection policies are often cited as being a time and cost barrier when installing a DG project; indeed this very issue is now being addressed both in some states and at the federal level (see page 1). Although state approved pre-certification programs are helping, siting remains a unique process raising DG installation costs considerably.

Fourth, there are DG use restrictions in some locations. Under the Clean Air Act stationary generators must meet strict air emission requirements in some nonattainment areas. Similarly, some jurisdictions limit the number of hours per year certain DG technologies, especially reciprocating engines, can be operated. Other building, safety and fire codes often restrict where or how fuel can be stored.

Thus, achieving full economic market potential is likely an improbable task. Actual market penetration will always lag market potential. However, estimates of which DG technology makes economic sense for which applications in a particular utility service area remains very valuable information, even though it must be evaluated in light of business barriers and challenges to market adoption. Decisions are not based on economics alone. Nonetheless, knowing that the existing market could grow as much as 500% by 2010 strongly motivates many industry stakeholders. ■

## TECHNOLOGY SERIES: STIRLING ENGINES

The Stirling engine was invented in 1819 by Scottish minister Robert Stirling, but the invention did not take off in America until the 1850s. The engine was known for its ability to use any burnable material as fuel, its safe and quiet operation, and its low maintenance requirements. Still, it was usually very large for its small power output and had a high initial purchase cost. It was used primarily for low-power water pumping applications, and with little maintenance requirements, it was preferred over steam engines. However, the Stirling engine disappeared from the commercial scene when internal combustion engines and electric motors arrived, offering higher power outputs with a smaller footprint and lower cost.

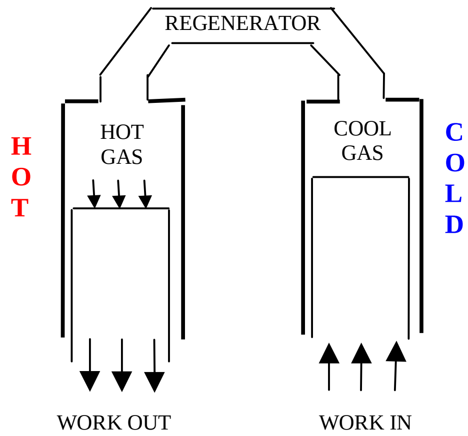
In 1980s, the United States Agency for International Development began promoting the Stirling engine for production and use in Third World countries because of its easy manufacturability and low maintenance. The program was successfully implemented in Bangladesh, breathing new life into the old engine design.

Plans are now in the works to commercially produce an improved Stirling engine design for various applications, including DG. The modern version will be much more powerful for its weight, and at the same time will be as quiet, easy to use, and reliable as the original design.

### Operation

The Stirling engine uses the Stirling cycle, where the engine's gases are inert and trapped inside. The gases are heated by an external heat source, so no combustion occurs inside of the engine. The heat source does not require any specific type of fuel, making the Stirling engine one of the most versatile of all engine designs.

A typical Stirling engine consists of a two-cylinder, two-piston arrangement as shown in the diagram. The gas inside of one cylinder, usually hydrogen or helium, is heated up by an external heat source. This increases the pressure of the gas and forces the piston to move down, doing work that can be translated to a rotating shaft. This piston is then pushed back up by a mechanical device that also brings the other piston down, forcing the gas to enter the cool cylinder. In this process, the gas temperature and pressure is lowered, making it easy to compress. The piston in the cool cylinder is then pushed up, compressing the gas and sending it back to the heated cylinder where the cycle starts over again. To aid in the reheating process a regenerator, or heat storage device (such as a metal screen or mesh), is used between the cylinders. While many different arrangements are possible for Stirling engines, they all operate on this same basic principle.




**Stirling Engine Schematic**

Stirling engines come in many different arrangements, and can utilize a number of different technologies. Until recently, most Stirling engines produced low output and required an extremely sizable housing. Their favorable aspects were minimal maintenance and low noise production. However, new materials and improvements in technology have yielded smaller, more efficient Stirling engines that could suit many applications, including DG.

### Manufacturers

Although there are currently no manufacturers producing DG-sized Stirling engines in large quantities, it is expected that they will be commercially available by 2005. The table at the top of page 5 shows a representative list of manufacturers.

STM is in the final stages of commercializing a 55 kW PowerUnit Stirling engine genset. It will have 31% net electric efficiency, hot water output for CHP applications, overall maintenance costs of $0.008/kWh, and low emissions, noise and space requirements.

*(continued on page 5)*

*(Stirling Engines, continued from page 4)*

| Manufacturer | Model | Notes |
|---|---|---|
| Kockums | 25 kW dish-Stirling engine | Swedish-based company |
| Stirling Energy Systems, Inc. | Kockums 25 kW dish-Stirling engine | Plans to produce 40,000 of Kockums' engines a year in Arizona and Nevada |
| Stirling Technology Company | Stirling engine generators ranging from 55-3,000 watts | Focusing on Stirling engine generators under 3,000 W |
| Stirling Technology, Inc. | ST-5: 5 hp stand-alone Stirling engine | For operation in rural areas, can run on a range of fuels |
| STM Power Incorporated | STM 4-120 Stirling engines | Linked to a solar dish system – ongoing DOE project with SunLab |
| Sunpower, Inc. | Bio-Watt cogeneration systems – free piston Stirling engine | Converts wood fuels into electricity and heat |
| WhisperTech Ltd. | WhisperGen cogeneration system based on the Stirling engine | 750 W electrical output, 5-6 kW of thermal output |

*(Update, continued from page 1)* Commission (FERC) issued standard procedures and a standard agreement for the interconnection of generators larger than 20 MW. This final rule, which applies to any new generator larger than 20 MW wishing to interconnect with a public utility's transmission system, is meant to expedite and reduce the cost of the interconnection process. It supports this goal by defining each party's legal rights and responsibilities, cost responsibilities, a time line for project completion, and a dispute resolution process.

FERC also proposed expedited procedures for small generators no larger than 20 MW, and is accepting comments on the proposed rule. The proposed rule draws from consensus documents drawn up in the Standardization of Small Generator Interconnection Agreements and Procedures Advance Notice of Proposed Rulemaking (ANOPR) process, and would apply to all public utilities that own, operate, or control transmission facilities in interstate commerce. It proposed establishing size ranges for super-expedited (2 MW or less) and expedited (between 2 and 10 MW, and larger than 10 MW) interconnection procedures. As with the Order, the proposed rule defines each party's legal rights and responsibilities, cost responsibilities, a time line for project completion, and a dispute resolution process.

With these issuances, FERC is supporting FERC Chairman Pat Wood III's professed goal, quoted in a FERC Press Release, to have "clear rules of the road in place…" and support the standardization of interconnection.

***Michigan PSC Adopts Interconnection Rules.*** Michigan Public Service Commission adopted interconnection standards with a target implementation date of March 1, 2004. The order, published on July 8, 2003, sets out interconnection application procedures, project timelines, costs and technical issues. In addition, the rules discuss pre-certification of interconnection equipment. The PSC defined DG size categories, which are broken into less than 30 kW; 30 kW or more, but less than 150 kW; 150 kW or more, but less than 750 kW; 750 kW or more, but less than 2 MW; and 2 MW or more.

The rules must pass through several more approval stages to become effective. To view the order, go to: www.cis.state.mi.us/mpsc/orders/electric/2003/u-13745.pdf

***Draft California Interconnection Guidebook In for Final Revision.*** On July 21st, the California Energy Commission (CEC) closed the public comment period on its *Draft California Interconnection Guidebook*. The draft *Guidebook*, published on July 10, 2003, is meant to assist with the interconnection of DG in California under Rule 21. It offers guidance specifically on interconnection to the Pacific Gas and Electric, Southern California Edison, and San Diego Gas and Electric systems, as they are the utilities under the jurisdiction of the California Public Utilities Commission and thus under Rule 21. However, it can be useful for planning projects in areas with interconnection rules similar to those of Rule 21.

The Guidebook will go through a final revision process, after which it will be published. To access the draft *Guidebook*, go to:
www.energy.ca.gov/distgen/interconnection/2003-07-10_DRAFTGUIDEBOOK.PDF

*(Industrial, continued from page 1)* This study examines cooling, heating and power market potential, including power generation without heat recovery, straight CHP, CHP with absorption cooling, and engine-driven chillers (EDC) for process cooling. This effort evaluates a wide range of CHP technologies under 50 MW, focusing on current technologies (base case scenario, year 2002), including reciprocating engines, industrial turbines, microturbines, combined-cycle turbines, and phosphoric acid fuel cells. As seen in Figure 1 on page 1, the potential for these applications in the U.S. industrial sector is estimated at 33 GW of power generating capacity with currently available technology. Based on data from the Energy Information Administration (EIA), it is estimated that current CHP use in the industrial sector for units under 50 MW is about 11 GW. Comparing this value with the market potential estimate of 33 GW, it would appear market penetration is about one-third.

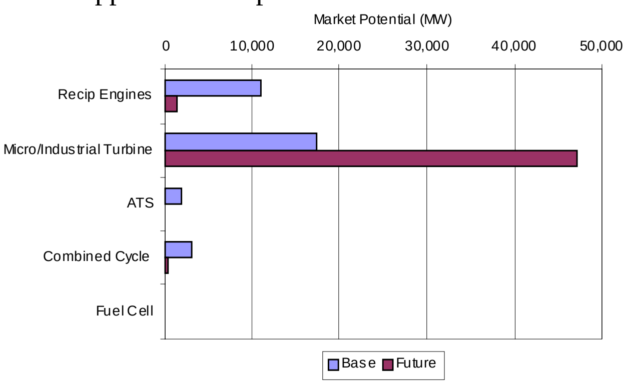



**Figure 2. Market Potential by Technology (MW)**

As shown in Figure 2, in the base case, the CHP marketplace is shared by turbines and reciprocating engines. In the future (year 2005+), turbines are projected to gain CHP market share because of price and performance improvements. In the future, fuel cells are projected to drop below $1,500/kW installed, and emerge in the future CHP marketplace with less than 5 MW of capacity (too small to be seen on Figure 2). This penetration could continue if further improvements in fuel cell cost are attained.

When CHP market potential is examined by generating unit size, in the base case, engines dominate in the smaller sizes (under 1 MW). In the mid range (1-20 MW), turbines take over, due to the large concentration of CHP compatible sites in this size range. In the larger sizes (20-50 MW), turbines do well in CHP applications and combined cycles emerge, offering economic potential for baseload power applications. In the future, the turbine CHP market potential expands as microturbines take over in the under 1 MW applications, and larger (over 1 MW) turbines benefit from improved electrical efficiency and lower capital cost.

Figure 1 shows that about 16 percent of the potential CHP applications favor the generation of cooling from the CHP unit. As such, four cooling operating strategies were explored: single effect absorption units and engine-driven chillers (EDCs), both baseloaded and serving the entire cooling load. EDCs are competitive in the smaller size ranges, particularly for serving the entire cooling load (sized to peak). In the 10-50 ton range, EDCs sized to peak offer a payback under 2 years, and almost 60 percent (about 20 GW) of the applications deemed economically feasible have a payback under 4 years.

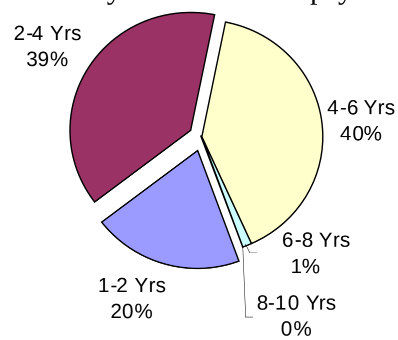



**Figure 3. Distribution of Payback Periods for Potential Industrial CHP Applications**

While the market potential presented here is based on a ten-year cash flow analysis to determine the option with the best net present value, a simple payback was also calculated. Figure 3 illustrates for the current case that almost 20 percent of the applications offer a payback under 2 years, and almost 60 percent (about 20 GW) of the applications deemed economically feasible have a payback under 4 years. Assuming that the 11 GW that has been installed was taken from the more attractive paybacks, this means that about 9 GW of under 4 year payback market potential is still unrealized. This portion is likely impeded by market or regulatory barriers. The report concludes by presenting options to help overcome these barriers and maximize the many benefits of industrial CHP.

*Cooling, Heating, and Power for Industry: A Market Assessment* will be available online soon. A companion study to this assessment, entitled *Integrated Energy Systems (IES) for Buildings: A Market Assessment*, was also developed for ORNL and DOE by the Resource Dynamics Corporation. It was published August 2002 and can be found online at: www.bchp.org/pdfs/IES_Resource_Dynamics-FinalReport-0209.pdf. ■

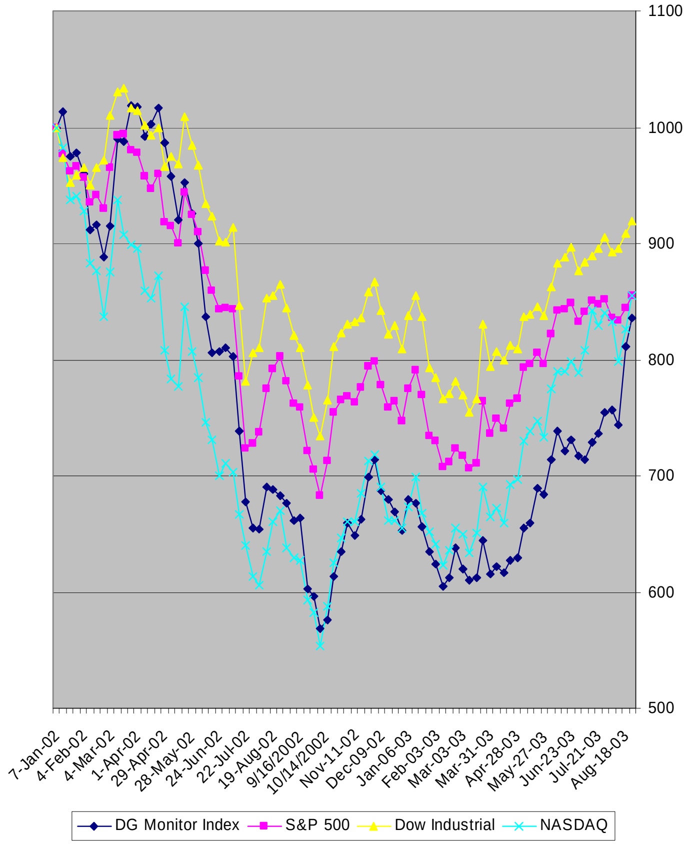
## *The DG Monitor Index℠*

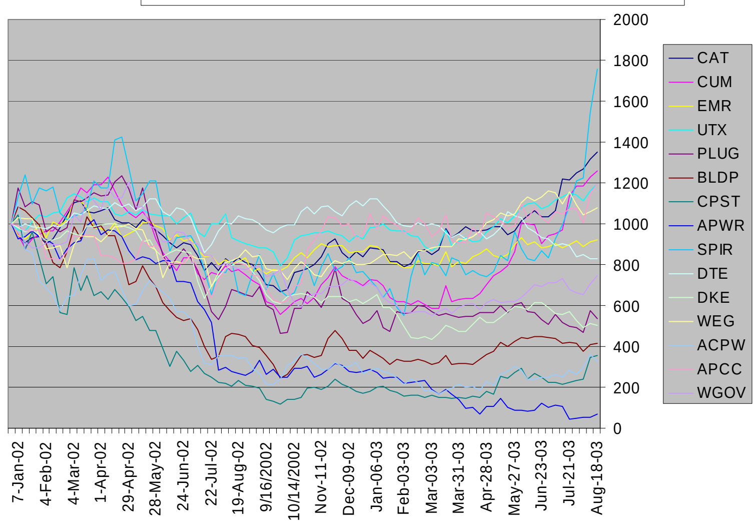
The DG Monitor Index℠ continues to lag all three major U.S. stock indexes from January 2002 through August 18, 2003, although it has re-gained much ground in the past month.

Top-performers since January 2002 include Spire, Caterpillar, and Cummins. Spire Corporation develops and manufactures solar electric module manufacturing equipment and systems and provides biomedical processing services and devices. The company markets specialized equipment for the production of photovoltaic (PV) modules. Spire also provides a service where they offer surface treatments to enhance the anti-microbial characteristics of orthopedic and other medical devices and also manufacturers catheter devices.

The poorest performers continue to be emerging technology manufacturers. Laggards from January 2002 include Astropower, Active Power, and Capstone, although both Active Power, which manufacturers flywheel-based uninterruptible power supplies and Capstone, which manufactures microturbines, were up sharply immediately following the blackout of 2003.

Companies in the DG Monitor Index℠ include: Active Power (ACPW); American Power Conversion (APCC); AstroPower Incorporated (APWR); Ballard Power Systems (BLDP); Capstone Turbine (CPST); Caterpillar Incorporated (CAT); Cummins Incorporated (CUM); DTE Energy (DTE); Duke Energy Corp (DKE); Emerson Electric (EMR); PlugPower Incorporated (PLUG); Spire Corporation (SPIR); United Technologies (UTX); Williams Energy Partners (WEG); Woodward Governor Company (WGOV). ■




## *High Natural Gas Prices May Impact the DR Market*

On August 21, 2003, the closing price for natural gas (Nymex Henry Hub) was $5.26. U.S. natural gas consumption continues to increase, while U.S supplies are going down. Earlier in the summer, Alan Greenspan even commented on the natural gas market. Greenspan said the "peak price will exceed $7.50 per million Btu [this winter]", and "we are not apt to return to earlier periods of relative abundance and low prices anytime soon," at the House Energy and Commerce Committee.

Last year, the Resource Dynamics Corporation performed a study for the Electric Power Research Institute showing that the potential market for DG is very sensitive to changes in gas prices. Total market potential varies from 53 gigawatts (GW) down to 18 GW. 53 GW is based on low wellhead gas prices ($2.50/Mcf) while the 18 GW uses $5.00/Mcf wellhead natural gas prices. ■

*(Blackout, continued from page 1)* after the blackout occurred. Emergency backup plans worked well for the New York Stock Exchange and other Wall Street institutions. The Nasdaq Stock Market was able to switch over to backup generation without loss of data, and was in business on Friday. Financial firms had backup plans in action, and generators powered Federal Reserve banks in New York, Cleveland and Detroit.

Backup generators kept the news flowing. They powered the New York divisions of ABC, CBS, NBC and Fox News Channel, and the networks were able to keep broadcasting throughout the blackout. At the Wall Street Journal, business was as usual, and several other large newspapers were able, with the aid of backup generation and contingencies plans, to get a normal run of papers out. Backup systems kept numerous computer systems online and websites up and running. For those requiring premium power, combined uninterruptible power supplies (UPSs) powered by batteries and backup generator systems had several trials. At data centers, UPS came on line immediately, allowing the centers to then switch over to backup generators without data loss.

For many, although backup systems minimized the damage and inconvenience of the blackout, they did not eliminate it entirely. Hospitals and other critical buildings came back online after short outages. These organizations are required by code to have backup generation available in case of power outages. However, only critical loads are covered, and in many hospitals, hallways remained dark or only dimly lit, and those who could go home were urged to do so. Most office buildings, also required by code to have backup power for some loads like emergency lighting, went dark and had to be closed after the safe evacuation of occupants. Footage of the New York skyline showed several buildings that had backup power generators to power their lights and stood in stark contrast to the dark buildings surrounding them.

There were some facilities where backup systems failed to operate. Air Canada had a backup system in place, but was forced to ground all its flights when the backup diesel power generator failed at its Toronto control center. In addition, the crisis illustrated that not all contingencies had been explored. The American Stock Exchange's backup generators ran as planned, and kept the Exchange's computer systems online. However, the Exchange relied on Con Edison for steam to run its air conditioners, and with no steam available, ultimately had to shut things down because they could not keep their computers cool.

Still, the blackout clearly illustrated the importance of backup power. Lacking sufficient backup power, plants and factories throughout the affected area had to shut down. Manufacturing equipment was damaged by the sudden loss of power. Manufacturing processes can be very susceptible to power fluctuations, and even a brief surge can cost tens of thousands of dollars in materials and equipment. Losses were also accrued from lost production time. The three large U.S. automakers shut down plants in the Midwest and Canada, and lost several days of production.

The blackout affected water supplies, sewage systems and garbage collection, leading to potential health risks. Residents of Cleveland and Detroit were urged to boil their drinking water, as the water-pumping stations in these city had no power supply. With these and other examples in place, the blackout of 2003 is likely to have an impact on the DG market.

DG distributors are already reporting increased interest in DG. According to several of those who sell backup and emergency systems, the blackout has led to increases in inquiries about systems from those in the areas affected, and those outside who want to avoid similar troubles. Lowe's, the nation's second-largest home-improvement chain, reported increased shipment and sales of generators. Lowe's spokeswoman Jennifer Stanbery is quoted in the Washington Post saying "[b]y 10 p.m. [Thursday] night, we had 12 truckloads of generators -- that's 3,000 generators -- on their way to affected areas…We shipped an additional 1,000 generators [yesterday] morning and then another 750 to Michigan later in the day." ■

## RDC DG NEWS

**Conferences**

"Interconnection Experience in the U.S.- Is it Working?" – presentation by N. Richard Friedman at *Eighth Annual EPRI Premiere Distributed Energy Resources and Renewable Energy Conference and Exhibit*, New Orleans, LA, Oct. 15-17, 2003.

## *How Much DG Is Really Out There?*

Until now, government and industry decision makers have lacked concrete data on how much DG actually exists in the U.S. Earlier in 2003, the DG Monitor published ***The Installed Base of U.S. Distributed Generation: 2003 Edition.*** The comprehensive report shows 10.7 million DG units in place in the U.S. with an aggregate capacity of 168 GW. These units annually generate 205 TWh of electricity.

On October 14, 2003 at 11:00 EDT, a DG Monitor Internet Briefing will be held that highlights the study's top-level conclusions and suggests how this information might be profitably used. The cost for the briefing is $95. If a briefing attendee purchases the publication, the briefing fee will count towards the purchase price. Sign up for the briefing at www.webtrain.com under Browse Future Events. Previous purchasers of the publication can attend the briefing without cost; notify us of your interest and we will register you.

In the report, the total number of DG units, capacities, generation, and thermal outputs are broken out by technology, by application, by primary fuel, and by their year of installation. Additional regional and industrial breakouts are provided for a subset of the larger generators. The report can be purchased at www.distributed-generation.com.

The first DG Monitor Internet briefing focused on the status and progress of the IEEE 1547 family of standards. This successful live presentation showed participants how promulgation of these standards will alter the DG grid-connection landscape. Participants attended from a number of different countries, including the U.S., Canada, Spain, and Taiwan. ■

***Our next briefing is scheduled for October 14, 2003 at 11:00 am EDT***, and will examine new data on the installed base of U.S. DG, and how that data can be used profitably.

To register please go to www.webtrain.com, click on "Browse Future Events", and navigate to the October 14th event titled "The Installed Base of U.S. Distributed Generation." You can enroll on that screen.

### *End User PJM Demand/Load Response Programs Training*

On September 18th, the PJM ISO is sponsoring a free web based training program on the New York ISO's, PJM's and ISO New England's Demand/Load Response Programs. Participants can find out more details about the Programs, including how to participate and how much they can be paid for program participation.

Demand/Load Response Programs provide an added incentive for end users to manage their electric usage, enable utilities to defer or eliminate costly investments in transmission and distribution (T&D) system upgrades, and possibly reduce the number of generators required during certain times of the day which should lead to a cleaner environment.

For more information, call Joe Polidoro at 610-666-4693 or register for a free web based training sponsored by the PJM ISO on September 18th. http://www.pjm.com/services/courses/c-load-resp.html ■

## CONFERENCES

DG Monitor Internet Briefing Series, *The Installed Base of U.S. Distributed Generation*, Tuesday, October 14, 2003, at 11 am EDT. To register please go to: www.webtrain.com click on "Browse Future Events", and navigate to the October 14th event titled "The Installed Base of U.S. Distributed Generation." You can enroll on that screen.

*Distributed Generation Applications & Utility Issues*, September 10-11, 2003, Portsmouth, NH.

*4th Annual Combined Heat and Power (CHP) Roadmap Workshop*, Sept. 22-24, 2003 Chicago, IL.

*The 16th NREL Industry Growth Forum: Financing the Path to Clean Energy and a Hydrogen Future*, Nov. 17-19, Austin, TX.

*Eighth Annual EPRI Premiere Distributed Energy Resources and Renewable Energy Conference and Exhibit*, New Orleans, LA, Oct. 15-17, 2003.

## *Ask the DG Monitor*

The new column responds to reader's questions about the DG market and DG technologies. Have a question for the Monitor? Email: askthemonitor@rdcnet.com.

***Reader Question:***

I am trying to figure out whether it would be economical to install DG on a rural electric system to improve reliability. I was wondering where I could obtain more specific information on installed cost, maintenance costs, and fuel costs for combustion gas turbine generators in Ohio? Also, how would you go about calculating fuel prices (dollars per thousand cubic feet for natural gas) into the total costs of running a DG unit?

*- C.P. in Ohio*

***DG Monitor Answer:***

The path most end users follow when exploring DG economics is to first consider the application and from this establish the best size DG unit to acquire. Together these parameters establish your choices for the most economical technologies to be further considered. You have obviously already determined that combustion gas turbines are your best choice for the desired application.

Most siting engineers use their previous experience to pick a particular DG unit for a technology. Since you are doing this analysis anew for your rural electric system, we suggest you start by contacting all the manufacturers of gas turbine generators in your size range. A list of manufacturers may be purchased as part of a market share report sold by several different consulting firms. However, you should be able to quickly create a fairly comprehensive list through web searches (maybe start with some of the links in www.distributed-generation.com) and the review of advertisements in magazines such as *Diesel and Gas Turbine Worldwide*. Then contact each manufacturer and request their capital cost, installation costs, maintenance costs and fuel consumption rate. After making comparisons, be sure to discount what seem to be out-of-range manufacturer estimates. Finally, check your resulting choice with other end users who have installed the same DG unit for a similar purpose elsewhere. Manufacturers should be able to provide references, or they can be obtained within public files of the Department of Energy (DOE), State of California, or State of Texas.

As for your second question, when RDC performs market assessments, we convert DG fuel consumption rates into costs using standard gas prices. Some utilities have access to wholesale rates as part of their normal business, other end users do not. Historic wholesale and retail gas prices are available at the state level from the DOE. While notoriously difficult to forecast accurately, DOE also provides gas price forecasts. RDC typically performs analyses for both the current city gate gas price and likely ranges of future prices. The economics of a DG unit vary considerably depending on the gas price assumed over the next 10 years (see page 7), so you are advised to analyze this variable carefully. The number of hours of operation per year obviously affects total fuel cost. Also don't forget fuel storage costs.

While it would seem that this type of elementary analysis would be cookbook, it rarely is. Currently almost all DG projects are sited uniquely at high cost, and most are done by specialty engineering firms or integrated solution providers. Indeed, this is a barrier to the more widespread adoption of DG (see page 3). RDC is currently performing a review of DG siting processes and costs for the DOE that will hopefully mitigate some of these costs. Watch for the report early next year.

*- The DG Monitor Staff*

## DG NOTES

*Aug 18, 2003* - **Northern Power Systems** will engineer, build, and operate a custom-designed, utility-connected MicroGrid® power network to serve several facilities within Mad River Park in Waitsfield, Vermont. This network will demonstrate integrated storage and DG technologies including engines, microturbines, wind turbines and photovoltaic panels with an initial aggregate capacity of approximately 350 kW. In later phases, emerging technologies such as fuel cells, Stirling engines and flywheels will be examined and may eventually be incorporated into the network. This project is supported by the Washington Electric Cooperative, the Vermont Department of Public Service, and the United States Department of Energy.

*Aug 18, 2003* - **Ballard Power Systems** introduced its Nexa® RM Series hydrogen fueled stationary fuel cell power generator. This modular system is scalable in 1 kW increments, and was developed to meet the needs of the uninterruptible power system (UPS) and telecommunications power markets.

*Aug 5, 2003* **- Caterpillar** sold five of its G16CM34 gas-fired reciprocating engines to supply energy for a new electrical power plant in Geneva, Illinois. The 29-MW power plant, capable of providing critical peak power for up to 40,000 homes, is scheduled to open in January 2004.

*July 31, 2003* - The American National Standards Institute (ANSI) certified **FuelCell Energy's** 1 MW Direct FuelCell® (DFC®) power plant, the DFC1500, as meeting ANSI Z21.83, the product safety standard for stationary fuel cell systems.

*July 30, 2003* - **LADWP** will install photovoltaic solar power systems at five branch libraries over the next two years. These new solar facilities are included within the LADWP commitment from its Public Benefits budget to assist in the installation of solar energy through June 2011. Solar systems approved in the specific agreement will provide up to 95 kilowatts of power, and produce about 148,000 kilowatt-hours each year.

*July 10, 2003* - A new Waldbaum's store on Long Island is the first supermarket in the United States to generate its own electric supply with a microturbine. A 60-kW microturbine, manufactured by **Capstone Turbine**, will run in parallel with a traditional electric grid and recycle the unit's heat to pull moisture from the air. The application resulted from a partnership involving Waldbaum's; KeySpan; the American Gas Association's National Accounts Energy Alliance; the U.S. Department of Energy's Oak Ridge National Laboratory; the New York State Energy Research and Development Authority; and the Gas Technology Institute.

*July 7, 2003* **- DTE Energy Technologies** completed a custom installation of three energy|now(TM) ENI 415 on-site energy systems for Medway Plastics Corp., a custom injection molding plastics company in Long Beach, CA. The ENI 415 units will provide base-load electric power generation, and waste heat from the engine jacket water will be used to drive a 151-ton, absorption chiller, which is used for cooling operations related to the injection molding process. The system will be remotely monitored by DTE Energy Technologies' energy|now System Operations Center(TM).

*July 1, 2003* - **Plug Power Inc**. introduced the GenSys(TM) 5P, a 5-kW, grid-parallel fuel cell system fueled by liquid propane gas. The system is being marketed to an audience that includes rural electric cooperatives, customers that have no utility-provided electricity supply, and federal and state government customers who require the remote fuel capability that LPG provides. ■