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Distributed Generation MONITOR

Demand Reduction Programs Open Market Opportunities for DG

Within the last two months all three Independent System Operators in the Northeast—ISO New England (ISO-NE), the New York ISO (NYISO) and PJM Interconnection—have developed year-round market-based demand reduction programs. Unlike past efforts, these new programs, all of which have been approved by the Federal Energy Regulatory Commission, go beyond asking consumers to reduce load during declared emergencies. They will instead allow customers to sell "negawatts" into the market, that is, to be paid market rates for using onsite generation to power their own load.

These new demand reduction programs have enormous potential to expand the market for DG in the Northeast. It is too soon to tell how large this market will be, but if past results are any indication, the impact may be significant. ISO-NE signed up 240 MW in past summer programs, and expects that this new program will garner at least that much of a response. Last summer PJM filed the first program of its kind—an emergency demand program that guaranteed customers a minimum of $500/MWh for load reduction during PJM declared emergencies. Within one month it had garnered over 100 MW in applications, 80 MW of which were approved.

ISO-NE has already met with success with its new program; two weeks before it was actually approved by FERC, 42 ISO-NE customers had signed up 21 MW to the program. Marketing companies in New England are expected to start signing up end users for the service as

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Wind Power Takes Off

In the last year wind power has shown new strength as a competitive player in today's power markets. Currently, the U.S. wind industry provides about 3.5 billion kWh of electricity each year. In 2000, only 53 MW of wind energy were installed in the U.S., but this year the American Wind Energy Association projects that as much as 2,000 MW of new capacity will be installed.

This explosive growth is due in part to electric industry restructuring in many states and the growing demand for "green" power. Traditionally, the electric industry has been handled as a natural monopoly, but as this view has changed, new opportunities for wind generation have emerged. Consumer choice is a key component of wind

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Japan: Hotbed for DG Technologies Testing

Japan is the world's second largest energy importer and also has the highest electricity costs in the OECD. In an attempt to address these problems, and in the process tap a potentially huge market, Japanese companies have turned to DG in increasingly numbers. Fuji, Hitachi Works, Ishikawajima-Harima, Mitsubishi, Osaka Gas, Toshiba, and Toyota are just a few of the growing list of Japanese companies engaged in DG development and testing. In addition, many Japanese companies have forged relationships with DG developers from around the world.

Fuel cell testing has been a particularly strong area of focus in Japan, especially testing of small scale fuel cell systems for stationary and portable applications. Several

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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 bi-monthly 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 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.

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RDC has entered its 21st year. Meeting our clients' needs has always been our top priority and we have consistently delivered outstanding consulting services to enable our clients to reach their goals. Clients include electric and gas utilities, energy companies and consumers, financial institutions, law firms, equipment vendors, trade associations, government agencies and international institutions.

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DG Notes

May 31, 2001 - **H Power Corp**., a fuel cell development company, announced the order of six Beta Residential Cogeneration Units by European energy company, **Gaz de France**.

May 29, 2001 - **Underwriters Laboratories Inc. (UL)** has certified the Model 330 **Capstone** MicroTurbine™ power system as meeting its UL1741 utility interactive requirements. The Capstone MicroTurbine is the only microturbine generator to achieve this safety certification.

May 22, 2001 - Congressman Jack Quinn (R-NY) introduced HR 1945, and Senator James Jeffords (I-VT) introduced S 933, which would require the Federal Energy Regulatory Commission to establish uniform, nationwide interconnection standards for CHP plants and other clean, efficient distributed generation technologies one year from enactment, addressing issues such as backfeed to the grid and safety measures. The legislation does not require states to allow retail competition or open access to distribution systems.

May 10, 2001 - Within the next few months, fuel cell developer **H Power Corp** and partner **Energy Co-Opportunity, Inc. (ECO**) expect to start manufacturing and shipping to market a residential fuel cell system for the California market.

May 10, 2001 - In several Chicago-area homes, a pilot project will assess the benefits of small residential fuel cell generating systems. The units will be installed by the **Community Energy Cooperative** and **EPRIsolutions** who hope to make these systems a practical reality within about two years.

May 4, 2001 - The Minnesota Senate voted unanimously to require all utilities in the state to make electricity produced from renewable energy available to their customers.

May 7, 2001 - New York State's Department of Environmental Conservation (DEC) will begin to draw up emissions standards for DG units. DEC will work with other states to ensure consistency in regulations.

April 30, 2001 - **Cummins Inc.** and **Capstone Turbine Corporation** announced a three-year agreement in which Cummins will incorporate Capstone's 30 and/or 60-kW microturbine systems into its new line of turbine powered generator systems to be sold worldwide, with the exclusion of Japan and Mexico, later this year.

April 16, 2001 - The San Diego Regional Energy Office (SDREO) will lead a new $15 million program through which electricity generation systems including small gas turbines, microturbines, wind turbines, solar, fuel cells, and non-diesel reciprocating engines, can receive as much as $4.50 per watt and up to 50% of the project's cost as monetary incentives for self-generation.

April 4, 2001 - **ALLIED Utility Network, ZeTek Power Corp**., and **SatCon Technology Corp**. will collaborate to develop networked, zero-emission, commercial-sized alkaline fuel cell power generation systems to be operated either on the grid or on a stand-alone basis. The three-phase program consists of a small scale modeling exercise leading to 500kW of networked fuel cell systems and finally the installation of up to 50MW of generating capacity.

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soon as they receive rate approvals from state regulators.

The three ISO programs are not identical, but they are similar in that each has separate programs for emergency demand reduction (generally paid $500/MWh or the market clearing price, whichever is higher), and an economic component that allows customers to decide if and when they want to participate in this new market. Customers must be able to reduce load by at least 100 kW or more for a minimum period of time.

What will make program participation attractive for downstream energy users is the ease by which they can access market prices with a minimum of equipment. Because customers will not actually be exporting electrons into the grid, they will not have to worry about signing separate wheeling agreements or file to become interstate marketers.

Instead, customers will simply need to have interval meters installed on their facilities and the ability to communicate with the ISO (or the third party company that is aggregating the load) and to verify load reductions. In New England they will be required to install Internet software to tie into the real time market. However, ISO-NE will be paying for the first 1,000 installations this year, and next year it is anticipated that Internet companies will be competing to provide the service.

PJM's Demand Reduction Program, which covers Pennsylvania, New Jersey and Maryland, allows Load Serving Entities to compete with each other to offer bids for reduced loads by end users. Companies that are already committed to reduce loads under "Active Load Management" contracts can still participate in the program, to the extent that they can reduce loads even further. For details go to www.pjm.com.

NYISO chose a three-pronged approach which includes an emergency load reduction program and two market-based programs: day-ahead demand reduction bidding (allowing customers to signal their willingness to sell into the NYISO day-ahead market at a particular price) and zonal price-capped load bidding (allowing customers to specify a price above which they will no longer buy from the day-ahead market). For details go to www.nyiso.com.

ISO-NE created two classes of interruptible load customers, which can be enrolled by any NEPOOL member. "Class 1" customers respond to declared emergencies and are paid the market clearing price, while "Class 2" interruptible customers can participate in the market whenever the clearing price exceeds $100/MW, based on real-time pricing. ISO-NE believes that its efforts will have a stabilizing influence on the volatile wholesale market, because even small injections of capacity in times of constraint can have a significant impact on price. For details go to www.iso-ne.com.

Programs like these will not be restricted to the Northeast. FERC has already issued an order calling on all ISOs to develop demand reduction programs. In the West, Bonneville Power initiated a similar program last summer, offering customers within their territory a percentage of the California Border price for reducing load.

While demand reduction can be achieved by merely shedding load during peak periods, DG is considered in each of these programs to be the linchpin to demand reduction efforts. In turn, these programs can open new opportunities for DG in markets nationwide. Customers who are considering DG installation (or upgrading existing equipment) may be able to recover their capital costs much more quickly by participating in demand reduction programs, particularly if they are able to participate year-round.

CONFERENCES:

Natural Gas & Power Generation Strategies 2001, 13-15 June, 2001, Tucson, AZ.
RDC's E.J. Honton will present "Emerging Opportunities for Power Generation Due to Restructuring."

International Symposium on Distributed Generation: Power System and Market Aspect, 11-13 July, 2001, Stockholm, Sweden.

The Clean and Green Technology for Tomorrow's Energy, 10-11 July, 2001, Tokyo, Japan.

EI Fuel Cell Transportation Technology Summit, 11 June, 2001, San Jose, CA.

Fuel Cell 2001: European Fuel Cell Forum, 2-6 July, 2001, Lucerne, Switzerland.

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energy growth, as there is evidence that some customers are willing to pay extra to ensure that their power is green. In fact, in an article published on April 24, 2001, the Tennessee Valley Authority reported that demand by its customers for green power was much higher than they had anticipated. More than 3,300 homeowners and businesses across the Tennessee Valley have signed up, and evidenced their willingness to pay more for green power. In late April, PECO Energy Company and Community Energy Inc., a renewable energy marketing company, announced they will also offer wind-generated green power to PECO customers in southeastern Pennsylvania on a voluntary, premium-price basis.

Government has assisted with the development of wind energy through both environmental policies and incentive programs. At the Federal level, a wind energy production tax credit (PTC) is currently in place that provides a credit of 1.5 cents, adjusted for inflation, per kWh of electricity generated by a new wind plant during the first 10 years it operates. States have begun similar programs, and in early April, the California PUC announced a new $15 million program to provide businesses with monetary incentives for self-generation. Wind turbine systems in California can receive a $4.50 per watt incentive up to 50% of the project's cost.

Technological advances have facilitated the emergence of wind energy into the market in a wide variety of ways. In one example, in March of this year, SatCon Technology Corporation announced the introduction of three technologies that may enable the usage of distributed power, including wind power. The PowerGate™100 converts DC electricity to AC electricity, the GridLink™8 is a utility interface controller that allows operation either in grid parallel (connected to the grid) or grid independent (not connected to the grid), and the CellPack™48 is an energy storage device that handles peak loading for the power generation technology. These technologies, and others both in the market and under development, will make both independent wind energy usage and grid interconnection more feasible.

Incentives, market changes and technology advances, plus energy supply and price concerns, especially in the west, have combined to make the conditions strong for U.S. wind energy market development. Responding to this potential, German wind developer proVENTO International announced this April it will invest $7.5 million in a U.S. headquarters facility and six 1.3-MW wind turbines on the Eastern Shore of Virginia. They are not the only ones to see a potential market. In early May, Exelon Power Team and Waymart Wind Farm L.L.C. announced they were collaborating on a 50-MW wind-powered electric generating plant near Scranton, Pennsylvania.

These projects, and a slew of others, illustrate the opportunity the U.S. wind industry has to compete in the emerging energy market. Already, U.S. firms are marketing utility wind turbines worldwide, and have installed turbines in Canada, The Netherlands, Mexico, South America, Spain, Ukraine, and the United Kingdom. As the U.S., and the International markets for wind energy develop, the sky is literally the limit to wind's ability to provide efficient and green power.

RDC DG NEWS

Presentations

"DG Interconnection & the Business Deal" - N. Richard Friedman, Distributed Generation & On-Site Power Conference, New Orleans, LA, March 21, 2001.

"The Role of Distributed Generation in Minnesota's Energy Future" - N. Richard Friedman, Sharing the Load: Local Energy Generation & Distribution Statewide Action Congress, St. Cloud, MN, March 29, 2001.

"Distributed Generation: Concepts, Technologies, Applications & Markets" - N. Richard Friedman, Intertech Distributed Power Conference, Pre-Conference Workshop, April 23, 2001.

"DG Interconnection & the Business Deal" - N. Richard Friedman, Distributed Power 2001 Intertech's 3rd Annual Conference, Washington, DC, April 25, 2001.

DG APPLICATION SERIES: PREMIUM POWER

Premium power is an application of DG that provides electricity at a higher level of reliability and/or power quality than is typically available from the grid. A complete premium power solution includes generation or backup power, along with power conditioning equipment.

The financial benefits of premium power will vary, depending on the potential loss to a company from power outages or disruptions caused by variances in power quality. Demand for reliable power is growing as companies become more computerized and safety standards are increased. The growing market for premium power—particularly among non-traditional users—provides attractive opportunities for utilities to provide a value-added service to their customers.

End users have different premium power needs which can range from only needing power to allow safe building evacuation during a grid interruption to requiring an uninterrupted supply of power of very high quality for extended periods of time.

Emergency Power Systems (EPS) automatically provide electricity to replace the normal source if it fails. In this case the system is used to power critical devices that protect health and safety, or ensure the protection of property. Typical systems include battery-based lighting, small backups for computers and communication, and engine-generator sets to power equipment for short durations in an emergency.

Standby Power Systems (SPS) allow a facility to continue to operate for an extended period if the normal power source fails. Engine-generator sets or turbine-generator sets that are sized larger than emergency power units allow facilities to operate normally and provide for a smooth transition from grid power to the DG technology.

True Premium Power Systems (TPPS) provide uninterrupted power, free of virtually all frequency variations, voltage transients, dips and surges. Power of this quality is not available directly from the grid but rather requires either emergency or standby power along with auxiliary power conditioning equipment, such as transient voltage surge suppression and harmonic filters. As an alternative, the DG technology can be used as the primary source of power, with the grid available as a backup. Data centers are a particularly fast growing customer base for TPPS applications (see February/March issue for more on data centers).

Traditional Premium Power Customers

Type of Power	Customer Segment
Emergency Power Systems	• Apartment buildings, Hotels, Office buildings • Schools • Theaters, stadiums, and other public gathering places • Industrial facilities that must remain operational to assure work safety
Standby Power Systems	• Commercial and Military Airports • Medium-Large Dairy Farms • Some Fire and Police stations • Military bases with active-duty troops • Natural Gas Transmission and Distribution • Medium and High-Security Prisons • Water supply and sewage treatment plants • Industrial facilities harmed by power interruptions (e.g. chemicals and plastics)
True Premium Power Systems	• Businesses with large, mission-critical computer systems (e.g. airlines, banks, brokers, computer data processing centers) • Communications stations (e.g. telephone companies, Cable TV, Internet service providers, cellular phone stations) • Large hospitals and other health care facilities • Some Airports, Fire and Police Stations • Industrial facilities damaged by poor power quality and power interruptions (e.g. fabric mills, paper manufacturers and printers)

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fuel cell systems are already installed in Japan, ranging from a 5-MW urban energy center installed at Kansai Electric by Fuji to over 100 plants of between 50 kW and 200 kW supplied by IFC, Toshiba, Fuji and Mitsubishi, and many more applications are possible. "We have long viewed the Japanese market as a favorable market for fuel cells," said Mark Brodsky, President and CEO of Massachusetts based Nuvera Fuel Cells in a recent company press release. Nuvera just announced a joint venture with Mitsui & Co., Ltd. to first study the feasibility of fuel cells in the Japanese market, and then develop, manufacture, market, distribute, and service integrated fuel cell power systems for a wide variety of applications.

Nuvera is not alone in seeing great potential in the Japanese fuel cell market. In late March, New Jersey fuel cell developer H Power Corp. announced it will integrate Tokyo-based Kurita Water Industries' water purifier into its 40 kW H Power residential cogeneration fuel cell systems for beta testing in Japan. That same week, H Power announced plans to develop and test a new 500 watt residential cogeneration fuel cell system for the Japanese residential market using a fuel processor from Osaka Gas Co., Ltd., a natural gas utility in the Kansai area of Japan. Canadian Ballard Generation Systems shipped its fifth 250 kW stationary fuel cell power generator in April for field testing at the Nishimachi Sewage Treatment Centre in Tomakomai, Japan, and is also in a collaboration with Tokyo Gas Co. Ltd. to develop a one-kilowatt cogeneration fuel cell stationary generator for the Japanese residential market. Finally, this December, Oregon based IdaTech announced it will deliver prototype 1 kW and 3 kW PEM fuel cell systems to Tokyo Boeki for field testing for residential and portable applications.

Microturbines have also garnered interest in Japan. Domestic models have been developed; Nissan Motors has had a 2.6 kW microturbine available in Japan since 1996. Several Japanese companies have also forged agreements with California based Capstone Turbine Corporation. In April, Meidensha-Sumitomo and Takuma Co., Ltd., of Japan announced they will purchase 100 and 250 Capstone MicroTurbine™ power systems respectively over the next 12 months to integrate with their own technologies. Demand for these products has been strong: Takuma already has orders for its Capstone-powered TCP-30 from several Japan utilities, including Tokyo Electric Power Company, Tokyo Gas, Osaka Gas, Chubu Electric and others.

Many of these DG developers, manufacturers and testers feel that new opportunities arising from deregulation of Japanese energy market, combined with Japan's growing energy demands and need for fuel diversity and lower cost electricity, can mean a potentially strong market for DG technologies in Japan. In addition, Japan, already one of the main exporters of energy-sector capital equipment, and engineering, construction, and project management services, is ideally suited for the development and commercialization of DG technologies for applications in other markets as well. As this recent flurry of DG testing and development in Japan shows, the Japanese market bears watching. Results there will have long term impacts on the commercialization of DG technologies not only in Japan, but world-wide.

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New Customers for Premium Power: Analyzing the Cost of Power Outages

Many organizations have not considered premium power because they believe that the costs of outages are less then the cost of the equipment needed to prevent these outages. For this reason, an analysis of the cost of interruptions can help customers accurately understand the benefits of premium power. Air reservation systems and credit card and brokerage operations are just a few of the traditional premium power users that already know these costs. This group can lose anywhere from $100,000 to several million dollars for one hour of lost power.

Annually, about 37,000 DG units are sold in the 20 kW-15 MW size range, and only a portion of these are used for premium power. A significant number of businesses not currently using DG solutions for premium power, including those in the food, beverage and drug industries, retail sales, accommodations, and amusement & recreation, may benefit from these technologies.