Volume III, Issue 6, November/December 2003

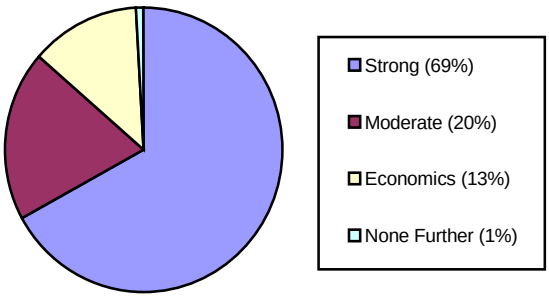
DG MONITOR[SM]

2003 Distributed Generation Survey Results

Over the last three years, the Resource Dynamics Corporation has asked visitors of www.distributed-generation.com to fill out a short survey regarding their interest in distributed generation (DG) technologies and applications. For 2003, a few new trends were seen, and many patterns began to emerge.

As expected, most of the survey respondents carried a strong interest in DG, since they were visiting a site dedicated to distributed generation. This year, 69 percent of the respondents claimed a strong interest, but this is down from 2002 when 86 percent showed strong interest. As opposed to previous years, many more claimed a moderate interest in DG (20%) or claimed they would be interested only if the economics improve (13%). Only 3 percent claimed they were no longer interested in distributed generation after visiting the site. The results are summarized in the pie graph below.

Interest in Distributed Generation



Site visitors were then asked which DG technologies were of the most personal interest. Since respondents could select more than one technology the results sum to more than 100 percent. Once again, the most interest was expressed in fuel cells and microturbines. These relatively new technologies have *(continued on page 5)*

California DG Exit Fee Waiver "Terminated?"

On his first day in office, Governor Arnold Schwarzenegger ordered a halt to all pending regulations, and a review of these and the last five years' worth of regulations. Schwarzenegger spokesman Vince Sollitto stated "[t]he review is to assess the impact on a variety of factors, including the economic climate, the ability to foster jobs and economic growth." Executive *(continued on page 7)*

PROMOTING DG TO ENHANCE THE T&D SYSTEM

The recent blackout has generated heightened awareness and sharpened the public policy focus on reshaping the future of the U.S. power delivery system. The Resource Dynamics Corporation, publisher of the DG Monitor, and Bingham McCutchen LLP are organizing the Council for Distributed Grid Enhancement (CDGE). CDGE will nationally promote DG as a solution to modernizing and strengthening our grid, and will be developing breakthrough concepts (some already on the drawing board) having the potential to revolutionize the role of DG in grid enhancement. CDGE stakeholders will be pushing the implementation of financial and policy incentives designed to lower the barriers to and ease the adoption of DG, and will be reaching out to policymakers, the public and the media. CDGE's goal is to become a sustaining center to advance and advocate near-term DG.

CDGE is being formed now, with a dozen key organizations expected to create the CDGE foundation. The kickoff meeting is being planned for early February 2004. If interested in learning more, contact N. Richard Friedman at 703/356-1300, Ext 203 or at nrf@rdcnet.com.

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 calling 703/356-1300.

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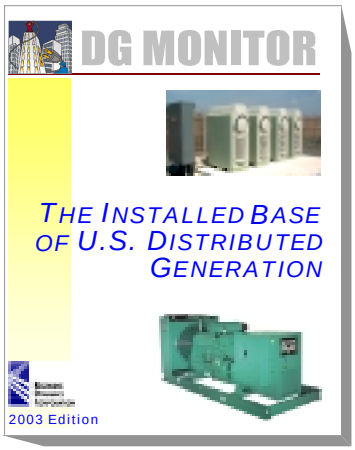
The **Resource Dynamics Corporation (RDC)** creates business solutions that empower clients to compete effectively in changing energy markets. Often, these involve evaluating the role of new technologies. All senior staff have both business and engineering backgrounds, with a distinct focus on strategy 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.

For more information, see www.rdcnet.com.



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 2004 DG Sourcebook!*** Available in November 2003, this report is 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.

APPLICATION SERIES: SUPPLEMENTING DG WITH THERMAL ENERGY STORAGE

Thermal Energy Storage (TES) uses ice or another material to store latent cooling (or heating) energy during periods when the cooling can be produced relatively inexpensively. This latent energy can then supplement DG generation during peak demand periods, in effect increasing the capacity of the DG system

Depending on building type and location, it is not unusual for air-conditioning chillers to contribute up to 40% of a building's on-peak electrical demand. Thermal storage allows users to turn off those chillers during the day, and dedicate the power they would have consumed to the remaining electrical loads. Using TES, a 1,000 kW building could be reliably and safely supplied by a 600 kW or 800 kW power generator.

To demonstrate the simple value of TES in everyday life, consider that to *instantaneously* heat water for a morning shower you would need 18 kW of electric power. However the largest electric domestic water heater has at most a 4.5 kW element in it. In this example, the use of storage reduces the power required to meet the load by a factor of 4. TES used for cooling buildings can have similar results.

There are two basic approaches to designing TES systems. In the first approach, full storage, a full size chiller is operated only during the night, producing and storing enough cooling (either in the form of ice or chilled water) to meet all of the following day's air-conditioning needs. In the partial storage approach, an approximately half-size chiller runs throughout the entire day, storing cooling at night and using the stored chilling directly during occupied hours.

Although it reduces demand by only half, the partial storage option requires half the chiller capacity and less than half the storage of the full storage method. In fact, partial storage systems are often installed for the same, or lower, cost than a conventional, non-storage, cooling system. The savings in chiller, cooling tower, electrical infrastructure, condenser piping etc. needed for a conventional cooling system offset the investment in the storage equipment. In many cases, TES makes a relatively small, simple and inexpensive air-cooled chiller a viable alternative to water cooled equipment.

Storage systems can provide the same capability as conventional systems and reduce the electrical peaks caused by chillers, which are often oversized in the industry.[1] TES may also allow you to take advantage of less costly, off-peak grid power.[2] When the nighttime utility rate proves less expensive than producing power onsite, the user can turn off the generator and produce cooling using utility power at rates that can be much less than those available on-peak, when demand charges are included.

These benefits are transparent to the building occupants. Comfort is equal to conventional equipment. There is no shedding or prioritizing of loads required. However, although the reduced generator capacity can sometimes ease the permitting process, there may be other areas of concern with a TES installation. For example, an increase in nighttime noise could be an issue.

TES is successfully operating in over 6,000 buildings throughout the world, from schools and places of worship to large office buildings and arenas. Also, more and more regulatory agencies are recognizing the advantages of consuming power off-peak; consider, for instance, the introduction of time dependent valuation for energy, which applies an hour-by-hour factor to energy savings (e.g. values energy savings more during on-peak times than during off-peak times), in California. Prior to deregulation, utilities across the country recognized the value of TES and Demand Side Management to increase load factors and these same tools are available to distributed energy producers.

1. MacCracken, M. 2002. "Thermal Storage Myths." *ASHRAE Journal*, Sept. 2003.
2. Audin, L. 2003. "Central Plant Savings." *Engineered Systems* (5).

This guest article was written by Mark M. MacCracken, CEO, Calmac Manufacturing Corporation, MMacCracken@calmac.com, based on his experience installing many TES systems. ■

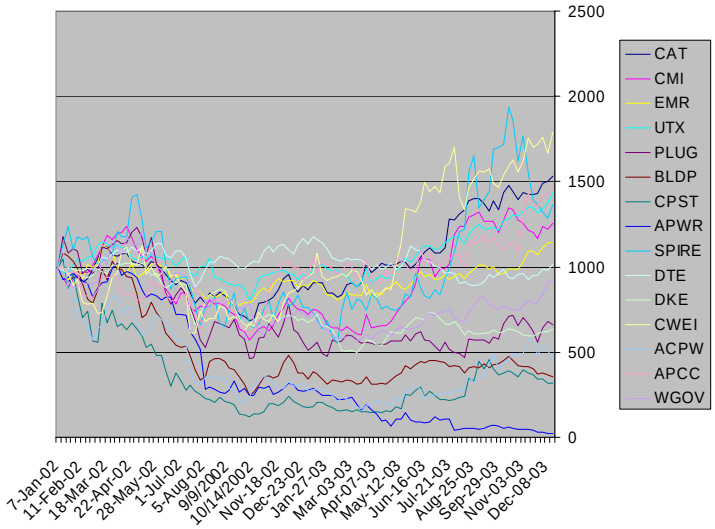
RDC DG NEWS

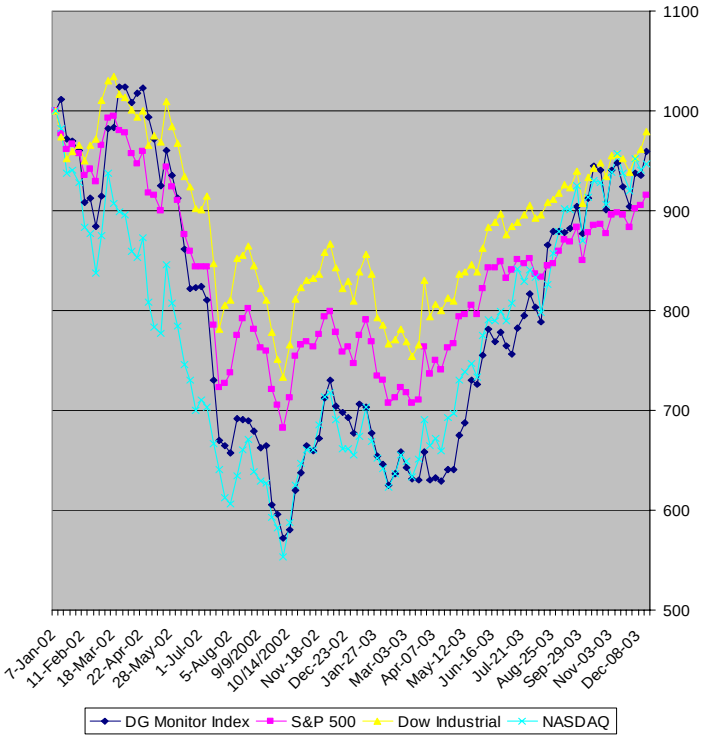
American Railroad Equipment Contract. The Resource Dynamics Corporation has been retained by American Railroad Equipment to provide feasibility studies for their containerized 2.5-2.9 MW diesel and dual fuel reciprocating engine DG power plants.

The DG Monitor Index℠

The DG Monitor Index℠ continues to lag the Dow Industrials, but now has surpassed the returns of the both S&P 500 and the NASDAQ from January 2002 through December 8, 2003, although there has been a considerable regrouping of all three. Since late 2002, the DG Monitor Index has been closely aligned with the NASDAQ.

Top-performers since January 2002 include Spire, Clayton Williams Energy, and Caterpillar. The poorest performers continue to be emerging technology manufacturers. Laggards from January 2002 include Astropower, Ballard, and Active Power.





Companies included in the DG Monitor Index℠ include: Active Power; American Power Conversion; AstroPower Incorporated; Ballard Power Systems; Capstone Turbine; Caterpillar Incorporated; Cummins Incorporated; DTE Energy; Duke Energy Corp; Emerson Electric; PlugPower Incorporated; Spire Corporation; United Technologies; Clayton Williams Energy; and Woodward Governor Company.

Because of the evolving DG market, some changes to the composition of the Index will be considered in the next issue. ■

Energy Bill Stalled in Senate

A final vote on the $31 billion energy bill was blocked in the Senate on November 21st 2003 when the bill's supporters came two votes shy of the 60 votes needed to end debate on the bill. HR 6, known as the Energy Policy Act of 2003, was passed by the House in mid November, but faced stiff opposition in the Senate.

The last energy bill, introduced during the 107th Congress, died in conference after lengthy negotiations. This new energy bill, weighing in at over a thousand pages, was written largely during closed-doors negotiations between Senate and House Republicans, and contains many controversial items including tax breaks for oil, gas, *(continued on page 7)*

CONFERENCES

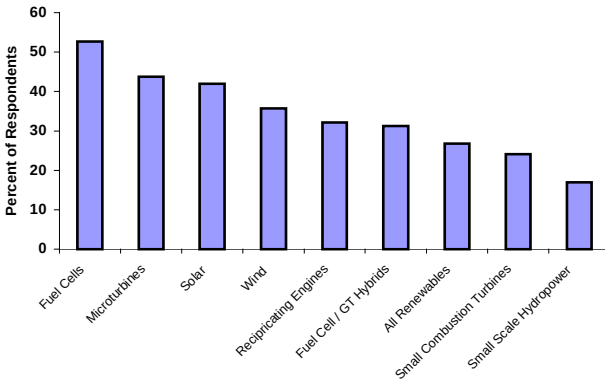
5th Annual International Symposium on Distributed Energy Resources; "Sustaining the Momentum: Delivering the Benefits," La Jolla, San Diego, CA, January 26-28, 2004.

IDEA 17th Annual Campus Energy Conference, San Diego, CA February 11-13, 2004.

5th Annual USCHPA Policy Day Conference, Washington, DC, May 10 - 12, 2004.

(Survey, continued from page 1) been the top two areas of interest in this survey for the last three years, with fuel cells always coming out on top. This year, fuel cells received interest from 53 percent of survey respondents (slightly down from the past two years, but still number 1), and microturbines received interest from 44 percent. Interest in solar power rose 13 percent compared to last year, receiving votes in 42 percent of the surveys. Wind turbines, reciprocating engines, renewables, and gas turbine/fuel cell hybrids all received interest from around 30 percent of the respondents. Small combustion turbines received only 24 percent interest, and small-scale hydropower showed the least interest, at only 17 percent. However, both of these numbers are up slightly from last year. These survey results are illustrated in the bar graph below.

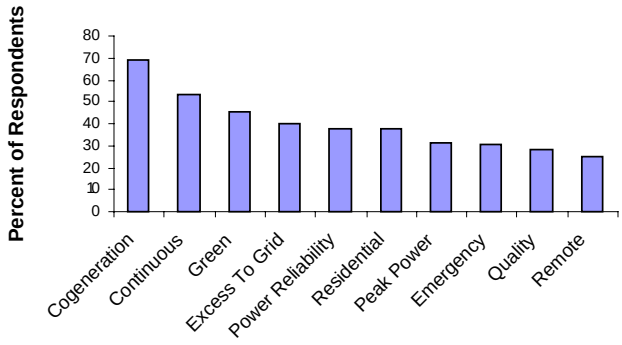
Interest In DG Technologies: 2003



Visitors were also asked what other distributed generation technologies they were interested in. Stirling engines and hybrid Stirling engine/fuel cell combinations both came up more than once. Another area commonly addressed in the surveys was waste-derived fuels and technology, including anaerobic digester gas and wood or biomass-fueled steam turbines or gasification systems. These systems conserve natural resources and often receive special government grants and incentives. Among other technologies, flow batteries, gas expanders, absorption chillers, and thermoelectric systems were also mentioned in some of the surveys.

The next survey question asked site visitors to specify which DG application(s) interested them most. As with previous years, cogeneration/ combined heat and power (CHP) applications received the most attention with 69 percent of respondents claiming interest. The number of people interested in CHP has risen each year, perhaps as DG users realize the many potential benefits of CHP systems. Continuous power was the second most

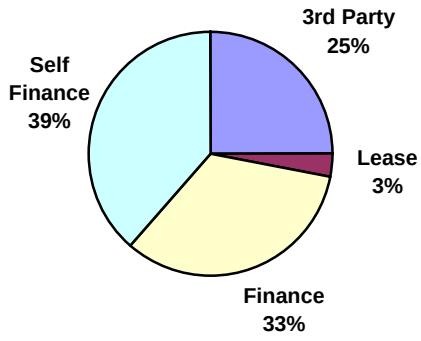
Interest in DG Applications: 2003



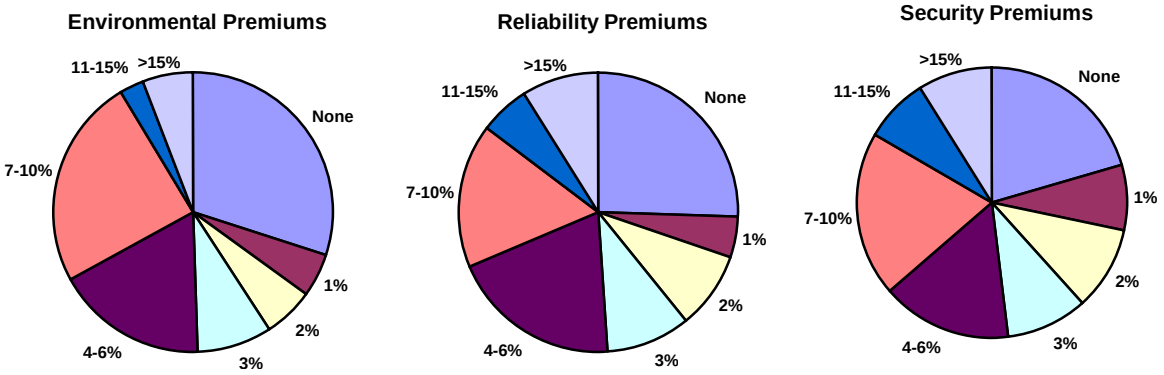
popular type of application, receiving interest from 54 percent of those surveyed. This number is also up significantly from previous years. Green power applications continued their slow rise, with 46 percent of respondents showing interest. Residential applications also saw a rise in interest, receiving votes from 38 percent of respondents. Other power applications, like selling excess power to the grid, quality, power reliability, and emergency power, all received about the same amount of interest as previous years, although interest in peak shaving applications dropped from 42 to 31 percent. Remote power applications remained as the lowest interest of all DG applications, at 24 percent (about the same as previous years). The results of this survey question are summarized in the bar graph above.

DG customers have four basic ways to pay for their equipment. They may finance it themselves, partner with a third party, lease the equipment, or finance it through a lending institution. The Resource Dynamics Corporation asked site visitors how they would finance their DG equipment, and the results are summarized in the pie chart. Most customers would finance their equipment *(continued on page 6)*

Method of Acquiring DG Equipment



(Survey, continued from page 5) in some way, either by themselves (39%) or through traditional lending institutions (33%). The percent of customers who said they would finance it themselves is up 12 percent from the 27% reported last year, but still down 3 percent from the 42% reported in 2001. The number of customers who say they would finance through lending has remained steady at around 30 percent throughout the years. Many fewer customers expect to lease equipment (only 3%, down from 17% last year), and about the same number of people as last year say they would obtain the equipment through a third party (25%). Overall, it appears that potential DG purchasers may be more confident than last year, being willing to finance the equipment themselves instead of leasing it for the short-term. This could be a good sign for DG equipment manufacturers and distributors.



Premiums for DG equipment are typically on the order of 1%-15%. RDC asked site visitors what type of premiums they would consider, and what percent they would be willing to pay. Security premiums were more popular this year, with 79 percent of respondents willing to pay (as opposed to 70 percent last year). Reliability premiums retained about the same interest as 2002, with about 75 percent willing to pay. Interest in environmental premiums was down this year, however, though still high with about 70 percent willing to pay a premium. Also, fewer customers were willing to pay high premiums (>10%) for environmental reasons. For all of the cases, however, well over half of the customers are willing to pay between 1 and 10 percent extra to ensure the environmental quality, reliability, and/or security of their product, and a few customers are willing to pay premiums over 10 percent. The survey results are summarized in the following pie charts.

Finally, www.distributed-generation.com visitors were asked how DG technologies and economics would have to change for them to consider using DG. While most site visitors simply stated that the economics needed to improve (i.e. lower capital and maintenance costs), some interesting responses were also provided. Most were aimed at utilities and governments, stating that barriers to market entry need to be broken, or interconnection standards need to be improved. One respondent suggested that utilities need to be more cooperative regarding interconnects and that "graciously offering 3 cents per kilowatt-hour is not an encouraging proposition." Other respondents suggested that the utility rates and standby charges are unfair, and that prohibitive interconnection policies need to be improved. Many visitors suggested that state and local governments should offer more tax incentives and rebates for DG users to encourage use. No matter what the complaint or suggestion, it is evident that some changes are required before DG is accepted by the mainstream.

These survey results mirror trends the DG Monitor has been observing over the last years. DG projects have moved from theory to practice. Fuel cells and microturbines continue to carry the most interest among DG technologies, although reciprocating engines continue to dominate the marketplace. Interest in photovoltaic systems and other green technologies is on the rise. DG developers, owners and operators realize that peak shaving economics are not always a viable solution, while CHP continues to work in many situations. The noted shifts in project financing and willingness to pay a premium for enhanced DG values reveal what customers facing the practicalities of DG installations are thinking.

The DG survey is an ongoing process. We plan on evaluating the information annually to gain insight and establish trends. To participate in the survey or to view the survey questions, please visit www.distributed-generation.com/survey.htm. ■

(Exit Fees, continued from page 1) Order S-2-03, issued November 17th, could affect everything from a new law requiring a minimum level of nurses on duty to proposed rules on power plants and air quality.

The rule directly impacts the DG market by putting the status of California Public Utility Commission (CPUC)-issued Decision 03-04-030 in question. This decision, issued in April of 2003, outlines a mechanism for exempting a range of DG customers from paying power surcharges known as "exit fees" or "cost responsibility surcharges" (CRS). Under April's Decision guidelines, the basic ground rules for utility customers that leave the utility system, in part or entirely, to self-generate electricity are:

- Systems smaller than 1 MW that are net metered and/or eligible for CPUC or Energy Commission incentives for being clean and super clean are fully exempt from any surcharge, including solar, wind, and fuel cells.
- Ultra-clean and low-emission systems 1 MW or greater that meet Senate Bill 1038 requirements and comply with California Air Resources Board 2007 air emission standards will pay 100% of the bond charge, but no future Department of Water Resources (DWR) charges or utility undercollection surcharges.
- All other customers will pay all components of the surcharge except the DWR ongoing power charges. When the combined total of installed generation reaches 3,000 MW (1,500 MW designated for renewables), any additional customer generation installed will pay all surcharges.

Under the governor's second executive order, proposed rules will be stalled for up to six months, and some may be frozen indefinitely.

Following this issuance of this order, the California Energy Commission (CEC) sent a letter to the Office of Administrative Law (OAL) requesting the return of the proposed CRS regulations for further review. Pursuant to Section 1(d) of the Executive Order, the CEC will review and reevaluate the potential impacts on business of the proposed regulations and resubmit the results of this review to the Legal Affairs Secretary and OAL as quickly as possible.

However, there are some conditions under which the CRS regulation could be granted an exception from being withdrawn. In a November 20 letter to California's Director of Finance requesting an exception, the CEC stated that putting the CRS regulations on hold will cause uncertainty in the DG market. Businesses seeking to install DG consider whether or not they will be exempt from paying exit fees when making their decision. Without a process in place to determine who qualifies for the exemptions, potential DG users face greater uncertainty. California public utilities, the letter continues, also need to know who is exempt for their own accounting purposes.

Several letters were attached to the CEC request, in which various stakeholders expressed their concern about the impact of Executive Order S-2-03. The CEC is waiting to hear back from the Director of Finance regarding their exception request, although it will not be any sooner than mid-December. ■

(Energy Bill, continued from page 4) coal and nuclear industries and a liability waiver for manufacturers of the gasoline additive MTBE. Two particularly controversial measures were not included in the bill, namely increasing automobile gas mileage requirements and allowing drilling for oil in Alaska's Arctic National Wildlife Refuge.

Supporters of the bill claim it would increase and diversify energy production through $23.5 billion in tax incentives for energy producers, increase energy security by strengthening the electricity grid and foster America's energy independence. The bill contains requirements to increase ethanol production, doubling it to 5 billion gallons a year by 2012 and, supporters claim, will increase jobs in the energy industry. Opponents argue that the $31 billion bill is too expensive, and that its many provisions cater to special interests.

The bill, which would be the first overhaul of the nation's energy policy since 1992, contains several provisions that would potentially impact DG. These include:

- Tax breaks of $5.5 billion for renewable energy sources -- wind, solar and biomass.
- Tax incentives for improving energy efficiency of homes and appliances, including a tax credit for buying hybrid gas-electric cars.
- Funding for research on hydrogen-powered fuel cells.

Approval of an energy bill has been a top priority for President Bush, and supporters of the bill say they will reintroduce the bill after Congress reconvenes in January. Until that time, many questions about the future of energy in the U.S. and of DG remain unanswered. ■

DG NOTES

Dec 2003 - The US Army selected **Stirling Technology Co.** to design and build a micro-cogeneration system for use in mobile field kitchens.

Nov 21, 2003 - Pierce College's new green power program includes a 191 kW **Powerlight Corporation** solar system, and a 360-kW cogeneration system comprised of six **Capstone Turbine** microturbines. The $4.1 million project cost, managed by general contractor **Chevron Energy Solutions**, was offset by over $2 million in state and municipal rebates, with the balance paid with funding approved by voters within the Los Angeles Community College District (LACCD) in April 2001.

Nov 20, 2003 - **DTE Energy Technologies** signed a $5.4 million contract with **NextEnergy** to develop, construct, operate and maintain a Microgrid in the Power Pavilion on the NextEnergy site in Detroit. The Microgrid project will use fuel cells, internal and external combustion engines, miniturbine technology and photovoltaic cells. The project is scheduled to be completed by December 2004.

Nov 19, 2003 - **FuelCell Energy, Inc.** and **Caterpillar Inc**. finalized a contract with the City of Westerville Electric Division to supply a 250 kW Direct FuelCell® power plant to feed power at a substation into the local electric distribution system in Westerville, Ohio. The State of Ohio Third Frontier Project award is the first by the state of Ohio, which is investing more than $100 million in an initiative to expand fuel cell R&D.

Nov 2003 - The U.S. Department of Energy (DOE) awarded **IdaTech** $9.6 million for the development of a 50-kW PEM fuel cell system suitable for providing grid-independent energy sources for large facilities. IdaTech's partners for the program include **Hydrogenics Corporation**, Sempra Energy, Puget Sound Energy, Marriott International and the California Hotel and Lodging Association.

Nov 2003 - **Energy Concepts Co**. factory demonstrated its new ThermoCharger inlet air cooling system, developed with cost-share assistance from the U.S DOE and **Ingersoll Rand Energy Systems**. The system uses turbine waste heat and, through an absorption process, cools the waste heat and funnels it back into the turbine's air intake. Inlet air cooling of turbines can add up to 40% capacity on warm days and increase the fuel efficiency by up to 10%.

Nov 2003 - A **Cummins** reciprocating engine, using **Westport Innovations Inc.'s** direct injection technology, was integrated into the Alberta power distribution system. The engine, primarily installed as a back-up unit for the wastewater treatment plant, is now being used by the city of Grande Prairie as a source of revenue by exporting up to 1.6 MW of power capacity to the Alberta Power Pool.

Ask the DG Monitor

Have a question for the Monitor? Email: askthemonitor@rdcnet.com.

Reader Question:
I work for a small natural gas company and would like to know when converting gas to electricity makes sense. Does the answer vary by gas volume availability, in particular in the 100 million cubic feet/day to 2,000 Mcf/d range?

– D.N., Illinois

DG Monitor Answer:
The first factor to establish is the magnitude of the "spark spread" – which is the difference between the price of generating electricity using natural gas and the price of purchasing electricity, in a particular territory. This varies considerably across the U.S. and the globe. For example, the largest spark spreads for industrial clients in the U.S. are found in the Northeast, with California and the Southwest regions also strong. The electric tariffs against which the gas must compete often have both kW demand charges and kWh throughput charges, so the price per kWh may fall if a larger demand is fairly continuous. Additionally, electric tariffs for larger customers may be lower.

The answer to your question also depends on the DG technology chosen and the unit's efficiency by size. The main gas-fired DG technologies you should investigate for this volume of gas are reciprocating engines and gas turbines. A number of manufacturers offer these units. The larger units tend to be more efficient, which means they are more likely to be able to compete with utility central station generation. So having larger volumes of available gas may be an advantage in this regard.

Marketplace experience suggests that more consumers operate gas-fired DG units in cogeneration mode than for baseload or peak shaving applications. If the thermal waste heat can be employed by the consumer, the economics are much more likely to be favorable toward converting the gas into electricity.

In sum, you will need to look carefully at where the DG project is located, the existing electric tariffs against which your gas supply is competing, the efficiency of the DG technologies that can be employed to make the conversion, and whether the DG can be applied as a CHP project. There is no simple answer – we suggest you consider several alternative scenarios and conduct sensitivity analyses for each.

- DG Monitor Staff