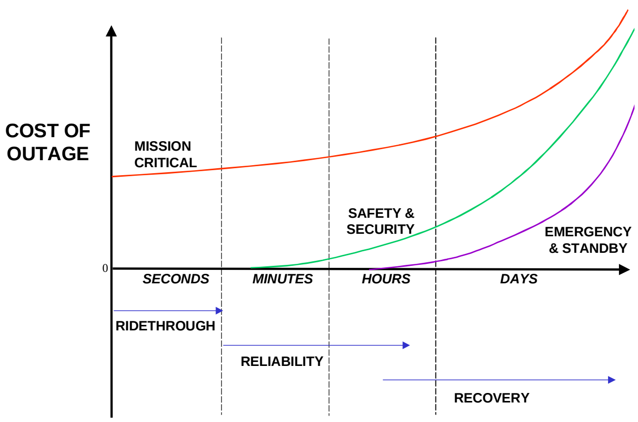
Volume IV, Issue 4, August/September 2004

DG MONITOR[SM]

The Three Tiers of Power Reliability and Security

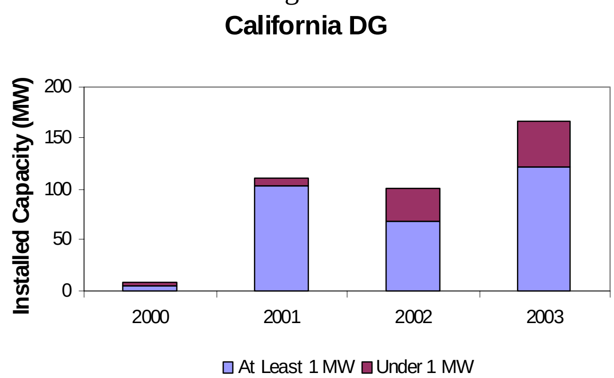
Some electric customers demand power with a higher level of reliability and/or power quality than is typically available from the grid. There are three tiers of power system reliability, as shown in the figure below.



The first reliability tier, "ride-through", refers to the ability of a power system application to withstand disturbances (e.g., surges, sags and other transients) lasting for fractions of a second through a few seconds. The second tier, "reliability", refers to a power system that can withstand both power disturbances and grid outages that can last for minutes or even a few hours. Finally, "recovery" refers to the ability to withstand a grid outage lasting for several days or longer. Each tier requires different levels of auxiliary power conditioning equipment and/or distributed generation.
(continued on page 3)

Update on California DG Initiatives

California is one of the most active DG states in the U.S. Their regulatory response to market forces and in meeting public policy needs has been significant. Continuing concerns about power reliability, quality and costs, plus evolving technology have all contributed to the use of DG. The figure below depicts how DG activity has increased in California since Rule 21 was issued in December of 2000. Aside from more transparent regulations, the market is also responding to the perceived risk of power shortages. Despite a slowdown in DG installations across the country during 2001 and 2002, California experienced real increases in the installation of both large and small DG units.



So what are California regulatory agencies doing in continued response? Plenty. The California Energy Commission continues to host regular meetings of the Rule 21 Committee that is working out additional details and issues around the interconnection and implementation of DG, especially in the 3 large IOU service territories. The CEC is also working to implement aspects of its 2002 DG Strategic Plan. To this end, they issued a DG Costs and Benefits Issue Paper in August, which is available on their website.
(continued on page 4)

IN THIS ISSUE
Articles

RESOURCE DYNAMICS CORPORATION

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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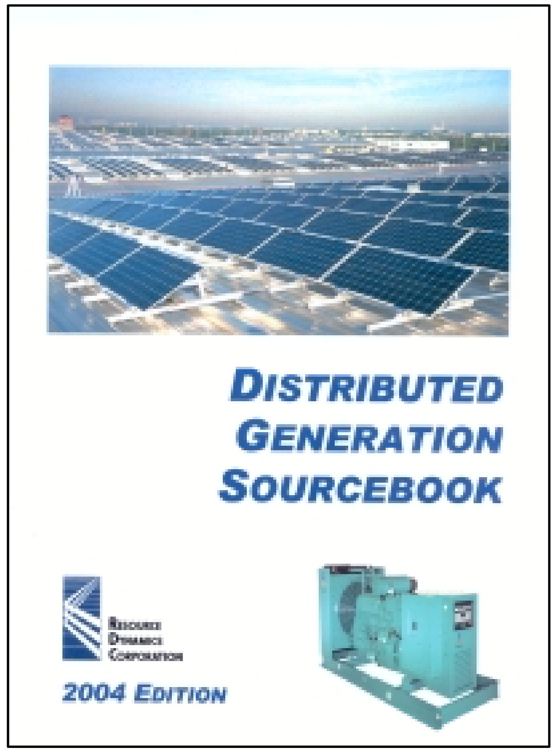
The **Resource Dynamics Corporation (RDC)** creates business solutions that empower clients to compete effectively in changing energy markets. Often, these involve evaluating the role of new technologies. All senior staff have both business and engineering backgrounds, with a distinct focus on strategy 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 25th 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.



The rapidly developing Distributed Generation (DG) market is complex, with many players and stakeholders. The Resource Dynamics Corporation has developed the Distributed Generation Sourcebook: 2004 Edition to serve as both a learning tool and a handbook for those hoping to understand and benefit from DG. Updated for 2004, this edition features new sections, case studies and more. A brief outline of the comprehensive 198-page report is provided below.

- Introduction
- Chapter 1: Applications of Distributed Generation
- Chapter 2: Distributed Generation Technologies
- Chapter 3: The Distributed Generation Marketplace
- Chapter 4: Distributed Generation Interconnection
- Chapter 5: What Makes Distributed Generation Applications Successful
- Chapter 6: Barriers to Distributed Generation
- Chapter 7: The Installed Base of U.S. DG
- Chapter 8: U.S. Distributed Generation Market Assessment
- Appendix A: Glossary of Distributed Generation Terminology
- Appendix B: Directory of Manufacturers

To order this report or other DG publications, go to www.distributed-generation.com

(Power Reliability, continued from page 1)
Important characteristics for auxiliary power conditioning equipment and DG system used for premium power applications are summarized below:

	Fast Power Transfer	Quick Startup	High Reliability	High Availability	Secure Fuel Supply
Ride-Through	✓	✓	✓	✓	
Reliability		✓	✓	✓	
Recover			✓	✓	✓

Up until 9/11, ride-through and reliability received the most of the attention, with little concern about recovery. Responding to natural disasters, such as Hurricane Isabel which hit the eastern United States on September 18, 2003, have highlighted the need for a recovery plan, and has taught us quite a bit about this third tier of grid reliability. In fact, one of the key conclusions in a report ("Hurricane Isabel Responses Assessment", James Lee Witt Associates, Washington, D.C., Draft, 2003) sponsored by Pepco Holdings, Inc., owner of two of the utilities hardest hit by the storm, emphasized this reliability topic. The Pepco report underscored the "need for the emergency management function to have a higher priority, with emphasis on developing operating concepts and support systems that can be scaled to respond to both routine and mass outages." Referencing the third tier of grid reliability, "recovery", the impact of Hurricane Isabel made it clear that an extended power outage (which lasted for up to 9 days for some customers) results in a major degradation of community services in the areas of public safety, transportation, health care, water treatment and delivery, and education. Some of these very customers, many with their own emergency distributed generation equipment, found that they ran out of fuel before restoration took place. Others found that they had no emergency generation but needed it to stave off losses from a prolonged shutdown. Examples of critical facilities during times of emergency include:

- Emergency services
- Emergency shelters
- 911 call centers
- Fire and rescue
- Municipal command centers
- Traffic control
- Communications
- Telephone switches
- Cell towers
- TV & radio
- Satellite links
- Internet
- Law enforcement
- Police
- National guard
- Other public or service activities
- Medical care
- Water and wastewater
- Air and rail transport
- Finance and banking
- Schools and day care
- Hotels
- Food services
- Hazardous material handling

The emergence of, and increasing concern associated with, manmade and natural emergencies has placed DG in the spotlight. Successfully reducing our vulnerability to such disasters calls for installing backup DG at critical public and private facility locations on the distribution system ("security nodes").

The Power Reliability and Security Council was launched to capitalize on this opportunity and support the use of DG as a measure for enhancing both power reliability and security. Its overall mission is to advance and advocate the integration of an enhanced electric power grid with distributed generation to meet the power reliability and security needs of our critical infrastructure. PRASC is beginning to foster cooperation between the public, private and utility sectors to a) upgrade the electric power grid, and b) fully integrate cost-effective distributed generation to enhance the security of continuous power supply to critical public facilities during emergencies; and, improve grid reliability and efficiency. For more information on PRASC, see www.prasc.org. ■

(California DG Initiatives, continued from Page 1)
The California Air Resources Board continues to approve DG equipment as being type tested and pre-certified. The most recent approval was in September for Fuel Cell Energy's DFC1500 fuel cell. A complete list of currently approved equipment may be found online. Developers using this equipment may find the siting process requires less time and cost than having to test a unique installation for air emissions.

Also on Friday, October 22, 2004, the CARB will be holding a workgroup meeting to discuss the 2005 Distributed Generation Technology Review, as part of its ongoing work considering the air emissions from DG units and Best Available Control Technologies. While CARB has previously determined that the appropriate NOx limit which should be met by 2007 is 0.07 lb/MWh, it is clear that this is not possible today for small DG units. The technology review will consider issues of this nature.

Finally, the California Public Utility Commission is in the midst of another distributed generation rulemaking (R.04-03-017). The CPUC's scoping order for this ongoing proceeding explores DG issues including developing a cost/benefit methodology for DG, streamlining data collection and dissemination, incorporating DG as a utility resource option, understanding new DG technologies, and removing barriers to interconnection.

Looking beyond regulatory progress, E2I in conjunction with Southern California Edison held a workshop on July 15, plus subsequent meetings, to discuss ways to implement DG pilot programs as an alternative to distribution wires programs. One of the Interest Group recommendations from this effort is for SCE to issue a request for proposals seeking qualified DG projects for this program. This RFP is expected to be released later in 2004.

Developers and end users should be aware that several California DG economic incentive programs still exist through the end of 2004, depending on your application, chosen technology, and location. ■

PowerQuality Exhibition and Conference to Feature a Distributed Generation Pavilion

The August blackout last year made businesses across the country recognize their vulnerability to power interruptions, and has put a premium on power quality professionals who can lead their companies to the right power quality products and solutions. Attendees of the PowerQuality Exhibition and Conference will can benefit from seeing, testing, and pricing the latest power quality and power reliability products and equipment, and learning about power quality issues, technologies, and methods from leading industry authorities.

The Show features an Exhibit Hall with top power quality manufacturers and suppliers, and a Conference Program featuring information packed 1 hour seminars, Professional Advancement Courses, Poster Sessions, and more than 50 Technical Paper Presentations. At both the Conference and Exhibit Hall, you can meet professionals who can answer your power quality questions and offer solutions to your power quality challenges.

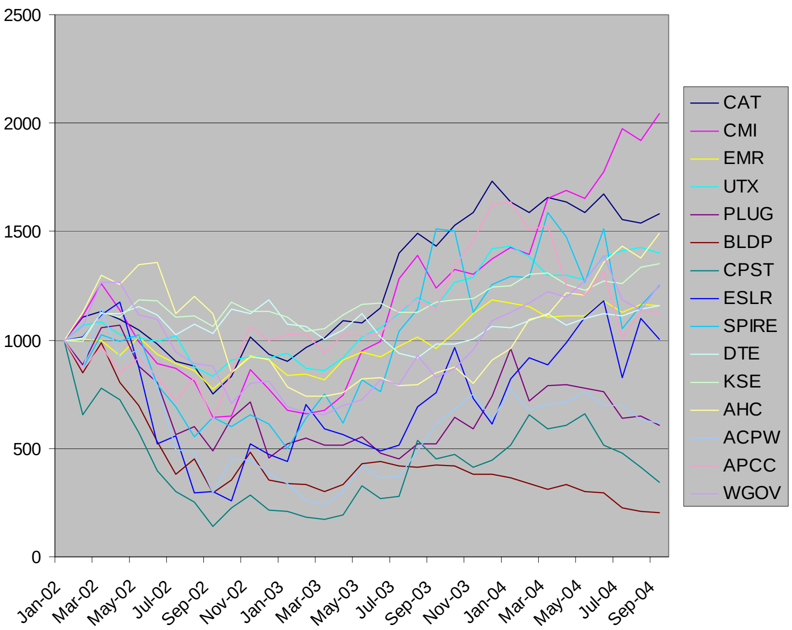
Some of the important and timely topics that will be addressed during the conference include: Troubleshooting and Solving Power Quality Problems; Grounding and Bonding; Present and Future Trends in Distributed Generation; Power Quality Technology for Increasing Reliability; UPS and Onsite Generation Systems; IEEE Emerald Book Standards; Harmonic Mitigation Technologies; Case Studies in Manufacturing, Healthcare and Data Center/Telecom Applications; and UPS, ATS and Backup Power Technologies.

This year the exhibition will feature a **DG Pavilion**, showcasing some of the top companies and emerging DG technologies.

The Power Quality Conference is held in conjunction with the Power Electronics Technology Conference to create PowerSystems World. These combined Conferences create a large event that covers subjects ranging from the basic building blocks of system components to large facility systems with power ratings in the megawatts, to the implications and effects energy management and reliability. For more information on the conference, which will be held November 14-18 at the Navy Pier in Chicago, Illinois, see http://home.powerquality.com/ ■

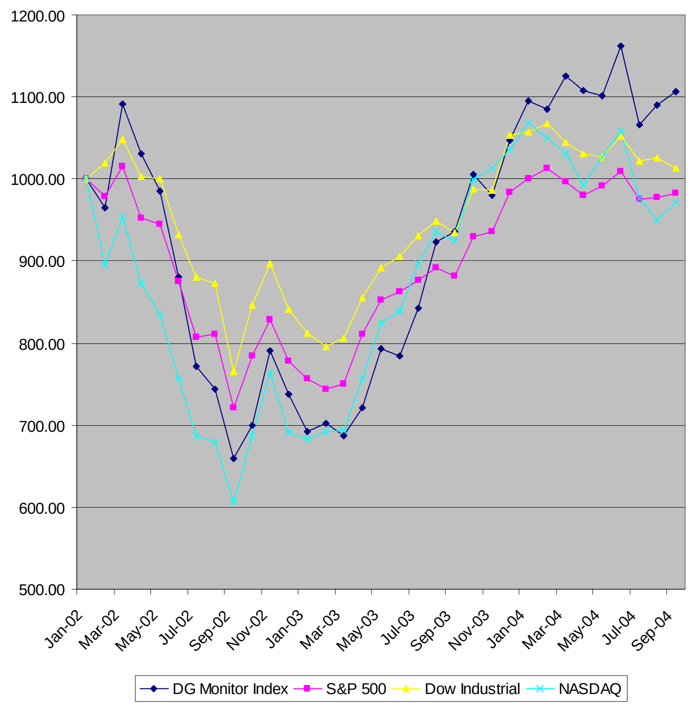
The DG Monitor Index℠

The DG Monitor Index℠ continues its 2004 run to outperform the returns of the Dow Industrials, S&P 500, and the NASDAQ. The overall stock market has been mixed over the last two months, but the DG Monitor Index℠ did well because of strong performances from companies such as Cummins.



Companies included in the DG Monitor Index℠ include:

- Active Power (ACPW)
- Amerada Hess (AHC)
- American Power Conversion (APCC)
- Ballard Power Systems (BLDP)
- Capstone Turbine (CPST)
- Caterpillar Incorporated (CAT)
- Cummins Incorporated (CMI)
- DTE Energy (DTE)
- Emerson Electric (EMR)
- Evergreen Solar (ESLR)
- KeySpan Corp (KSE)
- PlugPower Incorporated (PLUG)
- Spire Corporation (SPIRE)
- United Technologies (UTX)
- Woodward Governor Company (WGOV)



Over the past 2 3/4 years, Ballard Power Systems has weighed on the DG Monitor Index℠, with a loss of around 80%. The Ballard share price reached a peak of over 130 in 2000 during the dot-com and NASDAQ bubble, was 31.1 when the DG Index started in January 2002, and was 6.27 on September 4, 2004.

For the six months ended 6/30/04, Ballard revenues decreased 40% to $37.2 million. Net loss increased 21% to $67.7 million. Ballard has around $275 million in cash, which could be depleted in around 2-3 years at the current burn-rate. ■

Ask the DG Monitor

A number of *DG Monitor* readers have called asking about our recently released 2004 edition publications on the DG installed base and DG market potential:

Could you explain the difference between the two reports?
The baseline report looks at what has already happened. This report estimates the installed DG base in the U.S. as of January 1, 2004. Top-line report results estimate 12.3 million DG units in place with an aggregate capacity of 234 GW. 81% of these are emergency generators. In the report, the number of DG units, capacity, generation and thermal outputs are broken out for 19 unit sizes, by DG technology, DG application, primary fuel, and their original year of installation. Additional regional and industrial breakouts are provided for generators larger than 1 MW.

The market potential report looks at the future of the DG market. It estimates economically viable U.S. market potential. This is the first published national assessment based on today's higher natural gas prices. The report examines fossil fuel-fired DG technologies and examines baseload, combined heat and power, and peaking applications, but does not measure emergency or backup power uses. Significantly, results are available for each state to help identify specific market niches to pursue. The report provides detailed breakouts for number of DG units, capacity, generation, thermal output, equipment dollar sales, and natural gas consumption for 18 unit sizes, by DG application, DG technology, 20 industrial sectors and 18 commercial building types, and state.

The two reports are designed to complement each other by using the same unit size breakouts, many of the same technologies, and the same applications. If you need to do business planning based on servicing, fueling or knowing what is already installed then the baseline report is what you need. If you wish to plan based on new market potential and are looking for specific market niches, then the market potential report is what you need.

Do the reports provide breakouts for reciprocating engines by gas and diesel fuels?
Most of the report tables provide one metric of information (such as units, capacity or generation) by two variables, such as unit size and application. Some key multiple cross tabulations are also provided such as by technology by application by size. Specifically answering the question, both reports present information by technology (including reciprocating engines) and by fuel (including gas and diesel) but not both at once. However, we do have this information in our database, and it has not been presented merely to keep the reports to manageable lengths. If you have specific needs for cross tabulations, please contact us to see if we can provide them.

What is the time frame for the market potential forecasts?
The market potential report measures how much economically viable DG could be installed. Nominally in the Base Case (28 GW) this could occur over the next decade. Similarly in the Future Case (64 GW) this could occur over the next two decades. However, viable market potential is *not* a forecast. Instead it is a measure of how many commercial buildings and industrial centers could economically use a DG technology instead of buying power from the electric utility grid. Thus it is not possible to ascribe an actual time frame to this meaning of market potential. Essentially all the reported market potential exists today, given current DG and central station price and performance characteristics.

However, full market potential is unlikely to ever be fully realized for at least 3 major reasons. First, 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. Second, siting costs can be relatively high compared with a small DG unit's capital cost. Third, 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, which may eliminate economically viable DG projects. Thus, not only is achieving full economic market potential likely an improbable task, but also actual market penetration will always lag the market potential as new technology performance is achieved.

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

DG NOTES

September 9, 2004 - **UTC Power**, a unit of **United Technologies Corporation**, announces the PureCycle™ 200 power system, a unique heat-to-electricity technology that recycles waste heat as free fuel to generate electricity. The system operates without emissions and is completely pollution-free, employing a closed-cycle process using technology developed by UTC's Carrier division.

September 7, 2004 - **Microgy Cogeneration Systems, Inc**., a wholly owned subsidiary of **Environmental Power Corporation**, announced that it has signed an agreement with Seifert Dairy Farms of Acampo, CA for the on-farm location of an animal feed production system based on Microgy's anaerobic digester technology. The Seifert Dairy project is the second such facility proposed under Microgy's Feed System Project Development Agreement with The Scoular Company, which anticipates Microgy constructing up to 50 of these systems.

August 31, 2004 - **Plug Power Inc**., announced today the availability of GenCore® 5T24, a 24-volt, 5-kilowatt backup fuel cell system that will be marketed to wireless service providers.

August 27, 2004 - **Ingersoll-Rand Company Limited** has announced that it has agreed to sell its **Dresser-Rand** business unit to a fund managed by First Reserve Corporation, a private-equity firm, for cash proceeds of approximately $1.2 billion. The sale, which is subject to government regulatory approvals and other customary closing conditions, is targeted to close in the fourth quarter of 2004.

August 24, 2004 - **GE Energy** was awarded a $9.4 million contract by the City of Ames, Iowa to provide an LM2500+ aeroderivative gas turbine. The turbine will have dual fuel capability with a water injection system to reduce the nitrogen oxide (NOx) emissions. The gas turbine will be installed at the Dayton Avenue site, within the City of Ames. Rated at 29.2 MW, the unit will operate on fuel oil unless a natural gas pipeline is extended to the site.

August 11, 2004 **- Kyocera** announced today that it will begin large-scale assembly of solar photovoltaic (PV) modules this fall at its maquiladora facility in Tijuana, Mexico, with plans to establish a regional office in San Diego for solar system engineering and marketing. The Tijuana facility will produce state-of-the-art PV modules ranging from 35 to 190 watts, with a planned production capacity of 35 megawatts per year. This facility will eventually produce all of the PV modules that Kyocera sells in the Americas.

August 4, 2004 **- Fuel Cell Technologies Corp.** reported that its operating subsidiary, **Fuel Cell Technologies Ltd.,** will deliver four 5 kW solid-oxide fuel cells (SOFCs) to the Hydrogen Village at the University of Toronto at Mississauga campus in July 2005. This will represent the first-ever installation of fuel cells in Canadian university residences and represents a giant step toward commercialization of SOFC technology. ■

CONFERENCES

Ninth National Green Power Marketing Conference
October 4-6, 2004
Albany, New York

The Theory and Practice of Distributed Generation and Onsite CHP
October 6-8, 2004
Washington, DC

3rd Annual Renewable Energy Conference
October 11-12, 2004
Melbourne, Australia

Power Generation World, Australia
October 11-12, 2004
Melbourne, Australia

National Power and Gas Conference
October 11-13, 2004
Melbourne, Australia

World Alliance for Decentralized Energy's 5th International Conference on Cogeneration and Decentralized Energy
October 27-28, 2004
Beijing, China

2004 Fuel Cell Seminar
November 1-5, 2004
San Antonio, Texas

PowerSystems World Conference
November 14-18, 2004
Chicago, Illinois ■