Distributed Generation and Competitive Retail Electricity Markets

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This article discusses what it will take to finally make retail access and consumer choice happen. Many of the components are in place or are in the process of being addressed. These include FERC's Jurisdiction over wholesale rates and transmission tariffs; and the historic December 1998 California Public Utilities Commission's decision, at the urging of the California Alliance for Distributed Energy Resources (CADER), to begin a rulemaking on Distributed Generation.

With the federal role being solidified and definitive and progressive rules expected from the initiative in California and other states, the focus now shifts to the practical side of retail competition. In a nutshell, the make-or-break of fully competitive retail markets rests in Internet appliances and the start-up firms that are developing them.

RESTRUCTURING CONTEXT

All the rhetoric and flurry of restructuring aside, not much retail competition has occurred. Policy makers and market participants believed and continue to believe that competition in the electricity industry will tower rates. However, the numbing effect of the nonbypassable stranded assets charge on competition has been demonstrated.

To be fair, legislatures and regulators wanted to make sure that Wall Street did not lower the stock value of investor-owned utilities in response to any proposed non-recovery of 'sunked' utility investments. In addition to Wall Street, many individual investors in utilities, who sought safe retirement investments, ardently voiced their fears.

While stranded assets is the most visible reason, no less critical factors are the lack of interconnection and safety standards for distributed generation (DG), the lack of market rules governing competition among the participants, and the lack of streamlined siting and permit review.

Anyone observing restructuring across the U.S. has witnessed, if nothing else, the entrepreneurial aspects of deregulation. At the same time, fears about slamming, decreased reliability and abandonment of "poor and uninformed ratepayers" abounded after comparisons to deregulation of the telecommunications industry were made.

DG's role in this $200 billion dollar national industry will depend on the ability to have distributed intelligence and the appliances to reliably and precisely process an abundance of information. It is easy to conceptualize the distributed power market, one with a multitude of these small units on the system. Yet, how can the real business benefits of DG be realized? The answer lies in the ability to synchronize them, making them an integral part of the customer's operation and of the power grid.

REVIEW OF DG TECHNOLOGIES

Table 1 presents an array of distributed generation technologies assembled by CADER's Technology Committee.

Table 1. Distributed Power Technologies

Technology	Size (kW)	Year Commercial	Electric Efficiency (%) (HHV)	Installed Cost ($ kW)
ICE	50-6,000	Available now	29-37	200-800
Ind. GT	500-20,000	Available 1999	21-41	300-870
MT	25-250	1999	21-33	250-1250
Fuel Cell	3-3000	2003	35-63	815-4000
PV	10-10,000	Available now	15	5000-10,000

ICE = Internal Combustion Engines or Reciprocating Engines
Ind GT = Industrial Gas Turbines
MT = Mictroturbines
PV = Photovoltaics
Source: Final Report, 1998, CADER

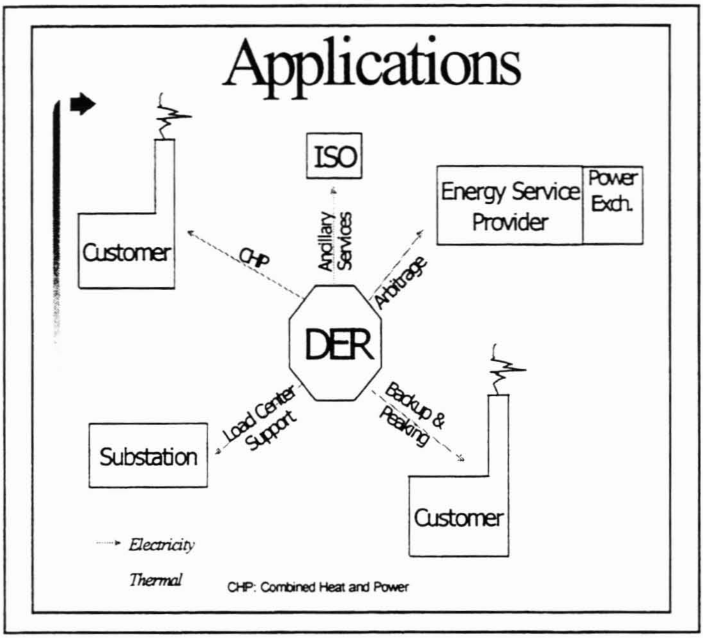


Diagram 1.

ROLE OF DISTRIBUTED GENERATION

Diagram 1 illustrates the key roles that distributed energy resources (DER) and combined heat and power (CHP) have in restructured electricity markets. In addition to the traditional customer load management and peak shaving, load support, and the deferral or elimination of new or upgraded transmission and distribution projects, DER and CHP can provide voltage and frequency support, load reduction, spinning reserves, power factor correction, and other ancillary services. Also, DER will enable customers to arbitrage their electricity costs against the cost of their on-site power.

Diagram 1 also illustrates the major conundrums that DER and CHP pose to regulators of competitive electricity markets.

- Whether utility distribution companies should have a role (in owning and installing DER and CHP) other than the management of the distribution wires.

- Whether distribution rates should be unbundled to allow compensation for ancillary services.

- Whether interconnection and safety standards need to be specially developed for DER and adopted expeditiously in order to have a competitive distribution market.

- Whether dispatch protocols for DER should be developed by the independent system operator.

- Whether the air quality regulatory paradigm should be revised to address the air quality implications of gas-fired DER technologies. For example, is pre-certification of technologies the most prudent approach to ensure timely entry of DER?

- Whether the possession of emission offsets by holders of permits for existing facilities in attainment areas represents otherwise unintended constraints on a fluid, efficient and competitive market.

ECONOMIC JUSTIFICATION—ONE PIECE OF THE PIE

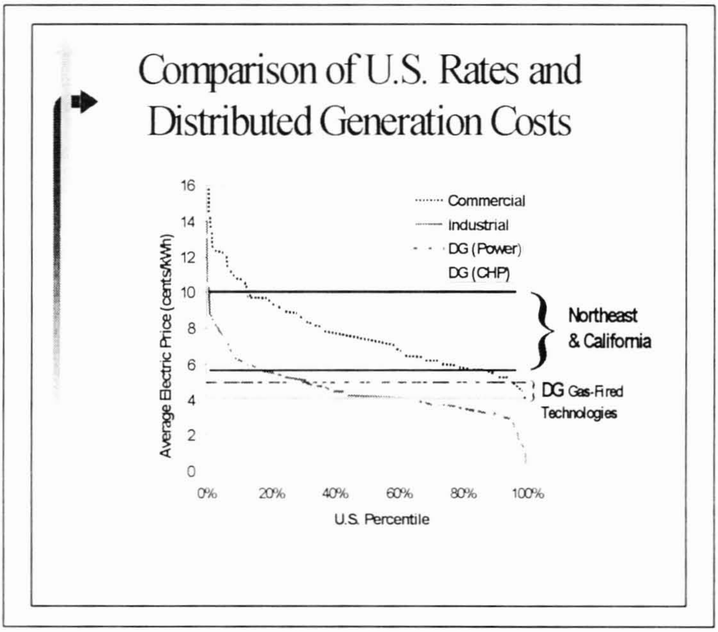
Generally, gas-fired reciprocating engines and small industrial turbines in stand-alone or CHP applications, from strictly a rate comparison perspective, are competitive with electricity rates of 6 cents/kWh and higher.

Yet, economic rate comparisons often fall short of the expectations of energy facility managers and chief financial officers. Other factors include:

Costs
- Special interconnect circumstances and charges
- tax consequences
- business shutdown for plant installation
- Other customer specific costs

Benefits

- Continued production—no loss of product
- Lower costs due to unmanned operation
- Avoidance of emission sanctions



E Source adds other efficiency-related services* to simple cost savings. Determining your audience, the facility manager, maintenance engineers, or the CFO is key to presenting efficiency related services.

- Marketing the "green-ness" of energy efficient lighting was often overlooked in the past as a public relations opportunity. Being perceived by the public as "being green" sells to senior managers more so than to facility managers.

  More and more firms are buying power from renewable resources, paying the premium costs for "green-energy." These firms, such as select KMart, McDonalds, and TARGET stores, are positively viewed as environmentally conscious by their customers.

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[1]E-Source Briefing; EB-99-9; Selling Energy Efficient Services to Large Commercial Firms: Operating Cost Reductions Are *Not* the Key; May 1999

- Decreased power costs from a utility equates to increased re-sale value of a property. This sells to property management staff that buys, rents, and sells property.

- Product manufacturing, retail sales, and jobs requiring applied intelligence may be enhanced by energy efficiency measures that improve indoor environment and comfort. While difficult to correlate, some companies may place a high value on measures that improve worker productivity.

  The Sacramento Municipal Utility District's customer service center's extensive use of daylighting in lieu of electric lights saves $56,000 a year in electric bills. However, what is exciting researchers, builders, and SMUD is the effect on the people inside. Energy costs about $2 per square foot per year, and people's salary cost about $200 per square foot per year in an office building. Any improvement in sick leave or productivity will pay off far more quickly than energy savings.*

- Reduced insurance premiums. Insurance costs about 20 cents per square foot in US office buildings, about the same as HVAC or elevator maintenance and repair. A very few insurance companies are reducing premiums for energy efficient buildings.

- New energy efficient equipment translate to improved performance and lower maintenance and repair costs.

THINKING OUTSIDE OF THE BOX

The City of Glasgow, Kentucky, created an "Info-tricity" Utility out of their municipal utility. What began as an investigation in 1988 of alternatives to the cable and phone company ended in the provision of combined services—cable TV, phone, Internet, class room instruction, notices of community events, real-time kid soccer games on the TV, and electric billing. The Info-tricity also found that their ratepayers signed up in great numbers for load-shedding in exchange for "free HBO" after previous offers of discounts on their monthly bills went unheeded.

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*Sacramento Bee, June 28, 1999.

Glasgow is still engaged in skirmishes, but this now classic story underscores that customers have a higher perceived value for the convenience of consolidated services. As life gets more complicated, people want their services to be simplified and often are willing to pay more.

The message of Glasgow is that people don't buy kilowatt-hours or a particular DG technology, unless they opt for green-energy, above all, they buy comfort, convenience, safety, information, entertainment, (and in small towns) a sense of community.

MARKET PUNCH-OUT

DG and CHP proponents are looking down the road for successful market penetration and competing in markets that allow robust competition. Gas-fired reciprocating engines fewer than 10 megawatts (MW) and industrial turbines under 20 MW are the first wave of DG technologies. Other emerging technologies like microturbines and fuel cells have fostered strategic alliances.

Meanwhile, DG and CHP detractors have surfaced a new argument: that DG and CHP are alternatives to merchant power plants. This focus steers the discussion to a fruitless end. Perhaps this end is intended; like a diversionary tactic, proponents of this argument seek to obfuscate the debate.

Clearing the smoke reveals that this is not an issue of David versus Goliath, i.e., small DG against merchant power plants and which is best to serve ratepayers and the environment. Three responses have come forth. One, DG and CHP complement, and in fact strengthen the existing power grid. Two, smart Energy Service Suppliers (ESPs) are stocking their portfolios with merchant powerplants that include technologies of ALL sizes and types. And third, investors characterize large merchant plants as highly leveraged, high fixed cost projects that place them at a sizable disadvantage to its lesser burdened competitors.

STRATEGIES IN COMPETITIVE MARKETS

How do market participants—the buyers and suppliers—position themselves in this new market? The buyer's side is simple. The City of Glasgow story resonates the earlier point that while the mission of delivering safe, reliable, and reasonable cost energy has not changed, the packaging of many associated services in a simplified manner is paramount. Buyers will now demand the convenience of consolidated services.

For the ESP, however, the challenge is at the top of the pyramid. The top of the pyramid is the cornerstone that allows the ESP to be of true value. Beneath this are all the traditional services that ESPs do.

The cornerstone is comprised of two key functions. First, the ability to assess what needs to be done for a customer or aggregated group of customers. The traditional approach to a customer's needs to cut costs, often because the RFP drove the bids in this manner, is to jump in and do an audit of the building envelope and of the customer's process be it making a "widget" or selling a product. This audit led to recommended energy efficient HVAC, lighting, and insulation measures to the building envelope, and then to meet whatever steam and electrical needs resulted in a properly sized power unit.

We need to back up and modify this paradigm. What needs to be done initially is for the company to do an internal assessment of its needs and how its energy budget can help achieve those needs. This will entail for small companies, considering all aspects of the companies' operation or, for large companies, to bring in the people responsible for those activities, such as the maintenance director, property manager, human resource manager, facility manger, and CFO. The following list of questions, at a minimum, needs to be asked. What value and weight should be accorded to:

1. Economic feasibility of the DSM/DG project(s) versus alternative power costs
2. Reduced maintenance and repair
3. The public's perception of the company's or agency's "greenness"
4. Increasing worker productivity and comfort
5. Increasing property value for resale purposes
6. Tax consequences
7. Shutdown consequences
8. Permit and interconnection obstacles
9. Avoidance of emission sanctions
10. Alliances and load aggregation to maximize arbitrage opportunities

The second function is applying the "appliance" that masterminds all components to speak and share information, delivering highly customized energy and non-energy products. This goes beyond SCADA or simple data acquisition.

- This device will integrate all information technology (IT) streams coming from the power exchange, the independent system operator, building management energy systems, the customer's 'manufacturing' process, and on-site power assets.
- The device would also be able to combine the IT of aggregated customers.
- Finally, the device will be able to provide what has been missing to date—real-time decision making capability.

Some human intervention may be required in very volatile and dynamic markets, but the idea is to limit human participation except for establishing decision parameters at the front end or to re-tune parameters when appropriate.

> Most utilities say that a few DG are "noise" on their system and can be ignored. However, in significant penetration, the stability of the grid is put in question much like the visual metaphor of the plate acrobat who keeps an ever growing number of plates spinning smoothly on the end of long flexible rods.

DG's successful penetration and effective use in markets* will depend on remote management and intelligence, While talked about actively over the past several years, the business benefits have not yet crystallized. And in fact, there are businesses that are doing parts, but not the whole. However, everyone agrees that as California and other states grapple with the difficult issues of competition at the distribution level, the benefits will become clear, driving the need for remote man-

*Assuming regulatory and institutional barriers are removed.

agement and intelligence.

Easier said than done. What are the "means" to accomplish this task? The answer lies in Internet appliances. A lesson can be taken from substation automation where it is being found that the real business benefits will be delivered by applications, not by information itself.

> Applications—in essence, computer algorithms that will process and interpret information, and ultimately provide decision guidance—have to be an important focus in the next phases of the automation revolution.—Substation Automation: A Real World Trial; Pace and Rubin. *Electrical World*; May/June 1999.

This quote is from a Pacific Gas & Electric Company project for the first transmission substation (Cortina, near Williams in northern California) to be retrofitted with transmission level automation and supervisory and control data acquisition style controls. The extrapolation to managing portfolio assets, including a multitude of DG units is plausible. As in substation automation, human ability to gather, interpret and act on such information will be next to impossible. With many units operating within a competitive power exchange many decisions on commodity bidding can be made by algorithms.

CONCLUSION

The ability to manage many discrete DG sources has stymied ESPs from truly providing value to their customers and the competitive market. Fortunately, several start-up companies are targeting their wares to this shortcoming. Enflex, Encorp, SixthDimension and others will provide the Internet appliance that will ultimately drive home true retail access and competition.

The ideas and positions presented in this article solely reflect the views of the author, and not Caterpillar, Inc.

ABOUT THE AUTHOR

Eric Wong is a product consultant to Caterpillar Gas Engines in Lafayette, Indiana. His focus is business development for CAT's state-of-the-art, natural gas-fired internal combustion engines for the distributed power market. This focus includes research and development and government affairs.

Eric formerly worked as an assistant executive director at the California Energy Commission, serving as a senior policy advisor to the chairman and, previously, to the vice chair. While at the Energy Commission, he organized the Distributed Generation Roundtable, which led to the formation of the California Alliance for Distributed Energy Resources (CADER). CADER is a public/private partnership dedicated to removing the barriers to distributed generation. He served as CADER's first chair from October 1996 to October 1998.

In recent years he has presented papers on distributed generation in Thailand, Malaysia, Singapore and California. In 1994, Eric studied electricity industry restructuring in Sweden, Norway, and the United Kingdom, being awarded a grant from the Swedish-American Bicentennial Exchange.

Mr. Wong spent 10 years with the Federal Power Marketing Agency, the Western Area Power Administration (US DOE), as director, Division of Power Contracts and Resource Planning. He has also worked in the governors offices of both California and Hawaii on environmental, energy, and land use issues.

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