

SYSTEM INTEGRATION -- THE MISSING LINK
IN DISTRIBUTED GENERATION

by
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It has been five years since I first began beating the drum for distributed generation, and three years since I first wrote about microgeneration for Standard & Poor's. So where have we come in that time?

Today -- unlike in those early years -- virtually everyone in and around the utility industry accepts that distributed generation will play some role in the industry's future. The technology optimists say it is here today; the more conservative industry observers say it will take a long time to make much of a dent. In this article, I will summarize my views on the emergence of distributed generation, five years after the wake-up call.

Can distributed generation ever make an impact? Skeptics say it will take an awful lot of generators to have any effect on the grid, and would be nearly impossible to get into place in any reasonable time. Well, consider this: At 50kW equivalent per car, and 15 million cars shipped per year, Detroit produces and delivers to customers 750,000 MW of capacity each year. Coincidentally, that is almost equal to the installed capacity in the U.S. Every year the automotive industry produces and ships enough capacity to replace the generating capacity of the entire utility industry! And cars last on average well over 10 years. So, a microgeneration industry of one-tenth or less the size of the automotive industry could make a pretty serious dent in the existing utility infrastructure. If that new industry grows at the rate the personal computer industry has grown, it will not take long to be a substantial force.

Is the technology ready? Five years ago the answer was-- not yet. Today the answer is unequivocally yes. For example:

- Capstone Turbine Corp. is already shipping its 30kW microturbine commercially -- not demo units, but commercial products. Allied Signal AG has built a large manufacturing facility in Albuquerque to produce microturbines.
- Engine World is shipping its 100 kW gas engine set, built around an automotive block; the major gas engine manufacturers like Waukesha Engine Division of Dresser Equipment Group, Inc. and Caterpillar, Inc.'s Engine Division have long shipped highly reliable and efficient units in the over 200 kW range, and are rapidly introducing smaller capacity units.
- The photovoltaics industry shipped 153 MW last year and will likely top 200 MW this year. In Japan and Europe much of that capacity is connected to the grid, and the grid-connected market is beginning to emerge in the U.S. The telecom industry has long accepted photovoltaics as absolutely reliable for powering installations at remote sites. It is a commercially proven technology in their eyes, yet the utility industry still seems to view photovoltaics as experimental.

Some of the more advanced microgeneration technologies, such as fuel cells and Stirling engines, are available only at demonstration scale, but development has been progressing at a rapid pace and commercial introduction is expected in the next two to three years.

Are the costs competitive? The most important point on costs is that microgeneration systems compete at the meter, not at the central station busbar. They have to beat the price per kWh the customer pays now -- including any charges levied by the utility to stay connected to the grid as a back-up. Small engine sets and microturbines are competitive today, even at low production volumes, in many parts of the U.S., Japan, and Western Europe, where customers are paying 10 cents per kWh or more. And, in virtually all of the developing world, they offer the only realistic option for electrification. But that is only the beginning of the story. These microgenerators are basically appliances; they are now, or soon will be, mass-produced just like appliances or, for that matter, car engines. And mass production in ever increasing volumes will inexorably drive the costs down, as happened with PC's. These microgeneration systems -- all of them, including those yet to be fully commercialized -- are "disruptive technologies" as described in the classic *Harvard Business Review* paper by Bower and Christensen, and in Christensen's recent book. As production volumes increase and learning/experience curve effects are realized in production, the cost of these microgenerators will approach the cost of the materials required to make them -- or something around \$100/kW. If efficiencies and lifetimes are reasonable -- and they already are for the commercially available systems -- new central station plants just will not be able to compete.

Are the financial markets receptive? Although Wall Street has been slow to understand the enormous financing implications of the emerging microgeneration market, that is beginning to change. Numerous utility analysts have sounded the alert and the recent initial public offering for Plug Power Inc. has certainly gotten people's attention. We are a long way from having an internet-type market frenzy in the microgeneration space, but the talk on the Street is increasingly encouraging.

So what's missing? There is still a missing link. Customers do not want to become experts in microgeneration and they certainly do not want to act as general contractors in selecting and installing components. Surveys by RKS Research and Consultants and others clearly show that customers purchasing microgeneration systems want three things:

- A competitive price per kWh --some customers may even pay a small premium if the system is environmentally benign or "green";
- High reliability and immunity from long storm-related outages that are very painful, and seem to be happening more frequently; and
- Assurance of rapid-response service and competent maintenance support.

In effect, they want an energy services solution: a plug-and-play, no hassle, don't-bother-me-with-the-details solution. This takes a systems integrator who designs the system, selects appropriate components, does the installation, monitors system performance, and provides seamless maintenance and emergency repair. Also needed is a simple way to link potential customers and system integrators together -- an obvious business-to-consumer internet opportunity.

Interestingly, there are relatively few system integrators or solution providers that have emerged in the microgeneration market space. Most of the technology providers are using direct selling to reach customers with their particular solution. Certain segments of the distributed generation industry, like the photovoltaics segment, have long-established channels of distribution, but those channels typically do not deliver other technologies and only recently have they begun to focus on being true solution providers, even with photovoltaics alone. Just try going to the Yellow Pages to see if you can find someone to install a photovoltaics system at your home or business.

In the off-grid market for telecom and pipeline systems, village power, and light industrial (under the fence) applications, there are a few well-established and superbly competent companies, like Northern Power Systems, dominating what is still a modest-size market. These players could easily migrate into the grid-connected market, and they doubtless will, but not yet.

A number of utilities have energy services companies, and several of those are actively offering distributed generation solutions, notably DTE Energy Co.; Niagara Mohawk Power Corp.; PECO Energy Co. and its affiliate Exelon Energy; Public Service Electric & Gas Co.; and Unicom Corp. A few major corporations with strong links to the energy industry have created business units focused on distributed generation — The Williams Cos. Inc. and General Electric Co. are among the highest profile, and both have been building alliances with specific technology providers. However, to date, there has been only one new start-up that we are aware of being formed to provide energy solutions with a technology-neutral portfolio of microgeneration systems -- and that is Microgenesis, the creation of two recently retired utility chief executive officers and CH2MHill, Inc., the worldwide engineering services firm. Although it is just getting underway, Microgenesis' vision is to be a worldwide energy solutions provider, bringing power systems to the customer and providing continuing service and support over the life of the system. This may be the missing link! It is a fascinating business model and will doubtless be copied.

The challenge facing the system integrators is to identify the attractive early niches, find a way to reach the customers in those niches, and put together attractive solution packages that meet the need. If they can do all this successfully, they will provide the critical link, missing until now, that will make the microgeneration wave really begin to break.

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