

11/15/028:28 PM



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## Distributed Energy Markets Expanding at Time of Uncertainty

11.6.02 Scott Sklar, President, The Stella Group, Ltd.

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As states have begun a march towards on-and-off deregulation or reregulation, the US market has picked-up for distributed generation in a big way. Prior, the international markets have been the mainstay for distributed generation technologies from diesels and reciprocating engines to battery banks and photovoltaics. The international markets for distributed generation have been telecommunications, (primarily cellular and redundant systems), uninterruptible power systems for banking and government, and back-up systems for the tourism industries.

But as the U.S. grid begins to age and regulatory swings slow investment into transmission and distribution infrastructure expansion and upgrades, distributed generation has taken on new significance in the U.S. domestic marketplace. The electric utility industry primarily relies on the traditional distributed generation solutions utilizing reciprocating engines with some experimentation in microturbines, fuel cells and photovoltaics.

**Basic prime drivers for distributed generation vary.**

For utilities, they either want to provide consumers options, build their own learning curve to figure out how to add limited electric capacity, or comply with green power programs, Clean Air Act Implementation, or renewable energy portfolio standards, now required in eleven states.

For consumers in the commercial sector, strong needs for power quality so they can avoid business disruptions due to the sags and swells of voltage and transients in the existing electric power grid that more easily burn out sophisticated controls and computers. As our country becomes more digital, these formerly imperceptible power swings will become even a greater problem. Also, as weather patterns become more intense and grid ages, particularly in the distribution lines, power outages are not only more common but last longer. Businesses that need to be "on line" at all times from web hubs to cellular repeaters to manufacturers - power outages can result in going from black to red financially.

Many utilities are also offering lower rates for those commercial and industrial customers if they are willing to be shut off when the electric grid is stressed, primarily during the summer months when air-conditioning loads can make many grid systems teeter. As one Ohio industry CEO told me, "these electric rate reductions saved the company \$1 million, but the forced work stoppages cost the company \$1.5 million in sales". Other utilities are resorting to very high peak power rates, demand charges or ratchet rates, many of which are higher than most of the higher cost distributed generation technologies now on the market.

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Page 1 of 3

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Utilities and non-utilities alike are beginning to buy multiple installations and more RFP's and engineering studies for a portfolio of small and large distributed generation has occurred in the 2001-2002 time frame,. more than any time in history.

long Island Power Authority has ordered over 20 fuel cells from Plug Power and Avista Laboratories, a subsidiary of the northwest utility, is offering 0.5 kW - 3 kW PEM fuel celis commercially on the market.

Sacramento Munidpal Utility (SMUD) has been the leader In use of photovoltaics, over 2000 installations and almost as much with solar water heating. Both the southern California municipal utilities, Arizona Public Service and Nevada Power are eying new concentrated solar power options utilizing solar to turn heat engines or even larger trough systems building upon the 350 MW of concentrated solar power plants stili operating in the California dessert. Duke Solar (NC) is now offering commercial systems.

Iowa has become a the wind Mecca, not only for larger wind farms but installation of small wind turbines in both rural and urban settings as their concentration of In-state utilities attempt to mine the resource. The state also has 22 MW generated by 24 biomass electric facilities. But more modular biomass technologies are on the horizon, such as STC's 1 kW Stirling unit and 5TM Power's 25 kW Stirling unit that works off of blogas, landfill gas, concentrated solar and natural gas. DTE, the utility subsidiary in Michigan, Is marketing the 5TM heat engine technology.

But non-utilities as well are beginning to step up with major investments In distributed generation. Home builders such as Shea homes have pre-Installed AstroPower (DE) photovoltaics In their San Diego development. AstroPower, the third largest US PV company, is the first to have their product nationally marketed by Wal-Mart. Design Homes and New Era Homes, upscale, premanufactured homebuilders in PA, are now offering a 3000 square foot home incorporating photovoltaics, ground-source heat pumps, solar water heater, double pane windows, and passive solar design for \$185,000 - with a maximum electric bill of \$500 per year (and in many cases no energy bill). These homes dubbed "The Solar Patriot", conceived by Solar Strategies (PA) made a debut on the Mall in Washington, D.C. last year.

Combined Heat and Power, utilizing waste heat from industry to generete electricity Is also making a comeback. Old

players are scaling-up activity and new players are entering the market. One of the most innovative companies, Ormat (NV) is now selling their 250 kW and 500 kW organic rankine cycle heat engine they utilize in their geothermal business for industrial waste heat applications. They have installed a system in a cement plant in Canada and are now offering units in the US market both for behind-the-fence commercial and industrial uses and even for waste heat from compressor pumps used by natural gas pipelines.

A whole new range of companies are developing sophisticated advanced batteries and one of the newest, Energy Conversion Devices (MI) have teamed up with Chevron/Texaco to bring Nickel Metal Hydride batteries into the energy marketplace. These deep cycle

batteries will be the choice for the automotive industry and probably the distributed energy industries because it can be fully recycled without harmful by-products as well as offer superior performance. The introduction of gel-cell deep cycle batteries which have ten year warranties and no maintenance has transformed the distributed generation industry

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Page 2 of 3

EnergyPulse Article 11/15/02 8:28 PM

resulting in more reliable products. Microturbines and fuel cells utilize batteries as do small wind and photovoltaics systems, so battery advances have been critical innovations.

Newer technologies are also on the horizon. Verdant, a VA-based company, will be showcasing its 25 kW small run-of-river hydropower unit in New York -- in the East River to be exact. This elegant, slow turning rotor allows power to be produced without using a dam, has no III effects to fish, and will not be hurt by floating or submerged debris. If this demonstration plays out as expected, small hydro may have a rebirth in the United States.

As distributed generation technologies begin to scale-up with photovoltaics now being mass-manufactured, and wind, fuel cells, heat engines and microturbine manufacturing beginning to grow, costs will lower, quality will rise, and more customers will enable a viable installation and servicing infrastructure to develop. New advances in interconnection equipment tied to passage of easier interconnection laws over the last 3 years by 36 states are beginning to "rev" the market. Even the national Federal Regulatory Commission, (FERC) seems to be leading the way to open the market for distributed generators through its recent set of regulatory notices.

Balance of systems, that is necessary technologies beyond the core generation technology, are also advancing. For instance, Xantrex Technologies (Vancouver, WA, CA), a merger acquisition company, of inverter and control companies including Trace, Statpower and Hart, has resulted into a company with bigger market power and better technology evolution. Xantrex has offered a series of technology dedicated inverters such as "Suntie" and "Windtie" that specialize the interconnection technologies. They are also on the verge of pioneering "smart Inverters" that will be able to hook-up any distributed generation technology quickly and safely.

Sales from all distributed generation is up. Except for large industrials and commercials, electric and natural gas rates are likely to go up. Grid reliability will likely become worse until the deregulation of the utility industry settles out, which is a long term proposition. Environmental regulations on traditional emissions, and likely new emissions such as mercury and carbon are also likely to become more intense. And growth and sophistication of real-time wireless controls, smart appliances and meters, advanced energy efficiency -- all lead to a much better market climate for distributed generation.

There is still a long way to go in removing regulatory blockages, corporate wariness within the utility sector, and large

needs for investment in the for distributed generation industries for scaling- up manufacturing and delivery systems. But the cork is out of the bottle, and the distributed generation genie is out the door. And the marketplace has been quite dynamic and should become more so.

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Page 3 of 3