

VISION

STRATEGY

REALITY

Integrating renewables

+ By William Opalka

➤ **CONSUMERS WANT TO BUY MORE OF IT. STATES ARE DEMANDING** utilities buy or supply ever-increasing amounts. Policymakers see it as the best hope of reducing carbon emissions. And the power industry is trying to adjust to all these pressures.

Renewable energy is hot, for all these reasons and more. While demand for power from all sources increases, overlaid on this issue are more worries about transmission capacity, aging assets and the effect all of this has on reliability.

And reliability drives much of the discussion when utility planners and renewable energy advocates meet to devise a coherent strategy for integrating larger and larger amounts of wind, solar and other energy sources into the transmission grid. Renewable resources now produce relatively small amounts of energy—think wind and its approximate 1-percent share of electricity production—but the conversation changes when amounts of 20 percent are encouraged or even mandated.

Many renewable energy projects, particularly wind and solar, require large amounts of land. The challenges are moving power from a massive multi-megawatt farm in the nation's midsection to a population center maybe 1,000 miles away. Solutions are also needed to solve the challenge of integrating a few kilowatts of juice from a single homeowner's rooftop solar array to a distribution network measured in a few square blocks or miles.

While an increasing number of states are requiring incumbent utilities to provide fixed percentages of renewable energy to their customers, often starting in the next decade, the challenge is taking on an increased urgency. With solar set-asides in a few states with renewable portfolio standards, the issue becomes more urgent for utilities from New Jersey to California.

RESOURCE DRAWBACKS

While the move toward renewable energy is unrelenting—nearly 30 states are requiring utilities to purchase energy on an ever-growing sliding scale over the next decade or more—its twin drawbacks remain. Intermittency and the energy's distance from load centers.

"I prefer to call it a variable output resource. Intermittent implies it comes and goes rather quickly and that's not the case," said Charlie Smith, executive director of the Utility Wind Integration Group. "While an individual turbine or turbines may stop spinning, the output over an entire area in the aggregate tends to balance the load.

One policy aid that could benefit renewable energy is the organization of markets into regional transmission organizations. Smith notes that wind integration has worked best in large geographic areas with a "balancing authority" that can tap into areas where varying levels of electrical output have to be evened out. A consideration is the possibility of sudden ramping up or down of wind generation in a weather event. Handling large output variations and steep ramps are more challenging in smaller areas as a result.

As the percentage of generation capacity increases, an imperative is the improvement in wind forecasting. Well-functioning day-ahead and real-time markets are seen as a way of dealing with wind variability.

On the equipment side of the scale, newer technologies have helped reduce one of the drawbacks. "The hardware is getting more grid-friendly," said Brian Parsons, of the National Wind Technology Center at the National Renewable Energy Laboratory. "Perhaps the greatest example is in the old days. If there was a fault, the entire system would go off. Now, low voltage ride through [LVRT] is developed into all hardware."

This has been encouraged, even mandated by the Federal Energy Regulatory Commission and National Electricity Reliability Corporation over the last couple years.

LVRT is an electronic capability that will allow its wind turbines to stay connected to the grid during low voltage events caused by system disturbances. Previously, most utilities requested that wind farms trip or drop out in the event of faults in the high-voltage grid. Local and remote faults on the grid produce voltage dips that cause wind turbines—normally programmed to drop out at 70 percent voltage—to trip.

Many utilities now request that wind farms ride through grid disturbances, remaining on-line and continuing to support the system. The



solution that the industry came up with is LVRT, which allows the turbine to keep operating with a voltage drop of 10 percent. And it is becoming a requirement for new turbines connected to transmission.

Much of what the industry says it needs to do was outlined in the U.S. Department of Energy's "20% Wind Energy by 2030" report.

A recent study, conducted for Xcel Energy by EnerNex Corp., examined the cost of meeting 20 percent of electricity needs with wind energy on Xcel's Public Service Co. of Colorado system. Studies in the United States and Europe have concluded there are no insurmountable technical barriers to the reliable integration of wind energy. The cost of adjusting power system operations to accommodate wind energy is typically low. Most studies have found that these costs are under \$5 per MWh, or about 10 percent of the typical wholesale price of wind energy, according to the American Wind Energy Association.

SOLAR SITES - FROM MASSIVE TO TINY

Solar generation is largely confined to house rooftops with a few exceptions. As this source moves toward larger power plants, it will face many of the same obstacles as wind. One issue in the west is that large-scale megawatt projects require vast amounts of land that most likely fall under the jurisdiction of the U.S. Bureau of Land Management and will have lengthy and difficult site hearings and siting requirements.

"Photovoltaic [PV], prior to 2006, was about 99 percent distributed and almost all of that less than a megawatt or two," said Mike Taylor, of the Solar Electric Power Association. But now that California utilities have signed power purchase agreement contracts with developers of projects that will exceed 200 MW, the transmission grid will face the same issues it has with wind projects. LVRT is now part of the

equation for these projects as well.

Dan Zaweski, head of renewable energy programs for the Long Island Power Authority (LIPA), recently spoke at the Solar Innovations and Investment conference in New York, N.Y.

More imperative is a commercial net metering rate that went into effect at the beginning of 2009. The LIPA program started in 2000 and is one of the most popular in the country. The demand is unabated and not affected by recessionary pressures, Zaweski said.

"A large-scale PV project, from our perspective, really looks like a small-scale fossil project," he added. Large-scale PV projects could mean 500 installations totaling 2 MW—a lot of transactions—sited on everything from school buildings and commercial sites to construction on top of landfills.

"This is nontraditional for us and certainly presents a number of challenges for the grid," Zaweski said. Multiple sources of small generation that don't really have meters that measure the amount of energy produced by the home and sent back onto the grid is an example.

While it may not require the scale of large transmission projects to bring the output to market, it has the burden of being integrated into existing systems because so much of it is generated on the customer's side of the meter.

So whether it's a few kilowatts of solar energy coming from someone's rooftop, or a 1,000-MW wind plant contemplated by the Pickens Plan, integration of renewable energy sources by utilities will be part of their agenda as they comply with new mandates and customer preferences.

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Better leverage SCADA

+ SYSTEMS EXPAND TO SUPPORT NEW CHALLENGES AND NEEDS

By Charles W. Newton

→ IN TWO RECENT 2008 SURVEYS conducted by research firm

Newton-Evans, utility officials acknowledged the importance of supervisory control and data acquisition (SCADA), energy management systems (EMS) and related control systems in the development of a smarter grid. Among American officials, the role of the control center and related budgeting for control systems upgrades and new systems from 2008 to 2010 ranked second only to the expenditures planned for advanced metering infrastructure (AMI).

Among respondents from the international

DISTRIBUTION NETWORKS

The next three articles consider how utilities can build more intelligence about their distribution networks both today and tomorrow. Charles Newton first discusses ways to better leverage an existing system, SCADA. Then William Gannon shares ComEd's use of midcircuit reclosers to prevent more outages, today. Lastly, Kurt Yeager looks at the possibilities with microgrids.