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Enhancing the Grid

SMALLER CAN BE BETTER

By George C. Loehr

TRANSMISSION & DISTRIBUTION AUTOMATION

With the separation of generation ownership from transmission, the number of players on the grid has gone up by an order of magnitude. This has led to increased complication in operation. There's been a concomitant increase in the number and complexity of rules and regulations. Furthermore, the former culture of cooperation and coordination has been replaced by competition. And, to make matters worse, a movement is afoot to water down long-existing reliability standards and criteria.

Since the 2003 blackout, conventional wisdom has concluded that more rules and greater Federal Energy Regulatory Commission and North American Electric Reliability Council authority are required, coupled with certain market adjustments. Increased bureaucracy and market manipulation will not solve physical problems. But sometimes physical changes can help fix market problems. Perhaps we can use the laws of physics to create a genuine North American market, and make it work reliably.

Most of today's policymakers came to the power industry by way of the deregulation of the natural gas industry. Consequently, they believe that the electric transmission system works just like gas pipelines. Nothing could be further from the truth, of course, but there is a way to make the power system work the way the lawyers and economists think it works. That way is to break up the present huge Eastern and Western interconnections into a series of smaller synchronous interconnections, and converting some of the current alternating current (AC) lines to high-voltage direct-current (HVDC) lines.

The present Eastern and Western Interconnections – about 600,000 and 130,000 megawatts, respectively – are just too large to operate successfully and reliably in the brave new world of deregulation and restructuring. The Eastern Interconnection alone contains more than 100 control areas. By replacing these with a series of smaller interconnections, both commercial opportunities and reliability would be enhanced.

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Why? Because direct current is "asynchronous." What happens at one end of an HVDC tie is not felt at the other end. Problems in one of the new, smaller interconnections would not spread to the others. Further, HVDC ties can be controlled – just set the desired power flow on each, and that's the amount of power that it will carry. No worries about parallel path flow or a neighbor's transmission and generation outages. If the Northeast had been set up this way in 2003, New York and the other eastern load centers would never have experienced blackouts because of contingencies in the Midwest.

Hydro-Quebec and ERCOT have operated like this for many years. Both systems export and import large amounts of electricity over their HVDC ties to the Eastern and Western Interconnections. In addition, a disturbance in one interconnection cannot affect another – the 2003 blackout had absolutely no ill effects in Quebec because Hydro-Quebec is a separate and distinct interconnection. Likewise, past blackouts in Quebec caused no problems in New York, New England, Ontario or the Maritimes, all of which are part of the Eastern Interconnection. Truly, such a system would work the way the lawyers and economists think it works.

The downside is the cost of making the change. Existing lines could simply be converted to HVDC, so essentially no new transmission would have to be constructed. But AC/DC converters would have to be installed at both ends of each HVDC tie. The cost of these would be about $100,000 per megawatt at each end. The total cost for all of North America would likely be something less than $10 billion. That seems like a lot, but the cost of the 2003 blackout alone has been pegged at $6 to $10 billion. Avoiding just one such massive interruption would pay the entire cost. The entire project could be financed by assessing an extra kilowatt-hour charge on all customers for two years – amounting to about $1 per month for a typical 600 kilowatt-hour residential customer.

One problem is the level of cooperation that would be required to implement such a plan – a serious problem in the current competitive environment. This would seem to be an appropriate place for governmental leadership.

George C. Loehr, the former executive director of the Northeast Power Coordinating Council, is a management consultant.

TACKLING T&D MYTHS

Since the 2003 blackout, we've seen plenty of myths in the electric power industry.

Take the frequent assumption that to increase reliability all we have to do is build more transmission lines. It may seem self-evident, but it's wrong. More transmission equals higher transfer capability. Only tougher, more stringent standards or criteria will result in greater reliability — the most common example being local load pockets. But a system with weaker transmission that's operated to higher criteria will be more reliable than one with stronger transmission that's operated to weaker criteria. Unfortunately, most policy-makers don't understand the difference between commercial congestion and reliability. As Jack Casazza, an industry expert, recently noted, "congestion is an economic limit and causes reliability problems only when reliability criteria are violated." If you want to facilitate greater commercial use of the grid, build new transmission. If you want higher reliability, though, use stronger criteria. If you want both, then do both.

Another common myth is that, until the energy act of 2005, we never had reliability standards for the bulk-power transmission system in North America. The fact is, the Regional Reliability Councils have maintained and enforced reliability criteria for more than 40 years. And, contrary to another myth, they were mandatory in many regions, including NPCC, MAAC, and SERC. In many parts of the country, imposing mandatory standards was nothing more than a solution in search of a problem.

I've often heard the present bulk-power system characterized as a patchwork of lines built by individual utilities without coordination with others. That is not correct. Before deregulation, integrated power pools like NYPP, NEPOOL and PJM effectively planned and operated their systems as single entities. The Regional Reliability Councils provided coordination on a much broader basis. There even were interregional groups that undertook regular programs of study to ensure that developments in one region would not have adverse effects in others.

A number of recent articles in the general press attribute recent capacity shortages, price spikes and blackouts to the growth in electrical demand brought about by our increasing use of computers and other high-tech devices — all of which, of course, depend on electricity. The truth is that today's 1 to 2 percent electrical growth is quite low by historical standards. Since Edison's Pearl Street system in 1882, electrical consumption has grown steadily every year, with the only exception being several years during the Great Depression. Even as recently as the 1960s, the growth rate was more than 7 percent. The only thing unusual about the rate of growth now is that it's so low.

– George C. Loehr