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Using More Of The Grid We've Got

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My daughter's WAZE GPS app sends her a different route to work every day. Back in the old days (2015), she would have had to sit in more traffic because she would have no idea where the congestion was or any ability to avoid it. Congestion on the transmission grid is both annoying and extremely costly for wind project owners. It is increasingly causing low locational energy prices and even physical curtailment. The wind industry can and should build more roads and more transmission lines in certain cases. The industry can also get more out of the grid with technologies that are now readily available.

Dynamic line ratings and power flow control are two examples that can help alleviate congestion and deliver more wind over existing lines. The wind industry and utility sector have succeeded before in improving use of the existing grid. The development of regional transmission organizations (RTOs) and independent system operators (ISOs) was, in part, an effort to allow the free physical flow of electrons

Commission's (FERC) transmission tariff reform effort that led to Order No. 890 10 years ago, the commission agreed with the wind industry and created Conditional Firm Transmission Service to allow use of the physical capacity that demonstrably existed but was not being sold by transmission operators (TOs). When the industry works with transmission owners, RTOs and FERC, a case for increased efficiency while protecting reliability, improvements can be made.

Dynamic line ratings (DLR) is one transmission utilization technology that can improve the economics of wind energy. There is an unexploited opportunity based on the fact that transmission lines can deliver more energy when they are cooled by wind. The same wind that generates wind energy cools lines and allows them to deliver more energy without harm to the lines or reliability. The transmission owner can change its line ratings from static to dynamic, adjusting each line's capacity over time based on monitoring of actual conditions to allow increased flow when the capacity exists. A U.S. Department of Energy (DOE) study tested DLR on the Oncor and New York Power Authority (NYPA) systems and found as follows:

• An increase in wind speed of 3 ft/s at a 90° angle to the line revealed a 44% increase in capacity;

• NYPA believes wind farm curtailment could be mitigated using dynamic ratings;

• Oncor observed real-time capacities that, on average, were between 30% and 70% greater than static ratings and between 6% and 14% greater than ambient-adjusted ratings; and

• NYPA observed even greater increased real-time capacity of between 30% and 44% above the static rating.

DLR is not a new concept, and the wind industry has been advocating it for well over a decade. What is new is the maturity and commercialization of the technology to monitor lines and integrate line monitoring information with ambient conditions to be able to predict flow capacity. System operators have also significantly improved their grid operations techniques, and at least one (PJM) now has security-constrained economic dispatch software that can accept dynamic ratings.

Another promising transmission utilization technology is advanced power flow control. This technology "pushes" and "pulls" power flow to move flow from constrained or congested lines to underutilized parallel lines. According to the DOE's ARPA-E program, which supported the technology's development, power flow control could increase grid utilization by 30% and result in cost-savings of 50% compared with other solutions. Any reduction in physical congestion would improve the locational prices received by wind generators and potentially reduce physical curtailments.

Better yet, when these two technologies are paired together, they create compounding benefits to grid efficiency, with the DLR system acting as the intelligent alerting system revealing the additional capacity and the power flow control devices directing the electrons based upon this information.

So how will these technologies be deployed? If they are so great, why aren't TOs using them? Those are fair questions. They also sound like the classic joke about the economist who says the $20 bill on the street cannot possibly exist because someone would have already picked it up.

But here's why the bills are lying all over the street: Transmission is a monopoly, so only one entity operates the lines, and revenues are currently regulated without any connection to how much energy is delivered. It is as if only one person is allowed to walk down the street and pick up the bills, but that person isn't allowed to keep them.

The regulations causing perverse incentives are the responsibility of FERC. In much of the country with RTOs or ISOs, transmission owners are regulated using cost-of-service regulation such that they are compensated for their "revenue requirement," which is a function of an allowed return on equity (ROE) and their invested capital, or rate base. The RTO or ISO collects access charges from load-serving entities and other transmission customers on behalf of TOs and distributes them out to participating TOs in their region. It is now standard practice to allow "formula rates" such that any under- or over-collection is trued up in subsequent years, making it nearly automatic for TOs to recover their revenue requirement.

Nothing in the above regulatory regime is connected to how much service is provided, how much power is delivered or any other metric of performance. TOs could deliver twice as much power but would get nothing for it. The actual facilities for power flow control or DLR could easily be incorporated into transmission rate base, but that is not enough; the tiny fraction of total rate base invested in the equipment makes the whole system more efficient, and those savings need to be leveraged to give appropriate incentive to employ them.

If we want TOs to deliver more power, we need to give them a reason. It is not their fault they are following the incentives that have been established for them. If we help them change the incentives, they might keep a portion of the economic savings created.

FERC can change the incentive structure. FERC has full jurisdiction over the rates, terms and conditions of service for these TOs. FERC uses performance-based rates in its regulation of oil pipelines so it can be done within its authority. In its regulation of gas pipelines and transmission service

are just, reasonable and not unduly discriminatory or preferential. If the efficiency savings are as much as studies indicate, there will be plenty of savings to share between transmission customers and TO shareholders while providing more service to wind generators and others.

FERC's authority to provide incentives was significantly strengthened and clarified by the Energy Policy Act of 2005: "The Commission shall establish, by rule, incentive-based (including performance-based) rate treatments for the transmission of electric energy … reducing the cost of delivered power by reducing transmission congestion … The rule shall … encourage deployment of transmission technologies and other measures to increase the capacity and efficiency of existing transmission facilities and improve the operation of the facilities."

Some willingness to innovate in regulatory policy will be needed by the new commissioners. FERC is an extremely precedent-driven organization. In the same way that people do not get fired for doing things the same way as before, FERC orders do not tend to get overturned by courts if they are following precedent. Innovation is not exactly FERC's forte.

The EPAct provision above was implemented but failed to result in any change in the incentives for grid utilization. The main focus of FERC's implementation in Order 679 was on grid expansion, not grid utilization. And the effort devolved into a mere determination of ROE adders, and opponents of higher ROEs succeeded in getting FERC to limit ROE incentives, so the structure is pretty much back to where it started before the EPAct.

The wind industry has an opportunity for regulatory innovation as four new FERC commissioners take their seats on the commission. First, the commission could allow a performance metric of congestion as an adder/subtractor above or below standard rates. The incentive could be ex ante, based on expected congestion and modeled congestion reductions, or ex post, based on actual congestion relative to expected levels. It need not be a whole new regime that tosses out formula rates, which are firmly entrenched at this point. The great regulatory economist Alfred Kahn was fond of saying "all regulation is incentive regulation." It would be a great start for FERC to recognize the incentive properties inherent in the current structure and open a process to consider modifications without necessarily taking on all the baggage from earlier "incentive ratemaking" attempts.

Another opportunity is the commission could require or encourage advanced technologies in transmission planning. Each region is required to have a transmission planning process. Those requirements are being reviewed in a process begun last year to review Order 1000. When Order 1000 was introduced in 2009 and when earlier planning requirements were installed in Order 2000 in 1999,

efficiency, not grid utilization technologies. If grid utilization isn't "transmission" or a "non-wires alternative," then the commission could require consideration of a third category called grid utilization improvements.

Finally, these technologies could be options in the interconnection process. A coalition of DLR providers submitted comments to FERC in the interconnection proposed rule proceeding requesting DLR as an option if transmission capacity were limited.

There are significant technological and economic opportunities to increase delivery of wind energy over existing lines ready to be deployed just when we need it.

To move these solutions forward, the wind industry will need to identify congested transmission systems that limit wind production and find TOs willing to try new technologies. Also, the wind industry needs to continue developing a tariff change to file with FERC that allows TOs to profit from the efficiency gains. These steps can all be made to avoid congestion and improve project economics soon before the problem worsens.

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