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With Interconnection Agreements, The Devil Is In The Details

It is important for an owner of a renewable energy asset to open a dialogue with the transmission provider early in the life of the project.

By Gary Bachman, Evan Reese & John Frenkil

Although the Federal Energy Regulatory Commission (FERC) has adopted a pro forma interconnection agreement that governs the interconnection of generating facilities to FERC-jurisdictional transmission assets, the pro forma nature of the agreement can be somewhat misleading, because the appendices attached to the agreement are drafted on a project-specific basis, often after lengthy negotiations between the generation project developer and the transmission provider.

This article identifies several issues that both transmission providers and renewable energy generators should consider during the negotiation of interconnection agreements to avoid implementation issues during the term of such agreements. Specifically, transmission providers and generators should be prepared to address low-voltage ride-through capability, curtailment procedures, the sharing of data and forecasting, scheduling rules and balancing-area integration costs, and opportunities for self-supply.

Under the Federal Power Act (FPA), FERC has jurisdiction over the transmission and resale of electric energy in interstate commerce. The FPA authorizes FERC to order electric utilities to interconnect with a variety of entities, including third-party generators, such as wind and solar power facilities, that are not directly affiliated with traditional vertically integrated utilities.

In Order No. 2003, FERC required public utilities to offer nondiscriminatory, uniform interconnection procedures and agreements for generators proposing new facilities over 20 MW as part of the pro forma open-access transmission tariff (OATT) adopted in Order No. 888. Subsequently, FERC issued Order No. 2006, which provides parallel rules for smaller generators with a nameplate capacity of 20 MW or less.

The provisions added to the pro forma OATT in Order No. 2003, known as the standard large generator interconnection procedures (LGIPs), direct the way in which interconnection requests are to be prioritized and the process for conducting interconnection studies. The LGIPs demand certain minimum requirements as part of an interconnection request for any proposed new generating facility and additional requirements for proposed wind generation pursuant to Order No. 661, including a set of preliminary design specifications depicting the wind facility's collection of turbines as a single equivalent generator.

Following the submission of an interconnection request, the applicant generator and the transmission provider are required to hold a scoping meeting, and the transmission provider must conduct studies to determine the feasibility of the generator's interconnection and the impact it will have on the reliability of the transmission system. The transmission provider must also identify and estimate the cost of the required network upgrades and other facilities needed to physically interconnect the generation facilities to the transmission system.

Standardization

The pro forma interconnection agreement negotiated subsequent to the aforementioned studies includes general terms and conditions that govern the interconnection of the generating facility. FERC required a uniform large generator interconnection agreement (LGIA) in Order No. 2003 because, in theory, standardization reduces the time and cost of interconnection, preserves reliability of the electric grid and promotes the development of new generating facilities interconnected to the transmission system.

While the general terms contained in the pro forma interconnection agreement are typically applicable to all proposed generation, in practice, the specifications included in

the appendices to each individual pro forma interconnection agreement are critical to the proper consideration and operation of the proposed interconnection and ultimately affect the bottom line of a renewable energy generator's balance sheet.

Specific provisions related to the integration of variable resources include, but are not necessarily limited to, the following:

■ **Low-voltage ride-through capability.** In Order No. 661, FERC required wind generators to include Appendix G to the pro forma LGIA in order to address the needs of transmission operators for voltage support from wind farms larger than 20 MW. If the transmission provider determines while conducting the interconnection studies that the new wind generator may adversely impact the safety or reliability of the transmission system, then the generator must include provisions establishing that the wind facility will maintain low-voltage ride-through capability or be able to remain online during voltage disturbances up to certain time periods and certain associated voltage levels.

■ **Curtailment.** In order to control power-system frequency, transmission providers are increasingly requiring wind developers to agree to curtailment provisions in the appendices to the LGIA.

Under a curtailment provision, wind generators may be asked during a reliability event to reduce output in real time by either adjusting the facility's turbine blades or shutting down the facility entirely. This is clearly an unfavorable option for generators due to the subsequent loss in electricity sales, along with losing the benefit from the production tax credit during periods when the facility is not producing energy.

Investor-owned utilities and other transmission providers subject to FERC jurisdiction are not authorized to curtail power, except for reliability purposes, without FERC's approval. Nevertheless, the terms of curtailment for reliability remain an issue to be negotiated. Installation of a so-called curtailment package or special protection system is often offered by the transmission provider in lieu of expensive upgrades to the transmission system.

Assuming a generator agrees to install a curtailment package, other contentious topics of discussion remain on the table. These issues include who pays for the installation, whether costs are eligible for transmission credits and who retains control of actually switching off the generator.

Of particular interest to wind developers in the Northwest, the Bonneville Power Administration (BPA), a federal entity that markets wholesale power in the region and runs the transmission grid, requires and has implemented wind curtailments for economic and environmental purposes.

When BPA reaches 90% of its decremental reserve capability, its interconnection customers - whose generating facilities include variable energy resources (VERs) - must either reduce generation when they have substantially overgenerated or completely shut down when they have substantially undergenerated.

In addition, BPA will curtail wind power facilities when there is overgeneration of hydro within its balancing authority to avoid excess water spills, which could cause gas bubble disease in salmon. This practice is currently being challenged but highlights the potential for increased curtailments, which underlines the importance of clearly addressing such issues in interconnection agreements.

■ **Sharing of data and forecasts.** Forecasting the output of generation by VERs, such as wind facilities, is critical to bulk power-system reliability in order to ensure that adequate resources are available for ancillary services and ramping requirements. As the accuracy of wind generation forecasts improves, so too does the transmission provider's ability to schedule load in real time.

Accurate wind forecasting helps to implement procedures for balancing the transmission system, which also reduces the amount of reserve products needed to maintain system reliability. Data collected from forecasting may include temperature, wind speed, wind direction, atmospheric pressure and the capacity available to produce electricity during the time frame of the operational forecasts.

In November 2010, FERC issued a notice of proposed rulemaking (NOPR) that addresses the impact that VERs have on the grid's reliability. The NOPR proposes requiring interconnection customers whose generating facilities are VERs to provide meteorological and operational data to their transmission provider.

This data would allow transmission providers to implement power-production forecasting to predict the timing of potential ramp events and to efficiently deploy resources in response. Where such data-sharing is a feature of an LGIA's appendices, the parties must still decide who can rely upon the forecast and which party will pay for collecting and administering the data.

■ **Scheduling.** Wind generators and other VERs potentially impose a disproportionate impact on the overall variability of transmission systems. This requires transmission providers to hold a greater amount of regulation reserves for VERs than for load or other generation resources. In order to improve the efficiency in dispatching all energy resources on its system, a transmission provider may require more sophisticated scheduling procedures from its generators, particularly VERs.

Because transmission schedules for VERs are usually set 20 minutes to 30 minutes ahead of the hour, the forecast of output may be up

to 90 minutes old when scheduling procedures are based on the hour. Therefore, FERC's November 2010 NOPR proposed the implementation of 15-minute scheduling for VERs.

Although hourly scheduling windows are traditionally the norm in regions outside those run by regional transmission organizations shorter scheduling windows, such as 15 minutes to 20 minutes, allow schedulers to be more precise in estimating output. This may result in generators paying less in penalties for inaccurate scheduling.

■ **Integration costs and self-supply.** As the penetration of wind generators increases in balancing authorities across the country, wind generators must actively participate in maintaining system reliability along with conventional generators due to the resulting impact of variable resources on power-system performance. In FERC's VER NOPR, it proposed allowing transmission providers to collect the costs associated with integrating variable resources into the transmission grid.

Alternatively, because transmission systems may lack ancillary markets or the ability to provide ancillary services, the wind generator may need to augment the system, either through self-supply or third-party supply of these services, in order to maintain the reliability of the transmission system. In Order No. 890, FERC revised the pro forma OATT to allow generators to self-supply or supply from a third party any ancillary service that their resources are capable of providing.

It is important for an owner of a renewable energy asset to open a dialogue with the transmission provider early in the life of the project with respect to the costs associated with interconnecting and what options, if any, are available for self-supply. Examples of self-supply can include either dynamic scheduling or contracting with a gas-fired generator to ensure stable supply when a variable asset is not producing as scheduled. Providing sufficient documentation for the self-supply of such ancillary services is critical for the proper administration of the interconnection agreement and any related transmission service agreement.

Although the general terms and conditions of the pro forma agreement are rarely changed, the devil is in the details of its appendices. Accordingly, both transmission providers and renewable energy generators should be prepared to address several issues when drafting and negotiating interconnection agreements.

Gary Bachman and Evan Reese are members in the electric practice at Van Ness Feldman, and John Frenkil is an associate in the firm's Washington, D.C., office. They can be reached at (202) 298-1800 or gdb@vnf.com, ecr@vnf.com and drf@vnf.com, respectively.