

## IMPLICATIONS OF ENERGY SCHEDULING REQUIREMENTS FOR WIND ENERGY

### *Issue Brief*

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#### **ISSUE DESCRIPTION/PROBLEM STATEMENT**

Operating rules of wholesale power markets typically require that power from generators – and thus corresponding transmission capacity – be scheduled in advance to meet predicted loads. In most cases, scheduling is done on a day-ahead basis, but in some instances shorter periods are accommodated. Once scheduled, generators or their scheduling agents are obligated to provide power to the grid in accordance with the amounts scheduled. If they do not, they are typically required to reimburse the system operator for the cost of correcting the imbalance. In some cases, such as when imbalances from scheduled amounts are large or frequent, generators or their scheduling agents may also be required to pay financial penalties designed to encourage adherence to scheduled power deliveries and prevent market gaming.

To correct imbalances, the system operator will typically turn to its real-time balancing resources or markets, comprised of generating units with the ability to ramp power generation upwards or downwards quickly in response to signals from the automatic generation control system or the system operator. If a real-time balancing market is present, these generators bid for the opportunity to provide balancing services to the system operator, which in turn dispatches the units – starting with the lowest cost resource and working its way up the bid ladder – as needed until the imbalance is corrected. System operators typically run intra-hour balancing markets at 5 to 10 minute intervals. Otherwise, a utility system operator will rely

on utility-owned resources to provide balancing services. Without these measures, electric reliability would decrease, and electric power outages would be common.

Besides maintaining reliability, real-time balancing markets are of primary importance to well-functioning bulk power markets. Even if most electric power is bought in forward markets, real-time prices are the foundation used to settle forward markets. Real-time prices also influence investment decisions, from whether to repower existing generating units, to build new power plants, and to invest in metering and control technologies that allow customers to shape their electric consumption in response to volatile electric prices.

Indeed, in Order 2000 and in its current proposed rulemaking on Standard Market Design (SMD)<sup>1,2</sup>, as modified by the FERC White Paper that was released in April 2003, FERC has emphasized the need for day-

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<sup>1</sup> See *Regional Transmission Organizations*, Order No. 2000, Docket No. RM99-2-000, issued December 20, 1999. Available at [http://www.ferc.gov/Electric/RTO/post\\_rto.htm](http://www.ferc.gov/Electric/RTO/post_rto.htm).

<sup>2</sup> *Standard Market Design*, Docket No. RM01-12-000, issued July 31, 2002. Available at <http://www.ferc.gov/Electric/RTO/Mrkt-Strct-comments/smd.htm>. See also the FERC White Paper, issued April 28, 2003, at [http://www.ferc.gov/Electric/RTO/Mrkt-Strct-comments/White\\_paper.pdf](http://www.ferc.gov/Electric/RTO/Mrkt-Strct-comments/White_paper.pdf) and [http://www.ferc.gov/Electric/RTO/Mrkt-Strct-comments/White\\_Paper\\_Appendix\\_A.pdf](http://www.ferc.gov/Electric/RTO/Mrkt-Strct-comments/White_Paper_Appendix_A.pdf).

ahead and real-time balancing markets. FERC has proposed to require RTOs or ISOs to operate a security-constrained real-time balancing energy market. In addition, FERC has proposed to require a RTO or ISO to operate a day-ahead energy market and an ancillary services market, unless the RTO can demonstrate that the costs of setting up such markets exceed the benefits. In Order 2000, FERC stated that:

We have determined that real-time balancing markets are necessary to ensure non-discriminatory access to the grid and to support emerging competitive energy markets. Furthermore, we believe that such markets will become extremely important as states move to broad-based retail access, and as generation markets move toward non-traditional resources, such as wind and solar energy, that may operate only intermittently.<sup>3</sup>

Wind generators are greatly affected by the operating rules pertaining to both scheduling requirements and real-time balancing markets. Because wind is naturally variable, wind generators may have a difficult time submitting accurate generation schedules on a day-ahead basis, and on meeting scheduled obligations in real-time operation. Thus, imbalance rules partially intended to prevent market gaming and to encourage bidding in good faith may expose wind generators to more frequent market price and penalty risks than those faced by traditional generators, even when wind generators are operating normally and following industry standard best practices.

The requirements that generators schedule power deliveries on a day-ahead basis, meet those schedules in real-time operations or pay the costs of correcting imbalances, and pay non-market-based penalties for large or frequent imbalances, are rooted in the following assumptions: (a) that operators of generating units are able to predict and control their output on an hour-by-hour basis with a high degree of certainty; (b) that requiring generators to pay the costs of correcting imbalances and non-market-based financial penalties will encourage generators to provide what they predict; and, (c) that imbalances from scheduled generation amounts are always detrimental to system operation.

These assumptions may work well for traditional or fossil-fired resources, but they do not match well to generating units that rely on naturally variable resources such as wind.<sup>4</sup> The reasons include the following:

- ✎ Assumption (a) simply does not hold for wind plants. Despite significant advances in modeling wind resources, the output of a wind plant cannot accurately be predicted more than a few hours in advance, and cannot be fully controlled during real-time operation;
- ✎ Assumption (b) is not valid because wind-generation imbalances are most often due to variations in wind speeds, over which the plant operator has no control. Thus, the imposition of costs or penalties for imbalances has little or no effect on the behavior of the wind plant operator; and

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<sup>3</sup> *Regional Transmission Organizations*, 89 FERC ¶ 61,285, issued December 20, 1999. Available at <http://www.ferc.gov/news/rules/pages/RM99-2A.pdf>.

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<sup>4</sup> Scheduling requirements may also negatively affect solar and run-of the river hydro plants.

✍ Assumption (c) is not always correct, because at certain times imbalances (over- or under-generation) may actually be beneficial by helping achieve system stability and reducing the need to dispatch balancing resources.

Under many open access transmission tariffs under Order 888, excess deliveries over energy schedules may be paid less than the market rate, or not paid at all, while energy deliveries below schedules may be penalized at levels beyond the market cost of correction. These policies are not tied to market costs, and can negatively impact wind generators who cannot schedule precisely in advance. These Order 888 provisions are still in effect in most regions of the country, and wind development generally does not occur unless wind energy is exempted from energy imbalance provisions, or energy imbalance penalties are dropped in favor of a real-time balancing market. Absent change, scheduling and energy imbalance provisions could negatively impact the operation of wind generators in the electric market, or sharply limit their contributions to the grid.

### ISSUE IMPORTANCE

Wind and other renewable energy resources, such as solar energy and run-of-the-river hydroelectricity, are naturally variable, and the energy output of a generating unit cannot be controlled fully in real-time. Therefore, how scheduling requirements and real-time markets are designed and how they operate are important to wind, as these rules can determine whether wind generators can effectively participate in electricity markets.

### OPTIONS FOR RESOLVING THE ISSUE

FERC envisions working with states and regional state committees to design regional wholesale markets that will fully implement Order 2000 and minimize seams issues between regions. This will take some time to accomplish, and likely in phases. Until then, much of the nation's power grid will operate under Order 888 tariffs, typically with heavy imbalance penalties. Thus, while examining options for resolving scheduling and balancing issues that affect wind generators, it is worthwhile to consider not only options that can be used under fully-implemented regional wholesale markets as envisioned by FERC, but those that can serve in a transition capacity as well.

In this light, a range of options have been advanced for resolving the issues faced by wind generators in balancing markets. The options can be implemented in isolation or in combination with each other:

(a) **Eliminate non-market-based imbalance penalties.**

Wind and other generators would be exempt from energy imbalance penalties, in some cases only if certain conditions are met, such as requirements to submit wind energy forecasts in advance or as long as energy imbalances from wind generators are within a certain band (see sidebar for examples.)

(b) **Create a real-time balancing market, where imbalances are priced at the real-time market price.** Here, a wind imbalance could result in either a charge or a payment to the wind operator, depending on the real-time needs of the system operator. These charges and payments would be determined through a real-time balancing market mechanism consistent with what was proposed in FERC's Order 2000 and in FERC's proposed SMD rule.

- (c) **Settle imbalances on a net basis over an extended time period.** Over a period of a few hours or days, wind generators may deviate significantly from their scheduled generation, but over a longer time period these deviations would tend to cancel each other out. Allowing imbalances to be settled on a net basis over a longer time period could significantly reduce operating risks faced by wind generators without unfairly shifting costs.
- (d) **Allow generators more flexibility to deviate from their predicted or scheduled output.** System operators can generally accommodate large load swings (for example, switching a 100 MW industrial load on or off) within 30 minutes' notice. Allowing generators similar flexibility on a short-term basis could reduce the risks that arise from the inherently unpredictable nature of the wind resource.
- (e) **Exempt wind or other generators relying on uncontrollable resources from scheduling requirements.** When the amount of wind generation on a transmission system is relatively small, the costs of implementing systems that fully integrate wind into scheduling and balancing markets may be higher than the benefits achieved by doing so. Under such an approach, the system operator would simply accept the output of these generating units in real-time. This approach effectively reassigns the costs of wind's intermittency away from the wind generator and toward all market participants. While potentially problematic, the amount of cost shifting may be tolerable if the level of wind generation is small.

- (f) **Encourage innovative private partnerships to mitigate risks.** Bilateral schedules could be arranged between wind generators and wholesale power purchasers, such as power marketers. In essence, wind generators would transfer the risk of non-delivery to wholesale power purchasers, who could mitigate that risk by incorporating the wind energy into a broader resource portfolio. Indeed, larger energy companies may have both wind energy and wholesale power purchasing operations in-house, and can take advantages of these synergies to bring wind resources into the electric market.

Private market exchanges may facilitate such partnerships by acting as intermediaries between generators and the ISO or RTO. The Automated Power Exchange (APX), for example, operates a green power trading platform in California, where renewable energy generators can bid hourly, in blocks of four hours, and also monthly into the exchange. The APX is also a scheduling coordinator on the California ISO and can aggregate the different characteristics of renewable generators, alleviating the problems of intermittency through diversification of resources.

### **IN PRACTICE...**

*PJM:* The PJM Interconnection administers day-ahead and real-time markets and does not levy penalties on scheduling deviations, settling these deviations in the real-time energy market. The measures in place do not penalize wind generators for not being able to control their resource and do not

create an unfair advantage over other generators. They allow wind generators to buy power at market prices to meet previously arranged schedules if the wind resource is unavailable, and provide market-based revenues if wind energy deliveries exceed previously submitted energy schedules.

**NYISO:** Like PJM, the New York ISO (NYISO) also allows wind generators to schedule near real-time and allows imbalances to be settled at the real-time market price. Alternatively, the wind generator could bid into the NYISO's hour-ahead market. If the wind generator's bid is considered economic, then it will be scheduled and the wind generator will be paid the real-time market price. The NYISO will also reset the wind generator's schedule to actual metered delivery before the market is settled in real-time.

**California ISO:** The California ISO won FERC approval in March 2002 for its plan to net deviations from variable resources over a monthly settlement period, consistent with options (a) and (c). In order to participate, wind generators must install metering equipment that permits real-time telemetry of operation and weather data to the ISO. Scheduling coordinators representing such generators must submit day-ahead schedules consistent with forecasts developed by the ISO and pay a fee to defray the ISO costs of the forecasting service. However, because of plans to extensively redesign the California ISO market, few wind generators are participating in this scheduling program.

**ERCOT:** The Electric Reliability Council of Texas (ERCOT) exempts intermittent renewables from scheduling penalties, as long as total metered generation of the intermittent renewable resource falls between 50% and 150% of the intermittent

renewable resource's schedule in any schedule interval.

**BPA:** The Bonneville Power Administration's Transmission Business Line (TBL) agreed to remove a 100 mill/kWh generation imbalance charge for energy deliveries that deviate from advance schedules by more than 10%. BPA will consider more substantive changes, such as averaging imbalances monthly instead of hourly and eliminating a 10% incremental cost adder, in a general transmission rate case, scheduled to take effect in October 2003.

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