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Backstopping Renewables

Who Pays for Firming Up Variable Energy Resources?

The major economic hurdle for renewable power generation technologies continues to be substantial installation costs. But another cost is associated with continuous load-balancing, made possible by backstopping that variable generation with dispatchable generators that typically consume expensive fossil fuels. Bottom line: Who pays for the capacity firming or backstopping resources?

By **Barbara S. Jost**, Davis Wright Tremaine, LLP

Renewable energy resources, principally wind and solar power, do not emit climate-changing gases or other pollutants, and are both free and plentiful. In contrast, fossil fuel resources emit carbon when burned and are viewed as declining in supply and growing in expense. Nevertheless, in the short term, the major economic hurdle for renewable generation technologies has been and continues to be capital costs; the challenge of load balancing when the grid has a substantial portion of variable generation, and the costs associated with providing dispatchable power to back up that variable generation, may raise the bar even higher.

Energy security and environmental concerns have fostered U.S. regulatory policies that actively promote development of generation from renewable sources. As of early 2011, 34 states and the District of Columbia had established either renewable or alternative portfolio standards, and an additional seven states had set renewable/alternative goals. These standards frequently require utilities to purchase a percentage of their energy requirements from generators that rely on renewable energy sources such as wind and solar.

In addition, a number of federal policies encourage renewable energy development by lowering installation cost hurdles. These include the production tax credit, the investment tax credit, accelerated depreciation for certain renewable generation property, and federal loan guarantees for renewables developers.

As a result, wind and solar power constitute an increasing percentage of new electric generation capacity in this country. At the end of 2009, wind accounted for 39% (10 GW) of all newly installed generation capacity, bringing total wind capacity to more than 35 GW; another 85 GW are pro-

jected to be online by the end of 2012. At the end of 2009, solar generating capacity was over 2 GW; almost half of that was added since 2007.

Leveling the Playing Field

In January 2010, the Federal Energy Regulatory Commission (FERC) began expressing its concern that this rapidly growing proportion of renewables generation was unable to access the interstate transmission grid on an equal footing with traditional fossil-fueled generation such as coal and natural gas. At the same time, FERC recognized that the variability of wind and solar generation, referred to by FERC as Variable Energy Resources (VERs), places unique demands on the electric grid. Balancing authority operators are required to balance resources and load continuously to maintain a scheduled interconnection frequency of 60 cycles per second. Yet VERs generators today cannot control or store their energy source; neither can they, today, economically store their electrical output, which is largely dependent on weather and time of day.

To maintain reliability, FERC recognized that transmission systems with substantial levels of wind need more active load-following generation capacity than a comparably sized system without wind. And such additional load-following capacity does not come free.

In November 2010, FERC proposed changes to its pro forma Open Access Transmission Tariff to remove barriers to the integration of VERs into transmission systems. This proposal included a new ancillary service rate schedule for Generator Regulation and Frequency Response Service, which would enable transmission providers to recover supply-side variability management costs. This regulation reserve rate schedule is

to be applied to all forms of generation, not just VERs, within a transmission provider's balancing authority area to the extent the customer cannot otherwise demonstrate that it has self-supplied a sufficient level of regulation reserves.

What is sufficient will vary. FERC recognized that VERs "may impose a disproportionate impact on overall system variability" and therefore transmission providers will need to hold a greater per-MW amount of regulation reserves for VERs as compared with other generation resources. Importantly, FERC specified that such regulation reserve costs "should be allocated to transmission customers consistent with cost causation principles." FERC also noted that, in addition to meeting the needs of systems with variable supplies for regulation reserve capacity, no barriers to electricity demand response should be erected in the process. Separately, FERC's recent Order No. 1000 addresses transmission planning and cost allocation methods for all resources, including VERs.

However, FERC's focus on just the transmission system costs associated with VERs integration is too narrow. The agency also needs to address the recovery of the upstream fuel costs incurred by power generators when they are called upon to firm up VERs generation. A substantial portion of such costs, in some regions of the country, is likely to be gas costs. That is because simple cycle gas generation can ramp up and down quickly to reliably integrate fluctuating VERs output. Another source of "fast-ramp" capability is hydroelectric pumped storage; however, such hydroelectric capacity is regional and limited by both geography and water availability.

Regulatory Uncertainty

The narrow focus of the FERC rulemaking leaves regulatory uncertainty as to cost

recovery for “upstream” variable management gas costs. Several commenters in the pending rulemaking on VERs electric integration costs have urged FERC to open a separate rulemaking docket to address and resolve such upstream cost recovery issues. Some commenters, including gas pipeline owners, have urged FERC to treat all gas costs associated with firming reserves as a cost of regulation reserve service and to find that such costs should be allocated to those receiving the service. FERC has yet to act on such requests.

This regulatory uncertainty may translate into inadequate financial incentives to construct not only new firming-capable generation but also the pipeline services or capacity to provide quick-response fuel supply so that adequate back-up generation capacity is available and can be relied upon.

The absence of such a “holistic” approach could create unanticipated electric system reliability issues as VERs generation capacity continues to grow in response to the federal and state incentive programs mentioned earlier. The omission of gas firming costs in the cost of VERs generation could also lead to an unintentional understatement of the actual cost of renewable generation.

Looking down the road, a recent study on wind integration, prepared for ISO New England (“New England Wind Integration Study,” Dec. 5, 2010), raises concern that a decline in revenues for gas-fired resources due to such unintentional subsidization could adversely affect gas-fired resources’ future economic viability and that “[a]s wind penetration increases, the market design may need to evolve to incent resources to provide the flexibility required to balance net load and dispatchable resource.”

Otherwise, the addition of substantial VERs generation, with its low operating costs, could eventually displace other resources with higher operating costs, such as gas-fired generation.

Expensive New Generation Required

At this juncture, it remains difficult to get a good fix on how expensive a problem this will be to resolve. Costs will necessarily vary by region. Costs will depend on the amount of incremental gas-fired generation needed to firm up the VERs load coming online in a particular balancing authority area. If existing combined cycle units are already operating in a region’s balancing authority area, have excess capacity, and can be modified to also run in simple cycle operation, that regional balancing authority area may not need new gas-fired units to firm up added VERs generation. However, if new gas-fired units are needed, there could be substantial gas interconnection costs, particularly if existing pipeline laterals must be expanded or new laterals constructed to provide gas service to the new facilities.

Conversely, other factors may reduce the need for new gas-fired generation to firm up VERs generation. There are proposals to expand existing balancing authority areas in some regions so as to reduce reliability impacts associated with VERs integration, and thus lessen the need for additional regulation reserves.

The level of required gas-fired generation will also depend on the amount (in absolute and percentage terms) of VERs generation to be added to the existing mix of generation within a regional balancing authority area and whether the transmission operator

has other available methods to firm up VERs generation without adding energy infrastructure, such as demand response.

In regions with substantial hydropower resources, the possibility of “environmental redispatch” decisions, which shut down wind resources in favor of hydroelectric resources to avoid adverse environmental effects, could reduce the pace of wind energy growth and thus the need for additional firming resources. Tighter restrictions on out-of-state imports of wind into major markets such as California could also reduce new wind demand.

More Gas Infrastructure Required

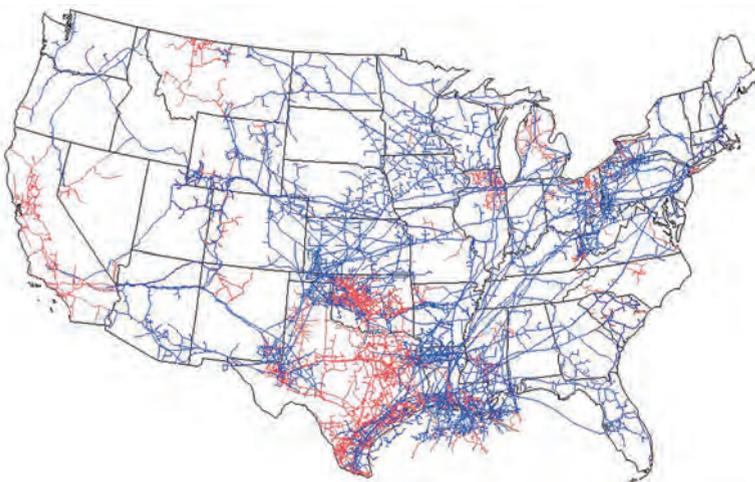
Yet a March 2011 study from the gas trade organization Interstate Natural Gas Association of America (INGAA) Foundation Inc. (“Firming Renewable Electric Power Generators: Opportunities and Challenges for Natural Gas Pipelines”) suggests that between \$2 billion and \$15 billion in new gas infrastructure will be needed over the next 15 years to support VERs firming generation requirements. To serve this new generation load, which INGAA estimates at 33 GW (45,500 GWh), this study estimates that the gas pipeline industry will need to provide almost 5 Bcf/day of incremental delivery capacity and that incremental gas consumption could reach 440 Bcf/day by 2025—almost 2% of current annual gas usage in the U.S.

These are staggeringly large numbers that arguably do not give enough consideration to the ability of gas-fired generators to work with pipelines to utilize existing gas infrastructure and transport services to provide the level of regulation reserves required (Figure 1). And it is not surprising that a study sponsored by the gas pipeline industry would envision the need to construct vast amounts of infrastructure to transport gas to new fast-ramping gas generators.

This study has been criticized by the American Wind Energy Association (AWEA), among others, as vastly overstating the impacts of VERs such as wind and ignoring the fact that there are many sources of variability and uncertainty on the grid and that they often cancel each other out. Somewhat inconsistently, AWEA also maintains that the substantial infrastructure improvements the INGAA study projects will be needed even in the absence of wind energy.

Another eye-opening element of the INGAA study is the projected cost of a pipeline transport service designed to allow a generator to quickly ramp up or down its gas usage, depending on VERs load-following requirements. Such service would need to be available on a firm, uninterruptible basis, and

1. U.S. natural gas pipeline system. This map shows interstate pipelines (blue) and intrastate pipelines (red) as of 2009. *Source: U.S. Energy Information Administration*



the cost would be in addition to the cost of the gas commodity itself. The INGAA study concludes that such a quick-response gas transport service, in part because of the forecast uncertainty of wind generation, would need to be designed at an assumed utilization rate of around 15% or less. Rates designed at such a low utilization rate would be over six times greater than the cost of the identical service, assuming a full rate of utilization.

However, it is not clear that many gas-fired firming generators would need to purchase a new gas transport service designed on such a low load factor basis. There are other potentially less-expensive ways for gas-fired generators to obtain gas transport services that enable quick ramping.

New Gas Tariffs Required

Most pipelines have substantial operational flexibility on a minute-by-minute basis. Although many pipelines have ratable 1/24 per hour take requirements for firm shippers, few pipelines have hourly balancing penalties to enforce such ratable take requirements. Most rely on daily balancing penalties, operational flow orders, or other limitations to ensure that they can meet their daily delivery obligations. Some pipelines offer enhanced hourly services that allow shippers to flow 24 hours worth of gas in a shorter period of the day, and perhaps at greater pressures. Other pipelines offer no-notice and park and loan services utilizing system linepack, effectively providing shippers with a form of horizontal storage service. However, no pipeline today offers a transportation service that provides a minute-by-minute ramp up or ramp down of gas usage that a generator following VERS load could require.

If a pipeline were to offer such an instantaneous service, issues would arise as to how to calculate the costs of maintaining linepack in the vicinity of the generators seeking such service. The outcome of this cost debate would likely turn on how the pipeline chose to design the service. Is there storage nearby that can provide some pressure regulation? Does the pipeline have to provide additional compression proximate to the generator, causing the pipeline to incur additional fuel costs? Do other shippers indirectly benefit from this service (for example, through pressure benefits) so as to justify some system-wide allocation of the costs?

Pipelines are likely to view providing such an instantaneous firming gas service as a new marketing opportunity. On some pipelines today, with demand still depressed due to a slow economic recovery, interruptible service is the functional equivalent of firm service. As a result, a portion of the gas-fired generation market currently relies on lower-cost in-

terruptible transportation services to deliver some portion of its gas supply. Pipelines are looking for any incentives, be they economic or regulatory, to convince gas-fired generators to subscribe to fixed-cost firm services. However, generators are also focused on managing their fuel costs efficiently to better compete in wholesale electric markets and ensure pass-through of costs in retail electric markets.

This has created disputes between pipelines and generators on the topic of gas/electric coordination, even before FERC's rulemaking on VERS integration. At meetings of the North American Energy Standards Board, pipelines and gas-fired generators battled over the need to change the existing gas scheduling rules. Generators insist that they need more gas scheduling flexibility to enable them to respond to unanticipated load swings. Pipelines contend that the existing rules are fine and that generators need to contract for greater levels of firm gas supply and transportation in order to ensure that they can reliably serve their load.

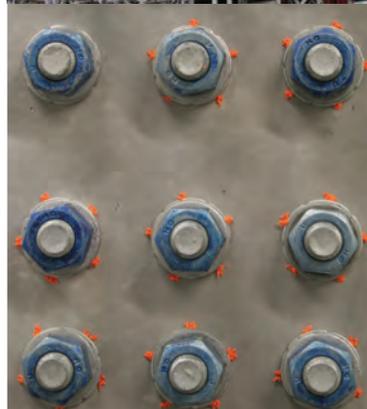
Strange Bedfellows

Ironically, the rapid growth in VERS has brought generators and pipelines together

on this topic. Both see the benefit of FERC determining the appropriate standards for recovery of upstream firming costs and providing a defined mechanism for recovery of such costs.

VERs renewable generation provides substantial environmental benefits. Such benefits are recognized by state renewable portfolio standards programs and by federal incentives that encourage renewables development. As renewable energy development accelerates, the energy and utility industries need clear guidelines as to how upstream gas and infrastructure costs associated with VERS integration are to be handled. An early decision by FERC on this matter will enhance the likelihood that growth in renewable power development, an important national objective, can continue in a fashion that does not injure fossil-based energy resources/infrastructure or detract from electric system reliability. ■

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