Focus on Finance

by Linda C. Byus

The competitive electricity market—a work in progress

While the U.S. electricity industry will face many challenges in 2014, its biggest challenge will be how to optimize the electricity market in terms of both price and reliability. From an economic perspective, the optimal market would provide the lowest cost generation 24 hours a day, 365 days a year, with 100 percent reliability. But lowest cost is difficult to determine when environmental and social costs are included in the cost structure. In addition, the economic value of reliability is variable and subjective. During the second half of 2013, traditional electricity generators, both nuclear and coal, suggested that the competitive market was not "fair" to baseload generation. Wind generators argue that "day-ahead" scheduling discriminates against wind producers. The transition to a competitive electric industry in the United States started almost 20 years ago, but with the impact on the nuclear industry and the broader generating industry, it is still a work in progress.

In April 1996, the Federal Energy Regulatory Commission (FERC) issued Orders 888 and 889 to begin promoting wholesale competition though open-access, nondiscriminatory transmission services. Independent system operators (ISO) grew out of Orders 888 and 889, as FERC suggested the concept of ISOs as one way for existing power pools to satisfy the requirement of providing nondiscriminatory access to transmission. Subsequently, through additional orders, FERC encouraged the voluntary formation of regional transmission organizations (RTO) to administer the transmission grid on a regional basis throughout North America (including Canada). In Order 2000, FERC delineated 12 characteristics and functions that an entity must satisfy in order to become an RTO. Currently there are 10 RTOs in North America.

The U.S. RTOs are the California ISO, the Electric Reliability Council of Texas, the Southwest Power Pool, the Midcontinent Independent System Operator, the PJM Interconnection, the New York ISO, and the New England ISO. ISOs operate a region's electricity grid, administer the region's wholesale electricity markets, and provide planning for the region's bulk electricity system. RTOs do the same thing, with greater responsibility for the transmission network. Since the Electric Reliability Council of Texas operates entirely within the state of Texas, it is not regulated by FERC, as all of the other U.S. RTOs are. In addition to FERC regulation, the RTOs are subject to state regulation, including resource planning and environmental restrictions. As a result, the operating rules vary across the RTOs.

The underlying concept of a competitive electricity supply market is simply supply and demand. There are buyers of electricity (customers) and sellers of electricity (generating companies). The job of the system operator is to balance supply and demand at the lowest cost possible. The system operator forecasts demand by using algorithms that incorporate a number of factors, including weather. Generation suppliers make day-ahead offers of generation at a given price. The ISO sets the structure of supply based on price—low to high—with the clearing price being the highest price that is needed to meet the forecasted demand.

In the traditional regulated electricity market, individual integrated utilities followed the same process to meet the forecasted demand. Large baseload plants, either coal-fired or nuclear, are the first plants used to meet demand. Baseload plants run

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around the clock and usually have the lowest cost per kilowatt-hour. The next level of demand is met by intermediate generating plants that run when needed. Typically, intermediate plants are smaller coal- or gas-fired plants. The final level of demand is met by gas- or oil-fired peaking units that run only at the occasional high peak demands several times a year. Renewable generators such as wind and solar were not a significant part of the fuel mix. Also in the traditional regulated market, the integrated utilities were responsible for having adequate generation for the long-term future. But in the competitive electricity market, individual generating companies (power plant owners) are not required to meet the around-the-clock demand or to provide long-term capacity or reliability.

Nuclear generating plants in the United States were built under the traditional electricity market structure. They are large baseload units that are most efficient when they run at full power around the clock. They were built for the purpose of providing a reliable source of electricity over a long forecast period. Because of the large construction cost of a nuclear plant, the plant becomes more cost-effective the longer it runs, as the construction cost is spread over more kilowatt-hours. Large baseload coal plants have a similar operating profile. Baseload plants cannot be cycled up and down as demand goes up and down—they cannot be shut off when they are not needed.

Renewable generating sources such as solar, wind, and hydroelectric are dependent on external conditions (weather) to generate electricity. Hydroelectric generation is sustainable and somewhat seasonal. But both solar and wind generation are subject to hourly changes in the weather. As a result, wind and solar are not controllable sources of electricity generation, and it is difficult to guarantee generation from these variable sources because there is no way to turn them on if weather conditions are not favorable. But when renewables are generating electricity, they may be the lowest-cost source on the grid at any given time.

Within a regional operating system, there may be times when the baseload generating plants are not the lowest-cost generators on the system. While an integrated utility would run its baseload plants around the clock, the RTO has no incentive to use the baseload units if lower-cost generation is available. The challenge for the system operator is to balance reliability versus low cost. Reliability and long-term resource planning have economic value that is not reflected in real-time electricity prices.

The challenge is exacerbated by the inclusion of environmental and social costs in the price component. While the actual price of generation—capital costs plus production costs—is easily calculated, environmental and social costs are not clearly defined. Coal-fired plants generate undesirable greenhouse gases and other pollutants, and limiting the production of pollutants adds to the cost of coal generation. For nuclear plants, radiation safety and security initiatives add to the cost of electricity generation. Currently, renewable sources of generation are viewed as environmentally desirable and receive government subsidies to encourage growth in the industry and lower the cost of the end product. As a result, public policy in the form of government regulation has the effect of increasing the cost of traditional baseload generation and lowering the cost of variable renewable generation.

RTOs have the responsibility to manage the wholesale market, with the goal of creating a competitive, low-cost electricity market, and to provide reliability planning for the region. They are subject to FERC regulation and state regulation and initiatives. The structure of a regional electricity wholesale market is not a linear problem with a "correct" answer. Electricity market design is a matrix with a number of simultaneous equations that will provide a number of different solutions based on the specific variables at a given time. A comprehensive national energy policy in the United States would help limit uncertainty and provide a defined structure for electricity production. A comprehensive energy policy, however, is not on the horizon.

From the perspective of customers, a diversified power supply—including traditional baseload generation, as well as variable renewables such as wind generation—is needed to provide the optimum mix of low cost and reliability. The goal of generating companies and investors is to maximize profitable sales of electricity.

Nuclear generating plants were built to maximize profits under the regulated market structure, with high-volume sales at a price that covered costs and provided a rate of return on investment. That business model does not exist in a competitive market, and so, a new flexible business plan is needed. Nuclear generating companies must embrace the competitive market by demonstrating that nuclear generation is clean, cost-effective, and reliable, and that it must be a key component of the U.S. energy mix. **FoF**