Regulation vs. Deregulation: It's All in the Externalities

by Christopher C. Klein

The nationwide move toward restructuring electricity markets stems, in part, from a recognition that technology has removed the "natural monopoly" justification for regulation of electricity generation. New natural gas-fired generation facilities can produce electricity at costs approaching those of large coal-fired plants at a much smaller scale and with much lower emission of pollutants into the environment. The less obvious and, until recently, less discussed factor is the increased connection of the transmission grid. This makes possible, at least in concept, the transportation of electricity over long distances between generators and consumers. Any single generating facility has become small in relation to its potential market, raising the hopes for fostering competitive markets for electric power.

Participants in the process of creating such markets, however, are discovering—or rediscovering—a nasty little secret: that natural monopoly in generation was not the *only* reason for regulating electricity in the first place. Any time a generating facility is connected to a grid of wires joining many customers and generators, it becomes part of an interdependent network. The production and consumption of electricity at any point on this interconnected grid affect the flow of electricity at every other point. A transmission constraint on the border of New Jersey and Maryland affects the flow—and price—of electricity in Boston.[1] This is an example of an externality.

Externalities arise whenever consumption or production by an individual market participant affects the well-being of other participants. Environmental externalities are perhaps the best known—sulphur dioxide emitted into the atmosphere from the burning of coal, secondhand cigarette smoke, etc.—but networks give rise to externalities as well, and electrical grids are no exception.

Consider our situation in Tennessee. The Tennessee Valley Authority (TVA) generates most of the power consumed in the state and operates the transmission grid that connects its generating plants to local distributors.[2] TVA's transmission system is connected to those of neighboring utilities to facilitate the exchange or sale of power among utilities. Power flows onto or off of TVA's system according to the laws of physics independent of the structure of any business transactions among utilities. These unintended inflows and outflows are externalities associated with the interconnectedness of the grid.[3]

These externalities are important because the associated costs and benefits are difficult to quantify in the competitive market prices that follow a restructuring of the electric industry. End-users benefit from the grid's interconnections that give them, or their power companies, access to power generated on neighboring systems. This not only facilitates competitive pricing of electricity, but increases the reliability of the grid. It also imposes costs, as customers over a wide area may experience power failures, or increasing power prices, due to imbalances between generation and consumption on neighboring systems.

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Typical solutions applied to these external problems would involve regulation or either government or cooperative ownership of transmission facilities. This led my colleague David Sapper and me to suggest recently that quasi-governmental, nonprofit entities like TVA might be usefully preserved as benchmarks against which to measure the performance of regulated or cooperatively operated systems after electricity markets are restructured.[4] Meanwhile, the Federal Energy Regulatory Commission (FERC) is aggressively pursuing the common or cooperative ownership solution through the formation of four regional transmission organizations (RTOs) nationwide, one each in the northeast, southeast, midwest, and west.[5] RTOs are to serve as independent grid managers that will insure nondiscriminatory access to the grid for customers and generators alike. However, the FERC currently lacks jurisdiction over TVA.

The FERC previously oversaw the restruc-

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turing of the natural gas industry 10 to 15 years ago. During that process, gas supplies were deregulated, allowing large customers and distributors to contract directly with gas producers. However, the interstate pipelines that delivered the gas from the producers to the distributors continued under regulation. The FERC set transportation rates for shipping gas as well as prices for reserving capacity on the pipelines. An electronic marketplace for resale or "rental" of unused capacity was also initiated. The pipelines were required only to maintain adequate pressure in the line and to account for injections into and removals from the line, balancing any mismatch between the two.

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Numerous aspects of the transmission system hinder the adoption of a similar system for electric power. First, the costs of transmission involve management of the entire system and are less related to the distance involved in any particular power transaction. Power is distributed more or less throughout its transmission network, rather than moving in a linear fashion through a pipe as natural gas does. Electricity will follow paths through the transmission network in proportion to the resistance on each path, not necessarily by the most direct route.

Power flowing over one of these indirect routes is called a *loop flow*. For example, if a total of 1000 megawatt hours (MWh) is sent from Ontario to New York City, roughly 640 MWh flow directly through New York state, while the remainder flows indirectly through Ohio, West Virginia, Pennsylvania, Maryland, and New Jersey.[6] The larger and more interconnected the transmission grid, the more numerous the potential loop flows become.

Now, for "loop flows," substitute "externalities." In the presence of loop flows, how does one price the transmission service? How do generators or power users reserve capacity when power flows over multiple paths? How do they pay for that capacity? The natural gas analogy breaks down at this point, and that system of restructuring provides no further help for the electric industry.

If we look to the United Kingdom, which began to restructure its electricity industry about 10 years ago, we find that competitive power markets are only now beginning to work as expected. The U.K. experienced California-like price spirals and market manipulation in its initial power pool market, which some likened to "a generators' club" for collusive price setting.[7] Certain areas were relatively isolated by lack of transmission capacity, creating unregulated near-monopolies. Moreover, the U.K. experienced these problems even though it is literally an island—a closed transmission system with limited loop flows—and has a single grid operator, the publicly traded National Grid Co., a possible model for RTOs in the U.S.

Economic theory has since shown that the transmission characteristics of electricity grids can play havoc with what would otherwise be well-functioning auction markets.[8] Practical experience of these problems led the U.K. to abandon its California-like power pool auction in favor of a system of bilateral contracts between generators and retailers or other large customers. Interestingly, the U.K. initially imposed price caps on power pool auction prices, as did California, a practice that may be supported in some cases by recent insights from economic theory.

To further complicate matters for the U.S., the existing transmission grid was never intended to support free-wheeling competitive markets in electric power spanning regions and other long distances. The system is rife with potentially inadequate transmission capacity. It is also larger and more open than the U.K.'s, thus more susceptible to loop flow externalities. A feared result of restructuring—higher prices in low-cost states as northeasterners buy up cheap power in Tennessee and Kentucky—may not come to pass if the transmission system is inadequate. If recent localized blackouts in the northeastern U.S. could not be cured by transporting surplus power from Maine due to inadequate transmission capacity, what is the likelihood that power from Tennessee could be transported there?

To make matters worse, the *environmental* externalities associated with siting and building both transmission lines and generation plants in the U.S. complicate the cures for these ills. In August, Governor Don Sundquist asked the Tennessee Department of Environment and Conservation to stop accepting air-permit applications for new power plants until an energy-policy task force evaluates the likely effects of such plants on the state's environment and economy.[9] Although only three such permits were pending at the time and will be processed, as many as 30 additional plants are planned across the state. Similar steps were taken in Kentucky and Florida prior to the action in Tennessee.

Here, as TVA goes, so goes Tennessee. Electric restructuring will require major alterations to TVA's enabling legislation and its charter. These are literally acts of Congress. Without such ac-

tion, TVA is limited to serving distributors within its region; in-region distributors and other large customers are restricted by contract from buying power from non-TVA sources; and any generators locating in Tennessee will be bound to sell power to either TVA or out-of-region customers. The FERC's RTO plans may also falter as TVA in its current form may be unable to cede control over its assets to an independent body.

These facts notwithstanding, the question of how TVA *should* be restructured remains. The pervasive externalities associated with transmission and other TVA functions, and the unavoidable incentives for integrated generator-transmitters to favor their own generation at the expense of independent power producers, suggest that preserving TVA as a quasi-governmental entity over its externality-laden operations may be worthwhile. The TVA operations associated with externalities—primarily hydropower and transmission—could be retained, while the remaining potentially competitive operations could be sold or spun off. Given that many of TVA's "potentially competitive" but aging coal-fired generation plants do not meet current environmental standards (they are exempt under "grandfathering" provisions), perhaps a phase-out of these plants as independent generation capacity comes on line would prove appropriate. There is also the lingering problem of debt associated with TVA's nuclear program, on which mere economic efficiency criteria are likely to have little bearing.

As TVA is eventually restructured, what happens to the local electric distributors? The state of Tennessee retains jurisdiction over distributors and the retail rates they charge. The TVA distributors are all either cooperatives owned by their customers or government-owned, largely by municipalities. Under current law, these entities are exempt from the regulation of investor-owned public utilities administered by the Tennessee Regulatory Authority (TRA) and would remain so.

After TVA is restructured and distributors are freed from their contracts with TVA, the people of Tennessee, through the General Assembly, may choose the level of further restructuring they desire. The main options are either that the distributors would gain the freedom to purchase power from the generator of their choice for delivery to their customers at "regulated" rates, or their customers would gain this purchasing freedom directly, leaving the distributors to provide distribution-only at regulated rates. This regulation could be provided through TRA oversight, through direct government ownership, or through the boards of customer-owned cooperatives. Nowhere to date have distributors been deregulated entirely (the U.K. uses a flexible price-cap system), as the "wires" segment of the industry, whether through externalities or "natural monopoly," defies competitive structuring with current technology.[10]

Restructuring of the electric power industry will surely alter the future landscape of Tennessee, which may be mined with dangers as well as opportunities. Just as frontiersman chose to risk the dangers of unknown territories in settling the lands that became Tennessee, the people of Tennessee will have the opportunity to choose the landscape of their electricity markets in the future. May we all choose well and wisely. ■

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Notes

1. Thomas-Olivier Leautier, "Electricity Auctions," *Journal of Economics and Management Strategy*, v. 10 n. 3, Fall 2001, pp. 331-358.

2. The exceptions are the Kingsport area, served by American Electric Power, and a few handfuls of customers served by Entergy-Arkansas or Kentucky Utilities.

3. The United States has three independent grids of this type covering the areas, respectively, east of the Rocky Mountains, west of the Rocky Mountains, and Texas. The three grids have limited interconnections that cannot be used for large transfers of power and do not cause significant externalities across multiple grids. See *The Wall Street Journal* report, "Out of the Darkness," September 17, 2001, pp. R1-R18.

4. Christopher C. Klein and David B. Sapper, "The Role of Public Power in a Restructured Electric Power Industry," *The Electricity Journal*, August/September 2001, pp. 39-50.

5. Texas is left out and continues as an independent grid. The FERC ordered these RTOs in a series of actions in July 2001. See Reed Wasden Research, "Here Come Super RTOs to Save the Day," *The Prometheus File*, September 7, 2001 (www.reedwasden.com).

6. Reported in Leautier (note 4, above), from the North American Electric Reliability Council (www.nerc.com).

7. United Kingdom Energy Minister Peter Hain quoted in Carl J. Levesque, "Electricity Evolution in the U.K.," *Public Utilities Fortnightly*, July 15, 2000, pp. 49.

8. See Leautier, footnote 4 above. A lack of transmission capacity on certain routes can lead to noncompetitive pricing behavior by generators. Moreover, since the generators benefit from these constraints through higher prices and profits, they have no incentive to finance capacity expansions to alleviate bottlenecks.

9. "Tennessee Suspends Accepting Power-Plant Bids," *The Wall Street Journal*, August 16, 2001, p. B4.

10. There is limited evidence to suggest that competing distributors—"duopolies"—may lead to lower rates, but the examples are few. Distributed generation, or generation of electricity at the customers' premise, whether by solar panels, fuel cells, or other means, may eventually provide competition even for distributor-delivered power.