
Currents of Competition in Electricity Markets

Vernon L. Smith

OVER THE PAST DECADE there has been an impressive decline in the scope of economic regulation. In major industries such as transportation and communications, firms have been exposed to the discipline of the marketplace, and consumers have reaped substantial benefits. Yet the archetypal utility, the electric power industry, has seen little change. This is not, in my view, because electricity is somehow an exception—the one true utility that must remain under the yoke of regulation if it is to serve the public interest. On the contrary, substantial deregulation of electric utilities is both possible and advisable, and promises significant improvements in the efficiency of power production.

The infirmities that typically afflict regulated industries are endemic among electric utilities, and they appear to be getting worse. This has been particularly evident in the enormous cost overruns in the construction of nuclear power plants. It is also evident in the inability of the industry to cope with the rapid fluctuations in energy prices in recent years, and with a widening array of new technologies. The regulation that now applies to the electric power industry has been largely incapable of responding to a rapidly changing environment.

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Despite the pervasiveness of regulatory control over electric power, there have emerged within the industry market-like institutions that are competitive and efficient. In this article I examine the potential for building upon these institutions to substitute competition for regulation in the electric power industry. I discuss some of the market-like arrangements that have emerged in recent years and the ways in which they enhance competition and lay the groundwork for deregulation. I also consider the longer run question of how the market for power might be organized among deregulated firms.

The Status Quo

The states regulate electric utilities under classical rate-of-return regulation, which involves setting prices that permit a firm to recover its costs, including an allowable “fair” return on invested capital. Investor-owned utilities accede to these price restrictions in return for an exclusive monopoly franchise for distribution, euphemistically referred to as a “certificate of convenience and necessity,” granted by the state. The Arizona constitution, for example, which states that “monopolies and trusts shall never be allowed,” grants an exception for electric power: “ordinarily the distribution of electric energy is essentially and rightly monopolistic in its application.”

The courts have consistently upheld the principle that utilities are to be assigned exclusive operating territories in the interest of avoiding wasteful "duplication of service." Where a certificate holder has been challenged on the grounds that a competitor could provide service at lower cost, this argument has been rejected because of the implicit obligation to permit the incumbent to provide the service. A certificate has effectively become an enforceable property right to an exclusive territory.

In thinking about the rationale for electric power regulation, it is helpful to distinguish the three primary segments of the production-and-delivery system: the *generation* of electric power from some energy source such as coal, gas, nuclear fuel, or water storage; the *transmission* of this power from remote sources using high-voltage lines; and the *distribution* of power at lower voltage levels, on demand, to individual metered customers in a service territory.

Early in this century when the industry was in its infancy, most electric power was generated locally or transmitted over relatively short distances (100 miles or less). The exclusive monopoly territories granted in state certificates reflected the service areas of these local, self-contained power systems. Today, individual regulated utilities vary considerably in the extent to which their distribution systems are supported

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by power from their own generators and transmission lines. Modern power networks consist of several generators and distributors interconnected through a grid of transmission lines so that any particular distributor may be served by several generators.

State regulators, when granting a certificate for distribution, do not presume that a utility will have a monopoly in the generation and transmission facilities serving its territory. However, most electric power is distributed by companies that are vertically integrated into transmission and generation and, in such cases, each of the functions is generally regulated as if it were a

monopoly. Pervasive regulation of electric utilities is now the norm.

This arrangement of local electric utility franchises subject to rate regulation has been justified over the years on the basis of natural monopoly arguments: in the presence of economies of scale, certain goods and services can be provided most efficiently by a single firm and are thus "natural" monopolies. In such cases, it is said, conventional antitrust remedies are of little use, and the preferred remedy is state control of prices.

But natural monopoly arguments cannot be used to explain the all-inclusive scope of state-guaranteed franchises. An examination of the electric power industry as it exists today reveals tremendous untapped potential for the development of competitive markets. Regulation has been applied far too broadly to the electric power industry. As a result, policies intended to restrain monopoly power have instead propagated that power.

Currents of Change

The interconnection of local utilities into networks and the development of remote sources of power have rendered obsolete the long-held view that regulation of electric power is an obvious corollary of the fact that electricity is delivered to the customer's meter on a single cable. These technological changes have given rise to new institutions foreign to the concept of regulated natural monopolies. Competition is now evident on the fringes of power generation, and a foundation is in place for deregulating not only generation, but possibly transmission and distribution as well.

Long-Term Contracts. Long-term contracting arrangements provide for the sale of power from generators to distributors over transmission lines owned by one or both of the parties, or by a third party. The buyer is either a distribution utility exclusively or a utility whose generating capacity is insufficient to meet customer demand. In either case the buyer has elected to acquire energy through contract purchases instead of through ownership. The seller is generally an integrated utility with power generating potential in excess of the utility's native load requirements, although this is not necessarily the case. The Alamito Company of Tucson, Arizona, for

example, is a wholesale power producer whose entire capacity is sold in the contract market.

Long-term contracts are typically “take-or-pay” agreements: the buyer agrees to pay all capital and other output-insensitive costs whether or not the power is taken, plus an “energy charge” equivalent to the variable costs of the fuel actually consumed. These contracts do not create a

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day-to-day market for power, but they do introduce a competitive discipline at the time they are entered into, provided there are alternative sources of power available to buyers and alternative buyers available to sellers.

The development of a contract market among locally regulated utilities has been driven by the economic efficiencies inherent in network systems. In the Southwest, for example, customers are located in the population centers of California, Arizona, New Mexico, and Utah, while the coal and the power plant sites are located in relatively remote sections of Arizona, New Mexico, and Utah. Contracting, not regulation, has allowed these pieces to be put together into a market system that serves the customer.

Economy-Energy Exchange. The exchange of what is called “economy energy” has established a spot market for bulk wholesale power in which electricity is traded on an hourly basis. This market is the short-term counterpart of the contracting market discussed above. It developed naturally from the interconnection of locally regulated utilities and the opportunities this created for short-term trading of electric power. Since seasonal and daily demand peaks occur at different times for different distributors in a network, spot transfers of power permit individual companies to smooth production and lower total network costs. Economy-energy exchange arose in response to market forces that crossed the traditional boundaries created by state authority. It was not the product of regulation.

Both the spot and long-term contract markets have the potential to play much larger roles than they presently do. The ownership of gener-

ating units is highly concentrated as a result of exclusive state franchising, not network economics. In Arizona some thirty-odd power sources are owned by only four utilities. Were it not for this artificial concentration of ownership that regulation encourages, a larger competitive market power from more numerous independent generating companies could easily emerge.

Power Pooling. Electric utilities invest in a product that, like the rental services of motels, cannot be stored. Hence surges in demand, and the need for replacement power created by equipment failures, can only be satisfied from reserve generating capacity. This is a source of interdependence among separate utilities on a network which, some conclude, mitigates against a decentralized market. This conclusion, however, overlooks the significance of power pools. Through power pools, utilities provide each other with on-line generating reserves and backup reserves to make blackouts both rare and brief. If power generation were deregulated, these bilateral and multilateral arrangements for emergency assistance and power pooling would continue to exist and, perhaps with further development, could provide whatever level of reliability customers demanded.

Shared Capacity Rights. Another common contracting arrangement is for several utilities to finance the construction of large generating units and transmission lines. Typically, the sharing companies receive capacity rights in proportion to their contribution to the unit’s annualized construction and output-insensitive operating costs. In the case of generators, each participant pays a “demand charge” for these capacity rights, plus an “energy charge” for fuel to the extent that the rights to draw power are exercised. In Arizona, for example, some generators have as many as six co-owners with capacity shares as small as 7 percent; transmission lines often have two, three, or even four owners of their transfer capacity.

Although shared capacity surely was not invented for the purpose of enhancing competition in the electric utility industry, it is a socially ingenious device for providing competition in the presence of scale economies. Consider this fact: if you own 7.5 percent of the capacity of a 750 megawatt unit at the Navajo plant, then you have rights to draw up to 56 megawatts of power that can be consumed by your customers, sold under

long-term contract to California, or sold at spot prices to a Utah utility, as you might choose. In effect, you get drawing rights to a small package of power at the unit-construction cost of a facility 13 times larger! Similarly, if you share the capacity of a transmission line, you can use it, sublet it, or sell it. If that is the only line with excess capacity, then a potential user has two or more owners with whom he or she can bargain. Consequently, competition in a market for shares can

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exist even where the number of physical producing units is very small. Scale economies in production need not engender monopoly in ownership rights and control.

The sharing of common facilities among independent competing users is not unique to the electric power industry. The shopping mall is an excellent example. In a single facility a dozen or more clothing stores (and clothing departments within general merchandise stores) compete for the same set of customers while sharing walkways, parking space, heat and power, and building maintenance. The mall concept exploits economies of scale, external benefits, and common inputs, while simultaneously enhancing retail competition among owners or lessors of condominium space within the larger structure. This concept, as I argue below, has enormous potential for the competitive supply of transmission and distribution services.

Economic Dispatch. The technology of "economic dispatch" or optimal network loading has become remarkably sophisticated in recent years. Every integrated electric utility now uses computer-optimized loading of its dispersed generating units and calculates a "lambda" for the system that continuously indicates the incremental cost of the most expensive operating generator. This procedure incorporates large amounts of information into simple price signals, just as a market might do, and it provides the basis for an economic dispatch center, or regional energy exchange. Such an exchange could

serve the same function as an exchange where gold, corn, porkbellies, or any other commodity is freely traded.

Enhancing Competition in Generation

Competition has arrived in the power generation business. Its genesis was the nuclear construction programs of the 1970s. Overbuilding in anticipation of demand growth that never materialized is bringing new capacity into a market that is already saturated. The bulk power market, which involves exchange between utilities, contract sales to distributors (usually municipal utilities), and sales to large commercial and industrial customers, is now characterized by sharp price competition. Several avenues are available for expanding this competitive market.

The Deregulated Fringe. Cogeneration, or the in-house generation of power as a by-product of an industrial process, is a relatively new source of competition in power generation, fostered by the general rise in energy prices in the 1970s and hastened by government policy. The Public Utilities Regulatory Policies Act of 1978, passed as part of President Carter's energy program, requires regulated utilities to buy unused cogeneration power for distribution to other customers. This act also mandates purchases from small "mom and pop" hydroelectric, windmill, and woodchip-burning producers of power.

While it is doubtful that more than a fraction of the cogeneration and small-scale generator capacity can be justified on grounds of economic efficiency, the presence of these alternative sources of supply has heightened competition and has begun to unravel the regulatory apparatus. With state regulatory commissions resisting additions to utility rate bases, the utilities increasingly are turning to these alternative energy sources—sources which are outside the regulated sector of the industry—for new capacity rather than undertaking their own costly construction programs.

The cogeneration phenomenon has demonstrated quite clearly that power generation is separable from distribution and transmission, and can be provided competitively through market processes. It is through this channel that new turbine technologies capable of burning oil, gas, or coal are able to obtain deregulated status. As these and other new technologies prove

economical, they will be in a perfect position to erode the market share of the regulated sector. The way to proceed is to eliminate any tax or regulatory preferences for particular technologies, and to encourage these technologies to compete within a thriving deregulated sector.

Spin-offs of Generator Capacity. One way to deregulate existing generating capacity within the present legal framework is through the spin-off of generators by integrated utilities. There is nothing that requires a regulated utility to be integrated, as evidenced by the existence of pure distribution utilities. A utility need not own generators, coal deposits, or rail facilities for hauling coal, any more than it need manufacture trucks because it employs a fleet of trucks. The revestiture of generating capacity would limit the scope of the regulated utility to the distribution network and, perhaps, its supporting transmission lines. (Revestiture actions require the consent of both the utility and the state regulatory commission.)

One or more generating units can be placed in an operating subsidiary and spun off by giving tradable shares in the new company to the shareholders of the parent utility. To ease the transition from a regulated environment to a competitive environment where risks are borne by stockholders rather than customers, these spin-offs could include five-year contracts for reselling to the parent firm some portion of this capacity. When these contracts expire, however, the

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generating companies would become "entrepreneurial generators," free to shop for a new buyer, while the parent company would be free to shop for a new seller.

For political reasons, it may be necessary to structure a revestiture in such a way that it creates some capital gains for stockholders, some immediate rate benefits for customers, and some political capital for the regulators. For example, as a condition for approving the spin-off, the regulatory commission could negotiate a lower

contract rate for the purchase of the new company's power. A well-managed utility will have a break-up market value in excess of historical cost, so there need not be any losers in the transition.

The pioneering example of this type of deregulatory mechanism is the Alamito Company, a subsidiary of Tucson Electric Power (TEP) that at one time owned a nearly completed coal generating unit and a fractional interest in an older unit. Alamito was spun off in 1985 as an independent wholesale power company by giving each stockholder 1 share in Alamito for every 10 shares of TEP. Alamito continues to sell power under long-term contract to TEP and to San Diego Gas and Electric. As another example, Commonwealth Edison has recently proposed that the Illinois Commerce Commission grant it permission to transfer three nuclear generating units to a subsidiary. If granted, Edison would write off \$550 million of its investment in the three plants and get a 13 percent rate increase next year, in exchange for agreeing not to seek any other rate increases for five years. Edison would pay the subsidiary \$600 million per year, plus the variable cost of the power taken, for five years. After that, the subsidiary would be free to compete in the market for bulk power.

The Sale and Lease-Back of Generators. Another way to deregulate existing generating capacity is through the sale and lease-back of generators. Several utilities have approached their regulatory commissions with proposals to sell and lease-back their generators. The motivation for these proposals has been to capture tax savings, to smooth or stretch out the rate shock of adding a new unit to the rate base (especially in the case of nuclear units with high cost overruns), and to generate an infusion of cash to help finance a diversification into other businesses. If regulatory commissions respond to these proposals with carefully structured alternatives, they could convert the sale/lease-back arrangement into a mechanism for enhancing competition in power generation.

The regulatory commissions should propose shortening the life of lease-back arrangements, with the buyer free to compete for customers after the lease expires. The lease-back period is generally 12 to 25 years—a considerable fraction of the presumed life of the generators—and this could be reduced to, say, five years. In this way, the sale/lease-back contracts could become vehicles for converting regulated generators into

competing generators. Nuclear facilities with a book value above market value could be bundled with coal-burning plants whose market value exceeded book value. Such an arrangement would provide a mechanism for offsetting the implicit capital losses on nuclear units with the capital gains inherent in non-nuclear generating units.

Further Down the Line

If the scope of competition in electric power generation grows and the number of deregulated facilities increases, we can entertain the prospect of even greater reliance on market mechanisms. Regulatory controls could be removed not only from generation, but also from transmission and distribution.

A Computer-Assisted Power Exchange. An efficient power network allocates loads among generation sources so as to minimize the total cost of supplying and transporting power from the source nodes to the consumption nodes. The efficiency of modern transmission lines now makes it feasible to operate such networks on a regional, or possibly even a national, scale. With decentralized ownership of generators, an efficient network would include scores of competing power producers—certainly enough to form a competitive market. With the aid of computers, regional dispatch centers would have no trouble clearing such a market on a continuous basis. Generator owners would submit incremental offer schedules, representing their willingness to sell, to a regional dispatch center that would use standard network computing algorithms to determine the cost-minimizing pattern of power injection among all generators. Essentially the same algorithms would then be used to calculate the wholesale spot rate to be paid by each distributor on a network.

Since power loss between any two network nodes varies approximately with the square of the power transferred, under this system the difference in the spot prices between any two points would be approximately twice the average power loss on the line connecting them. In other words, on a line with 10 percent average power loss (over, say, 500 miles), the difference in the incremental spot rates between the cities on each end of the line would be about 20 percent. The existence of such a network, with prices varying over time and location in response to



"For God's sake, shape up! Is that the face of a power broker?"

Drawing by W. Miller © 1986 The New Yorker Magazine, Inc.

demand and supply conditions, would convey accurate market signals to investors contemplating a new power plant and to major power consumers making location and operating decisions.

Competition in Transmission. An element of competition already exists in transmission where alternative transmission systems are available to export power to other states. There are two ways to deregulate transmission, either of which would exploit the competitive potential of shared capacity rights. Under one scenario, perhaps more applicable to thin networks, independent transmission companies could be formed by spin-offs. Combinations of generators and transmission lines could be allowed where such integration would not affect market competition. For example, remote generators connected to a network by a single stub could be treated as a unit. In general, however, as a condition for deregulation, commissions could require lines to be jointly owned, with shares in the line's transfer capacity competing separately and being sold independently.

As an illustration, suppose that several distributors are served by only two transmission lines that connect to several remote generating units. Rights to each line's transfer capacity could be shared jointly by two or more independent owners; access to transmission could therefore be purchased from any of four or more owners of transmission rights.

The construction of new transmission lines would be deregulated. That is, any joint owner or outsider could unilaterally acquire additional transfer capacity simply by building it. No co-owner would have the right to veto such a decision to expand capacity. State policy would promote free entry by anyone, including the railroads (which have already entered fiber optics signal transmission) or other owners of land rights-of-way. The goal would be to promote competition in capacity expansion. The transmission network would be open to all users in that no distributor, independent bulk customer, or generator owner could be denied access rights, *provided that those rights are purchased* on terms negotiated with one or more of the transmission line owners. There would be no "mandatory" uncompensated use of transmission lines which would discourage investment in new transfer capacity.

In tightly knit interconnected networks where flows of power in particular segments are less controllable, a transmission system could be treated as an integrated unit—a separately operated joint venture owned by all the generator companies. The point is to let contracting define property rights and financial obligations. Capacity rights to the network would be held by all users, and defined by contract. Any individual user in the joint venture could acquire additional transfer rights either by purchase from another user or by new construction that increased network capacity.

Competition in Distribution. There are numerous ways to introduce competition into electric power distribution. Perhaps the most obvious is to eliminate state policies which grant distributors exclusive operating permits. Customers should have the right to bypass distributors and contract directly with generator owners. Telephone and cable television companies should have the right to offer power service. New distribution territories should be open to competing service. Each of these changes would increase market competition in distribution service.

The goal is not to create duplicate distribution lines (although they do exist in some cities, such as Lubbock, Texas), but to allow the *possibility* of duplicate lines to discipline costs and prices. Any distributor charging rates in excess of the replacement cost of distribution facilities

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would face the prospect of entry. If distribution is truly a "natural" monopoly, duplicate lines would not be built even if the legal monopoly were eliminated.

An alternative is to create tradable shared rights in the customer service capacity of a distribution system. In this case the distribution system, together with its maintenance and operating personnel, would become a separately managed cost center with its ownership shared by competing solicitors of residential power accounts. Each solicitor company would acquire rights to some number of customer hook-up facilities—perhaps initially by spin-off assignments, thereafter by purchase from other owners or by new construction—but these rights could be exercised anywhere in a city. No solicitor would have an uncontested local monopoly. The cost of the system as a whole would be supported jointly by these competing solicitors in proportion to their customer access rights.

Summary

The gradual interconnection of local utilities into networks, and the increasing reliance on remote sources of power that can be delivered to alternative distribution systems, have set the stage for the deregulation of electric power generation and, quite possibly, transmission and distribution. Replacing the entrenched regulatory regime, after eighty-odd years, with a competitive regime will require regulators to be forward looking, politically bold, and cognizant of the disciplinary value of competition. But many precedents exist, even within the power industry itself, which demonstrate the potential of competition. That potential should be tapped. ■