

Electricity: Price Spikes by Design?

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and Jerry Ellig

If free-market electricity is coming, the summer of 1998 gave policymakers food for thought. Over a week in late June, utilities and marketers in the Midwest went from power transactions at \$50 per megawatt-hour (MWh) to transactions at \$7,500/MWh. Some saw an episode of panic buying by inexperienced traders, others thought they saw monopoly, and still others thought the spikes proved that competitive power markets could not work.

We believe that the evidence suggests the wholesale electricity market operated with surprising efficiency under difficult circumstances and that regulators should not take the price spikes as evidence of the need for price controls or other guidance. Remarkably, both the Federal Energy Regulatory Commission (FERC) and commissions in the affected states largely agree with us.

Unlike their counterparts in the Northeast and West, self-sufficient midwestern utilities traditionally have relied sparingly on market purchases of power. In the extreme conditions of last summer, the market flourished and helped keep the lights on. The reliable supply of electricity depends on complex coordinated networks. The United States is learning that markets can perform much of the necessary coordination.

IMPROBABLE EVENTS OCCURRED SIMULTANEOUSLY early in 1998 the north american electric reliability Council (NERC), an industry group that monitors reli-

ability and sets operating standards, had warned that generating capacity was very close to likely demand, particularly in Wisconsin, Illinois, Indiana, Ohio, and Michigan. In late June 1998 the Midwest experienced unexpected changes in electricity demand and supply that made the warning a reality: the weather was unusually hot, creating more air conditioning demand, and major unplanned generator outages reduced the supply of electricity. In its post-spike report to the Indiana Utility Regulatory Commission, American Electric Power estimated the probabilities of these events at 0.3 percent for the heat and 1.5 percent for the outages. Utilities caught short supplemented their own production with market purchases, sometimes arranged through third-party marketers. The power was transmitted to them at regulated rates mandated in FERC's open-access policies. In the most affected states, consumers had no rights to bypass local utilities and go to the market themselves.

As weather and outages worsened through June 23, the trade press reported some transactions at \$400/MWh for delivery on June 24. At that point Federal Energy Sales, a small marketer, is alleged to have defaulted on uncovered \$50/MWh call options (promises of delivery)

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it had sold to utilities and marketers. As the utilities and marketers sought replacement power, they bid prices as high as \$1,400/MWh in Ohio and \$3,000/MWh in Chicago. Prices also rose in the Southeast, an important exporter to the Midwest.

Then on June 24 weather disabled important transmission lines. A day later some prices reached \$5,000/MWh. As the weather eased and some generators returned to service on Friday, June 26, prices fell sharply. After the weekend, prices averaged under \$100/MWh throughout the Midwest, and a week later they were back in the \$20/MWh-\$30/MWh range.

TRANSMISSION REGULATION EXACERBATED SUPPLY PROBLEMS

on June 24 and 25, three high-level transmission alerts further constrained the supply of electricity to the Midwest market. Before the summer, ferc imposed new nerc Transmission Loading Relief (t1r) procedures over the Eastern Interconnection, which includes the Midwest and South. t1r provided an engineering solution for an economic problem. Prior to the imposition of t1r, the owner of an overloaded line would modify the production of electricity by its own generating plants (a process called redispatch) to cope with the overload at least cost. t1r turned a local generator problem into a regional one by allowing the overloaded line's owner to force the curtailment of third parties' transactions all over the system on the basis of a mathematical model of power flows.

Because of the physics of power flows, the electricity production activities of a utility can affect line loadings hundreds of miles away. From an economic perspective, in a t1r emergency the value and volume of the power curtailed may vastly exceed the value and volume of the original overload. For example, in one of the t1r alerts that occurred on the two spike days, a 30 MW overload in Wisconsin led to curtailments of more than 1,900 MW as far away as Georgia and New York. If transmission problems were viewed in an economic rather than an engineering fashion, 1,900 MW of power would not be curtailed to solve a 30 MW problem.

ECONOMIC ANALYSIS OF THE WHOLESALE ELECTRICITY MARKET

in markets, people make mutually beneficial exchanges and trade goes on until a single price rules. There are no generally agreed-on statistical methods to determine whether two areas form a unified market, and publicly available data on average prices rather than individual transactions are not appropriate to the task. Average daily regional prices, however, tell a convincing story.

Before, during, and after the spikes, daily prices in regions electrically linked with the Midwest moved together. Although never equalized because of transmission constraints and regulatory limits, the observed correlations are evidence of a regional market that functions in both normal and spike times. Prices in weakly linked

areas (e.g., New England and Texas) did not move with those in the Midwest and Southeast. In the linked areas, average prices per MWh differed by hundreds of dollars over the spike days, but they rose and fell together. In percentage terms, the regional spread was unchanged from more normal times.

Within the spike days, prices behaved competitively. Low demand and plentiful transmission in off-peak hours produced prices below \$15/MWh on the spike days, the same as before and after the spike days. On-peak, a confidential survey of power marketers by Tabors Caramanis and Associates (tca) showed a normal intraday pattern, rising with the sun and cresting prior to the late afternoon peak for deliveries to be made in the following hours. In a given hour, the risks of shortfalls (which can cause systemwide outages) and the uncertainty about transmission produced large differences between reported high and low prices. Both high and low prices, however, showed the same pattern over the day.

Restrictions resulting from t1r probably widened the range of hourly prices and increased their volatility. The spike days exhibited increased demand and decreased supply that should ordinarily increase traded volumes, but our data indicate the opposite. There were more hours of high-level t1r incidents during the spike week than in any other week of the summer. In that week, however, the volume of power moving between regions was significantly less than in surrounding ones.

Four-digit prices were rare. Utility-owned generators produce most of the Midwest's power, dedicated to customers within the region. tca found that most transactions over \$100/MWh were small (50 or 100 MW) and flowed for only an hour or two. tca estimated that during the spike days only 695 MW of power flows per hour cost more than \$100/MWh compared with a 1997 regional peak of 168,000 MW. In a similar vein, ferc staff noted that despite a few trades at \$7,500/MWh, the regional average over the spike week was \$61/MWh.

WHAT WE LEARNED

an interesting outcome of the crisis was the unexpected opposition of private firms to market forces. An Ohio industrial customer on market-sensitive rates discovered what that meant and asked ferc to cap the rates. Illinois Power did likewise, possibly because the state had recently removed automatic cost passthroughs from its rates. Major marketers, including pioneer LG&E Energy Marketing and giant PacifiCorp, abandoned the business after taking losses.

Possibly the most refreshing outcome was a general reluctance, even on the part of regulators, to endorse intervention in competitive markets. ferc staff's report saw the spikes as singular but necessary growing pains. The Ohio Public Utilities Commission also rejected price controls, while concluding that conditions favoring recurrence of the spikes (most particularly low capacity margins) continue to exist. A study sponsored by the nor-

mally interventionist American Public Power Association concluded similarly. In retrospect, some transactions by inexperienced traders could only be called panic buying. Watching the market, an experienced oil trader remarked "it's not just the heat, it's the stupidity."

Some underlying characteristics of the midwestern market worsened the spikes. If buyers and sellers are insensitive to price, a given shock will have a greater impact. In the Midwest, generators are predominantly large coal and nuclear units. In normal times, midwestern utilities go to market for a smaller fraction of their energy than utilities in the West or Northeast, and the relative inexperience of the midwestern utilities may have made the spikes more severe. For comparison, some California utilities obtained more than half of their power on the market well before restructuring.

In other regions of the country, independent power producers also increase the flexibility of supply, but their presence in the Midwest is minor. The only midwestern state in the independent power top ten is Michigan, with only 21 percent of California's capacity. Illinois, Indiana, and Ohio together have less than 1,000 MW of independent power capacity, 20 percent of Michigan's total. The Electric Power Supply Association reports that independent power producers have proposed 5,000 MW of new midwestern plants since the spike, but their construction will take time.

If power users do not face prices that reflect market reality, they will not reduce their power use when the cost of increased supply is very large. The midwestern states have lagged in instituting market-based rates that vary with the time at which power is used. Midwestern utilities also lag in the use of interruptible service in which customers pay less in return for giving utilities the right to interrupt their service during peak-demand crises. Instead most midwestern customers enjoy constant prices that average the costs of utility power supplies. Only after the spikes did Commonwealth Edison of Chicago propose paying large customers the market price of power if they cut their peak consumption when asked to do so by the utility, a practice common in other industrial states. In California, all users with demands over 1 MW (13 percent of total use) must take power at time-varying rates, and many smaller users have also chosen to do so. California can shave its peak by up to 6 percent by interrupting loads and calling on industrial generators, a larger amount than any midwestern state.

CONCLUSION

California offers one more noteworthy comparison. During a transition to retail consumer choice that will end in 2002, California's three major corporate utilities must transact all of their electricity through the California Power Exchange, where hourly bidding balances supply and demand. The size and elasticity of the Power Exchange have probably been responsible for a lack of price spikes on the exchange. Spikes have occurred, however, in California's inadequately designed markets for the

ancillary services (reserves of varying readiness) that are needed to maintain reliability. There, odd bidding rules were responsible for the price of low-priority "replacement reserves" rising as high as \$9,999/MWh for a few hours during the summer.

After those price spikes, ferc reluctantly authorized the California Independent System Operator (iso) to cap ancillary services prices at \$250/MWh until ferc had approved a March 1999 iso filing of new market protocols. (Under California rules, a utility recovers more of its transition costs as prices fall, and utilities were the major backers of considerably lower caps. ferc, to its credit, understood why the utilities backed lower caps.) In late May, ferc again exceeded most observers' expectations of a regulatory agency and chose to maintain the iso's authority to cap prices through the summer of 1999, but to terminate it on November 15. The iso may, of course, request renewal of its authority if there are untoward events in the markets, but ferc's order notes that "the iso's purchase price cap is not an ideal approach to operating a competitive market, and we do not expect it to remain in place on a long-term basis."

ferc's order also establishes alternatives to today's single market, in which the iso is the only purchaser, by authorizing self-provision and bilateral exchanges of reserves. Earlier, ferc had approved ancillary services trades between Californians and out-of-staters, which until then had not been possible because the iso's software could not implement them. These and other changes may bring more rational pricing, but there can be no assurance that new difficulties will not surface as unintended consequences of the new rules.

By contrast to the events in California, the Midwest's unplanned market spiked for two days in response to obvious pressure and returned to normal when the pressure was gone.

ferc commissioner William Massey rationalized imposing the California price caps by noting that contrast. Chairman James Hoecker went further to explain that good markets don't just happen ... they are developed, structured, created. ferc has learned a lot about competition in recent years and embodied some of it in intelligent policy, but the two commissioners seem to have missed the point. The market they played no part in setting up was the one that worked well.

readings

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