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Electricity and the Midwest: A survey of conditions and issues

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Not since the days of the Carter administration have electricity issues and energy markets received such intense national attention. Special energy task forces have sprouted up at all levels of government in response to fears of electricity shortages and high prices. In this *Chicago Fed Letter*, I take a look at conditions for electricity provision in the Seventh District states. As the survey demonstrates, while the situation in the Midwest is far more secure than in California, the region still faces some significant choices if it is going to provide for its electricity future.

In an age in which globalization is enlarging markets and equalizing prices for goods and services, electricity remains relatively balkanized. The five states that make up the Seventh Federal Reserve District (Illinois, Indiana, Iowa, Michigan, and Wisconsin) are a heterogeneous group in terms of their electricity profile. For example, Illinois and Michigan have relatively high electricity prices[1] and have moved fairly aggressively in restructuring their electricity systems to encourage competition in the provision of electricity. Conversely, Indiana, Iowa, and Wisconsin have lower electricity prices and have been cautious in opening their retail electricity markets. Another difference is that while Illinois and Indiana are exporters of electricity, the remaining three states are importers. Perhaps the most common feature that the five states share is their preference for coal for generating electricity, but even here the reliance on coal ranges from 50% in Illinois to 94% in Indiana (see figure 1).

Currently, all five states report that they have sufficient electricity generation capacity to meet most of their own near-term demand. However, studies conducted in each of the five states have identified needs for additional generation to reestablish peak-load generation margins that will protect against unplanned outages. Of even greater concern to all five states is the lack of an adequate transmission system to move electricity across the grid without bottlenecks.

Deregulation and restructuring

Much policy attention has focused on the merits of electricity deregulation and programs designed to introduce market competition, increase the diversity of product offerings, and drive down prices. Roughly 30 states have taken steps toward introducing competition and consumer choice into their systems. Based on experiences gained from other efforts to open network economies (airlines, telecommunications, and natural gas) to competition, electricity restructuring has been seen by its advocates as a logical next step. In the case of electricity, restructuring focuses on dividing the provision of electricity into its three component parts—generation, transmission, and distribution. It is the opening up of electricity generation that is at the heart of the debate.

Traditionally, electricity was generated and delivered to consumers and businesses by regulated monopoly utilities. These utilities were usually vertically integrated in the sense that they provided the generation, transmission, and local distribution of electricity to customers. The utilities had an obligation to serve all customers in a designated service area, and the price was regulated by state public utility commissions to reflect the cost of providing service plus a fair rate of return.

Restructuring "unbundles" these integrated functions. Specific entities become responsible for each aspect of the system. Particularly important is the establishment of independent sources of generation. Rather than being limited to selling generation within a designated area, generators can sell power across the electricity grid. It was widely assumed that by introducing competition into the generation market, prices would be driven down and more efficient generation would occur as electricity would be traded across the grid to move power from generators with

1. Selected electricity attributes for Seventh District states

State	Importer/ exporter	Primary fuel for electricity generation	Avg. revenue for electric, all sectors[a]	Avg. revenue, residential	Avg. revenue, commercial	Avg. revenue, industrial
		(%)	(cents/kWh)	(cents/kWh)	(cents/kWh)	(cents/kWh)
Illinois	Exporter	Coal (50.7)	7.46	8.83	7.39	5.02
Indiana	Exporter	Coal (94.2)	5.29	6.96	6.05	3.89
Iowa	Importer	Coal (83.5)	6.04	8.35	6.45	3.89
Michigan	Importer	Coal (68.8)	7.09	8.73	7.86	5.05
Wisconsin	Importer	Coal (70.6)	5.44	7.31	5.88	3.89
U.S.		Coal (50.0)	6.66	8.16	7.26	4.43

[a]Average revenue is the measure commonly used to reflect the "price" of electricity at the state level. All figures are from 1999, the most recent reported year. Variations in "price" by sector reflect the cost to the utility of providing service to different customer classes. Revenues per kWh are lower for customers that cost the utility less to serve.

Sources: U.S. Department of Energy, Energy Information Administration, 1999; and 2000, *Electric Power Annual, 1999*, Vol. 2, Washington, DC, Table 7, p. 22.

excess capacity to utilities experiencing peak-load shortages. For the most part, electricity generation would eventually be carried out as an unregulated service. Generation would be supplied both by traditional local utilities and new independent power supply companies, which would enter the generation business and sell power into the grid. Also, power marketers (firms that trade electricity) could broker power to local utilities in the form of contracts and hedges, allowing utility companies a wider range of options for managing their energy demands.

The second unbundled function is transmission. Transmission applies to the bulk movement of power across high voltage power lines—linking individual utilities to sources of power. However, in the past, integrated utilities tended to favor building limited transmission networks. These networks would often link a single utility with one or two other outlets for importing or exporting power. They were not designed to serve as universal transmission grids for multistate regions, since most utilities built their own generation systems that served even their peak-load requirements. Fundamental to restructuring has been the assumption that an independent entity needs to be established to run the transmission system. Without an independent transmission organization, local utilities will still want to establish transmission systems that meet their local needs. Such an approach does not provide a transmission system that can efficiently serve a multistate area.

The third unbundled element is the distribution system. While the transmission system serves as the superhighway for moving bulk electricity, the distribution system can be thought of as the off-ramps and local roads that bring electricity into the homes and businesses of consumers. Under restructuring, traditional utilities often create a subsidiary that is purely in the distribution business. Since it makes little sense to build competing distribution networks, these distribution companies are often state-regulated monopolies that are responsible not only for the wires that run into individual homes or businesses, but also for billing and administrative functions.

Restructuring in the Seventh District

Illinois committed to restructuring in 1997, and nonresidential customer choice has been available since December 31, 2000,[2] in the territories served by investor-owned utilities. While it is too early to pass judgment on the progress toward introducing competition into the Illinois market, an April 2001 report by the Illinois Commerce Commission (ICC) identifies some concerns.[3] The report notes that since the opening of the market in October 1999, alternative suppliers have only captured 7% of the state's electricity sales. In addition, outside of the Commonwealth Edison service territory (metro Chicago and northern Illinois), few suppliers are providing services to any significant customer base. Part of the reason for this is the transmission system. If alternative suppliers lack confidence that they can reliably provide electricity over the current grid, they are less likely to enter the market. In the case of a constrained transmission system, the only way for an alternative provider to reliably provide service is to build new generation near the load it is trying to serve, often a costly proposition. This lack of competition combined with a constrained transmission system led the ICC to conclude that, without changes, retail residential prices could be significantly higher when price caps are removed. Under current plans, the state will offer retail choice of electricity supplier to residential customers by May 2002, but will keep price caps until 2005.

Michigan began its restructuring efforts in 1995. Since then, the Michigan Public Service Commission (PSC) has created a series of pilot projects designed to permit customers to select competitive suppliers of generation services. Four active programs exist, with full open access to electricity generation sources scheduled for January 1, 2002.

For the most part, the PSC has found participation in these alternative choice programs disappointing. In three of the four cases, only a small fraction of the available load was being purchased. For example, the Electric Choice Program in the Detroit Edison service territory made available a potential 1,125 megawatts (MW) of power for customer choice. (1 MW is generally considered sufficient to provide power for between 750 and 1,000 homes.) As of January 22, 2001, only 93 MW of load were in use.

In its report on the Status of Electric Competition (Feb. 1, 2001), the Michigan PSC was particularly critical of a lack of adequate transmission infrastructure as limiting the number of alternative energy suppliers wanting to enter the market. As of February 1, 2001, the commission had certified only ten "alternative electric suppliers," with only four serving retail customers. In evaluating the pilot projects, the PSC report states, "The pilot programs have also demonstrated the importance of transmission in making customer choice effective. Without adequate transmission, new suppliers are unable to secure and deliver power to their customers. The existing transmission system is physically not adequate to support a vibrant competitive market." Michigan has begun to address this transmission shortage by requiring that transmission capacity be increased by 2,000 MW by mid-2002. The commission is currently conducting hearings on transmission expansion.

The remaining three District states have studied restructuring but have chosen to move cautiously given their generally low electricity prices. For example, Iowa conducted an extensive review of the pros and cons of restructuring through the work of the Iowa Utilities Board (IUB) and issued five reports on various aspects of electricity restructuring in March 1999.[4] The state continues to monitor restructuring activities in other states, but has no immediate plans to offer full-fledged retail choice. Given the favorable electricity prices in these states, there is little consumer pressure to open the market to competition.

Electricity generation capacity

None of the Seventh District states report any likelihood of an immediate shortfall in electricity generation capacity that would trigger unplanned outages or could not be managed by demand-side programs and voluntary electricity curtailments by large customers. However, future generation needs are significant, particularly in those states that are currently importers of electricity. For example, the Indiana State Utility Forecasting Group reports that the state faces a declining ability to meet its future electricity needs, assuming a 15% resource reserve margin. (Reserve margins of at least 15% are considered prudent since electricity cannot be stored). In its 1999 projections, the group estimated that the state would face a deficit of 2,000 MW by 2005 and 4,000 MW by 2010 (assuming no new production). An August 2000 report by the IUB examined Iowa's supply situation in terms of the difference between annual load and annual load obligations for the large investor-owned utilities (IOUs). IOUs comprise 76% of the state's electricity sales, and IUB forecasts show these utilities moving from a surplus of 495 MW in 2000 to a deficit of 2,208 MW in 2009. The turning point occurs between 2002 (14 MW surplus) and 2003 (191 MW deficit). These deficit estimates assume that each utility will continue to serve all of the customers in its supply area, cover peak loads, and maintain a 15% reserve.

Iowa recently announced plans to expand electricity supply. One large utility—MidAmerican Energy—plans to build the first new Iowa power plant in 20 years. It will begin construction on a $340 million natural-gas-fired plant east of Des Moines in spring 2002. The plant will operate as a "peaker" and will eventually expand its technology to capture waste steam from the gas-fired turbine to produce a total of 540 MW of electricity by 2005. In addition, the utility proposes opening a $1 billion coal plant by 2007 that would deliver between 800 MW and 900 MW of power.[5] Alliant Energy has also said that it is investigating building up to 1,000 MW of new generating capacity in the state.

The Michigan PSC estimated in February 2001 that two of the state's major utilities would need to purchase 2,900 MW of generation capacity this summer to maintain an adequate reserve margin. This represents approximately 15% of estimated total demand. On very hot days, the utilities expect that they will need to purchase much of this from out-of-state facilities. A major concern for Michigan is that the state has an inadequate intra- and interstate transmission system. Interestingly, Michigan does not appear to be suffering from a lack of potential new generation. Since 1999, 2,000 MW of generation capacity has been added in the form of upgrades to existing plants or new peaking units. Furthermore, expansion plans for an additional 8,000 MW by 2004 have been reported. Of course, like any state operating in the new world of deregulated electric markets, Michigan cannot assume that all the new generation will be sold within the state.

The Wisconsin PSC's Strategic Energy Assessment for 2001 reports tight energy supplies for 2001 and 2002. The report notes that Wisconsin's electricity system can be split into two transmission segments. The western area of the state tends to have more comfortable electricity reserves. The eastern area accounts for the overwhelming share of the state's electricity usage and experiences much tighter reserves, particularly during the summer peak-use months. Most of the generation capacity in Wisconsin is still utility owned. By the end of 1999, the state had only two merchant/independent plants operating, although the PSC anticipates that merchant plants will produce up to 10% of the state's generating capacity by 2002. From 2001 to 2002, merchant plants are expected to provide 740 MW of new capacity, while Wisconsin utilities are expected to add 300 MW. According to the PSC, the state will import 500 MW in 2001, declining to 100 MW by 2002.

Illinois is an exporter of electricity, indicating that supplies of electricity are sufficient. In addition since 1997, the state has added 6,600 MW of new generation. Nonetheless, Illinois has experienced electricity reliability problems during peak energy usage periods in the summer months. Blackouts have usually been triggered by a lack of transmission capacity into metro areas such as Chicago, rather than by a physical shortage of electricity.

Conclusion

Electricity policymakers are facing very complicated issues. California's experience with a failed restructuring program has slowed what had once seemed a fairly steady movement toward competition in the electricity business. States pursuing restructuring are still hoping that competition will increase generation capacity, provide greater consumer choice, and lower prices. However, countervailing forces such as regulatory uncertainty and the lack of an adequate transmission grid could discourage new market entrants and limit expansion. Without new generation, prices are unlikely to fall and the other benefits of restructuring will not be realized. In the worst case, if capacity cannot be expanded, even tighter electricity reserves will lead to price spikes and reliability problems.

For the five states in the Seventh District, three issues deserve special attention and would likely benefit from greater regional policy coordination. First, transmission needs to be upgraded to meet future needs. Achieving this goal will be no easy feat and will require two distinct actions. This will involve physical investment in the transmission infrastructure at both the intrastate and interstate level. The existing grid is aging and not designed to meet the needs of an increasingly regional electricity system. Under the current system, whereby utilities are mostly attuned to their own transmission needs, it is unclear who has an incentive to invest in this regional transmission infrastructure. Additionally, the siting of high voltage

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power lines has never been easy, and the construction of such a system across state boundaries is likely to meet with significant opposition. Improving transmission will require the establishment of new forms of transmission governance—independent grid operators to manage a transmission system in which generation is available from an increasing number of sources. A key aspect of creating this grid will be the role of the Federal Energy Regulatory Commission. This body has suggested that four super-regional transmission organizations (RTOs) be established to perform this function nationwide. The creation of these four RTOs will be a difficult process, because it will require merging or restructuring existing regional entities. For example, in the Midwest, the RTO could require merging the Alliance Transmission Organization, the Midwest Independent Systems Operator, and the Southwest Power Pool. Establishing an efficient transmission infrastructure and an appropriate governing entity will be at the heart of the region's electricity future.

The second issue is air emissions. Like most of the nation, the Midwest uses coal to fuel the bulk of its production. Coal has significant advantages over other fossil fuels in terms of price,[6] domestic abundance, and existing position in powering large, baseload generators. It also has one obvious disadvantage. It is far less clean than alternatives such as natural gas and petroleum. In fact, the U.S. Environmental Protection Agency estimates that coal-fired power plants produce 63% of U.S. emissions of sulfur dioxide and 19% of nitrogen oxides. The agency's requirements for ozone compliance stipulate a 65% cut of nitrogen oxide emissions on utility boilers. Nitrogen-oxide control equipment will need to be installed and in operation by May 31, 2004.[7] While clean coal technology can significantly reduce electricity plant emissions, it significantly increases prices—often to more than double that of traditional coal plants. Thus, the District states will need to develop creative methods for meeting environmental requirements while expanding capacity.

Finally, it is important to consider the potential consequences from piecemeal restructuring of the electricity market in the District. While Michigan and Illinois are moving aggressively to offer retail choice to customers, the remaining three states are being cautious. Creating an electricity system with varying degrees of regulation is likely to create uncertainty, complicating the investment decisions of firms that are interested in serving the Midwest market.

[1]"Price" here is defined as the average revenue that utilities receive per kilowatt hour (kWh). This is a commonly used proxy for establishing the statewide price consumers pay for electricity, given the variation in the actual prices charged by individual utilities within their service territories, reflecting their unique costs.

[2]Illinois Commerce Commission, 1999, "A consumer's guide to electric services restructuring," available on the Internet at www.icc.state.il.us/pluginillinois.

[3]Illinois Commerce Commission, 2001, "Assessment of retail and wholesale market competition in the Illinois electricity industry," April.

[4]Iowa Utility Board, 1999, "Emerging competition in the electricity industry, a staff analysis," docket, No. NOI-95-1, March.

[5]Dave DeWitte, 2001, "MidAmerican Energy plans two plants, rate freeze in Iowa," in *The Gazette*, Cedar Rapids, IA, July 11.

[6]The Energy Information Administration reports that the average utility delivered fuel price for coal in 1998 was $1.25 per million BTUs. In contrast, the cost of petroleum was $2.13 per million BTUs, and natural gas was $2.38 (EIA, 1999, *State Electricity Profiles*, figure 1, p. 311).

[7]Indiana Utility Regulatory Commission, 2001, "In the matter of the investigation of the commission's own motion into any and all matters affecting the adequacy and reliability of electric service to Indiana retail customers," Cause No. 41736, final report, July 31.

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