CHAPTER 1

INTRODUCTION TO THE ENERGY INDUSTRY

The characteristics of an industry often play a significant role in antitrust cases, and this is particularly true in the energy industry. This chapter provides a brief, nontechnical introduction to the energy industry. It also defines some of the basic terms used in the chapters that follow.

A. The Electric Power Industry

1. Unique Features of Electricity

Electricity is an unusual product. It cannot be efficiently stored or inventoried. It must be produced by electric generators and instantaneously delivered over transmission and distribution wires in response to customer demand. Nor can the flow of electricity be readily channeled. Once produced by a generator, electricity does not flow directly from seller to buyer. Rather, it flows over the path of least resistance (least impedance) according to the laws of physics.

For example, when an air conditioning compressor in a downtown office building starts up on a hot August afternoon, electric power generators that serve this load must instantaneously produce more electricity to drive the compressor machinery. In all probability, however, this electricity will not flow directly from the generator to the city. Instead, it will flow along several different paths depending on the configuration of the transmission network.

For these reasons, when analyzing competitive electricity markets it can be difficult to determine whether a generator located at one point can serve customer load located elsewhere.[1] The amount of competitively priced electricity that can reach buyers in a particular area depends on the customers' demands, the generators that are in operation, and the capacity available in the transmission network to deliver electricity to customer destinations. This capacity, however, can vary from hour to hour. In particular, "constraints" can arise on the transmission network, which can affect the choice and output of generation units selected to run

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1. *See, e.g.*, Comments of DOJ, Inquiry Concerning the Commission's Policy on the Use of Competitive Models in Merger Analysis, FERC Dkt. No. PL98-6-000, at 2 (June 15, 1998).

to serve load. Constraints do not necessarily correlate to peak-load hours. Sometimes the transmission constraints arise during off-peak hours.

The fact that electricity cannot be stored and must be delivered over a network that is greatly affected by customer demands and the generators available to respond to them has influenced both the historical development of the industry and the evolution of competitive power markets. Variable output associated with increasing amounts of generation powered by intermittent wind and solar energy is another factor affecting these markets.

2. Traditional Industry Structure

The growing industrialization of the United States at the end of the 19th and beginning of the 20th Centuries gave rise to a recognition of the need to ensure reliable supplies of electric power. Private investors and municipalities formed investor- and municipally owned utilities to fulfill this role. Later, with encouragement from the federal government, rural electric cooperatives formed as the use of electricity spread to rural areas.

Because electricity must be produced and delivered simultaneously, most utilities took the form of vertically integrated firms. In other words, the utilities constructed and operated their own power plants, built high-voltage transmission systems to transmit power from those plants to their service areas,[2] and distributed the output of their plants to their customers through local distribution systems. Some utilities, however, did not vertically integrate and instead bought their electricity requirements from other utilities.

Over time, it became clear that to bolster reliability individual utilities needed to interconnect their transmission systems with the systems of adjacent and nearby utilities. Eventually, three large transmission areas, commonly referred to as "interconnections," emerged in the United States to facilitate the provision of reliable electricity supplies: the Eastern Interconnection, generally covering areas east of the Rocky Mountains, the Western Interconnection, generally covering areas west of the Rockies, and the Electric Reliability Council of Texas (ERCOT), which includes most of Texas except for areas in its easternmost and westernmost parts. Historically, utilities within an

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2. Transmission generally refers to the system of higher voltage wires, transformer substations, and computer control centers necessary to transport and deliver power efficiently from plants generating electricity to distribution systems, which operate at lower voltages for ultimate distribution to the consumer.

Interconnection exchanged little electricity with utilities in another Interconnection.

In addition, within the Eastern and Western Interconnections, some utilities joined together to form power pools through which they shared reserves and engaged in short-term trading of electricity. A number of these power pools evolved into some of the regional transmission organizations (discussed below) that operate the transmission grid and provide sophisticated markets for the dispatch and trading of electricity.

3. Traditional Regulatory Structure

Historically, utilities have provided retail service to end-use customers as regulated monopolies. The rates that retail customers pay for electricity have rested exclusively within the jurisdiction of the states, while sales by one utility to another for purposes of resale—that is, wholesale sales—have rested within the exclusive jurisdiction of the Federal Energy Regulatory Commission (FERC), and its predecessor, the Federal Power Commission (FPC). FERC also exercised jurisdiction over the terms and conditions of transmitting electricity on the transmission system of another utility.

In the traditional regulatory paradigm, the utility was committed in the first instance to developing and using its generating resources to satisfy the long-term power requirements of retail customers in the service areas assigned to it, and to complying with any requirements contracts it might have with wholesale customers. In this traditional regulatory structure, only power generation that was not used to serve a utility's retail and wholesale requirements load was generally available for sale to other utilities. Thus, competition existed principally for these wholesale sales. (There were small exceptions. For example, a municipality might opt to substitute self-supply for investor-owned utility service or vice versa, or so-called yardstick competition where a state regulator would compare rates offered by one franchised investor-owned retail utility or municipal system in determining the reasonableness of another franchised utility's rates.)

4. Electricity Generation

Customer demand for electricity (or customer "load") usually varies over the course of a day and among seasons of the year. A utility serving load, often referred to as a "load-serving entity" or "LSE," must own or purchase enough generation to meet the expected peak load of its customers throughout the day and year. For example, in regions with hot summers when electricity is needed for cooling, load will reach its peak in July or August. By contrast, a rural service area where many homes have electric home heating may experience peak load during the winter months.

Utilities have traditionally served their loads by engaging in "economic dispatch." Under this process, the utility plans and builds a system comprising multiple generating units that it operates to minimize the overall cost of generating electricity. Because load varies from hour to hour, not all online generators are run at full capacity. Under "economic dispatch," generators that can produce more output at lower marginal cost are usually called on first to supply electricity, whereas units with higher operating cost are run as demand grows. Transmission constraints, however, may require the utility to dispatch a higher cost generator, rather than a lower cost one, to ensure adequate supply on the grid.

As a general matter, generation operators increase or decrease the output of plants by increasing or decreasing the amount of fuel to be burned. Generating plants also vary in the speed with which their output can be modified in response to changes in system demands. Some generating plants, including nuclear power and coal-fired plants, respond more slowly, whereas other plants, such as natural gas-fired combustion turbines, can be started and "ramped" up quickly. Operators have less control over wind and solar generation plants, the output of which depends on forces of nature and not human control over fuel inputs.

Historically, utilities used large coal and nuclear powered plants to serve constant "baseload" requirements—that is, the load that exists during both on-peak and off-peak periods. Such operation was consistent with both the operating characteristics of the plants, which function better at steady output levels and change output slowly, and their relatively lower operating costs. Other plants, such as oil or natural gas fired plants, including combustion turbines, had operating characteristics allowing them to respond quickly to changes in loads and, again, historically had higher operational costs, which made them the operational and economic choice to serve loads during increases or decreases in system demands. But increases in the efficiency of natural-gas fired generation and the lower cost of natural gas have sometimes made natural-gas units the most economical to run to serve baseload needs. In addition, declines in the cost of renewable generation resources, such as wind and solar power, have made them economic choices to displace other generation.

Various factors have contributed to the rise and fall of each kind of generation. For example, pressure to reduce reliance on coal and fuel oil comes from environmental concerns about carbon emissions and climate change and, in the case of fuel oil, the rising cost of petroleum products. Regarding natural gas, supplies are increasingly abundant (see below) and prices are relatively low after several years of very high gas prices. These factors, along with the somewhat lower carbon emissions associated with burning natural gas and efficiency advances in gas-fired generation, have made natural gas an increasing share of new generation investment.

Nuclear power, too, has seen its ups and downs. Initially developed with hopes that nuclear-generated electricity would be "too cheap to meter,"[3] the cost of that electricity source skyrocketed during the 1970s and 1980s due to cost overruns in the construction of nuclear plants. Since the early 2000s, however, competition in wholesale markets spawned greater efficiency in the operation of nuclear plants. That, along with a desire for non-carbon-emitting generation resources, has sparked hopes for a nuclear renaissance, which government policies have sought to support. The Energy Policy Act of 2005 (EPAct 2005) ended the NRC's authority to review antitrust issues in connection with new plant construction and operating license applications.[4] The NRC subsequently withdrew its antitrust review regulation regarding the evaluation of new plant construction and operating license applications.[5] Nonetheless, U.S. utilities have proposed few new nuclear plants.

With respect to renewable energy, technological, policy, economic and infrastructure developments have helped increase its share of the generation mix. Technology has lowered the cost of renewables such as wind and solar, and these generation sources are increasingly competitive with other forms of generation. States have enacted laws requiring utilities to include renewables in their generation portfolios, and federal tax credits have supported investment in renewables. In addition, consumers increasingly demand the ability to purchase electricity generated from renewable sources. Finally, utilities and other energy industry participants have made investments in the transmission grid to

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3. The phrase is attributed to a former U.S. Atomic Energy Commission Chairman, Lewis Strauss, in a September 16, 1954, speech to National Association of Science Writers.
4. Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594, § 625 (2005) (codified at 42 U.S.C. § 2135(c)(9)) [hereinafter EPAct 2005].
5. Withdrawal of Regulatory Guides, 72 Fed. Reg. 59,574 (Oct. 22, 2007).

connect renewable generation facilities, such as large wind farms and solar installations, located in remote areas far from electricity customers.

In 2015, approximately 10 percent of U.S. energy consumption, and 13 percent of U.S. electricity generation, could be attributed to renewable sources, such as biomass, geothermal, hydroelectric, solar, and wind power generation.[6] Moreover, notwithstanding slight declines from 2011 to 2012 and 2014 to 2015, renewable energy consumption grew 55 percent from 2007 to 2016.[7] Texas, Iowa, Oklahoma, and California have been the leading producers of wind energy,[8] an industry that has averaged an annual growth of 39 percent from 2007 to 2014.[9] Due to such growth, the United States is the second largest generator of wind power in the world.[10]

Another source of generation is known as distributed generation or "DG," which consists of various cogeneration and small power production technologies often owned by retail customers and connected to utility distribution systems. Traditional forms of DG are owned by entities such as hospitals and telecommunications centers needing highly reliable power sources.[11] These entities typically install electric generation units for their own emergency power during outages, but may also supply electricity to the overall electric system.[12] Another growing source of DG is solar power systems installed by residential, commercial

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6. U.S. ENERGY INFORMATION ADMINISTRATION, U.S. DEP'T OF ENERGY, FREQUENTLY ASKED QUESTIONS, *available at* http://www.eia.gov/tools/faqs/faq.cfm?id=92&t=4.
7. U.S. ENERGY INFORMATION ADMINISTRATION, MONTHLY ENERGY REVIEW (Sept. 2015) at tbl. 1.3, *available at* http://www.eia.gov/totalenergy/data/monthly/pdf/mer.pdf, at tbl. 1.3.
8. AMERICAN WIND ENERGY ASS'N, U.S. WIND INDUSTRY FIRST QUARTER 2017 MARKET REPORT 6, 8.
9. *Id.* at 4.
10. The Wind Power Energy Market Intelligence, Country Production Capacity, *available at* www.thewindpower.net/statistics_en.php.
11. U.S. DEP'T OF ENERGY, THE POTENTIAL BENEFITS OF DISTRIBUTED GENERATION AND RATE-RELATED ISSUES THAT MAY IMPEDE THEIR EXPANSION, at i (2007). *See also* U.S. ENVIRONMENTAL PROTECTION AGENCY, DISTRIBUTED GENERATION OF ELECTRICITY AND ITS ENVIRONMENTAL IMPACTS, *available at* https://www.epa.gov/energy/distributed-generation-electricity-and-its-environmental-impacts#ref1.
12. *See* POTENTIAL BENEFITS OF DISTRIBUTED GENERATION, *supra* note 11 at i-ii.

and industrial customers.[13] Advances in technology and materials have allowed a wider array of consumers to meet their energy needs through modern DG.[14] Both traditional and modern DG benefit the electrical system as a whole through increased reliability, reduction of peak power requirements, provision of ancillary services such as reactive power, improvements in power quality, reductions in land-use effects and rights-of-way acquisition costs, and improvements to infrastructure resilience.[15] At the same time, DG such as solar power presents the previously mentioned issues associated with intermittent power supply that cannot be varied through human control of fuel inputs.

5. Transmission and Distribution

As noted, utility companies traditionally were vertically integrated; they owned generation capacity, the transmission wires to deliver electricity to load areas, and the distribution wires used to sell supply to retail customers. Nonetheless, even before the advent of widespread wholesale competition led to the ability of utilities to purchase supply from a seller other than an incumbent, there was some access to transmission lines to permit the delivery of wholesale electricity supply from alternative sellers.

During the twentieth century, the U.S. government developed large, often hydroelectric, generation projects, the output of which needed to be delivered to remote utilities over another company's transmission lines. *Otter Tail Power Co. v. United States*, one of the principal cases applying antitrust law in the context of the regulation of electricity markets, involved, among other things, a dispute over the transportation of government-generated power supply to municipally owned distribution utilities.[16] Similarly, the Nuclear Regulatory Commission required nuclear plant licensees to provide transmission service to third parties as part of the antitrust review of applications for nuclear plant operating licenses.[17]

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13. DISTRIBUTED GENERATION OF ELECTRICITY AND ITS ENVIRONMENTAL IMPACTS, *SUPRA* NOTE 11.
14. *Id*.
15. POTENTIAL BENEFITS OF DISTRIBUTED GENERATION, *supra* note 11 at i-iii.
16. 410 U.S. 366 (1973).
17. *See, e.g.*, Consumers Power Co. (Midland Plant, Unit Nos. 1 & 2), NRC Docket Nos. 50-329-A, et al., 6 N.R.C. 892 (1977).

Congress passed statutes in 1978 and 1992 that provided FERC with additional authority to order a utility to provide transmission access to another utility for purposes of purchasing power supply.[18] In 1994, FERC became concerned that transmission owners might deny transmission access in favor of their own generation.[19] That concern culminated in FERC's landmark Order No. 888, which required public utilities to separate (or "unbundle") generation and transmission functions and to file tariffs governing nondiscriminatory, open access transmission services.[20] (Order No. 888 is described in greater detail in the next chapter.) Order No. 888 also required transmission providers to supply certain specified ancillary services,[21] including services that are important to operating the electricity system reliably.

Subsequently, because of continuing concerns about the incentives for transmission owners to favor their own generation through transmission system operations, despite the existence of open access rules, FERC sought to encourage governance and operation of transmission systems by entities that were independent of generation owners and other market participants. The entities came to be known as Independent System Operators (ISOs) or Regional Transmission Organizations (RTOs).[22] The ISOs/RTOs are public utilities regulated by FERC and are each managed by an independent board. They have

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18. Public Utility Regulatory Policies Act of 1978, Pub. L. No. 95-617, 92 Stat. 3117, § 203 (1978); Energy Policy Act of 1992, Pub. L. No. 102-486, 106 Stat. 2775, §§ 721-722 (1992).
19. *See, e.g.*, American Elec. Power Serv. Corp., 67 F.E.R.C. ¶ 61,168 (1994).
20. *See* Order No. 888, Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, 61 Fed. Reg. 21,540 (May 10, 1996) (codified as modified at 18 C.F.R. pts. 35 and 385).
21. Ancillary services are those necessary to support the reliability of the transmission system, such as auxiliary capability, online "spinning reserve" or offline "black start capability," and voltage support. These services are necessary at crucial times but might not be sufficiently available to be priced competitively. Generally, ancillary services have been deregulated only where an Independent System Operator (ISO) or Regional Transmission Organization (RTO) operates the transmission system and where such services are procured in a bid-based market.
22. *See* Order No. 2000, Regional Transmission Organizations, 65 Fed. Reg. 810 (Jan. 6, 2000) (codified as modified at 18 C.F.R. pt. 35).

authority over the scheduling of transactions involving the transmission facilities of participating utilities.

Traditional, vertically integrated utilities have responded to these developments in a variety of ways. Many remain vertically integrated, owning generation, transmission, and distribution. Some have chosen to become wires-only companies by selling all of their generation resources and focusing their businesses on the transmission/distribution of electricity and on sales to end-use customers. Others have sold their transmission facilities to stand-alone transmission companies, while continuing to own generation facilities and distribution systems. These stand-alone transmission companies have become important participants in efforts to construct new transmission facilities needed to meet the evolution of the industry, such as the integration of large, renewable generation installations.[23]

Efforts are also underway to apply digital technologies to the grid, and enable real-time coordination of information from generation supply resources, demand resources, and DG. The process of upgrading will take place over the next decade or so, and will require controls, computers, power lines, new technologies and equipment.[24] Expected benefits include greater reliability, security (including cyber-security), and efficiency of the electric grid.[25] The smart grid should also allow for quicker and more strategic restoration of electricity after power outages, reduced peak demand, and integration of large-scale renewable energy systems and customer-owned power generation.[26]

Another aspect of the smart grid is consumer access to meters that contain advanced technology and are intended to provide significantly more information regarding electricity usage and pricing.[27] In some

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23. For example, transmission companies have made significant investments in transmission to move power from production areas in West Texas to consumption areas in East Texas. *See Texas CREZ Transmission Projects*, ELECTRONIC TRANSMISSION TEXAS, LLC, *available at* http://www.ettexas.com/projects/consortium.asp.

24. OFFICE OF ELECTRICITY DELIVERY & ENERGY RELIABILITY, DEPARTMENT OF ENERGY, What is the Smart Grid?, *available at* https://www.smartgrid.gov/the_smart_grid.

25. FEDERAL ENERGY REGULATORY COMMISSION, Smart Grid, *available at* http://www.ferc.gov/industries/electric/indus-act/smart-grid.asp.

26. OFFICE OF ELECTRICITY DELIVERY & ENERGY RELIABILITY, DEPARTMENT OF ENERGY, What is the Smart Grid?, *available at* https://www.smartgrid.gov/the_smart_grid.

27. *Id.*

states, utilities have installed advanced metering, which measures customer consumption at least hourly if not more frequently; transmits the measurements over a communications network; and provides the information to both consumers and energy companies at least once daily.[28] With the data supplied by advance metering, consumers can make choices about electricity consumption, including based on forecasts and real-time prices in energy markets. Penetration of advanced metering increased from 9 percent in 2009 to 40 percent in early 2014.[29]

6. Traditional Electricity Products

In parts of the United States without organized wholesale electricity markets (and throughout the United States, before the advent of such markets), trading generally has occurred between a buyer and seller in a bilateral transaction. The two principal electricity products traded have been capacity and energy. Capacity refers to the ability of a generating plant to produce electric energy, usually measured in megawatts. Energy refers to the electric output of a generator, usually measured in megawatts per hour. Participants in electric power markets over the years of have developed a number of different ways to package capacity and energy in terms of firmness, duration, and price.

Utilities traditionally have been required to maintain specified "reserve margins," or generating capacity reserves, in excess of their anticipated peak loads. These margins provide reserve capacity that can be called upon in the event of unexpected outages of generation or unusually extreme weather (e.g., heat, cold) that causes demand to spike. In addition to planning sufficient generation to serve its own retail customers, a utility might also have long-term commitments to serve the requirements load of another utility. Capacity in excess of the utilities' retail and wholesale requirements loads can be sold on a short-term or long-term basis.

Energy may be sold on both a "firm" and "nonfirm" basis. Firm sales are sales that the seller cannot interrupt in ordinary operating

28. FEDERAL ENERGY REGULATORY COMMISSION, ASSESSMENT OF DEMAND RESPONSE & ADVANCED METERING STAFF REPORT 1 (2016), *available at* https://www.ferc.gov/legal/staff-reports/2016/DR-AM-Report2016.pdf.

29. *Id.* at 3.

conditions.[30] Nonfirm sales are interruptible, with the permitted circumstance of interruption defined by tariff or contract.[31]

The various products have been sold on a long-term and short-term basis. Long-term supply often includes capacity along with associated energy.[32] Short-term products are often sold on an hourly, daily, and weekly basis.[33] In the past, a common hourly product was "economy" energy, whereby one utility with lower marginal costs in a particular hour would sell to another utility with higher marginal costs.[34] The utilities would then split the higher cost utility's savings.[35] Such economy transactions were a precursor to power pooling among multiple utilities.[36]

Historically, wholesale transactions included use of the transmission system to deliver the energy. As explained above, transmission is now sold as a separate product from wholesale power supply, which supports competitive trading of wholesale electricity products.[37]

For retail sales, utilities historically supplied the full requirements of end-use customers within their assigned or franchised service territory. As competition developed in wholesale markets, a number of states also implemented retail competition programs, often referring to the process as "retail restructuring."[38] These programs, which varied from state to state, permit retail customers to buy from suppliers other than their historical distribution utility, at rates set by the marketplace. States that have restructured retail markets tend to be located in regions with the kinds of organized wholesale electricity markets described below.

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30. *See* FEDERAL ENERGY REGULATORY COMMISSION, ENERGY PRIMER: A HANDBOOK OF ENERGY MARKET BASICS 65 (2015), *available at* http://www.ferc.gov/market-oversight/guide/energy-primer.pdf.
31. *Id.*
32. *See id.* at 118.
33. *Id.*
34. *See id.* at 36.
35. *See id.*
36. *See id.*
37. *See id.* at 53.
38. *See* ENERGY INSTITUTE AT HAAS, The U.S. Electricity Industry after 20 Years of Restructuring 4 (MAY 2015), *available at* https://ei.haas.berkeley.edu/research/papers/WP252.pdf.

7. *ISOs, RTOs, and Organized Electricity Markets*

Years ago a number of utilities formed power pools to share reserves, increase reliability, and trade energy on a short-term basis to minimize costs.[39] The power pooling structures along with developments in electricity markets, including the separation of electricity supply from transmission service, played a role in the power pools' evolution into ISOs and RTOs. In addition, through regulatory policies (described in Chapter 2), FERC encouraged utilities to form and join ISOs and RTOs. There are currently six RTOs under FERC jurisdiction, each covering multiple states: ISO New England, the New York ISO, the PJM Interconnection, the Midcontinent ISO, the California ISO, and the Southwest Power Pool.[40] A seventh RTO, the Electric Reliability Council of Texas, only covers Texas and is therefore not subject to FERC jurisdiction.[41] ISOs/RTOs currently serve about two-thirds of U.S. electricity consumers.[42]

RTOs are independent entities that control and operate regional electric transmission grids in a non-discriminatory fashion.[43] RTOs also coordinate regional planning, coordinate dispatch of generators in their systems, and operate regional organized energy markets offering day-ahead and real-time energy products with price transparency for energy,

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39. In 1927, three utilities formed PJM, the world's first power pool. In 1966, the New York Power Pool was formed, and the New England Power Pool was formed in 1971. *See* FEDERAL ENERGY REGULATORY COMMISSION, ENERGY PRIMER: A HANDBOOK OF ENERGY MARKET BASICS 39 (2015), *available at* http://www.ferc.gov/market-oversight/guide/energy-primer.pdf.
40. AMERICAN PUBLIC POWER ASS'N, A BRIEF DESCRIPTION OF THE SIX REGIONAL TRANSMISSION ORGANIZATIONS (RTOS) (2009), *available at* http://www.publicpower.org/files/PDFs/23%20RTOs.pdf [hereinafter A BRIEF DESCRIPTION OF THE SIX REGIONAL RTOS].
41. *Id.*
42. ISO/RTO COUNCIL, IRC History, *available at* http://www.isorto.org/about/irchistory.
43. OFFICE OF ELECTRICITY DELIVERY & ENERGY RELIABILITY, DEPARTMENT OF ENERGY, REPORT TO CONGRESS ON COMPETITION IN WHOLESALE AND RETAIL MARKETS FOR ELECTRIC ENERGY, 23-24 (2006), *available at* http://www.ferc.gov/legal/fed-sta/ene-pol-act/epact-final-rpt.pdf [hereinafter COMPETITION IN WHOLESALE AND RETAIL MARKETS FOR ELECTRIC ENERGY].

congestion, and losses.[44] RTOs do not own electric generation facilities and do not furnish electricity products. Rather, they organize and administer the market through which electricity producers and marketers sell their products and utilities purchase them.[45] RTOs develop rules for administering the markets in which generators sell power, coordinate dispatch of generators and determine the levels at which generators run, sell transmission services under a single RTO open access tariff, and operate regional organized energy markets.[46]

RTOs operate three types of markets: energy markets, capacity markets, and ancillary services markets. Energy markets include day-ahead forward markets and real-time markets.[47] These markets are used to determine which generators run on the following day and on a real-time basis, respectively.[48] Capacity markets are forward markets for the capacity of generators to produce electricity on both a short-term and long-term basis. They are intended to help ensure an economic incentive for suppliers to keep and invest in electricity generation.[49] Finally, ancillary services markets encompass a range of products needed to reliably operate in the electric system. One set of such products provides electricity in response to instantaneous changes in electricity supply or demand, or where a generation unit suddenly becomes unavailable. These products are known as "reserves." Another ancillary service, "reactive power," helps to regulate and maintain the voltage of the electric system.[50]

The organized electricity markets typically rely upon locational marginal pricing or "LMP" in which energy prices vary by location to reflect the value of the energy at the specific location at the time it is delivered. In the absence of transmission congestion, energy can flow freely throughout the grid, and energy prices will be the same across all locations. With congestion, however, energy prices can differ to reflect the marginal price of the resource needed to serve that location at a

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44. *Id.* at 31.
45. A BRIEF DESCRIPTION OF THE SIX REGIONAL RTOS, *supra* note 40.
46. COMPETITION IN WHOLESALE AND RETAIL MARKETS FOR ELECTRIC ENERGY, *supra* note 43, at 31.
47. DEPARTMENT OF ENERGY AND MINERAL ENGINEERING, COLLEGE OF EARTH AND MINERAL SCIENCES, PENN STATE UNIVERSITY, REGIONAL TRANSMISSION ORGANIZATIONS, *available at* http://www.e-education.psu.edu/eme801/node/535.
48. *Id.*
49. *Id.*
50. *Id.*

particular time. The use of LMP has given rise to financial hedging instruments, such as financial transmission rights, which enable an owner of these rights to a stream of revenues (or charges) based on the hourly congestion price differences across transmission paths. These revenues help to hedge price risk in energy markets.

Another product found in organized markets is demand response, which reflects the change in electricity usage by customers caused by changes in electricity prices over time, or to incentive payments designed to lower electricity use during periods of high demand.[51] Demand response permits greater reliability of the grid during periods of peak electricity consumption, and enables consumers to reduce consumption in response to higher prices for electricity.[52] Utilities, RTOs, and ISOs have encouraged demand response through adoption of time-based rates and demand-response policies, made possible with technologies such as advanced metering.[53] FERC has further encouraged the use of demand response through its orders, public conferences, and collaborative efforts with state enforcement agencies.[54]

In markets without competition, such as markets with cost-based rate regulation, rates are based on average historic cost of production plus a fair return on investment.[55] In such markets, rates do not reflect the current cost of electricity, and suppliers do "not receive economically accurate price signals to guide their short- and long-term sales of generation."[56] However, the development of organized competitive markets, including ISO/RTO markets, has introduced price signals that guide suppliers in their decisions to invest in additional capacity.

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51. FEDERAL ENERGY REGULATORY COMMISSION, ASSESSMENT OF DEMAND RESPONSE & ADVANCED METERING STAFF REPORT, at 3 (Sept. 2007), *available at* http://www.ferc.gov/legal/staff-reports/09-07-demand-response.pdf.
52. *Id.* at 6.
53. *Id.* at i.
54. *Id.* at i-ii. The D.C. Circuit recently held that FERC did not have jurisdiction to set rates for demand response resources sold into wholesale markets. Electric Power Supply Ass'n v. FERC, 753 F.3d 216, 224 (D.C. Cir. 2014). The Supreme Court reversed and held that the Federal Power Act authorizes FERC to regulate wholesale market operators' compensation of demand response bids. FERC v. Electric Power Supply Ass'n, 136 S. Ct. 760, 773-82 (2016).
55. COMPETITION IN WHOLESALE AND RETAIL MARKETS FOR ELECTRIC ENERGY, *supra* note 43, at 44.
56. *Id.* at 45.

Electricity prices in these markets increase when there is resource scarcity, signaling an opportunity for profit and investment, and "attracting new resource construction where it is most highly valued."[57]

8. Reliability

Prior to enactment of the Energy Policy Act of 2005 (EPAct 2005),[58] electric utilities voluntarily set and enforced rules to ensure the reliable supply of electricity through an organization known as the National Electric Reliability Council. That organization formed in 1968 following a major blackout affecting the northeast United States, including New York City. Partly in response to another major blackout in the Midwest and Northeast in 2003, Congress included in EPAct 2005 authority for FERC to regulate reliability and required FERC to designate an Electric Reliability Organization (ERO). In 2006, FERC designated the North American Electric Reliability Corporation (NERC) as the ERO responsible for adopting and enforcing reliability standards for operation of the power system. NERC has the authority to issue sanctions and directives to address and prevent violations of its standards.[59] "Entities found in violation of any standard must submit a mitigation plan for approval by NERC and, once approved, must execute this plan as submitted."[60]

B. The Natural Gas Industry

Natural gas is found and produced in a number of regions in the United States and Canada. These fields often are called "production areas." New technology has expanded production, both in traditional production areas and in new parts of the country, such as the Northern Great Plains. For example, natural gas found in shale beds, long thought to be unrecoverable, became a leading source of new supply.[61]

Gas must be transported by gas pipelines from the production areas to gas-consuming areas, and must be delivered locally to gas consumers.

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57. *Id.* at 51.
58. EPAct 2005, *supra* note 4
59. NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION, COMPLIANCE & ENFORCEMENT, *available at* http://www.nerc.com/pa/comp/Pages/Default.aspx.
60. *Id.*
61. Clifford Krauss, *Drilling Boom Revives Hopes for Natural Gas*, N.Y. TIMES, Aug. 25, 2008, at A1.