



Regional Transmission Organizations and Independent System Operators

Overview of RTOs and ISOs

Regional Transmission Organizations (RTO)¹ and Independent System Operators (ISO) are non-profit organizations established in particular geographic regions to manage the operations of the transmission grid. Broadly, RTOs/ISOs are responsible for ensuring the reliability of the transmission grid by facilitating wholesale power markets, monitoring transmission grid performance, and coordinating the operations of power generators in the region. *An RTO performs the same type of business activities as ISO, but has additional requirements and has to be approved by the Federal Energy Regulatory Commission (FERC). FERC defined four characteristics and eight functions that an entity must satisfy in order to become an RTO (Exhibit 1).*

Exhibit 1 Regional transmission organization characteristics and functions

Regional transmission organization characteristics	Regional transmission organization functions
<ul style="list-style-type: none"> ▶ Independence from control by any market participant ▶ Sufficient scope to maintain reliability and support nondiscriminatory power markets ▶ Operational authority for transmission facilities under their control ▶ Exclusive authority for maintaining the short-term reliability of the grid they operate 	<ul style="list-style-type: none"> ▶ Administer tariffs and a pricing system to promote efficient use and expansion of transmission and generation facilities ▶ Create market mechanisms to manage transmission congestion ▶ Address parallel path flow issues ▶ Serve as a supplier of last resort for ancillary services ▶ Operate a single Open Access Same-Time Information System (OASIS) site for transmission facilities under their control ▶ Monitor markets to identify design flaws and market power ▶ Plan and coordinate transmission additions and upgrades ▶ Ensure integration of reliability practices within an interconnection and market-interface practices among regions

Existing voluntary power pools that shared power and system stability were the earliest examples of an ISO. In the early 1990s, the federal government, along with several states, began to take a series of steps aimed at restructuring the electricity industry, particularly targeted at increasing the competition in wholesale power markets. To facilitate competition, FERC issued a variety of orders, starting in April 1996 with Order 888², which required that transmission owners under FERC jurisdiction (mainly large investor-owned utilities) allow other entities to access the transmission owner’s lines at the same prices and with the same terms and conditions that they applied to themselves. This effectively required vertically integrated utilities to internally create organizational divisions that would split the operation of their transmission lines from their generation and distribution operations, although the utility continued to maintain ownership of the transmission assets. This organizational change was required in order for a utility to be able to accurately determine the cost of transmission service, such that this service could be provided to both internal and external customers (i.e., the utility that owned the transmission assets as well as third parties). Additionally, Order 888 encouraged—but did not require—transmission owners to form independent entities called ISOs to manage the transmission network (neither ISOs nor RTOs own transmission lines). FERC did not (and still does not) require vertically integrated utilities to sell their transmission assets, but rather encouraged participation in ISOs as a means of institutionalizing the

¹ Many of technical terms used in this primer are defined in a companion *Glossary for Power Market Primers*.

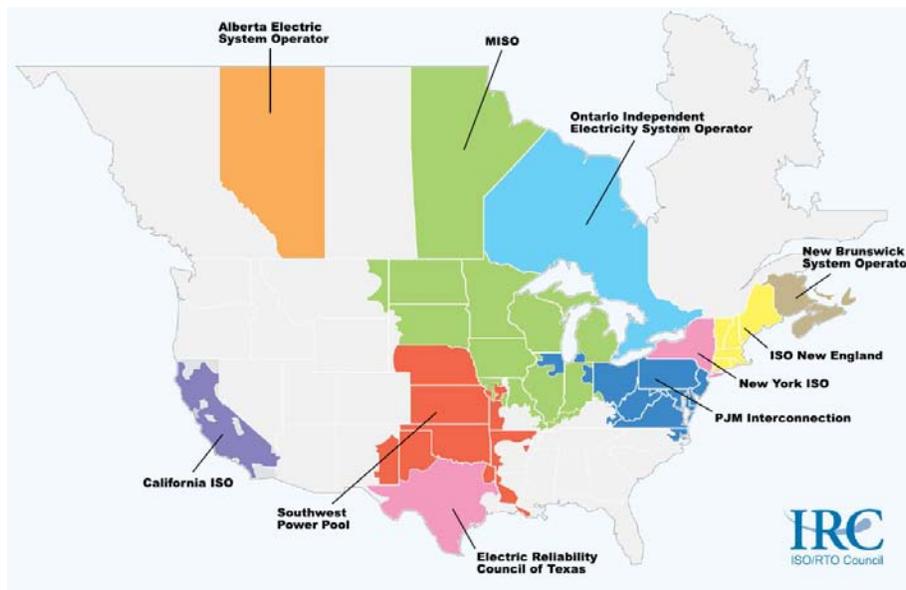
² Federal Energy Regulatory Commission. (1996). *Order No. 888: Promoting Wholesale Competition Through Open Access Non-discriminatory Transmission Services by Public Utilities and Recovery of Stranded Costs by Public Utilities and Transmitting Utilities*. Retrieved on September 16, 2011, from <http://www.ferc.gov/legal/maj-ord-reg/land-docs/order888.asp>

separation of the operation of transmission assets from the ownership of generation assets. FERC recognized that the initial regulatory efforts outlined in Orders 888 and 889³ were not sufficient to guide non-discriminatory access to the transmission grid, and in December 1999 issued Order 2000.⁴ Order 2000 encouraged transmission owners to form RTOs, and outlined the minimum characteristics an RTO should have, and the minimum functions an RTO should perform.

Currently, approximately two-thirds of U.S. electricity consumers are served by seven ISOs/RTOs, predominantly in the Northeast, Midwest, and California. In other areas of the country, particularly in regulated states, the regulated utilities, Publicly Owned Utilities (POU), or federal Power Marketing Authorities (PMA) own and operate transmission assets.

The seven regional grid operators in the U.S. are: California ISO (CAISO), Midwest ISO (MISO), Southwest Power Pool (SPP), Electric Reliability Council of Texas (ERCOT), PJM Interconnection (PJM), New York ISO (NYISO), and ISO New England (ISO-NE) (Exhibit 2).

Exhibit 2 North American transmission organizations



Source: ISO/RTO Council⁵ (Copyright © ISO/RTO Council, all rights reserved)

RTO: MISO, ISO-NE, PJM and SPP

ISO: CAISO, ERCOT, NYISO, Alberta Electric System Operator, Ontario Independent Electricity System Operator, and New Brunswick System Operator

Of these seven U.S. grid operators, six are regulated by FERC, and four have been approved by FERC to be recognized as RTOs (i.e., they meet the requirements set out in FERC Orders 2000 and 2001⁶). NYISO and CAISO have not gained FERC approval because they do not cover a large geographic area and FERC does not see them as regional in scope. ERCOT is not regulated by FERC because it is not under FERC jurisdiction. ERCOT operates fully within Texas state lines and has chosen to remain

³ Federal Energy Regulatory Commission. (1996). *Order No. 889: Open Access Same-Time Information System (formerly Real-Time Information Networks) and Standards of Conduct*. Retrieved on September 16, 2011, from <http://www.ferc.gov/legal/maj-ord-reg/land-docs/order889.asp>

⁴ Federal Energy Regulatory Commission. (1999). *Order No. 2000: Establishment of Regional Transmission Organizations Proposals*. Retrieved on September 16, 2011, from <http://www.ferc.gov/legal/maj-ord-reg/land-docs/RM99-2A.pdf>.

⁵ ISO/RTO Council. (2011). *ISO/RTO Operating Regions*. Retrieved on September 16, 2011, from <http://www.isorto.org/site/c.jhKQIZPBImE/b.2604471/k.B14E/Map.htm>.

⁶ Federal Energy Regulatory Commission. (2002). *Order No. 2001: Revised Public Utility Filing Requirements*. Retrieved on September 16, 2011, from <http://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=9512346>.

regulated by the Public Utility Commission of Texas. The transmission grids that are not covered by these regional grid operators are controlled by the individual utilities for their specific service areas.

All seven transmission organizations in the U.S. are organized as non-profit corporations or limited liability companies, and recoup expenses through regulatory-approved tariffs. These expenses are outlined below in the major categories as identified on FERC Form 1.⁷

Exhibit 3 RTO/ISO expenses and category descriptions

Category	Description
Transmission service	<ul style="list-style-type: none"> ▶ Load dispatch scheduling, monitoring, and reliability ▶ Reliability planning ▶ Interconnection studies
Market expenses	<ul style="list-style-type: none"> ▶ Day-ahead, real-time, transmission rights, and ancillary markets facilitation ▶ Market monitoring and compliance services
General and administrative expenses	<ul style="list-style-type: none"> ▶ Administrative salaries, benefits ▶ Outside services, insurance, rent
Other expenses	<ul style="list-style-type: none"> ▶ Customer assistance service (e.g., billing / cost / contact inquiries) ▶ Informational and instructional services expenses

Source: GAO, "Electricity Restructuring," (2008)⁷

While a small portion of an ISO/RTO's revenue is derived from membership fees or reimbursements for integration studies, the majority of an ISO/RTO's costs for administering the transmission grid are passed on to the market (ultimately paid by the electricity consumer) based on FERC-approved tariff formulas. This cost reimbursement can be thought of as a small surcharge on each transaction in the power market, and is collected by the ISO/RTO as the settlement agent between generators, transmission owners, and load-serving entities. Thus, the cost per MWh for administering transmission services in a given region can vary fairly significantly based on the services provided by the ISO/RTO and the volume of electricity transferred by the region's transmission system.

Products and Services of RTOs and ISOs

Despite differences in nomenclature, RTOs and ISOs largely serve the same market purpose and provide similar market services. RTOs previously have been ISOs and that is why some of the RTOs still have ISO as part of the name (e.g., ISO New England). These organizations are charged with operating the transmission grid, and are responsible for maintaining the reliability of the systems under their control. RTOs/ISOs oversee and direct the high-voltage, bulk power systems, and provide a clearinghouse for wholesale power purchases by matching buyers and sellers of electricity in day-ahead, hour-ahead, and real-time markets. RTOs/ISOs offer different market services depending on the accepted market design (e.g., a market design accepted by ERCOT, SPP, and CAISO does not include a capacity market). The market can evolve over time, and additional services can be added to the market (e.g., SPP will launch day-ahead and ancillary service markets in 2014). Additionally, they have the authority to coordinate the output of generators in their service area, and provide reliability services such as outage coordination, generation scheduling, transmission planning, voltage management, ancillary services provisions, and load forecasting.

In areas of the country not covered by regional grid operators, market offerings are typically performed by vertically integrated utilities, under the oversight of the state Public Utility Commissions/Public Service Commissions. These utilities will forecast daily loads and coordinate generation facilities to meet the expected demand, and will provide regulation services with their own generation assets in real-time.

⁷ United States Government Accountability Office. (2008). *Electric Restructuring: FERC Could Take Additional Steps to Analyze Regional Transmission Organizations' Benefits and Performance*. Retrieved on September 16, 2011, from www.gao.gov/new.items/d08987.pdf

There is no need for day-ahead or real-time energy markets, as the vertically integrated utility owns and controls the full value chain from generation through transmission and distribution.

Exhibit 4 RTO/ISO characteristics and market offerings

	Profile			Transmission functions				Wholesale energy market functions			
	RTO/ISO	Approx pop. (Mil)	Line miles (>230 kV)	Service provider	Balancing authority	Reliability coordinator	Planner	Real-time market admin.	Day-ahead market admin.	Ancillary services market admin.	Capacity market admin.
California ISO	ISO	30	11,730	✓	✓	✓	✓	✓	✓	✓	
ISO New England	RTO	14	2,526	✓	✓	✓	✓	✓	✓	✓	✓
Midwest ISO	RTO	40	14,678	✓	✓	✓	✓	✓	✓	✓	✓
New York ISO	ISO	19	4,121	✓	✓	✓	✓	✓	✓	✓	✓
PJM	RTO	51	19,710	✓	✓	✓	✓	✓	✓	✓	✓
SW Power Pool	RTO	5	10,257	✓		✓	✓	✓	(2014 launch)	(2014 launch)	
ERCOT	ISO	22	8,917	✓	✓	✓	✓	✓	✓	✓	

Sources: GAO, "Electricity Restructuring" (2008)⁷; ISO/RTO Council, "The Value of Independent Regional Grid Operators" (2005)⁸; and the organizations' respective websites

Exhibit 5 Description of RTO/ISO market offerings

Service provider	Administers the transmission tariff and provides transmission services, receives and processes transmission service requests, and determines available capacity
Balancing authority	Integrates resource plans regionally and maintains in real time the balance of electricity resources and electricity demand
Reliability coordinator	Ensures the real-time operating reliability of the transmission system
Planner	Works with stakeholders to develop overall plans for new transmission needed to meet future projected electricity demand
Real-time market administrator	Administers a market where electricity is bought and sold at prices determined in real time to satisfy the difference between projected needs and actual demand Many of these markets price electricity differently at various locations across the region in order to reflect the costs associated with congestion.
Day-ahead market administrator	Administers a forward market where electricity is bought and sold for use the following day based on projected customer needs
Ancillary services market administrator	Manages services necessary to support the reliable operation of the transmission system and provision of electricity at appropriate frequency and voltage levels
Capacity market administrator	Administers a system to procure a sufficient portfolio of supply and demand resources to meet future electricity needs and encourage investment

Source: GAO, "Electricity Restructuring," (2008)⁷

More details about different ISOs/RTOs can be found in the ISOs/RTOs primers: *California Independent System Operator*, *ERCOT Independent System Operator*, *MISO Regional Transmission Organization*, *ISO New England Regional Transmission Organization*, *New York ISO Regional Transmission Organization*, *PJM Regional Transmission Organization*, and *Southwest Power Pool, Inc.*

⁸ ISO/RTO Council. (2005). *The Value of Independent Regional Grid Operators*. Retrieved on September 16, 2011, from http://www.isorto.org/atf/cf/%7B5B4E85C6-7EAC-40A0-8DC3-003829518EBD%7D/Value_of_Independent_Regional_Grid_Operators.pdf