Free markets. Real solutions.

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TYPES OF ORGANIZED ELECTRICITY MARKETS

INTRODUCTION

Regional transmission organizations and independent system operators (RTO/ISOs) deliver reliable electricity through organized competitive markets. These markets reduce the costs to operate the grid and send long-term investment signals (e.g., resource construction, retirement and maintenance) that ensure there will be enough future supply resources to meet demand. RTO/ISOs also plan and coordinate the operation, maintenance and expansion of transmission facilities to ensure reliable grid operations.

The market price for wholesale electricity is determined by the levels at which suppliers are willing to provide an electricity product and those on the demand side are willing to pay for it. Generation and demand participate in organized markets by submitting offers and bids to sell or buy an electricity product in an organized marketplace. The RTO/ISOs run computerized market models that accept the lowest-cost offers needed to meet demand, while respecting the physical constraints of power plants, demand response and the transmission system. An RTO/ISO has discretion to commit and dispatch resources that did not clear a short-term market, if needed to maintain reliable grid operations.

TABLE I: ELECTRICITY MARKET TYPES

Market	Purpose	Function
Energy market	Facilitate efficient actions by market participants in the short term (e.g., generation and demand response) and guide long-term investment decisions.	Uses short-term supply and demand to form prices that reflect the location-based marginal value of bulk energy.
Ancillary services markets		Uses short-term supply and demand to form prices that reflect the location-based marginal value of specific energy services.
Capacity markets (ISO-NE, NYISO, PJM, MISO only)	Facilitate efficient long-term decisions to ensure sufficient capacity to operate the system reliably in the future.	Uses an auction to procure a level of future capacity deemed necessary for grid reliability.

SHORT-TERM MARKETS

Energy markets use locational marginal pricing (LMP) to reflect the marginal cost to serve load at specific locations on the grid. LMP reflects three marginal-cost components: system marginal energy cost, transmission line loss and transmission congestion. The system marginal energy cost represents the supply/demand baseline, which does not vary across the footprint. Line losses are relatively small across an RTO/ISO. Transmission congestion is the difference maker. Congestion occurs when there is insufficient transmission capacity to run all least-cost resources. This tends to drive up LMPs in high-demand areas where transmission capacity is limited (e.g., New York City) and drive down LMPs in areas with an abundance of inexpensive generation that lack the transmission capacity to get to higher demand areas (e.g., wind power in the Midwest).

LMPs are very volatile compared to non-electricity commodities. This reflects the large, rapid shifts in electricity supply-demand balance at both the systemwide and local levels. Average energy market prices fall in the low-to-mid tens of dollars per megawatt-hour (MWh). High demand (e.g., hot days) and transmission constraints often will cause prices in the mid-to-high tens of dollars per MWh, sometimes briefly into the hundreds of dollars per MWh. Rarely, prices can exceed $1,000/MWh.

RTO/ISOs employ day-ahead and real-time energy and ancillary-service markets. The day-ahead market produces financially binding schedules for electricity supply and demand a day in advance of the operating day. This allows for lower-cost pre-positioning of power plants based on expected conditions. More than 90 percent of energy transactions are usually scheduled in the day-ahead market. As conditions change (e.g., errors in wind or load forecasts), the real-time market balances the difference between the day-ahead schedule and the actual amounts needed in real time.

Energy markets arrange the bulk of electricity flows, while ancillary services cover additional services needed to maintain grid reliability. Ancillary-services markets are tied to energy markets such that ancillary-service prices reflect and influence LMPs. "Regulation service" is an ancillary service that fine-tunes efforts to balance the grid by matching generation with very short-term changes in demand. "Operating reserves" are also needed to restore the balance between supply and demand when a generating unit unexpectedly goes offline. "Black start" resources have the ability to start without power assistance from the grid. This service is needed to restore operations in case of a full grid blackout, with compensation generally determined via an administrative process, rather than market mechanisms.

Short-term market prices offer signals to guide resource planning and investment decisions. Specifically, existing or prospective resource owners will retain or build resources if revenue from energy and ancillary-services markets exceed their resource cost. Otherwise, they will retire or opt not to build the resource in question. The Electric Reliability Council of Texas (ERCOT) relies exclusively on this model, employing robust "scarcity pricing." Scarcity pricing is a mechanism to send price signals in the real-time market when there is a systemwide shortage of power reserves. Without this scarcity pricing, the energy and ancillary service markets might not give facilities enough revenue to stay open, jeopardizing a system's reliability. This revenue shortfall is often referred to as "missing money."

CAPACITY MARKETS

Capacity markets present one option to address the "missing money" of short-term markets. They set a procurement target for the amount of capacity needed to meet expected future demand reliably. If facility operators aren't taking in enough revenue in the short-term markets, they have an incentive to make up that "missing money" in the capacity markets.

The interplay between short-term markets and capacity markets is similar to squeezing one side of a balloon. Price pressure in short-term markets shifts price pressure in capacity markets in the opposite direction. For example, downward pressure on short-term market prices from low natural-gas prices has decreased revenues for most generators, which increases their "missing money." This drives an increase in their capacity offers and puts upward pressure on capacity prices.

Making promises in the capacity market can come at a cost. If a facility fails to deliver its promised capacity because of an equipment failure or problems accessing fuel, it has to pay a penalty. PJM and ISO-New England (ISO-NE) recently increased their penalties greatly.

> Energy markets are the bread-and-butter of RTO/ISOs. They comprise the vast majority of transactions and costs to customers, even in RTO/ISOs with capacity markets. For example, energy markets totaled 65 percent of the 2015 total cost in the PJM Interconnection (PJM), followed by the capacity market (20 percent), transmission services (12 percent) and other services (3 percent).

Capacity markets have inherent limitations, and poorly account for things like transmission constraints and the transient value of reliability (e.g., system resource needs are much higher on a hot summer day than a mild fall day), , all of which can be reflected in the short-term market. Because of these limitations, capacity markets require extensive administrative rules. A wide degree of variance and controversy exists over capacity-market design. For example, the capacity markets in PJM and ISO-NE are held three years ahead of the delivery period to provide a longer-term signal to resource developers, whereas the Midcontinent Independent System Operator (MISO) and New York Independent System Operator (NYISO) hold theirs weeks or months in advance.

TRANSMISSION OPERATIONS AND PLANNING

Competitive, organized markets require equal access to the transmission system. To provide this, RTO/ISOs offer two primary types of transmission service: network service and point-to-point service. Network service refers to the transmission of energy from an RTO/ISO's network-generating resources to network loads, and serves as the primary priority of the transmission system. For bilateral transactions, like the sale of power from a power plant to a single customer, RTOs/ISOs provide point-to-point service. This uses the transmission system to transmit energy between a point of receipt and point of delivery. RTO/ISOs approve or deny customers' requests for transmission service based on anticipated effects on the transmission system.

RTO/ISOs are also responsible for transmission expansion, which affects the performance of organized markets. RTO/ISOs conduct systemwide transmission planning processes with their stakeholders. These identify transmission-system additions and improvements for reliability and market benefits. RTO/ISOs are in different stages of implementing disparate frameworks for competitive transmission planning. Competitive processes and cost recovery of transmission projects remain contentious, evolving topics.

CONTACT
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