



## ERCOT Independent System Operator

### History and Geography of ERCOT

The Electric Reliability Council of Texas, Inc., (ERCOT) is an Independent System Operator (ISO)<sup>1</sup> that manages the high-voltage transmission system and the wholesale electricity markets in the majority of the state of Texas (Exhibit 1). ERCOT's four main objectives include ensuring reliability and adequacy of the regional electric network, facilitating nondiscriminatory access to transmission/distribution systems, maintaining a competitive retail electric market (ensuring customers have choice in providers), and operating a fair and competitive wholesale electric market. ERCOT is unique in that its electrical transmission system is contained entirely within the state of Texas, and thus is primarily regulated by the Public Utility Commission of Texas (PUCT) and not the Federal Energy Regulatory Commission (FERC). ERCOT dispatches approximately 74,000 MW of capacity over 40,500 miles of transmission lines to more than 23 million Texas consumers. An all-time peak demand of 68,305 MW was set on August 3, 2012.<sup>2</sup>

Exhibit 1 ERCOT geographic area



Map developed by NETL. Source: ABB Velocity Suite<sup>3</sup>

Similar to other ISOs, ERCOT is responsible to facilitate the energy markets in its service area and maintain reliable electricity service in a cost-effective manner. ERCOT manages this responsibility by operating the energy markets to serve load and meet reserve obligations with the lowest-cost resources possible, serving as a data clearinghouse for wholesale energy markets, and facilitating the retail electric competition in the state. While the total cost of wholesale electricity includes services to ensure a reliable supply of power, and non-market-based expenses (uplift cost which includes out-of-merit energy dispatch, out-of-merit commitment, replacement reserve services, and reliability must-run contracts),<sup>4</sup> the

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

<sup>2</sup> ERCOT. (2012). *Company Profile: ERCOT Quick Facts (October 2012)*. Retrieved on December 3, 2012, from <http://ercot.com/about/profile/>

<sup>3</sup> ABB Velocity Suite. (2012). *Intelligent Map – US RTO Regions*. Retrieved on November 29, 2012, from <https://velocitysuite.globalenergy.com/Citrix/MetaFrame/auth/login.aspx>

<sup>4</sup> Potomac Economics. (2011). *2010 State of the Market Report for the ERCOT Wholesale Electricity Markets (August 2011)*. Retrieved on October 19, 2011, from [http://www.potomaceconomics.com/uploads/ercot\\_reports/2010\\_ERCOT\\_SOM\\_REPORT.pdf](http://www.potomaceconomics.com/uploads/ercot_reports/2010_ERCOT_SOM_REPORT.pdf)

majority of the wholesale electricity price in ERCOT is dominated by energy services (i.e., the cost of generating power, which includes fuel costs, operation and maintenance for generators, reimbursement for the capital cost of generators, etc.) (Exhibit 2).

**Exhibit 2 ERCOT average wholesale electricity price 2009, 2010 and 2011 (\$/MWh)<sup>5</sup>**

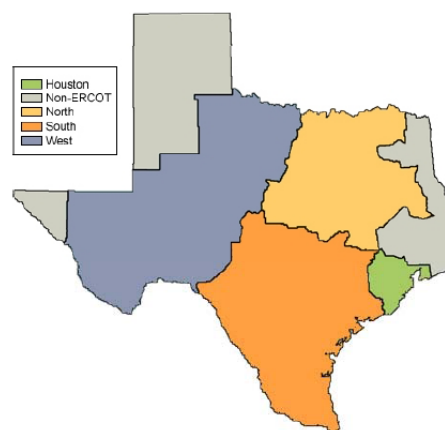
Price	2009	2010	2011
<b>Energy</b>	\$ 34.03	\$ 39.40	\$ 53.23
<b>Ancillary Services</b>	\$ 1.15	\$ 1.26	\$ 2.41
<b>Uplift</b>	\$ 0.65	\$ 0.40	---
<b>Total</b>	<b>\$ 35.83</b>	<b>\$ 41.06</b>	<b>\$ 55.64</b>

## ERCOT Retail Competition

Deregulation in the electric utility industry created a landscape open for retail competition for residential, commercial, and industrial electricity customers. The requirement that transmission and distribution line owners allow third parties access to these assets (in exchange for compensation) created an opportunity for a new market to exist. In this new market—retail competition—third-party retail electric providers (REP) are allowed to purchase wholesale power, delivery service, and related power services (i.e., ancillary services), and sell the power to retail customers at retail rates.

ERCOT plays a key role in maintaining and facilitating retail competition in Texas, as all retail electric providers are required to register with the Public Utility Commission in Texas, which adds them to a centralized registration database managed by ERCOT. Additionally, ERCOT tests retail provider's electronic interface systems prior to the retail provider serving customers to ensure adequate, accurate information flow. ERCOT then serves as the transaction clearinghouse for all retail transactions, matching retail provider's wholesale power purchases with the aggregated loads of retail customers, and ensuring payments are processed properly. Additionally, ERCOT is responsible for managing all retail customers' switching choices in order to facilitate customer choice. This means that ERCOT must maintain a record of individual retail customers changing their electric service providers (e.g., new service requests, change of provider, account cancellations, etc.) in order to properly match the usage of customers with the wholesale power purchases of each REP. As of October 2012, 58 percent of residential load and 64 percent of small commercial load had switched electricity providers to a competitive retailer.<sup>2</sup>

**Exhibit 3 ERCOT zonal market**



(Used with permission from ERCOT<sup>6</sup>)

## ERCOT Zonal vs. Nodal System

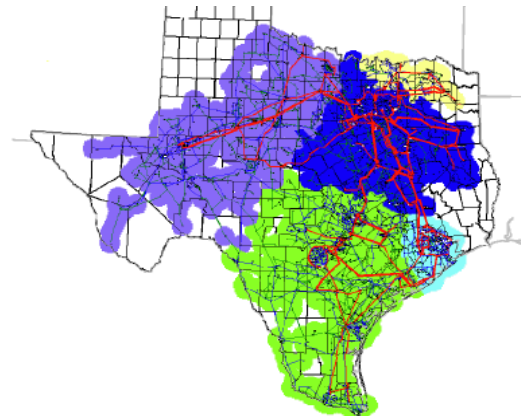
In response to a PUCT order in 2003, ERCOT undertook a significant change to the region's market structure by changing from zonal pricing to a nodal pricing system. Under the zonal pricing system, ERCOT's geographic region was divided into four zones, also known as congestion management zones (Exhibit 3).<sup>6</sup> By having only four zones, at any one time there were at

<sup>5</sup> Potomac Economics. (2012), *2011 State of the Market Report for the ERCOT Wholesale Electricity Markets* (July 2012). Retrieved on October 19, 2011, from [http://www.potomaceconomics.com/uploads/ercot\\_reports/2010\\_ERCOT\\_SOM\\_REPORT.pdf](http://www.potomaceconomics.com/uploads/ercot_reports/2010_ERCOT_SOM_REPORT.pdf)

most four different prices for electricity, with congestion within a zone essentially averaged out within the zone.

Since inter-zone congestion costs were averaged to apply to the zone as a whole, the market signal for new generation or transmission needs was lost. However, as shown in the map to the right (Exhibit 4)<sup>6</sup>, several transmission corridors experienced ongoing constraints—these constraints are exactly the cause of congestion costs. As part of “Project 26376,” in September 2003 PUCT ordered ERCOT to institute a nodal wholesale market, which would serve to eliminate the averaging of inter-zonal transmission costs, provide better price signals for locating generation and transmission, and develop a day-ahead energy market. On December 1, 2010, the new market design was launched, with locational marginal pricing (LMP) at over 8,000 nodes. Potomac Economics estimated that ERCOT’s nodal market design provided approximately \$30 million in savings over its first four months of operation.<sup>7</sup>

**Exhibit 4 ERCOT zones  
(with congestion highlighted)**



(Used with permission from ERCOT<sup>6</sup>)

## ERCOT Products and Services

ERCOT facilitates markets for energy services and reliability services through a day-ahead market and a real-time market, as well as a congestion revenue rights (CRR) market. In 2011 ERCOT’s markets consisted of approximately \$34 billion in billings with over 1,100 market participants generating, moving, buying, selling, or using wholesale electricity.<sup>2</sup> The wholesale power markets are managed with a day-ahead market and a real-time market.

### Day-Ahead Market

In the day-ahead market, ERCOT clears both energy and operating reserve requirements by accounting for existing bilateral contracts, matching bids for supply with demand projections, determining a clearing price at each node, and providing dispatch orders. This scheduling process takes into account multiple physical limitations of the system, including planned generator outages due to maintenance, as well as physical constraints of existing transmission lines.

### Real-Time Market

In the real-time market, generators not already contracted to run via bilateral contracts or dispatched in the day-ahead (or other ancillary service market commitment) can provide bids to run for the next hour. ERCOT runs a dispatch model every five minutes that calculates the LMP for each node and issues orders to generators participating in the real-time market to run and at what level. While ERCOT plans sufficient generation capacity to cover anticipated demand in the day-ahead market, unforeseen outages, weather problems, or significant variations from anticipated load can create energy needs in the real-time market.

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<sup>6</sup> Electric Reliability Council of Texas. (2010). *ERCOT Board Members Overview and Orientation*. Retrieved October 18, 2011, from <http://www.ercot.com/content/news/presentations/2010/ERCOT%20Board%20Orientation,%20June%202010.pdf>

<sup>7</sup> ERCOT. (2011). *ERCOT Quick Facts*. Retrieved on October 3, 2011, from <http://www.ercot.com/content/news/presentations/2011/ERCOT+Quick+Facts+-+Aug+2011.pdf>

## Ancillary Services Market

Generators are required to provide their own ancillary services (i.e., reliability services) in order to participate in the wholesale power market. A generator can achieve this in three ways—by agreeing to provide the services through its own generation fleet; by contracting with another generator to provide the services; or by purchasing ancillary services in the day-ahead market. In this transaction, ERCOT solicits bids to provide ancillary services and matches the needed quantity with the available supply; thus, a specific generator is not buying services from a particular supplier, but rather from a pool of available supply.

## Congestion Revenue Rights Market

The congestion revenue rights (CRR) market provides a financial instrument for market participants to hedge congestion costs in the day-ahead market. In the absence of any transmission constraints, prices at all nodes would equal the lowest-priced generation resource. However, transmission constraints exist in that there is not enough physical transmission to deliver electricity from the lowest-cost resources to all the places demanding electricity at all times. The system operator will calculate the least expensive way to service load while respecting transmission limits, but some nodes will be required to draw power from higher-cost resources, and thus the LMP at those nodes will be higher. The difference in LMP between nodes that is attributable to transmission constraints is called “congestion cost” or “the cost of congestion” because, but for the lack of transmission capacity, a lower-cost resource would be used to meet demand. A CRR can be thought of as a “reservation” for access to a specific transmission path (e.g., between LMP nodes) for a specific timeframe, but does not actually correspond to a physical right to deliver energy. Rather, a CRR will create a revenue stream (or charges) based on the difference between the prices of two nodes for a particular hour of delivery in the day-ahead market.

## ERCOT Generation Profile

Although ERCOT does not own or directly operate power generation facilities, it is responsible for managing scheduled outages for maintenance, and maintaining reliable electricity service at the lowest cost possible, as provided by the generators on the system. The diversity of fuel sources in ERCOT’s system helps it maintain reliability at a low cost by ensuring that individual fuel price spikes do not disproportionately affect system cost. The capacity and energy from different fuel types in the ERCOT region are shown in Exhibit 5.

**Exhibit 5 ERCOT capacity and energy production by fuel type (2011)<sup>2</sup>**

