Texas : Demand Response Case Study

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Texas
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This case study summarizes the situation regarding demand response in Texas. Texas has one of the most competitive retail electricity markets in the world, with a market structure that has major similarities to GB. Texas has developed a substantial demand response market totaling approximately 2 GW out of an annual peak of 68 GW,[1] with the total potential demand response estimated to be 18 GW,[2] or 26% of the annual peak. This case study describes the existing programs and activities now underway to increase demand response in the market.

Texas Market Overview

Texas is comprised of two areas, with 85% of the state's electricity under the purview of the Electric Reliability Council of Texas (ERCOT) and the Public Utilities Commission of Texas (PUCT). ERCOT is the independent system operator that oversees the wholesale power market, while the PUCT oversees retail services

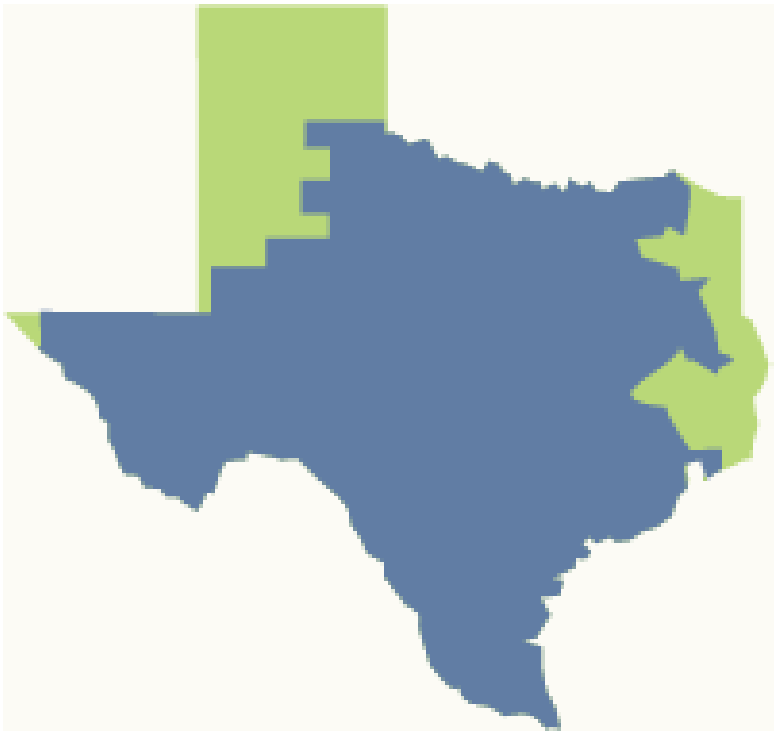


Figure 1: The ERCOT grid covers approximately 75% of the land area in Texas and 85% of the load.

[1] - Paul Wattles, "Demand Response and ERCOT Grid Reliability," Energy Efficiency Forum, Arlington, TX, May 23, 2012.
[2] - Federal Energy Regulatory Commission, "2012 Assessment of Advanced Metering and Demand Response," December 20, 2012.

There are five major types of market players. First, generation is provided by independent, competitive, and lightly regulated companies owning generation assets. Second, ERCOT operates the transmission grid and settles the wholesale market. Third, transmission and distribution are provided by regulated network companies – Transmission and Distribution Service Providers, TDSPs – that are not permitted to offer retail electric service either directly or through affiliated companies. TDSPs provide metering, with virtually all customers in having smart meters (fifteen-minute interval data retrieved daily, plus other functionality). Fourth, retail service is provided by Retail Electric Providers (REPs) who compete for end use customers. Fifth, third party aggregators and energy service companies offer demand response and other services to end users. ERCOT is the primary driver for demand response.

ERCOT manages the flow of electric power to 23 million Texas customers. As the independent system operator for the region, ERCOT schedules power on an electric grid that connects 40,500 miles of transmission lines and more than 550 generation units. ERCOT also performs financial settlement for the competitive wholesale bulk-power market and administers retail switching for 6.7 million premises in competitive choice areas.[3] ERCOT is a membership-based nonprofit corporation, governed by a board of directors and subject to oversight by the PUCT and the Texas Legislature. ERCOT's members include end-users, cooperatives, generators, power marketers, retail electric providers, investor-owned electric utilities (transmission and distribution providers), and municipally-owned electric utilities.

Texas Nodal Electricity Market

The Nodal ERCOT electricity market is balanced and settled based on over 4,000 local areas – "nodes" – within the overall ERCOT geography. The market has both a "bilateral" market where market participants arrange to meet their anticipated electric energy needs through the use of third party supply contracts and a "power pool" market that allows loads to purchase their supply needs in a Day Ahead or Real Time energy market. ERCOT retail entities have access to a large "pool" of resources from which they can choose to acquire resources and assign a portion of their load responsibilities. This structure makes ERCOT similar to other markets in California, New York, and Pennsylvania-New Jersey-Maryland (PJM). In these markets, a significant amount of wholesale energy is purchased at open auctions where buyers and sellers reach agreements in both day-ahead and same-day environments.

Market participants known as Qualified Scheduling Entities (QSEs) have the responsibility for communicating with ERCOT to purchase energy to meet the REP's load requirements and for companies to sell their generation capabilities at prices set by supply and demand on a daily basis. Retail Electric Providers (REPs), must contract with a QSE to provide coordination and settlement services for their load customers. REPs may be the same company as the QSE, and thus contract for energy supply through direct agreements with generators or purchase energy from ERCOT markets. Although prices in bilateral contracts are confidential, the prices paid by

[3] - The franchise areas of the four large investor-owned distribution companies: AEP Texas, CenterPoint Energy, Oncor, and Texas New Mexico Power. Customers of municipally-owned and cooperative utilities do not have competitive choice.

market participants for energy in the Day Ahead or Real Time nodal markets are publicly disclosed.

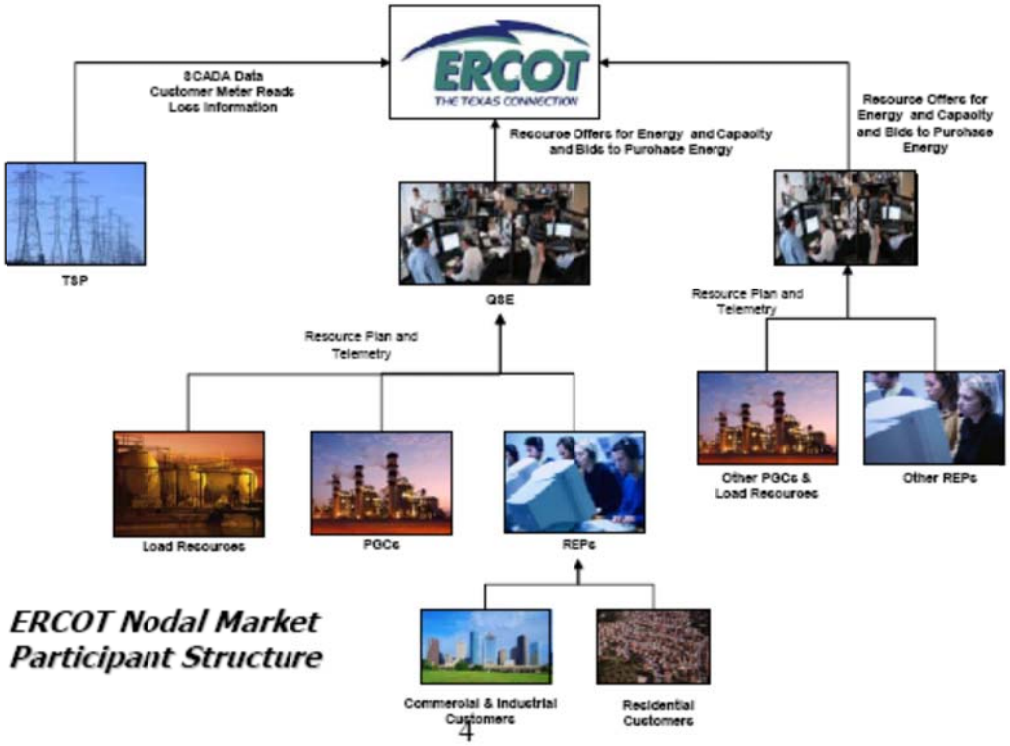


Figure 2: The Texas electricity market and its major participants.

ERCOT's Ancillary Services are those "services necessary to support the transmission of energy to Loads while maintaining reliable operation of the transmission system using Good Utility Practice." ERCOT requires REPs to carry a specified level of operating reserves—the ability to call up additional resources, whether load increases or reduces, on varying levels of short notice. These operating reserves serve as insurance in case a generating unit goes down, load is higher than anticipated, or another problem emerges. Most such reserves can be self-arranged. If a REP doesn't self-arrange all its reserves, then ERCOT purchases the necessary reserves on the REP's behalf by operating a Day Ahead Market for the various Ancillary Services programs.

Demand Response Market

The ERCOT market is explicitly designed with a number of features to reward energy users that are willing to curtail or shift load as a way of helping maintain system reliability. These demand-side resources are encouraged to make their resources available by responding to wholesale price signals. Actual dollar values to be paid for these resources are established in the form of Market Clearing Prices, which in a Nodal market are based on bids and offers in the various ERCOT-operated markets. The Market Clearing Price for Capacity (MCPC) expressed in dollars per megawatt per hour represents the price paid for making a capacity resource (load reduction or generation increase) available to the ERCOT Grid. The Locational Marginal Price (LMP) expressed in dollars per megawatt-hour represents the price paid for generation at a specific

location on the ERCOT Grid. The same calculation engine that ERCOT uses to dispatch generation also calculates the value of energy at every electrical bus in the Transmission System. The individual bus load weighted average of all the LMP prices in a Load Zone is the price paid by loads who consume the energy from the generation in ERCOT. This Load Zone Settlement Point Price is sometimes referred to as the Load Zone Market Price or LMPZ. Since this price is calculated in real-time, it is not known to energy users in advance but is posted to ERCOT's web site immediately following each calculation of LMPZ.

In the Texas market, there are eleven Ancillary Services programs in place, four of which are available for participation by loads. These are summarized in the table below.

Resource Type	Resource or Service that can be Provided	Requirements
Voluntary Load Response	Curtailment or reduction in response to LMPZ or other factors	• Metering and/or curtailment technology defined in REP contract
Day Ahead Market bids and response	Load may choose to curtail or reduce consumption in response to prices bid in the Day Ahead energy market	• Day Ahead Market Pricing • Metering and/or curtailment technology defined in REP contract
Real Time Market and passive response to price	Load may choose to curtail or reduce consumption in response to prices in the Real Time energy market	• Real Time Pricing • Metering and/or curtailment technology
Load Resources	Various ERCOT Ancillary Services (AS)	• IDR meter • Telemetry • Qualification

Table 1: Demand response programs in the Texas market.

Voluntary Load Response
Voluntary load response (VLR) refers to a customer's independent decision to reduce consumption from its anticipated level in response to market prices. Thus, VLR is not a structured demand response program and applies to situations where the customer has not formally offered this response to the market as a Load Resource. This practice has also been known as "passive load response" and sometimes as "self-directed load response."

VLR providers may gain financially from the ERCOT markets over and above the savings they may enjoy on their electric bills from reducing consumption when market prices are high. They can do so by assisting their REP in meeting the REP's supply obligation. Payments depend on the contractual relationship with the REP.

One example of VLR would be during periods when the Load Zone Price (LMPZ) is high, based on the dynamics of supply and demand. A load reduction or load shift could allow the customer's REP to benefit by selling the customer's anticipated power requirements to another facility willing to pay higher prices to ensure service. While prices will be set in advance in the Day Ahead market will provide some advance "price signal" to consumers, the market is ultimately settled on the basis of nodal prices set in real-time. Unfortunately, there is no advance

notification of real-time prices, since they are calculated after each pricing interval. However, a customer may react to real-time prices that are posted from each execution of ERCOT's Security Constrained Dispatch calculation that is occurring every 5 minutes. Those prices ultimately make up the real time prices. The customer would have to predict real-time prices based on patterns of pricing observed in prior postings or other factors such as pricing patterns from prior days and similar hours.

VLR is not reported to ERCOT. However, in analyzing the system peak load in ERCOT for 2011, when the all-time peak occurred, the Brattle Group estimated that VLR accounted for 1,700 MW of demand reduction during scarcity conditions.[4] This includes voluntary response to the day ahead and real-time markets as well (see following).

Day Ahead Market
Customers who have the ability to reduce consumption at certain times of the day or move energy requirements from one hour to another, may be able to take advantage of ERCOT's Day Ahead energy market. These markets operate using ERCOT systems to match willing buyers and sellers bids and offers for energy for the next day. The prices loads are willing to pay in the day ahead are matched with prices generators are willing to accept at various locations throughout ERCOT. ERCOTs computers calculate the LMPs for all settlement points and post these prices on public web sites. Understanding historical prices and applying supply and demand economics provide customers with opportunities to reduce their overall costs to serve their electric energy requirements.

Participation by demand resources in the Day Ahead Market is not reported separately to ERCOT. The amount of such participation in the Texas market is presently unknown but is included in the estimated 1,700 MW of voluntary price responsive demand reduction estimated by the Brattle Group, described above.

Real-Time Market
Customers may request their REP to provide prices equal to the prices ERCOT establishes during Real Time operations. These prices are provided to the public through web postings or directly from the customer's REP to enable the customer to adjust its consumption pattern to reduce energy at times of high prices and potentially increase consumption at times of lower prices. Customers need to be careful when structuring contracts with their REPs to be clear if the REP or the customer will be responsible for ERCOT charges for any Reliability Unit Commitment Capacity Short Charges. QSEs and their REPs who purposely do not purchase supply prior to the real time market may be subject to additional charges if ERCOT has to purchase additional generating capacity. These capacity charges may be passed on to the customer or may be covered by the REP's contract

Participation by demand resources in the Real-Time Market is not reported separately to ERCOT. The amount of such participation in the Texas market is presently unknown but is included in the estimated 1,700 MW of voluntary price responsive demand reduction estimated by the Brattle Group, described above.

[4] - Brattle Group, "ERCOT Investment Incentives and Generation Resource Adequacy," June 1, 2012, at 99.

Load Resources
Customers with interruptible loads that can meet various performance requirements can be qualified to provide operating reserves in ERCOT as Load Resources (LRs, formerly known as "Loads Acting As a Resource" or LaaRs). In the eligible Ancillary Services markets, the value of demand response from a Load Resource is equal to the value of having a generator available to increase its generation at a generating plant. These providers of operating reserves selected through an ERCOT AS market are eligible for capacity payments, regardless of whether the Resource is actually deployed (or curtailed, in the case of the LR).

ERCOT qualifies LRs to be able to provide AS based on the load's available technology, as follows (see Tables 2 and 3 also):

- Responsive Reserve: Requires that an Under Frequency Relay (UFR) be installed that opens the load feeder breaker on automatic detection of an under frequency condition or in the case of a Controllable Load Resource respond similarly to a generator's response to frequency change. These loads are also required to be manually interrupted within a 10 minute notice. The load, breaker status, and relay status, if applicable, must have real-time telemetry to ERCOT (through the QSE) installed. Loads qualified for the Responsive Reserve market are also automatically qualified for the Non-Spin market.
- Non-Spin Reserve: Requires that interruptible loads be manually interrupted (e.g., opening a circuit breaker) within 30 minutes notice. The load must also have real-time telemetry installed.
- Regulation Up and Down Service: Requires that loads through automatic controls respond by changing consumption to signals provided by ERCOT to increase and decrease load while meeting rigorous performance monitoring criteria, and also to provide primary frequency response. The controllable load must also have real-time telemetry installed and be able to receive certain control information from ERCOT every 4 seconds. Loads qualified for Regulation Up and Down service are also qualified to provide Non-Spinning Reserve.
- Emergency Response Service (ERS): ERCOT procures ERS by selecting qualified customers and generators (including aggregations of customers and generators) to make themselves available for deployment in an electric grid emergency. ERS is an emergency service designed to decrease the likelihood of the need for firm Load shedding ("rolling blackouts"). ERS is technically not an Ancillary Service; it is specifically defined as "Special Emergency Service."

ERCOT holds daily auctions for the first three of the above four services and quarterly auctions for ERS. Demand-side resources participate alongside supply-side resources in these auctions. As with other market options, participation in ERS is via a QSE.

Type of Service	Down Reg	Up Reg	Responsive Reserve	Non Spin Reserve
System Response to instruction:	Must be on AGC	Must be on AGC	AGC or in 10 minutes manually or Relay Action	Responds w/in 30min
Generation Resources	X	X	X	X
Controllable Load Resources	X	X	X	X
Load with Under frequency relay installed and capable of being deployed within 10 minute notice			X	X
Load with real time telemetry and that can be deployed within 30 minute notice				X

Table 2: Ancillary Services participation requirements in the Texas market.

Service	Metering	Used by	Participation Basis for Payment	Markets Payment Determination	Time to Curtail/ Interrupt
Regulation Up and Down	Telemetry& IDR settlement metering	ERCOT	Ability to control load consumption to respond to ERCOT signals	Market clearing capacity price in Regulation Up or Down Market and LMPZ for energy when deployed	4 seconds or less
Responsive Reserves	Telemetry& IDR settlement metering	Market Participant or ERCOT	Being available to be interrupted	Market clearing capacity price in Responsive Reserve Market and LMPZ for energy when deployed	Instantaneously or within 10 minutes if manually deployed Load Resources providing Responsive Reserve are manually deployed during emergency operations in two steps;
Non-Spinning Reserves	Telemetry& IDR settlement metering	Market Participant or ERCOT	Being available to be interrupted	Market clearing capacity price in Non-Spinning Reserve Market and LMPZ for energy when deployed	Within 30 minutes of Interruption
Day Ahead Market	Contractual with REP	REP	Actual load pattern and Day Ahead prices	LMPZ in the Day Ahead market	Contractual with REP
Real Time Market	Contractual with REP	REP	Actual load pattern and Real Time prices	LMPZ in the Real Time market	Contractual with REP
Voluntary Load Response	Contractual with REP	REP	Actual deployment	LMPZ in the real time market	Contractual with REP

Table 3: Requirements for participation by demand side resources in the Texas market.

ERCOT estimates participation in Responsive Reserves, as of summer 2012, at 900 to 1300 MW.[5] For ERS, ERCOT purchased 513 MW of resources for the period June-September 2012. [6]

Outlook for Future Demand Response Programs

[5] - Paul Wattles, *Op. cit.*

[6] - ERCOT, "Results of the ERS Procurement for the June-September 2012 Standard Contract Term," May 30, 2012.

Texas policymakers have promoted a strong role for demand side resources in the state's electricity market to improve reliability and reduce costs. ERCOT is the primary driver for demand side participation in its market area, because one of ERCOT's key duties is to ensure the availability of sufficient capacity to serve the needs of customers in the ERCOT area. For several years, ERCOT has sponsored the Demand Side Working Group (DSWG; eMeter/Siemens is a member) to work out the implementation details of adopted demand response policies and programs and to propose additional programs. ERCOT works closely with the PUCT in this arena.

Going forward, the state sees dynamic pricing[7] as a key means of achieving the state's potential for demand side response. As a result of rules developed by the PUCT, the deployment of smart meters is designed to support competitive demand response retail service markets through the requirement for all meters to record 15-minute interval data, and for each customer to be settled on that data at the wholesale market level. This paradigm ensures that the benefits of any demand response action taken by a customer will flow directly to the REP in the settlement process. After an electric distribution utility installs a smart meter, end users – including residential and small business enterprises – in Texas have the option to choose demand response services and compatible technologies from a number of competing companies. Eligible demand response service providers include both REPs and vendors of third-party products and services. Third-party providers that participate in Texas's program have noted that they must engage and educate consumers on the benefits of demand response technology.

The PUCT, ERCOT, and interested stakeholders are also working, via the DSWG, on reducing barriers to increased demand response participation among smart metered customers. Through a series of workshops, stakeholders are examining a broad variety of potential barriers, including (1) the short duration of retail contracts (e.g., 12 or 24 months) that may not allow retail demand response providers to recover product and service costs, (2) the lack of regulatory requirements for retail energy providers to offer specific products, (3) limited third-party access to data, and (4) the reliability of communication networks.

[7] - FERC*, Op. cit.*