

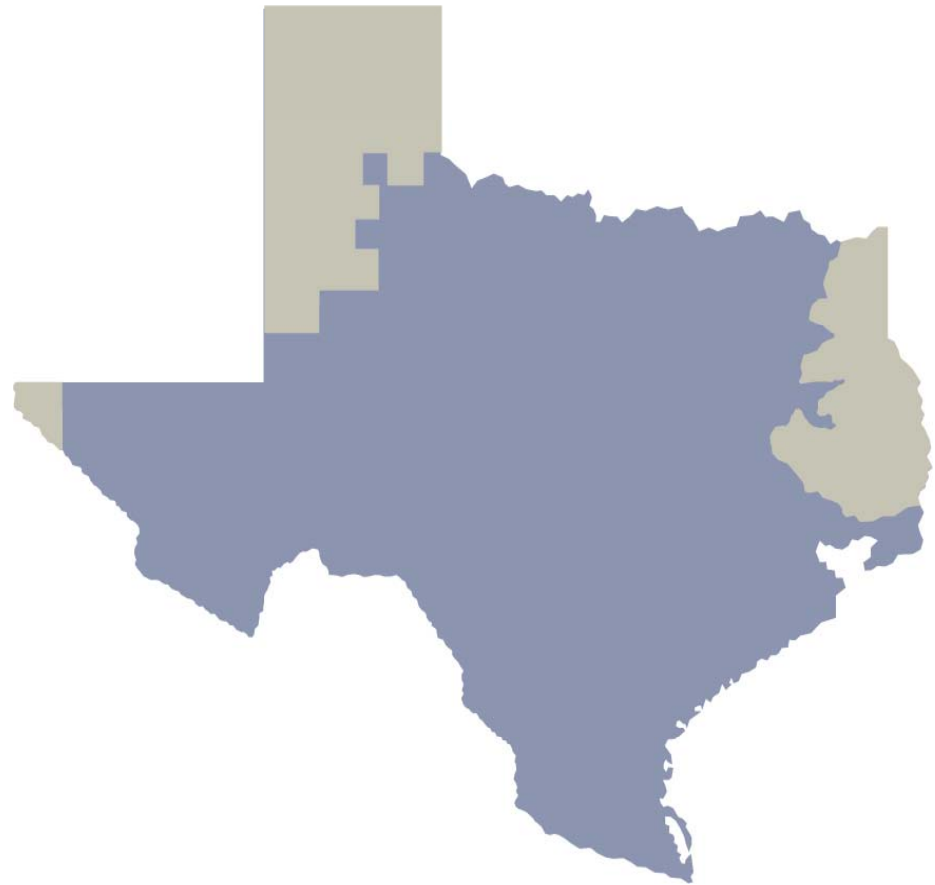


ERCOT Board Members Overview and Orientation

Electric Reliability Council of Texas
July 2010

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Electricity Basics

Board Orientation

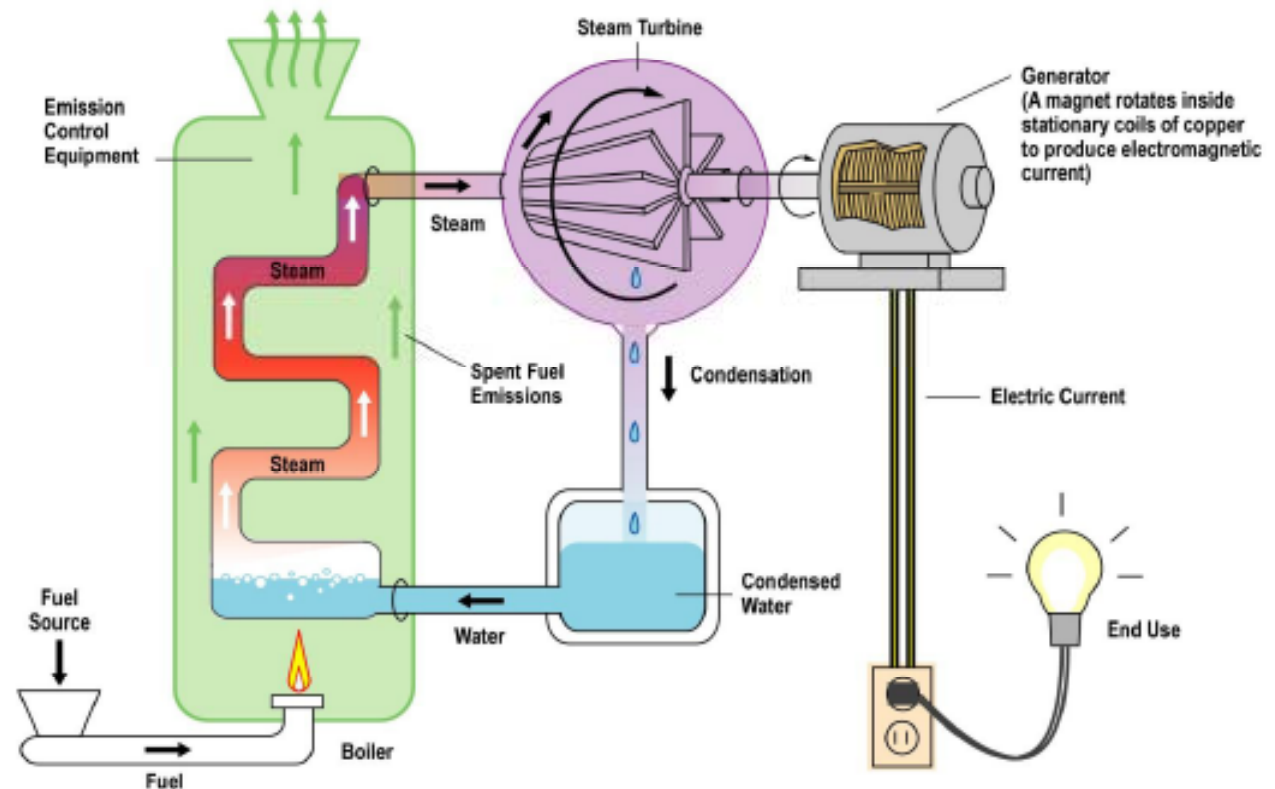
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Generating Power and Getting it to the Consumer

Electricity is a **secondary energy source** which means that we get it from the conversion of other sources of energy, like coal, natural gas, oil, nuclear power and other natural sources, which are called **primary sources**.

The energy sources we use to make electricity can be renewable or non-renewable, but electricity itself is neither renewable or non-renewable.

(Source: U.S. Energy Information Administration)



Basic Terms for Measuring Electric Power

Watt (W) – The basic unit of measure of electric power. The power dissipated by a current of 1 ampere flowing across a resistance of 1 ohm.

Kilowatt (kW) – A unit of power equal to 1,000 watts.

Kilowatt Hour (kWh) – A unit by which residential and most business customers are billed for monthly electric use. It represents the use of one kilowatt of electricity for one hour.

A 100-watt light bulb burning for 10 hours would use 1 kilowatt-hour of electricity.

A typical U.S. household uses 934 kilowatt-hours of electricity a month.

Megawatt (MW) – A unit of power equal to one million watts.

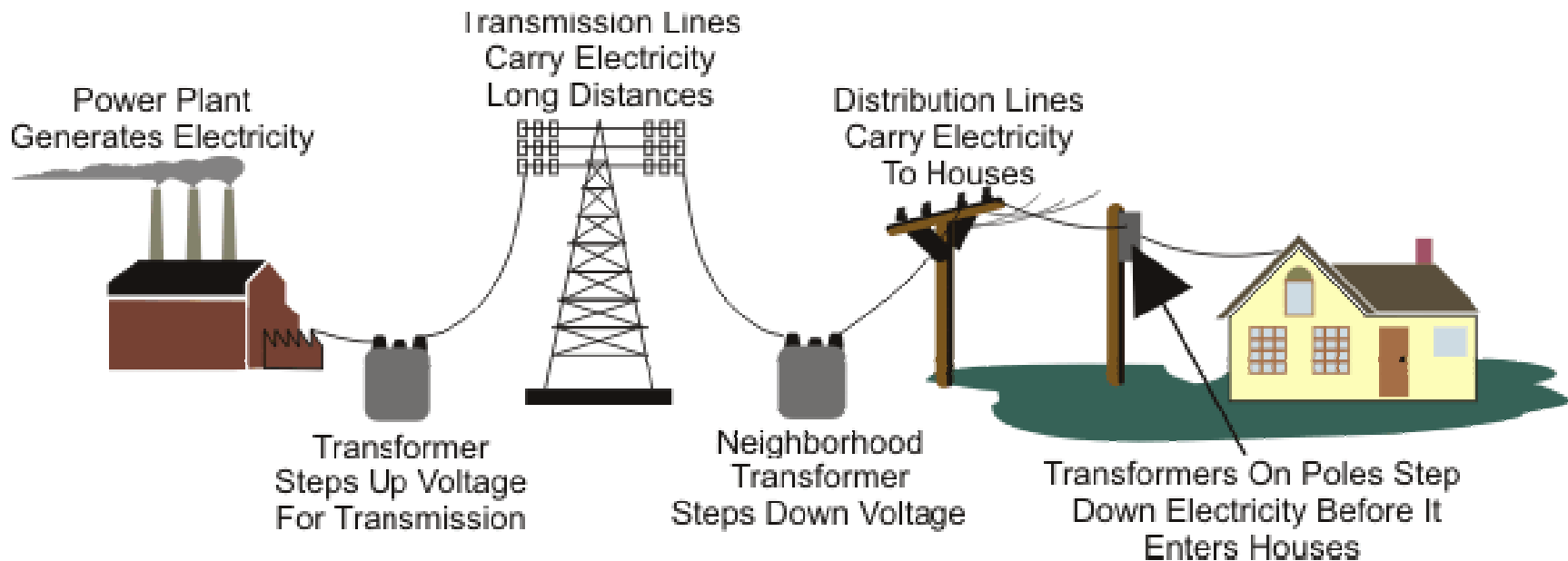
Megawatt Hour (MWh) – The use of 1 million watts (or 1,000 kilowatts) of electricity for one hour. This term is used most often for large-scale industrial facilities and large population centers.

The average U.S. household uses 11.2 MWh (11,202 kWh) of electricity a year.

Power (measured in Watts) equals its current (measured in Amps) times its voltage (measured in Volts) or Volts X Amps = Watts.

How Electricity is Delivered: Transmission and Distribution

- **Electricity has been generated for the purpose of powering human technologies since 1881, over 120 years, from various sources of energy.**
 - Centralized power generation became possible when it was recognized that **alternating current power lines** can transport electricity at very low costs across great distances by taking advantage of the ability to raise and lower the voltage using power transformers. (Source: Wikipedia)



How Reliability of a Grid is Maintained

- **Electricity storage is not yet viable on a commercial scale so supply (generation) must be produced exactly when needed to meet customer demand and to avoid system failure**
- **Level in electricity “lake” must be kept constant at all times**
 - **Supply and demand must be balanced at all times to maintain a constant frequency (60 hertz)**
- **Laws of physics dictate that power flows along path of least resistance**
 - We cannot direct it along specific route

Section end page



Fuel Basics

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Fuel Diversity: Key to Affordable and Reliable Electricity

- **No individual fuel is capable of meeting all of our nation's electricity demands**
- **Diversity of fuel resources helps ensure we do not become too dependent on one fuel source**
- **Fuel diversity protects consumers from contingencies such as fuel unavailability, price fluctuations, and changes in regulatory practices**
- **Fuel prices greatly affect the price of electricity—and some fuel prices have been highly volatile in recent years**

Environmental Aspects of Fuel Diversity

- Competing interests are involved in electricity fuel choices:
 - Reliability
 - Cost
 - Environmental impacts
- Any fuel source for generating electricity involves some environmental impact, although the impacts vary widely
- Most prominent environmental effect is air emissions, but may also impact water quality, fish and wildlife, waste disposal concerns, and aesthetics
- Newer plants have far less of an environmental impact than older plants of the same type

Electricity Generation from Natural Gas

- 20% of U.S. total generation is gas-based; in past decade, almost 95% of new plants have been gas-based
 - **42% of energy produced in ERCOT is gas-based**
 - ERCOT has the highest dependency on natural gas of any other region – making it more vulnerable to supply disruptions and price volatility
- Lower emissions than coal
- Low capital costs and regulatory barriers make gas-based generation easier to site and build
- The average price electric utilities paid for natural gas rose from \$2.38/million Btu in 1998 to \$7.50/million Btu in 2007
- Natural gas prices fluctuated in 2008 but dropped considerably in 2009
- U.S. isolated from global market and its plentiful supply and lower prices



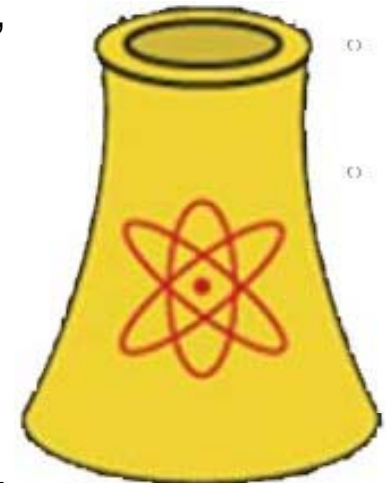
Electricity Generation from Coal

- **Coal is a fuel source for 49% of electricity generated in the US**
 - **37% of energy produced in ERCOT is from coal**
- **Most abundant domestic energy resource**
 - U.S. has about 25% of world's total coal reserves (275 billion tons) and consumes 25% of world's coal used annually
- **Significant improvements in pre- and post-combustion emission-reduction technology**
- **Like prices for other fossil fuels, coal prices have increased**
 - From \$1.25/million Btu in 1999 to \$1.78/million Btu in 2007
- **Key drivers to future use of coal:** Developing clean coal technologies, resolving coal delivery problems, and finding out what coal power may cost with new emission regulations



Electricity Generation from Nuclear

- 104 nuclear power plants in the U.S. provide 20% of this nation's electricity
 - **14% of energy produced in ERCOT is from nuclear**
 - Two nuclear plants in ERCOT: Comanche Peak in north-central region (Luminant) and South Texas Project (NRG, Austin Energy, CPS San Antonio) in coastal region
- Nuclear power produces no sulfur dioxide, nitrogen oxides, mercury, or carbon dioxide emissions
- Uranium is plentiful and efficient. One pellet of enriched uranium—the size of the tip of your little finger—is the equivalent of 17,000 cubic feet of natural gas, 1,780 pounds of coal, or 149 gallons of oil
- Existing nuclear power plant performance continues to improve
- **Major challenges to building new plants:** High construction costs; used fuel disposal; lengthy regulatory and construction timelines; in some areas, water/cooling needs



Electricity Generation from Renewables

- 6% of US electricity generation is from hydro – the largest source of renewables nationally
 - **0.2% of energy produced in ERCOT is hydro**
(dependent on existing rivers or man-made facilities such as reservoirs, pipelines and canals)
- Generation from non-hydro renewables nationally is 4%, primarily from biomass, wind and geothermal generation
 - **6% of energy produced in ERCOT is wind**
 - **1.3 % of energy produced in ERCOT is biomass**
 - **ERCOT has no solar generation at the transmission level**
- Renewables are largely CO₂-emission free
- Renewable technologies face high initial capital costs
- **Current and future challenges:** Geographic limitations, intermittent nature, transmission availability, reliance on federal production tax credit, environmental and aesthetic challenges



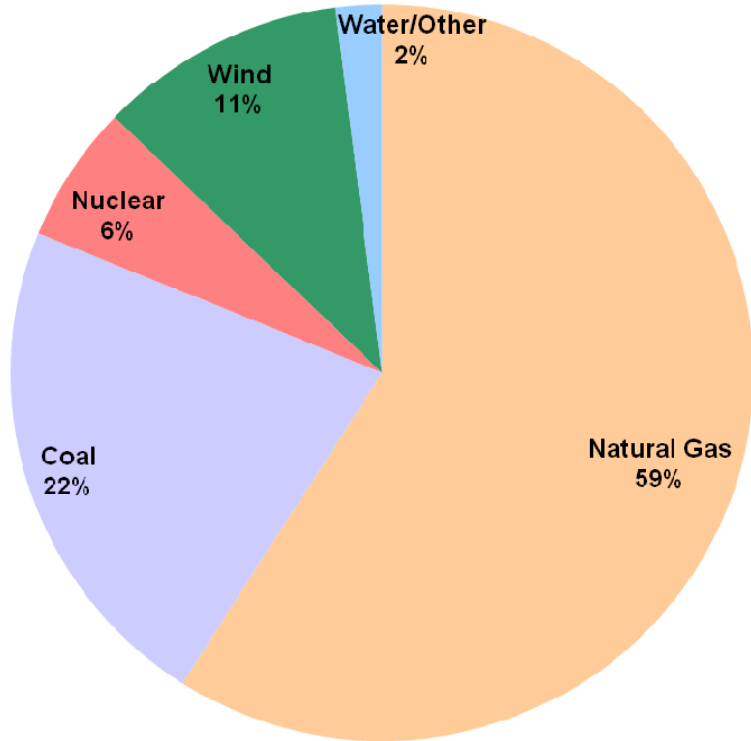
ERCOT Capacity and Energy by Fuel Type

Fuel Source	2010 Installed Capacity Percent of total installed capacity	2010 Available Capacity Percent of total available capacity*	2009 Energy Percent of actual energy production**
Natural Gas	59	66	42
Coal	22	25	37
Nuclear	6	7	14
Wind	11	1	6
Water & Other	2	1	1

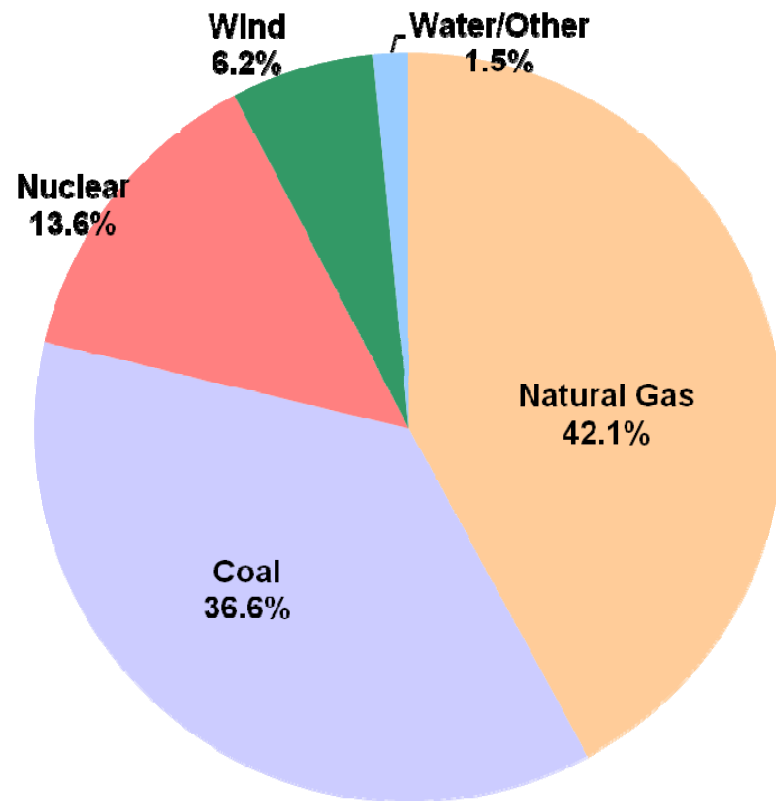
* Wind and hydro sources have been discounted using availability factors of 8.7% and 0% respectively

** Base-load generation units (nuclear and coal) run continuously, as opposed to peak-load generation units (gas)

ERCOT Capacity and Energy by Fuel Type



Installed Capacity by Fuel Type, 2010



Energy by Fuel Type, 2009

Renewable Portfolio Standard, CREZ

What is a Renewable Portfolio Standard?

It requires a certain percentage of a utility's power plant generation to come from renewable sources by a given date.

Texas Senate Bill 7 (1999) established a Renewable Portfolio Standard (RPS) for Texas:

- **Required 2,000 MW of new renewables by 2009**
 - In addition to existing 880 MW
- Established a **Renewable Energy Credit (REC) program**
 - Provided liquidity and tracking
 - Load-serving entities required to buy RECs to meet a load-ratio share of the RPS requirement

Texas Senate Bill 20 (2005):

- (1) Increased RPS:
 - **5,880 MW requirement by 2015**
 - 10,000 MW target by 2025
 - 500 MW non-wind target

- (2) Initiated Competitive Renewable Energy Zones (CREZs)
 - Goal: Break the chicken-and-egg deadlock (which comes first, wind farms or power lines?)
 - Three key data points:
 - Wind quality
 - Developer interest
 - “Most beneficial and cost-effective to consumers” transmission plan

Wind-Resource Benefits and Issues

Benefits

- **The fuel (wind) is free**
- **If the wind farms are geographically diverse, they are more reliable**
- **Wind power creates no environmental pollutants or greenhouse gases**
- **Texas has enormous wind-resource potential**

Issues

Wind is not as controllable or predictable as traditional generation

- Cannot be dispatched
- Voltage control and reactive coordination are difficult
- Highly dependent on weather conditions

Works best in conjunction with other generation in same area

- Conventional resources provide regulation and responsive reserve services
- Possible ancillary service impacts

Creates new challenges in system design and operation

- Difficulty in coordination of transmission outages and construction, i.e., system off peak = wind peak production
- Development of standard software stability models for operations and planning environment



Energy Efficiency

- **Energy efficiency** refers to actions taken by customers to use less energy to achieve the same result, for example:
 - Better building insulation
 - Compact fluorescent lighting
 - Energy-efficient appliances
- **EE is frequently driven by public policy incentives, especially in recent years:**
 - TDSPs in ERCOT have been required to meet a percentage of their growth thru EE programs since 2001 (SB7)
 - HB 3693 (2007 Texas Legislature) increased the requirement
 - Roughly \$100 million annually
 - Texas will also receive >\$750 million Federal stimulus funds for EE in 2010-2012
 - Funneled through State Energy Conservation Office (Comptroller) and Texas Department of Housing and Community Affairs

Demand Response

- **Demand response** refers to a temporary change in electricity usage by a Load in response to market or reliability conditions
- Two broad categories of DR:
 - Economic -- Loads respond to economic signals such as:
 - High energy prices. In ERCOT, some customers with interval metering have the incentive to reduce Load if their retail contracts are tied to wholesale market prices
 - Advanced metering deployment is expected to increase this activity
 - Transmission tariffs. Some interval-metered Loads also curtail during summer peaks to reduce their annual transmission costs (4CP)
 - Operations-based -- Loads are under contract and obligated to respond when dispatched due to system conditions
 - **Loads Acting as a Resource** (LaaRs) are eligible to provide Ancillary Services in ERCOT
 - ERCOT also administers **Emergency Interruptible Load Service**, an operating tool available for use in late stage grid emergencies

Demand Response (LaaRs)

- ERCOT is a global leader in allowing Loads to provide **ancillary services**
 - Defined as services necessary to support the transmission of energy from resources to loads while maintaining reliable operation of transmission systems
 - A.K.A. Operating Reserves (Responsive Reserves, Nonspin Reserves, etc.)
- ERCOT has over 2,200 MW of LaaRs registered and qualified to provide ancillary services
 - LaaRs regularly provide up to half of ERCOT's hourly requirement for 2,300 MW of Responsive Reserves
 - LaaRs may be deployed verbally or automatically
 - When dispatched verbally, they must reduce their obligated Load within 10 minutes
 - When system frequency drops past a specified set point, Under-Frequency Relay trips the LaaR's Load instantaneously

Generating Unit Load: Base, Intermediate, Peak

Generating units vary by intended usage:

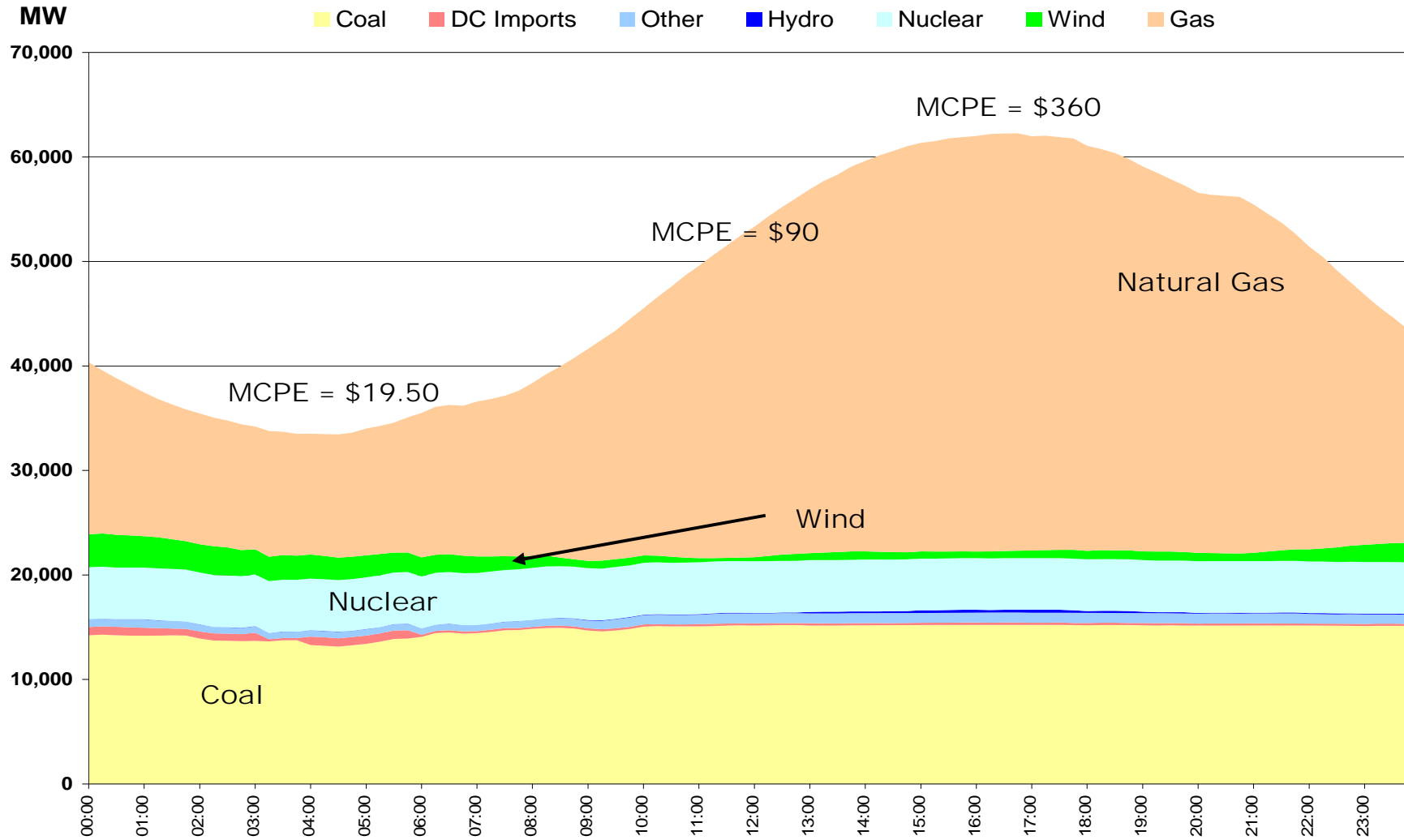
- **Base-load generating units** are normally used to satisfy the minimum, or “base load,” of system demand (think of the power used at 3 a.m. on a 65-degree morning)
 - Produces electricity at an **essentially constant rate and runs continuously**
 - Base-load units are generally the newest, largest, and most efficient of the three types of units.
- **Intermediate-load generating units** meet system requirements that are greater than base load but less than peak load – hence “**intermediate.**”
 - Intermediate-load units are used during the transition between base-load and peak-load requirements.
- **Peak-load generating units** are normally the **least efficient** of the three unit types
 - Used to meet requirements **during the periods of greatest load** on the system

Operating efficiency of a generating unit is measured by the amount of net heat that it can extract from the energy source for use in the production of electricity.

- **Heat rate** is the measure of how efficient a plant is at converting fuel (Btu) to a kW of electricity. *The lower the heat rate – the more efficient the unit is – the lower the cost is to generate electricity.*
 - 1999-2005, ERCOT’s market heat rate declined from 14.2 MMBtu/MWh to 8.5 MMBtu -- a reduction of 42%

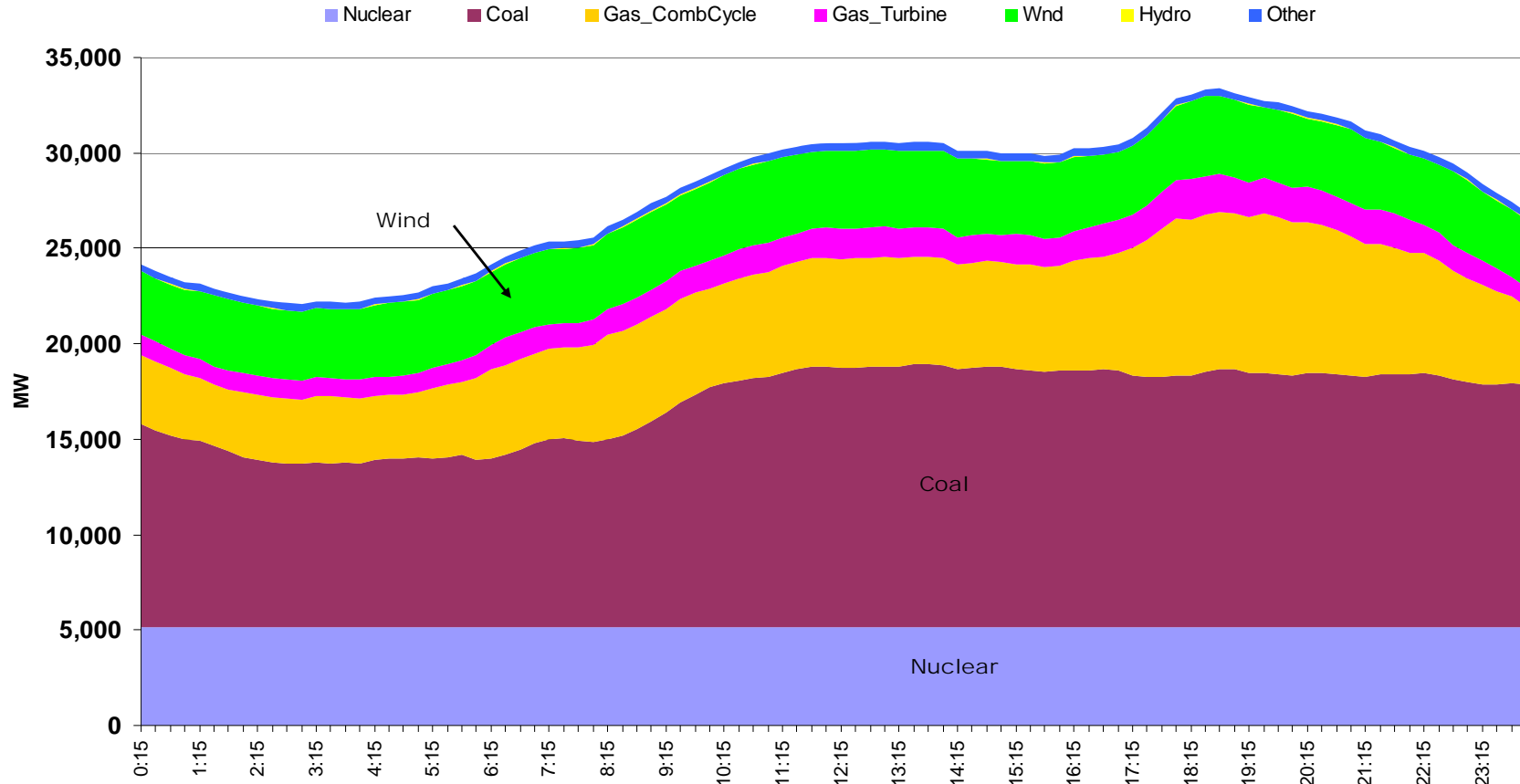
Summer Day Load Shape with Fuel Mix

Generation by Fuel - August 4, 2008



Winter Day Load Shape with Fuel Mix

Generation by Fuel - December 26, 2008



Impact of Technological Advances on Generation Costs

- Competition in electricity markets – as with competitive market structures for other commodities – **creates incentives for efficiency and innovation while providing the most affordable prices consistent with long-term investments.**
- From 1995-2004, significant gains in efficiency, attributable to competitive markets, were seen in coal and nuclear plants in the eastern United States.
- Competition also led to the innovation and increased deployment of new gas-fired generation technologies providing significant new efficiencies and environmental controls.

These efficiency gains translate to reduced fuel use, lower costs, lower emissions and fewer power plants needed to meet demand.

Source: EPSA; Global Energy Decisions, Inc., “Putting Competitive Power Markets to the Test,” 2005



History of Deregulation

Board Orientation

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ERCOT History At a Glance

- **1941** – Texas utilities band together to aid war effort; Utilities interconnect to send excess power to manufacturing companies on Gulf Coast for aluminum smelting; become **Texas Interconnected System (TIS)**
- **1970** – **TIS forms ERCOT** to comply with North American Electric Reliability Corporation (NERC)
- **1992** – President signs Energy Policy Act of 1992, encouraging the Federal Energy Regulatory Commission (FERC) to foster competition in wholesale energy markets
- **1995** – Texas Legislature deregulates wholesale generation
- **1996** – **ERCOT is designated Independent System Operator (ISO)** to ensure impartial, third-party organization to oversee equal access to power grid
- **1999** – Texas Legislature passes **Senate Bill 7** requiring retail electric utility market opened to competition by 2002
- **2001** – Existing 10 control areas consolidated to single control area
- **2002– Retail market opens**; customer choice for 6.1 million
 - Municipal-owned utilities and co-ops remain vertically integrated and closed to competition unless they “opt in”
- **2003** – PUC orders ERCOT to re-design market; **nodal project begins**
- **2004** – First cooperative (Nueces Cooperative) “opts in” to competitive market

Background of Deregulation: Pre-1975

- **Pre-1975, Cities regulated electric utility service and rates**
 - Generally, a declining cost industry – rate applications most often filed to decrease rates
- **In 1975, inflation, construction costs and fuel costs drove electricity rates up**
- **64th Texas Legislature enacted the [Public Utility Regulatory Act \(PURA\)](#) to implement state regulation of electric utility service and rates (Cities permitted to retain original jurisdiction)**
 - Service area, transmission line and generating plant certification
 - Rate regulation (based on cost of service plus reasonable return on investment)
 - Rates based on historical test year costs and original costs of infrastructure, less depreciation
 - Service quality regulation
 - Customer protection

Source: Association of Electric Companies of Texas

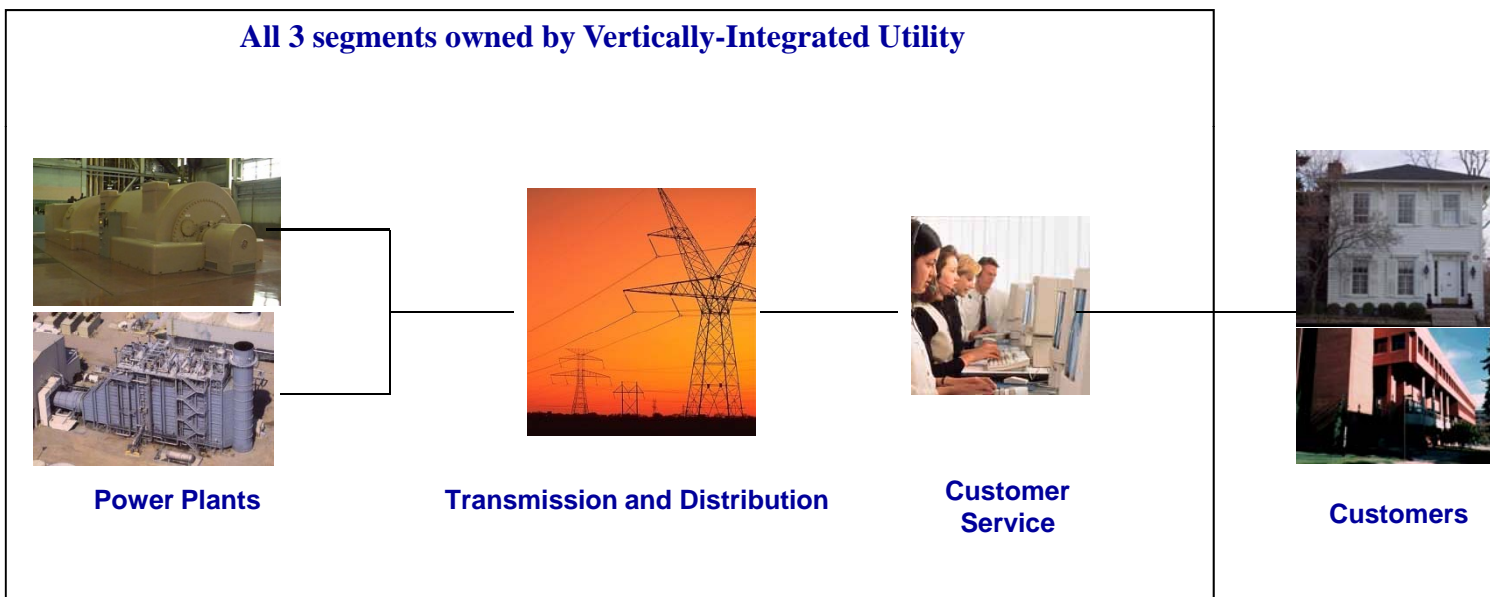
Background of Deregulation: 1976-1995

- **U.S. Fuel Use Act (1978)** required utilities to discontinue use of natural gas and encouraged the use of coal and nuclear for fuel
- **Inflation, volatile fuel costs and the need to add new generating capacity continued to increase electricity rates**
- **Rate proceedings at PUC became increasingly adversarial**
 - Consumer groups concerned about frequency and amount of rate increases
 - Utilities concerned about increasingly large PUC cost disallowances at odds with the regulatory compact and erode rates of return
- **Large customers tired of subsidizing other ratepayers and sought opportunities to by-pass regulated rates and obtain choice of suppliers**
 - Advocated wholesale competition and transmission open access
- **Natural gas was favored again when the 1978 U.S. Fuel Use Act was repealed in the 1990s**

Source: Association of Electric Companies of Texas

Electric Utility Structure Through 1995

Before electric competition began, each utility was vertically integrated and responsible for generating, transmitting and distributing electricity, as well as performing customer service provisions (such as billing).



Wholesale Deregulation: Senate Bill 373

Texas Senate Bill 373 (1995) enacted

- Required utilities to provide independent generators with non-discriminatory, open access to transmission to support wholesale competition in ERCOT
- Recognized new, unregulated participants in ERCOT wholesale market
 - Exempt wholesale generators
 - Power marketers
- Allowed non-utility wholesale market participants to offer market-based prices in ERCOT
- Deregulated electric cooperative distribution rates

ERCOT Designated Independent System Operator

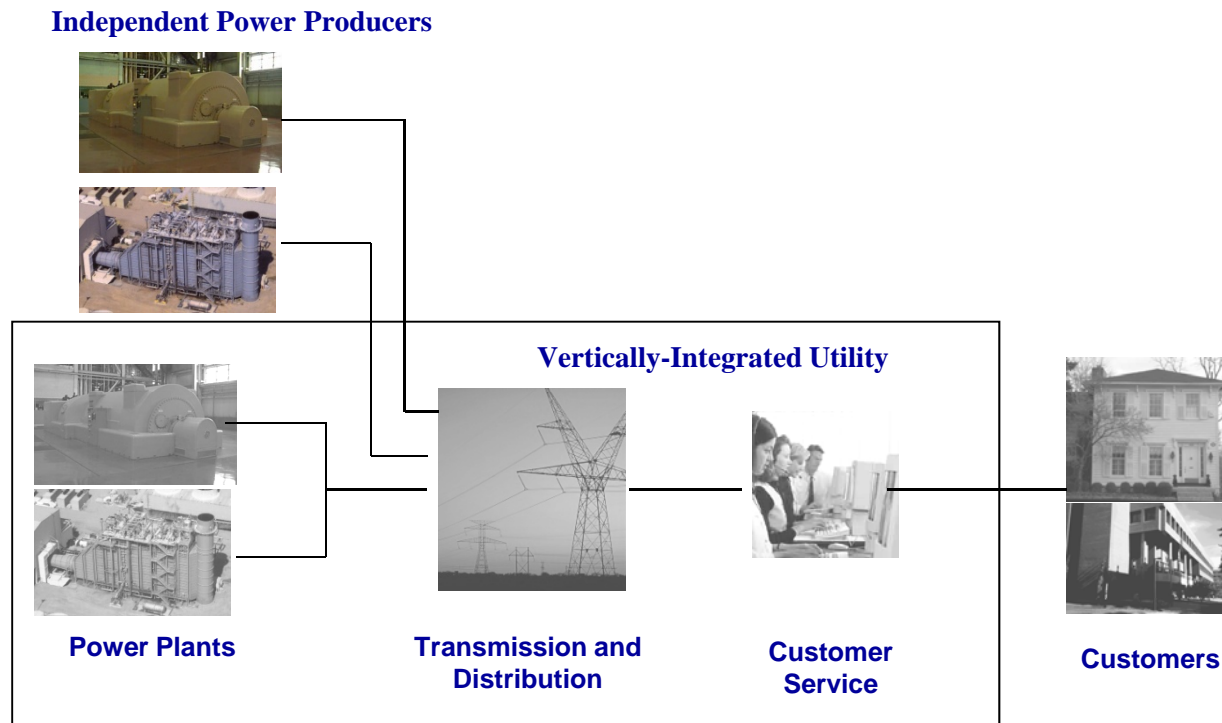
1996 – ERCOT was designated the Independent System Operator (ISO) to insure impartial, third-party organization to oversee equal access to power grid.

This change was officially implemented **September 11, 1996**, when the ERCOT Board of Directors restructured its organization and initiated operations as a not-for-profit ISO, making ERCOT:

- The first electric utility industry ISO in the U.S.
- The only ISO created under state law, not by FERC.

1995: A Change in the Texas Electric Market Structure

Vertically-integrated utilities continued to operate in all three segments of the market. Independent power producers began to sell wholesale power within ERCOT.



Steps to Retail Competition: Texas Senate Bill 7

1999: ERCOT market restructuring legislation, Senate Bill 7, is passed

- Final House Vote: 142 - 4; Final Senate Vote: 29 - 2
- Initiated competition in ERCOT retail markets beginning January 2002
- Municipally-owned utilities and electric cooperatives allowed not to “opt-in,” leading to their “**NOIE**” (non-opt-in-entity) moniker
- Included environmental and energy efficiency provisions
 - Required reduction of nitrogen oxide (NOx) emissions from older power plants by 50%, and sulfur dioxide emission from coal-fired facilities by 25%
 - Utilities required to fund energy efficiency programs equal to at least 10% of each year’s annual growth in demand
 - Established a **Renewable Portfolio Standard (RPS)** for Texas:
 - Required 2,000 MW of new renewables by 2009
 - » In addition to existing 880 MW
 - Established a **Renewable Energy Credit (REC)** program
 - » Provided liquidity and tracking
 - » Load-serving entities required to buy RECs to meet a load-ratio share of the RPS requirement

Electric Utility Structure in Competitive Market 2002-Present

Incumbents were required to separate business activities into the following units:

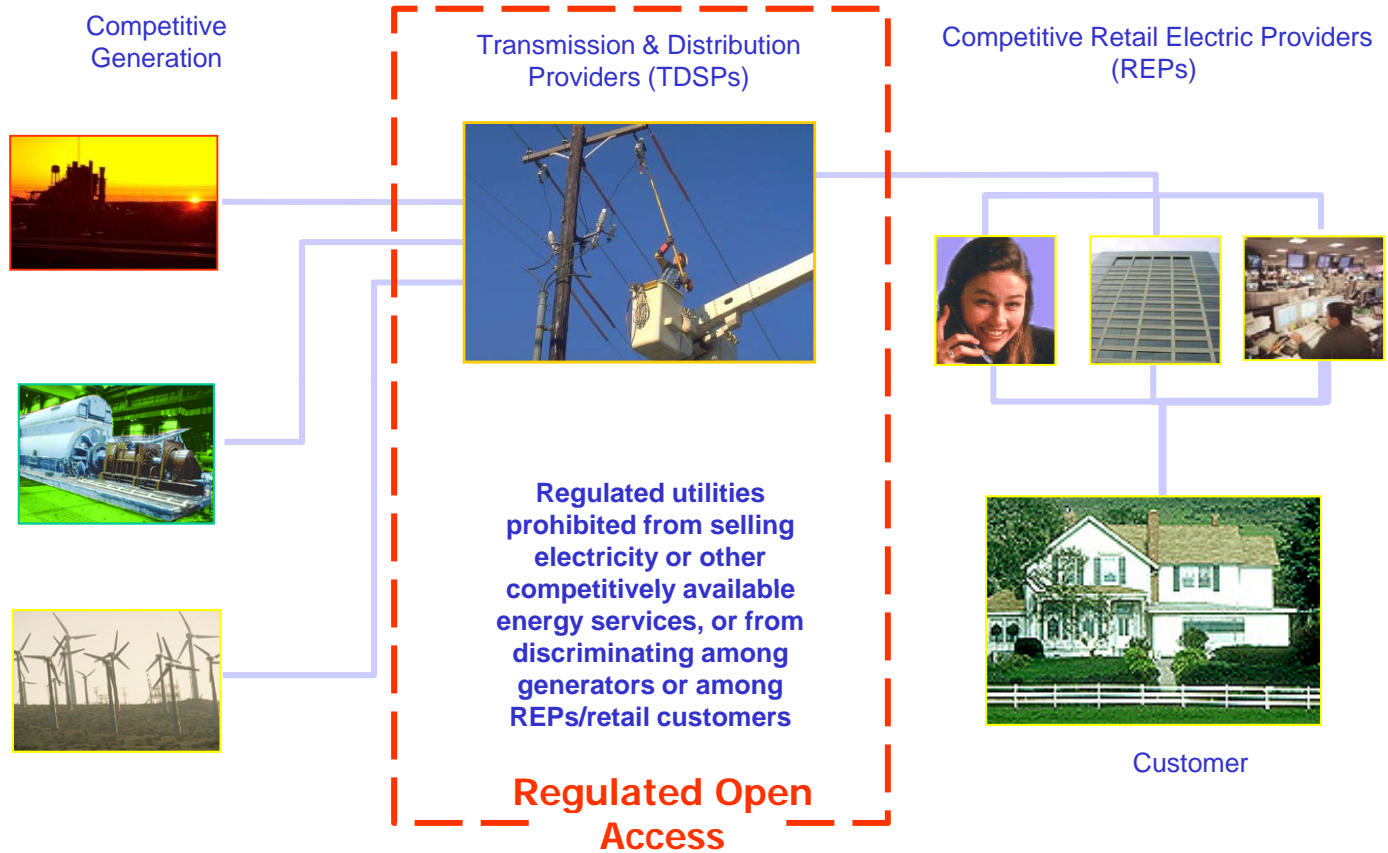
- Power generation company
- Transmission and distribution utility
- Retail electric provider

Generation and retail businesses are not traditionally regulated, but:

- Power generation companies must be registered with PUC
 - And they shall not manipulate the market
- Retail electric providers must be certified by PUC
 - And they shall not violate customer-protection rules

Transmission and distribution businesses remain regulated utilities

Electric Utility Structure in Competitive Market 2002-Present



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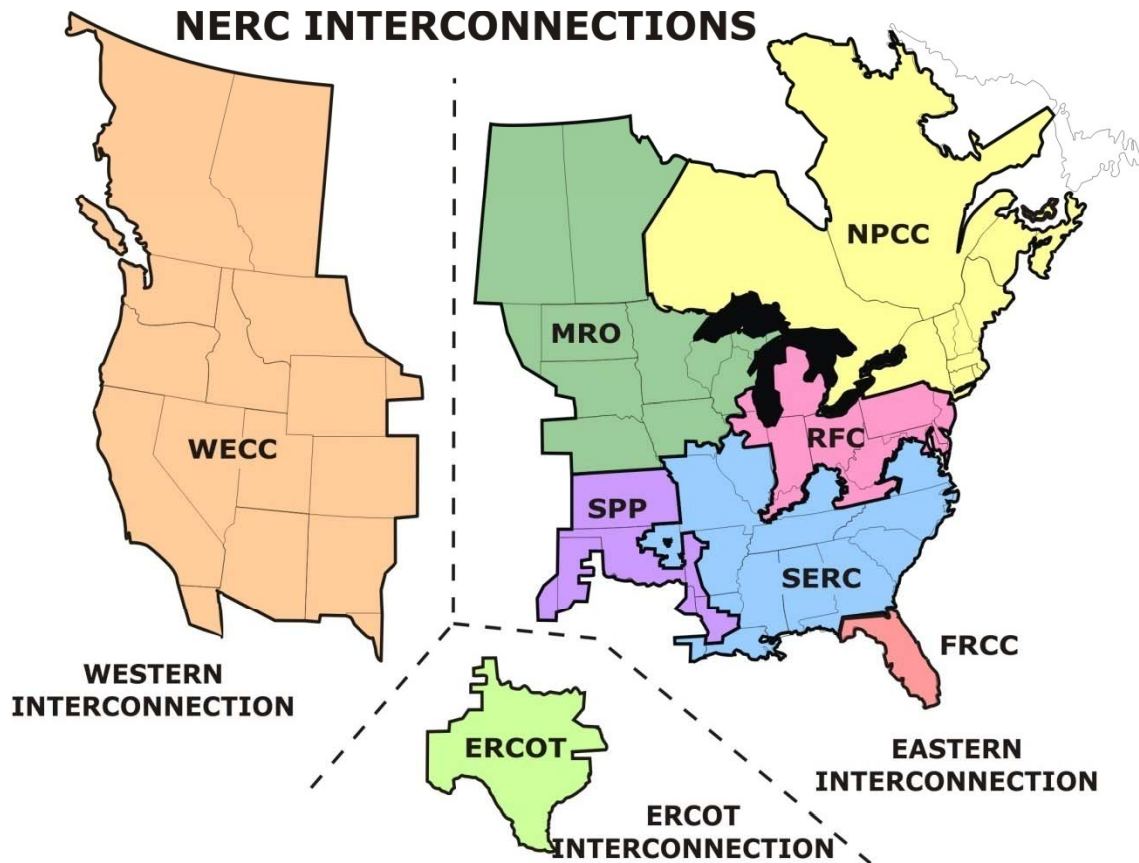


ERCOT Today

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ERCOT: One of Three Grid Interconnections in the US



The ERCOT Region is one of three North American grid interconnections.

Grid interconnections are based on **Alternating Current (AC)** – electricity flows on path of least resistance

ERCOT connections to other grids are limited to **Direct Current (DC) ties**, which allow control over flow of electricity.

ERCOT has no synchronous (or AC) connections to grids outside of Texas.

The North American Electric Reliability Corporation (NERC) enforces reliability standards for the bulk power system in North America, as granted by the U.S. Federal Energy Regulatory Commission (FERC) in 2007.

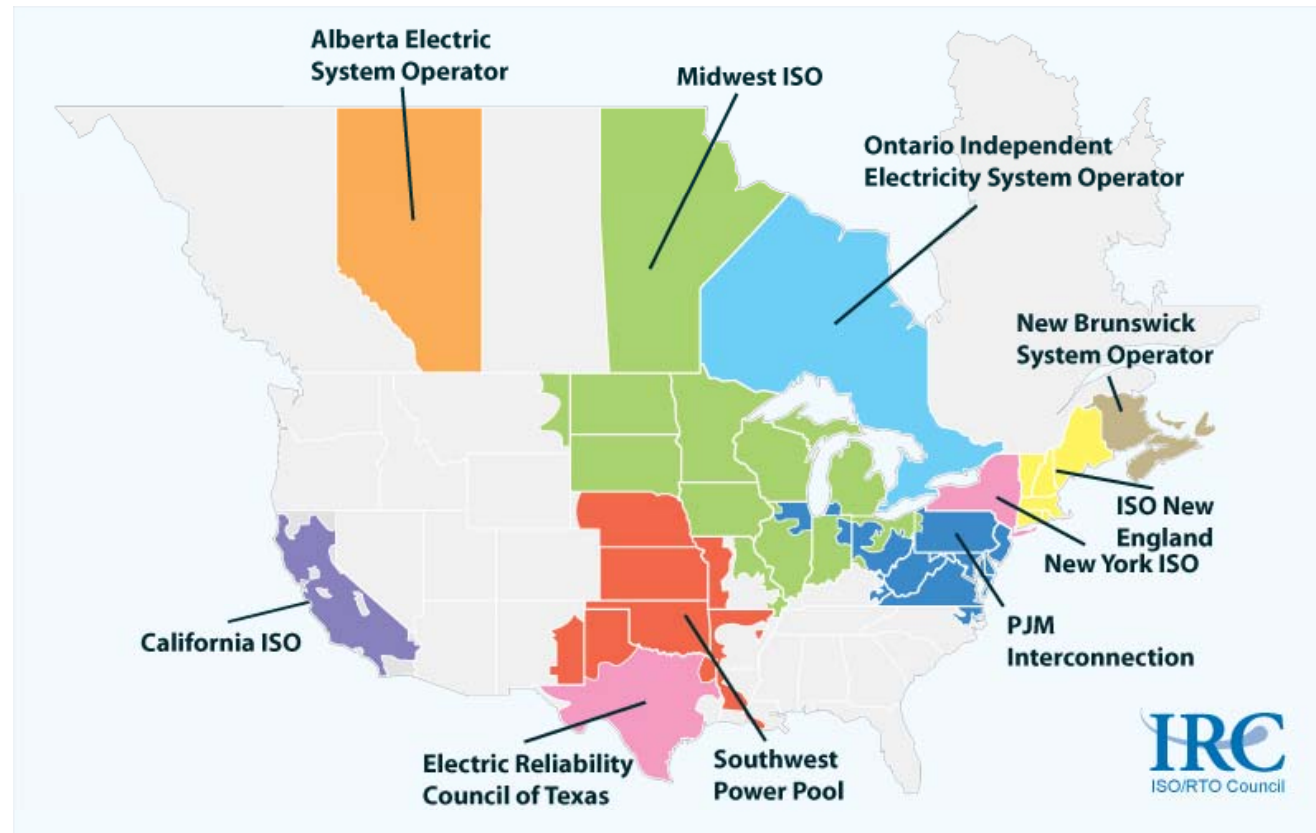
ERCOT: One of Ten ISO/RTOs in the US

ERCOT is one of ten North American ISOs/RTOs

ISOs/RTOs serve 67% of U.S. population

Goal: Efficiency and impartiality

Means: Security-constrained economic dispatch (SCED)



Independent System Operators (ISOs) are single-state or multiple-state entities established under Order 888 of the Federal Energy Regulatory Commission. Regional Transmission Operators (RTOs) perform similar or expanded services across a multi-state area, and have been approved by FERC as meeting the requirements of FERC Orders 2000 and 2001. ISOs perform equivalent services but tend to be smaller in geographic size, or are not subject to FERC jurisdiction (as in Canada and central Texas).

ERCOT's Primary Mandate

As the designated independent organization under Senate Bill 7, ERCOT was assigned these responsibilities [Public Utility Regulatory Act (PURA) 39.151]:

System Reliability

- Ensure reliability and adequacy of regional electric network

Open Access to Transmission

- Ensure nondiscriminatory access to transmission/distribution systems for all buyers and sellers

Competitive Retail Market

- Facilitate retail registration and switching

Competitive Wholesale Market

- Ensure accurate accounting for electricity production and delivery among the generators and wholesale buyers and sellers in the region

What Does ERCOT Do?

ERCOT 'directs traffic' on the grid to maintain reliability and ensure supply of electricity:

- Coordinates scheduling of power by market participants
- Analyzes grid conditions continuously in real-time
- Dispatches generation to ensure power production matches load at all times
- Secures available generation capacity to meet reliability requirements
- Coordinates planned outages of generators and transmission lines
- Relieves transmission system congestion
- Coordinates emergency actions and recovery
- Operates markets to meet regional energy and capacity requirements not met through bilateral arrangements
- Forecasts and coordinates improvements to the transmission grid

RELIABILITY: A Constant Balance Between Supply and Demand

Unlike in other commodities markets, electricity cannot be stored – it must be generated and consumed at nearly the same time.

An intricate physical balance must constantly be maintained between the amount of power generated and the amount consumed.

The 'Four ERCOTs'

ERCOT, Inc.:

- 501(c)(4) nonprofit corporation whose employees execute the duties assigned by the Texas Legislature, the Texas PUC, and the ERCOT Board

The ERCOT Board of Directors:

- The governing body of ERCOT, Inc.

The ERCOT Region:

- \$34 billion electric market that covers 75 percent of the Texas land area and 85 percent of the state's load

The ERCOT Stakeholders:

- Retail consumers, investor- and municipal-owned electric utilities, cooperatives, river authorities, independent generators, power marketers and retail electric providers
 - Each market segment elects representatives to serve on the Board of Directors and stakeholder committees, subcommittees, working groups and task forces, which make recommendations to the board regarding ERCOT policies and procedures.
 - Stakeholder meetings are called and chaired by stakeholders.

ERCOT Region: 22 Million Texans

75% of Texas land area
200,000 square miles

85% of Texas load

63,400 MW peak demand
Set July 13, 2009

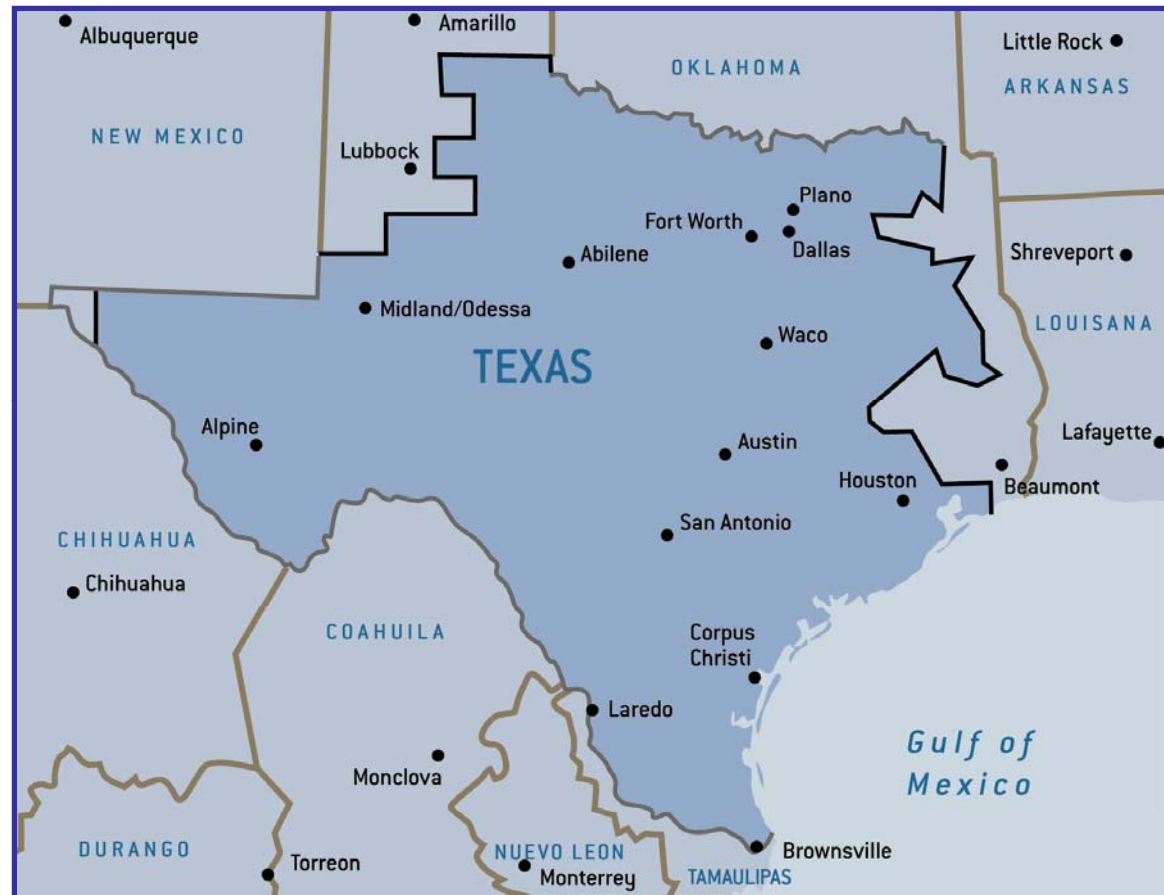
308 billion kilowatt-hours
energy produced, 2009

\$34 billion market

22 million Texans served
~7.5 million households

ERCOT does not include:

- El Paso area
- Texas Panhandle
- Northeast Texas
 - Longview, Marshall and Texarkana
- Southeast Texas
 - Beaumont, Port Arthur, and the Woodlands



ERCOT Grid: A Bulk Electricity Transmission Grid

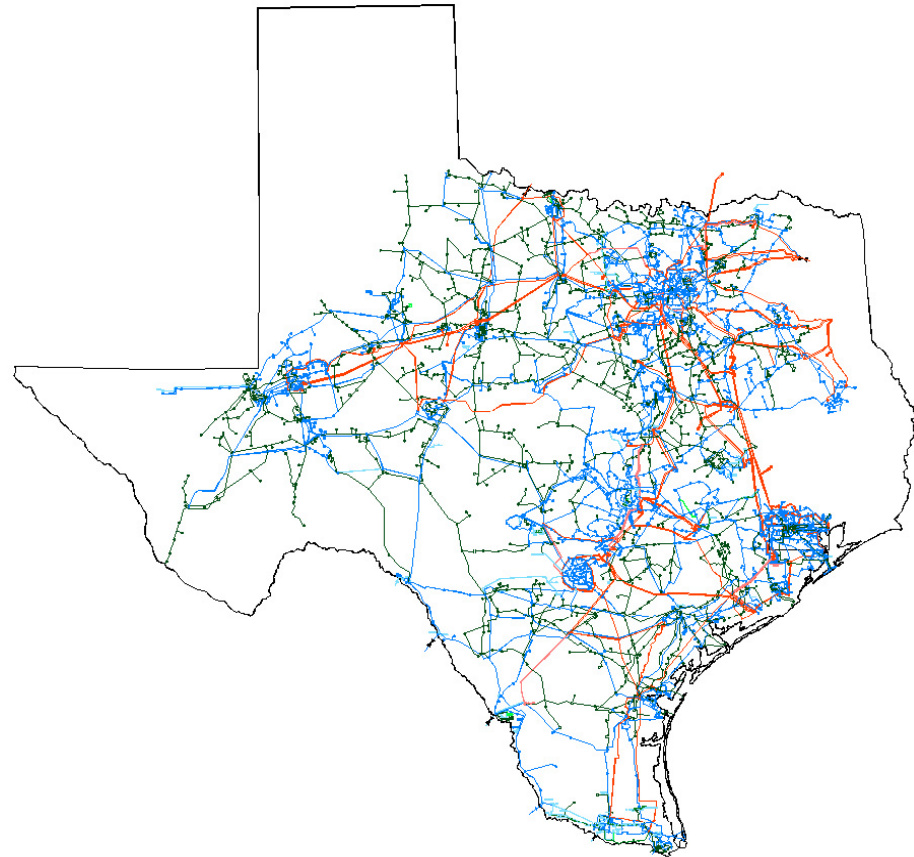
40,327 miles of high-voltage transmission lines

Connecting 550+ generation units

Physical assets are owned by transmission providers and generators

Largest Transmission Providers

- AEP Texas Central and North
- Austin Energy
- Brazos Electric Cooperative
- CenterPoint Energy
- CPS Energy
- Lower Colorado River Authority
- Oncor Electric Delivery
- South Texas Electric Cooperative
- Texas-New Mexico Power Company

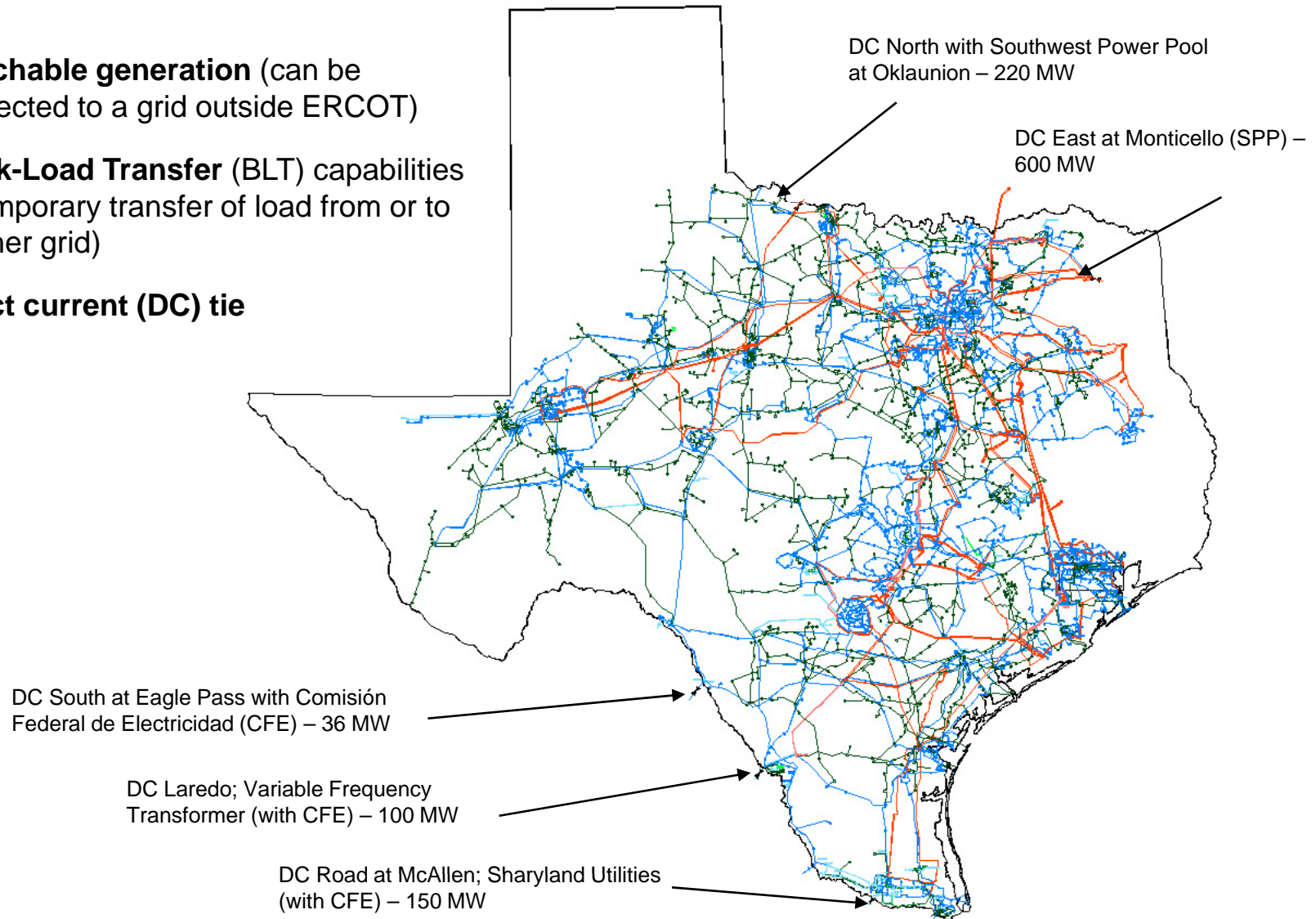


ERCOT Grid: Connections to Neighboring Grids

Switchable generation (can be connected to a grid outside ERCOT)

Block-Load Transfer (BLT) capabilities (a temporary transfer of load from or to another grid)

Direct current (DC) tie



How is ERCOT Unique?

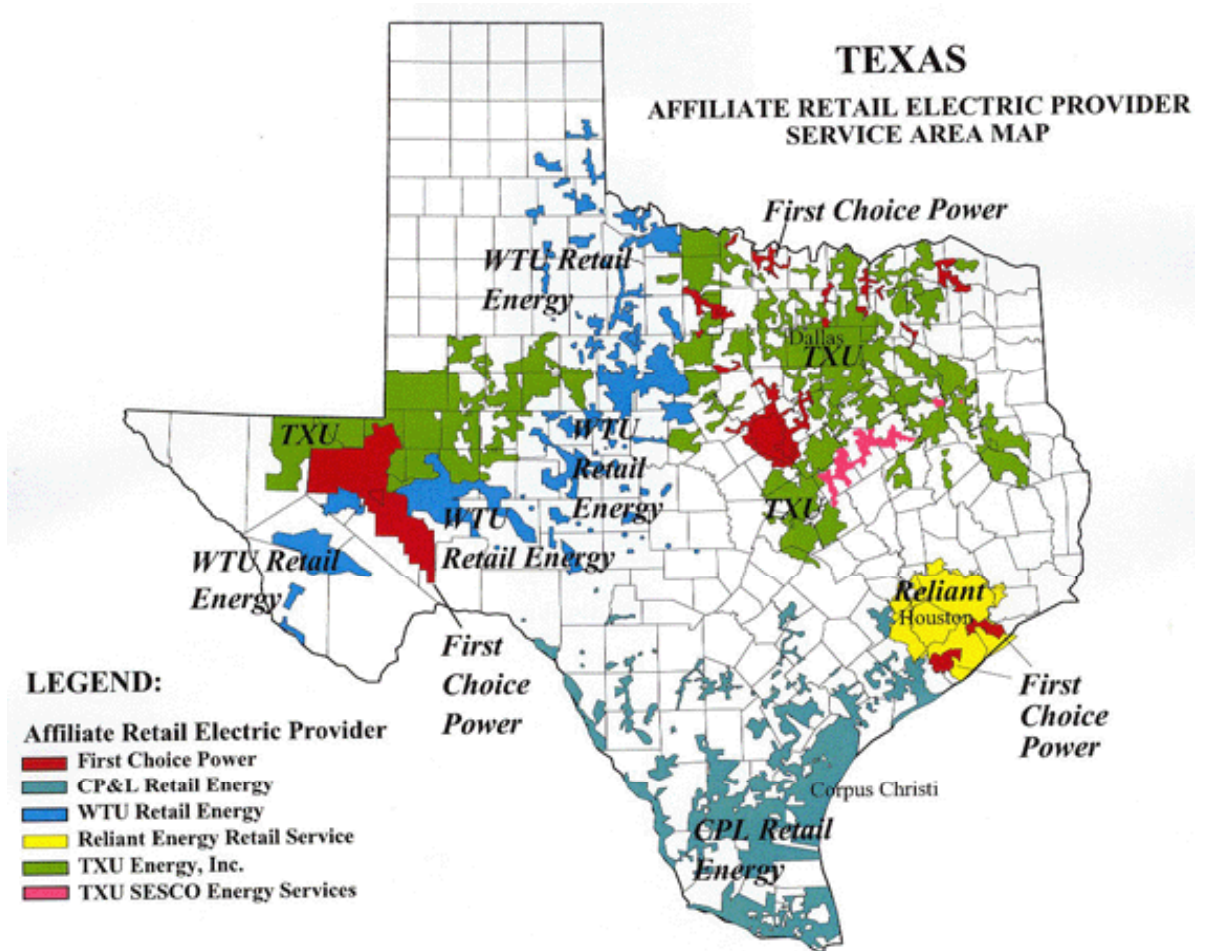
- ERCOT is the only entity of its type in the United States. No other entity performs a similar range of grid, wholesale market and retail market operations.
 - ERCOT is the only ISO/RTO with responsibilities as **registration agent for retail transactions**
- For most purposes, ERCOT is not under the Federal Energy Regulatory Commission (FERC) jurisdiction like the other ISOs in the country because we do not have synchronous connections across state lines.
 - ERCOT is subject to oversight by the Texas Legislature and is regulated by the Public Utility Commission of Texas (PUC).
 - For issues arising under the federal Energy Policy Act of 2005 (EPAct) provisions, ERCOT is accountable to the Texas Regional Entity (TRE) and ultimately to FERC. The TRE was established in 2006 to serve as the regional entity for the ERCOT region, pursuant to the reliability provisions of EPAct.

The ERCOT 'Retail Competition' Map

- This map shows the regions of Texas that are open to retail competition
- These are the areas served by the former monopoly investor-owned utilities (IOUs)

IOU Transmission Providers

- AEP Texas Central and North
- CenterPoint Energy
- Oncor Electric Delivery
- Texas-New Mexico Power Company



ERCOT Transmission Policy

Transmission is regulated

The Public Utility Commission oversees the rates and operations of transmission and distribution providers (TDSPs)

Who pays for it?

Cost of transmission is “uplifted to load,” that is, it’s rolled into costs that all ratepayers pay

- Also known as a “postage-stamp” transmission rate because – like stamps – it’s the same access fee no matter where you are
- Generators post security for new interconnection facilities
- Utilities are responsible for transmission upgrades; costs are ultimately rolled into regional rate

Components of retail electric bill

54%: Generation

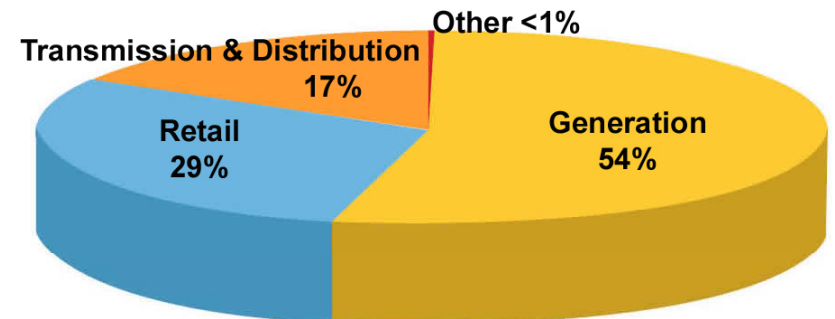
- Includes fuel costs and congestion charges (the cost of relieving local or intra-zonal congestion – transmission overloading and imbalance – is uplifted to load, like transmission costs)

29%: Retail provider costs

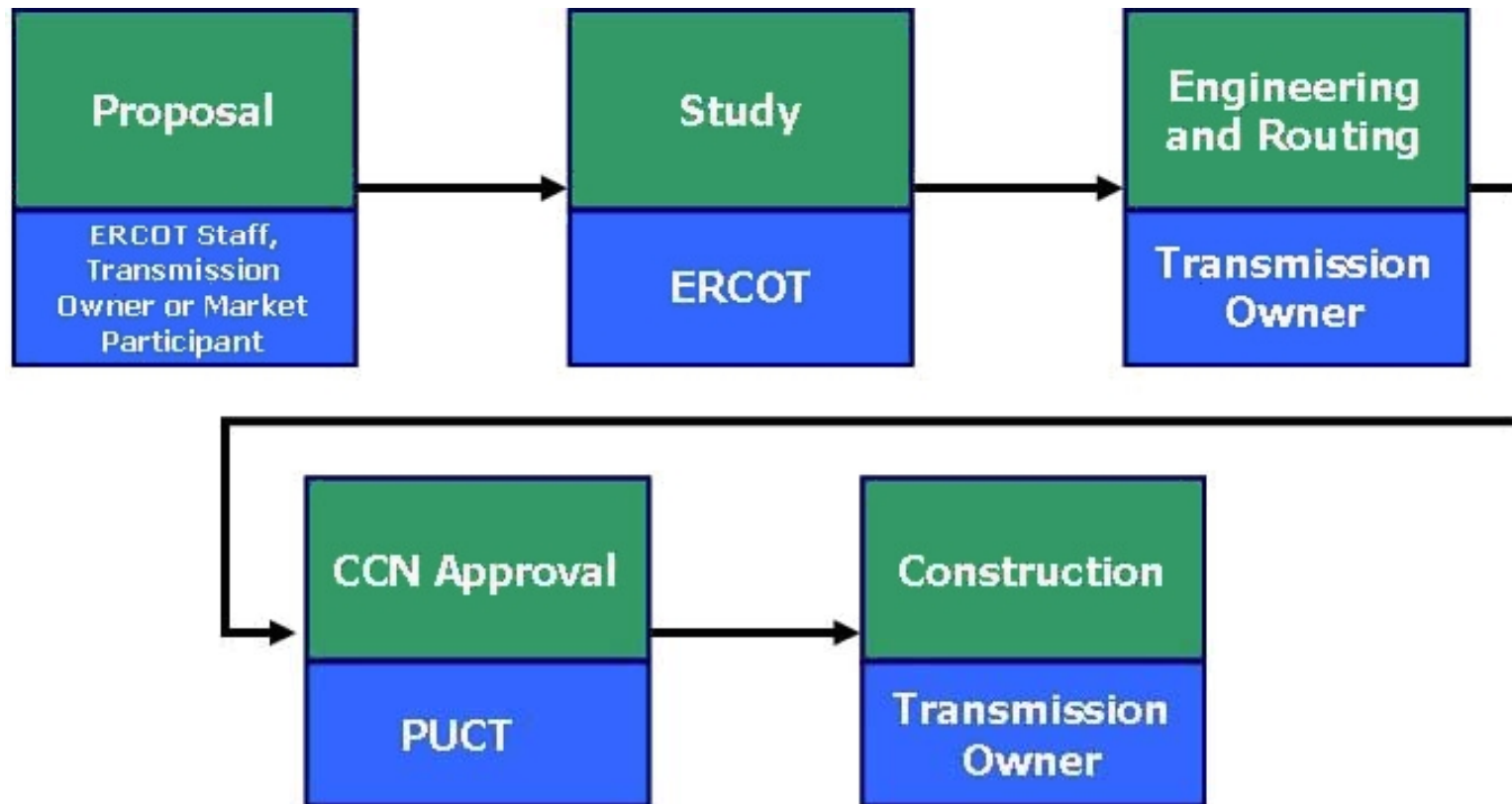
17%: Transmission and distribution

<1%: Other (ERCOT fee, nodal surcharge, NERC fee)

Breakout of Electric Bill
Applies to Competitive Choice
Areas of ERCOT



Major Steps in the Transmission Planning Process

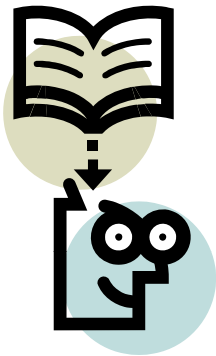


CCN: Certificate of Convenience and Necessity

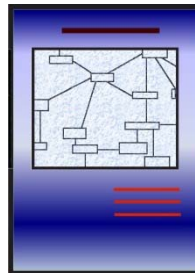
ERCOT leads an open and non-discriminatory planning process for the identification of new transmission facilities, considering and balancing the impacts of facility additions on stakeholders.

ERCOT Generation Interconnection Process

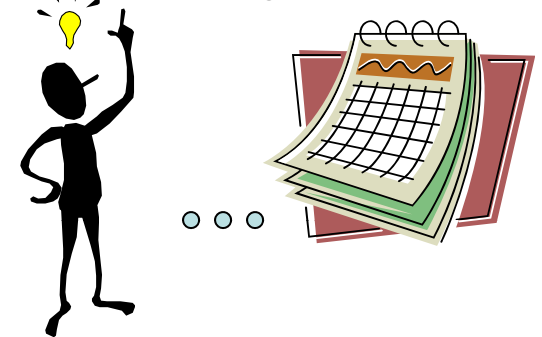
I. Interconnection Feasibility Request submitted to ERCOT



II. ERCOT performs steady state analysis and provides rough estimate of facility additions



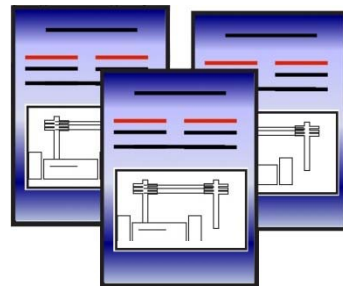
III. Generation owner reviews information and incorporates it into its decision-making process



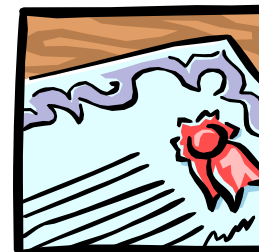
IV. Generation owner requests a full interconnection study



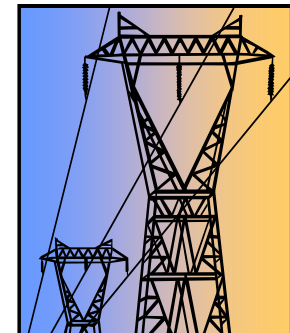
V. Transmission Owner (TO) performs detailed analysis and determines final cost estimate.



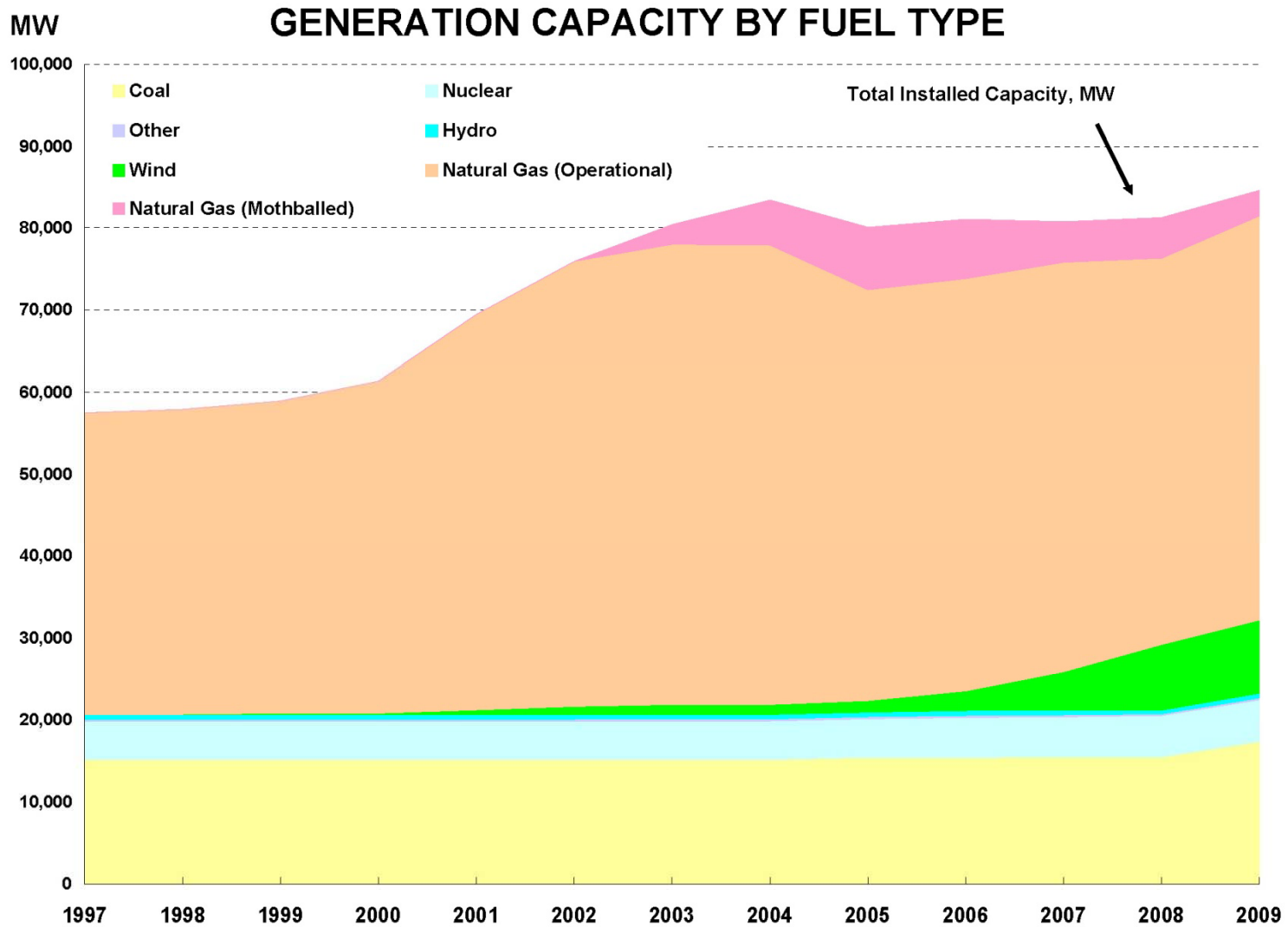
VI. Generation owner signs interconnection agreement with TO



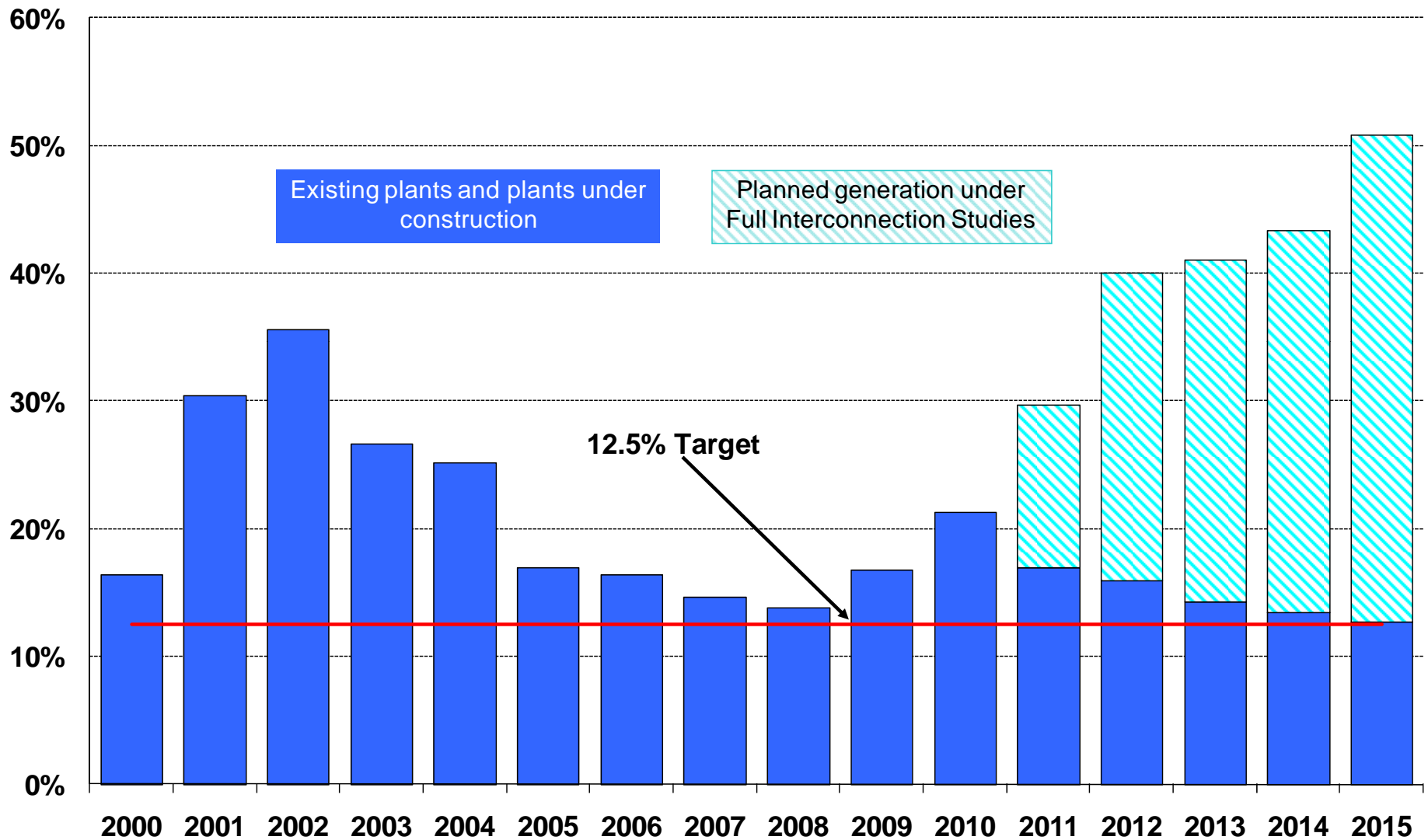
VII. Transmission Projects are approved



Historical Generation Capacity - 1997-2009



Generation Reserves Appear Adequate through 2015



Reserve Margins: Projecting Adequacy of Supply

- **Target reserve margin for the ERCOT Region is 12.5%**
- **Defined as:**
 - Percentage difference between available generating capacity and forecasted peak system load
- **Ensures (but does not guarantee) adequate electric supply will be available in case of contingency need**
 - Unexpected weather extremes or loss of major generation units
- **Available capacity includes:**
 - Gas, coal and nuclear fuel units accounted at their season operating limit level (unless scheduled to retire or mothball)
 - Hydro plants and wind farms at their “high confidence summer peak” level (0% for hydro and 8.7% for wind)
 - Planned units with signed transmission interconnection agreements only
 - Loads Acting as a Resources - large customers registered and bidding to provide capacity services in market-based load participation program
 - DC Ties - capacity that can be imported through links to neighboring grids (factored at 50%)

Organizational Overview and Funding

- **ERCOT has two facilities, both of which are located in Central Texas.**
 - Taylor
 - Austin
- **Construction underway on two facilities:**
 - Secure control and data center in Bastrop County (est. Oct. 2010)
 - Data center at Taylor facility (est. Sept. 2010)
- **The PUC authorizes all ERCOT fees and reviews and approves the ERCOT “System Administration Fee”**
 - ERCOT files a proceeding at the PUC each time a change in the System Administration Fee is requested
 - The review process allows an opportunity for interested parties to participate in the review and to provide information concerning ERCOT fees directly to the PUC for their consideration

ERCOT Fees

System Administration Fee

- Represents ~98 percent of ERCOT's total base operating revenue requirement
- Assessed on wholesale energy transactions and becomes part of the overall cost of electricity
 - It does not appear on residential bills, but if it were passed directly through to end-use customers, it would average about **42 cents/month or \$5/year**, based on 1,000 kilowatt-hour usage per month
- **The fee has not increased in the last five years, although future projections show that a significant increase will be needed in the near future**

Nodal Surcharge

- ERCOT is presently collecting additional revenues via a special fee designed to provide recovery of costs to implement a nodal market as mandated by the PUC
 - Assessed to generation resources at rate of \$0.375 per megawatt-hour (effective January 2010), approximately **38 cents/ month** for an average household using 1,000 kilowatt-hours per month

ERCOT Successes

- A highly-reliable bulk electric system
- A successful wholesale market as evidenced by steady generation construction and consistently adequate reserve margins
- An ERCOT-led industry process that has enabled the construction of thousands of miles of transmission over the past ten years
- The most successful and competitive retail market in North America
- The successful integration of the most megawatts of renewable energy in the country
- An electric market that is widely recognized as one of the best in the country and that contributes to the continued economic prosperity of Texas

Key Obstacles to Continued Success

- Staff attraction and retention and creating a pool of resources from which ERCOT can hire continue to be a challenge
- Attention should be focused on the creation of a long-term and comprehensive energy strategy that is agreed to by key constituencies
 - For instance, there is an ongoing need to balance two critical objectives: highly efficient markets and gold-standard reliability
- Federal and state policymaking bodies can have competing goals, which affect ERCOT operations and actions
- A significant learning curve exists as ERCOT learns to manage new energy sources
- Funding issues:
 - Pressure to keep the ERCOT fee low or stable while the organization is asked to implement cutting-edge energy technologies
 - Variability of electric usage (MWh), on which ERCOT fee is based

Opportunities for the Future

- ERCOT is evolving from an entity entrusted with overseeing and ensuring a highly-reliable electric grid to an entity that also facilitates a market capable of responding to the pressures and opportunities of 21st century innovation and economic demands
- ERCOT's focus on Smart Grid initiatives such as advanced metering and increased Demand Response technology will benefit Texas consumers by giving them increased control over their electric usage and boost overall reliability
- ERCOT's move from an inefficient Zonal market to an advanced Nodal market will significantly increase market efficiency and contribute to the smarter use of the state's energy resources
- ERCOT's role in expanding energy efficiency and demand response will lead to a more deliberate use of the state's energy resources
- As ERCOT and Texas continue to be the national leaders in the integration of renewable resources, the state will continue to benefit from the introduction of cleaner energy sources, lower emissions and improved air quality



Oversight and Governance

Board Orientation

July 2010

ERCOT Oversight and Governance

Texas Reliability Entity

The Texas Reliability Entity monitors and enforces compliance with reliability standards for the North American Electric Reliability Corporation; develops regional standards; and monitors and reports on compliance with the ERCOT Protocols.

Federal Jurisdiction

For federal reliability standards, ERCOT is accountable to the Texas Reliability Entity, the North American Electric Reliability Corporation, and the Federal Energy Regulatory Commission.

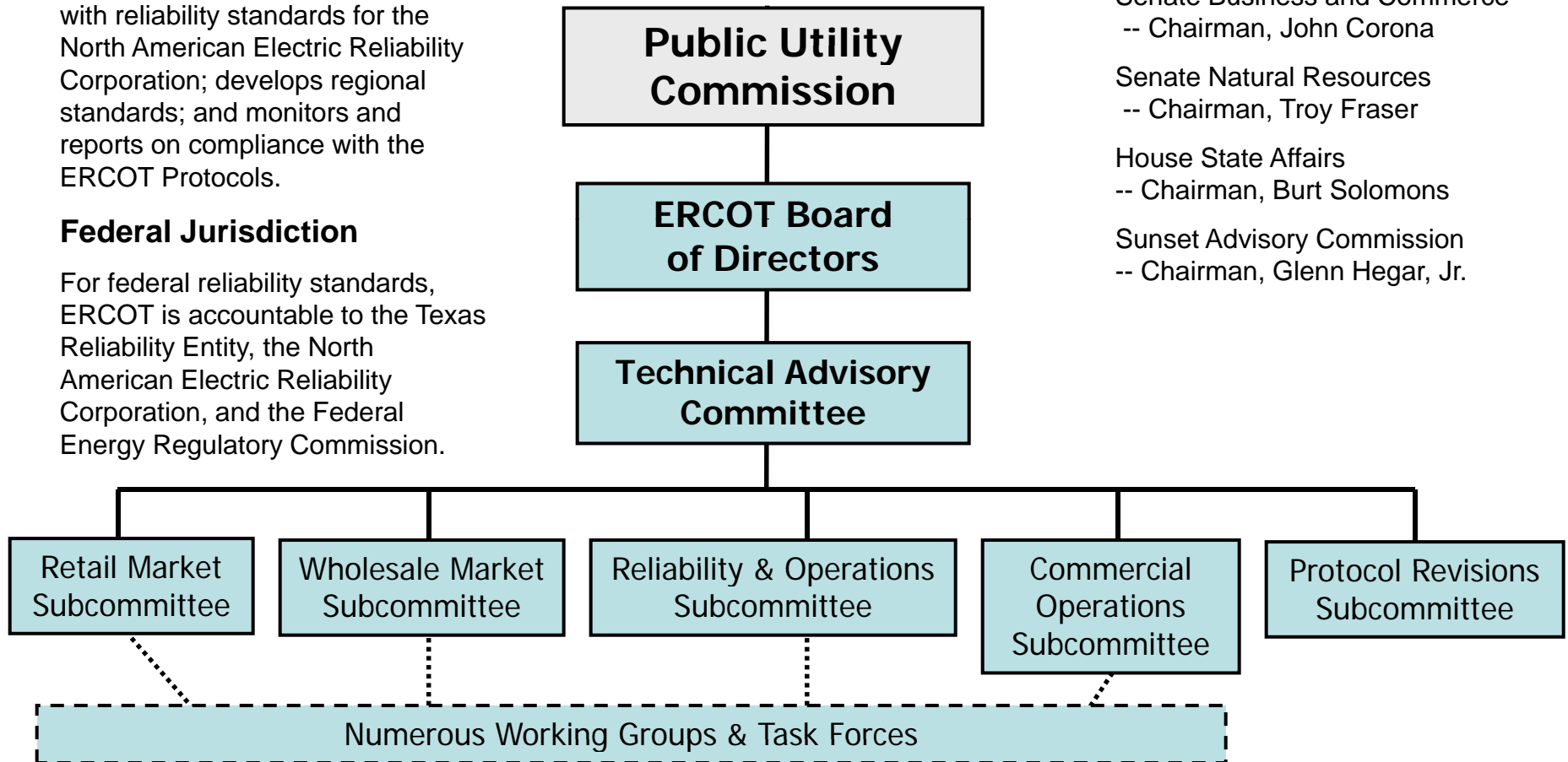
Texas Legislature Jurisdictional Committees

Senate Business and Commerce
-- Chairman, John Corona

Senate Natural Resources
-- Chairman, Troy Fraser

House State Affairs
-- Chairman, Burt Solomons

Sunset Advisory Commission
-- Chairman, Glenn Hegar, Jr.



ERCOT and the Public Utility Commission

- The Public Utility Commission of Texas (PUC) is the primary regulatory authority for ERCOT
 - ERCOT works with the PUC to provide advice and data on reliability and the wholesale and retail markets
 - ERCOT works at the direction of the PUC on special efforts in the market and with individual market participants
 - ERCOT works with the market to help ensure all changes to ERCOT Protocols and systems are in compliance with PUC Rules and Regulations

State Jurisdiction and Oversight

Texas Legislature Jurisdictional Committees

- Senate Business and Commerce (Sen. John Corona, chair)
- Senate Natural Resources (Sen. Troy Fraser, chair)
- House State Affairs (Rep. Burt Solomons, chair)
- Sunset Advisory Commission (Sen. Glenn Hegar, Jr., chair)

Public Utility Commission of Texas (PUC)

- Oversees the rates and operations of TDSPs and the construction of new transmission lines
- Oversees the retail market and enforces customer protections
- Monitors the wholesale market and administers new enforcement authority
- Members: Barry T. Smitherman (Chair); Donna Nelson; Ken Anderson

Texas Commission on Environmental Quality (TCEQ)

- Administers state and federal emissions rules in Texas
- Issues permits for construction and operation of generating companies based on state and federal law
- Sets regulatory standards for air and water emissions from power plants
- Administers penalties for violations of state environmental standards
- Members: Bryan W. Shaw (Chair); H. S. “Buddy” Garcia; Carlos Rubenstein

Federal Jurisdiction and Oversight

Federal Energy Regulatory Commission (FERC)

- Historically has regulated the interstate transmission of natural gas, oil, and electricity
- Under EPAct, regulates electric reliability throughout the U.S., including ERCOT

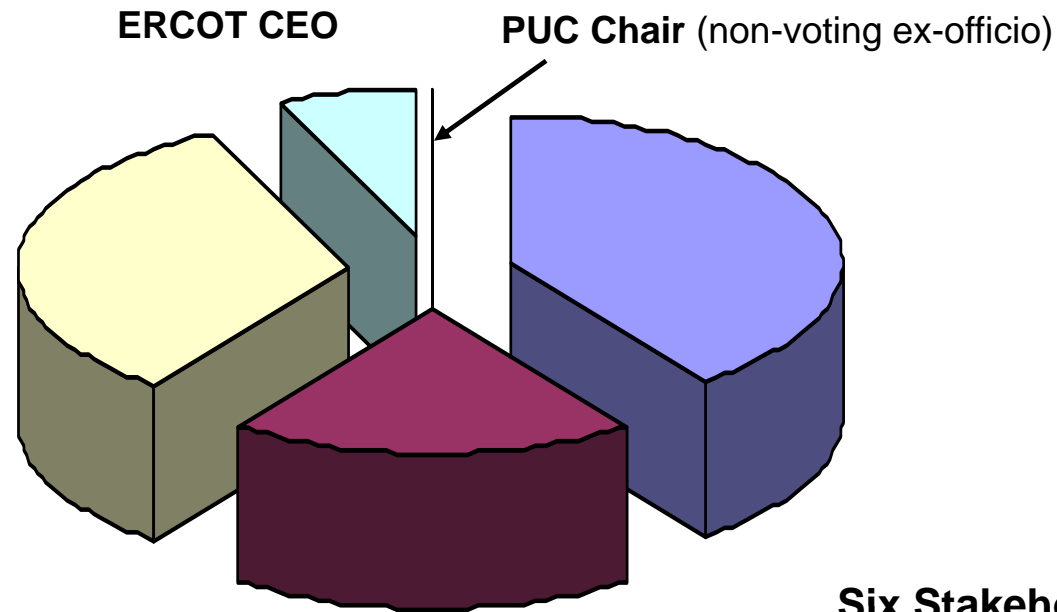
North American Electric Reliability Corporation

- Develops and enforces reliability standards
- Monitors the bulk power system
- Assesses future adequacy
- Audits owners, operators, and users for preparedness
- As the Electric Reliability Organization (ERO) under EPAct, NERC is accountable to FERC and governmental authorities in Canada

Energy Policy Act of 2005 and the Texas Reliability Entity

- **August 2005 – Energy Policy Act (EPAAct) of 2005 signed into law**
 - July 2006: FERC approved NERC’s application to become the Electric Reliability Organization (ERO)
 - November 2006: Regional Delegation Agreements filed with FERC, including the proposal that an ERCOT Division become the ERO’s “Regional Entity” for the ERCOT Region
 - March 2007: ERCOT Compliance submitted its Entity Registration List to NERC
 - April 2007: FERC rules on Regional Delegation Agreements certifying the Texas RE to be the Regional Entity for the ERCOT Region
- **June 2007: NERC Reliability Standards in place – mandatory compliance enforcement began**
 - Regional Entities focused on most serious Reliability Standard violations until January 1, 2008
- **July 2010: Texas Reliability Entity assumed all responsibilities of the Texas Regional Entity**

ERCOT 16-member 'Hybrid' Board



Five Independent Members

(unaffiliated with stakeholders)

Three Consumers:

- Industrial
- Commercial
- Public Utility Counsel (Residential)

Six Stakeholders:

- Investor-Owned Utilities
- Municipals
- Co-ops
- Retail Electric Providers
- Generators
- Power Marketers

Alternates selected for each market segment.

Two-thirds majority vote required for Board action.

Board Committees and Their Responsibilities

Finance and Audit Committee

- Oversees ERCOT's budget process and adherence to budget, and provides recommendations to the Board of Directors for establishing levels of financing and in setting ERCOT's fees, including its administrative fee
- Reviews ERCOT's credit policies and recommends to the Board
- Ensures that ERCOT's financial statements are properly and effectively audited by qualified accountants who are independent
- Assists the Board of Directors in fulfilling its oversight responsibility with respect to ERCOT's maintenance of an effective internal audit function

Human Resources and Governance Committee

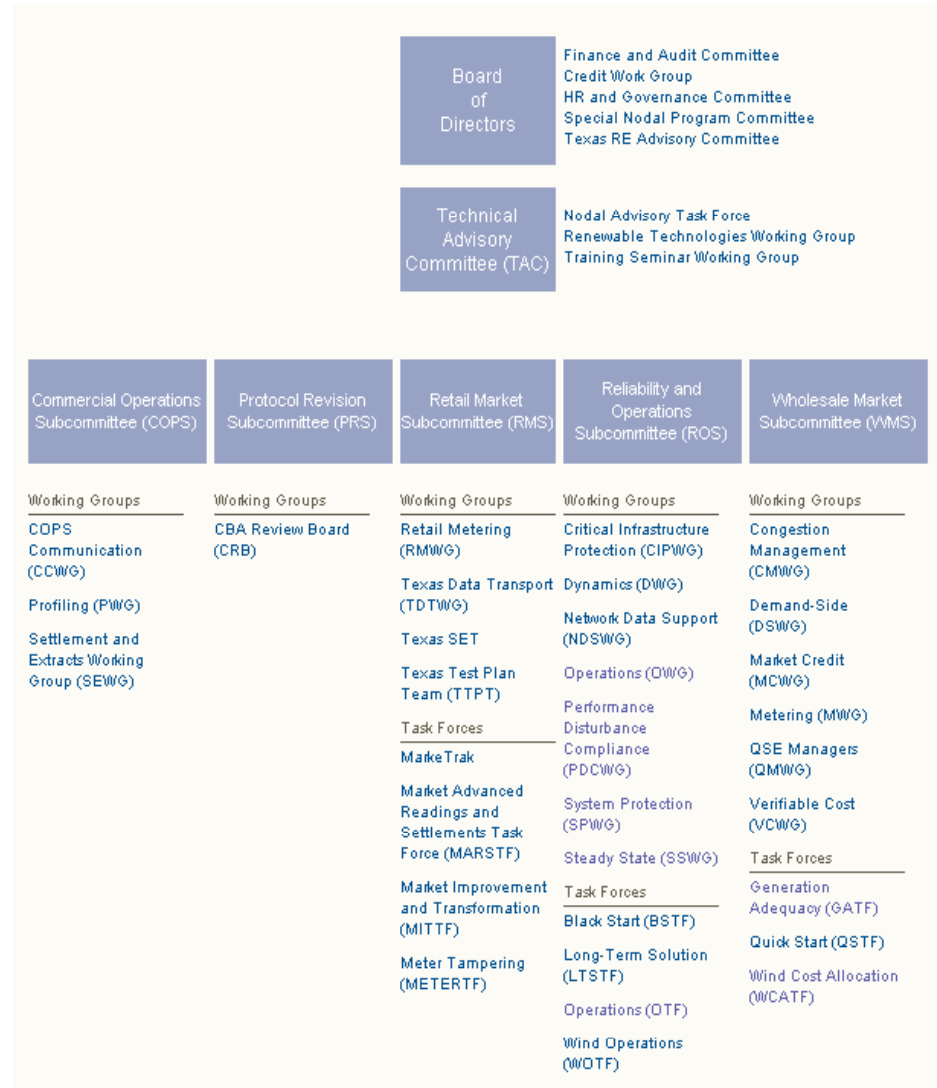
- Develops ERCOT's compensation, benefit, and succession-planning strategies
- Develops Board training and other governance efforts
- Oversees ERCOT's government-relations and policy strategy

Special Nodal Program Committee

- Assists and advises the Board with respect to oversight of the Texas Nodal Market Implementation Program (Nodal Program)

ERCOT Stakeholder Process

- Rules are made using a “stakeholder” process
- Changes to market rules are made and implemented by stakeholders
- Market participants fall into these categories:
 - Consumers
 - Electric cooperatives and river authorities
 - Generators
 - Power marketers
 - Retail Electric Providers and aggregators
 - Investor-owned utilities (transmission owners)
 - Municipal-owned utilities



ERCOT Protocols and Protocol Revision Process

- **Standard market rules created through the collaborative efforts of representatives of all segments of market participants**
 - Procedures for the orderly functioning of the ERCOT system and zonal market
 - Clear, predictable and well-designed market rules help foster a stable electricity market
 - Reviewed by the Public Utility Commission of Texas to ensure that they satisfy the public interest
- **Guides, policies and procedures provide finer detail**
 - If conflict between the Protocols and another guidance document, the Protocols prevail
- **Protocol Revision Process**
 - ERCOT members, market participants, PUC staff, ERCOT staff, and other entities may request Protocol revisions
 - Protocol Revision Requests (PRRs) are reviewed and documented by designated ERCOT staff, and then presented to a subcommittee of TAC called the Protocol Revision Subcommittee (PRS) before moving on to TAC and then the ERCOT Board for approval.
 - Approved PRRs are filed with the PUC

Zonal, Nodal Protocols Developed in Stakeholder Collaboration

Zonal Market Protocols, 1999-2000

- ERCOT sponsored a stakeholder process to address how ERCOT's organization would administer its responsibilities to support the competitive retail and wholesale electricity markets while maintaining the reliability of electric services.
- In thousands of hours of meetings and mark-up sessions, the stakeholders or market participants worked together to develop new ERCOT protocols – the rules and standards for implementing market functions.

Nodal Market Protocols, 2003-2006

- In September 2003, the PUC ordered ERCOT to develop a nodal wholesale market design, with the goal of improving market and operating efficiencies through more granular pricing and scheduling of energy services.
- On April 5, 2006, the PUCT signed an order approving the stakeholder-developed protocols for the nodal market, with an implementation date of January 1, 2009.
 - A new go-live date of December 2010 was announced in 2008.

Section end page



ERCOT Organizational Overview

Board Orientation

July 2010

Vision and Mission

The ERCOT Vision

To be innovative in providing a world-class, cost-effective, reliable electric grid and efficient electricity markets.

The ERCOT Mission

ERCOT serves the public interest by:

- Ensuring open access to transmission and distribution systems;
- Maintaining system reliability and operations;
- Enabling retail choice;
- Operating fair and competitive wholesale markets;
- Maintaining the renewable energy credits registry;
- Providing leadership and independent expertise to improve system reliability and market efficiency.

ERCOT Executive Team

H.B. “Trip” Doggett

President and Chief Executive Officer

Mike Cleary

Senior Vice President and Chief Operating Officer

Bill Magness

Interim Vice President and General Counsel

Chuck Manning

Vice President and Chief Compliance Officer

Richard Morgan

Vice President and Chief Information Officer

Kent Saathoff

Vice President of System Planning and Operations

(position vacant)

Vice President and Chief Financial Officer

ERCOT Organizational Overview

- **Grid Reliability Operations**
- **Grid Operations Support**
- **Grid Planning and Infrastructure Development**
- **Market Operations**
- **Client Services**
- **Compliance**
- **Market and Product Development and Implementation**
- **Legal**
- **Information Technology**
- **Internal Audit**
- **Finance**
- **Corporate Administration**



Assessment of Wholesale Market Performance

Board Orientation

July 2010

Independent Market Monitor

- **Senate Bill 408**, approved by the Texas Legislature in 2005, directed the PUC to hire a wholesale electric market monitor “to detect and prevent market manipulation strategies and recommend measures to enhance the efficiency of the wholesale market” (Public Utility Regulatory Act, Sec. 39.1515).
- The main function of the Independent Market Monitor (IMM) is to analyze information concerning the operation of the wholesale electric market in the ERCOT region, analyze market rules to detect opportunities for strategic manipulation of the market, conduct investigations into irregular market events, and support the PUC’s enforcement activities.
 - The IMM is required to be completely independent from market participants and must have no conflicts of interest.
- In 2006, the PUC selected **Potomac Economics** of Fairfax, VA to serve as the IMM.
 - **Dan Jones** of Austin, a former high-ranking official with the PUC and CPS Energy, was named by Potomac to serve as the IMM director. Dan manages several analysts and works out of offices located at ERCOT’s Austin facility.

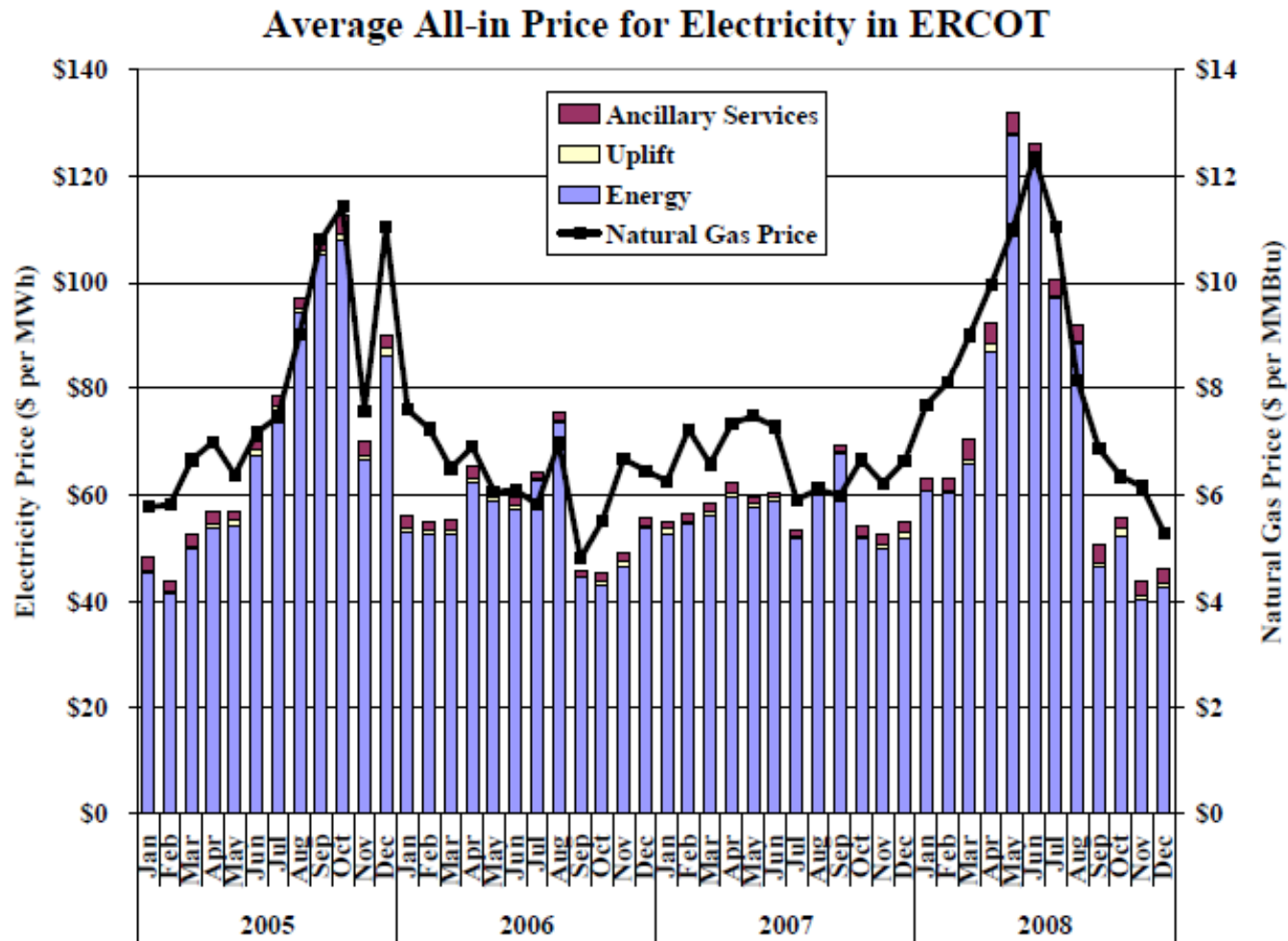
IMM Role

- Under authority and direction by the PUC, Potomac:
 - Analyzes information concerning the operation of the wholesale electric market in the ERCOT region
 - Analyzes market rules to detect opportunities for strategic manipulation of the market
 - Conducts investigations into irregular market events
 - Supports the PUC's enforcement activities
- The company also works with the PUC and ERCOT to identify enhancements to the design of the wholesale electricity market.

2008 State of the Market Report

- Potomac Economics' "2008 State of the Market Report for the ERCOT Wholesale Electricity Markets" (August 2009) found that **the ERCOT wholesale market "performed competitively in 2008."** Other findings:
- Confirmed prior findings in six previous annual reports that ERCOT's current zonal market is causing "systemic inefficiencies" affecting management of transmission congestion and effectiveness of the scarcity pricing mechanism
 - Wholesale market should function more efficiently under the nodal market design by providing better incentives to market participants, facilitating more efficient commitment and dispatch of generation, and improving ERCOT's operational control of the system.
 - Report states: ***"In the long-term, these enhancements to overall market efficiency should translate into substantial savings for consumers."***
- Estimates savings of \$87 - \$175 million could have occurred through more efficient congestion management had the nodal market been in place during the spring congestion.
- Monthly average all-in energy prices for 2005-2008 indicate **natural gas prices were primary driver.**
- Continued increase in wind production in 2008 served to displace more costly generation resources when the wind was producing, **which tended to lower average prices across the market.**
- Electricity demand will continue to grow and a significant number of generating units will soon reach or are already exceeding their expected lifetimes; without major capacity additions, **resource margins could diminish over the next three to five years.**
- Increasing penetration of intermittent resources such as wind and solar facilities will likely create the **reliability need for additional operationally flexible resources, such as modern gas turbines.**

ERCOT Market Prices Track Natural Gas Prices



Source: 2008 ERCOT State of the Market Report, Potomac Economics

Section end page



How the Wholesale Market Works

Board Orientation

July 2010

What is a Wholesale Electricity Market?

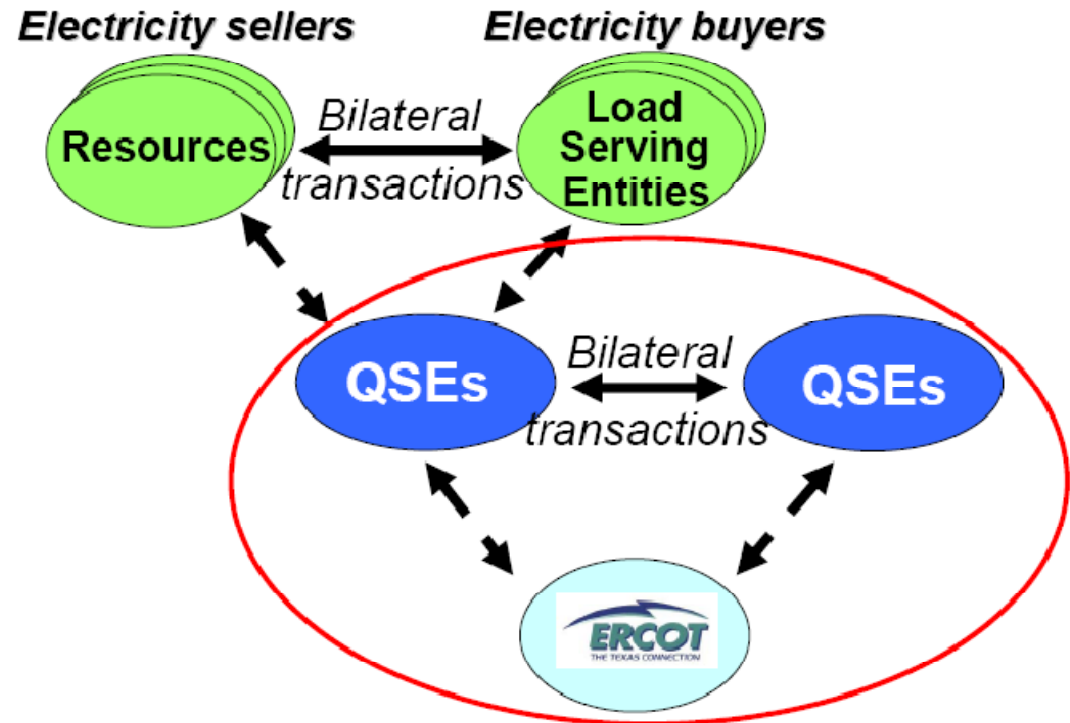
- The wholesale market is open to anyone who, after securing the necessary approvals, can generate power, connect to the grid and find a counterparty willing to buy their output.
 - **Includes competitive suppliers and marketers that are affiliated with utilities, independent power producers not affiliated with a utility, as well as some excess generation sold by traditional vertically integrated utilities.**
 - **All these market participants compete with each other to sell power**
- To be a participant in the wholesale market, however, one does not need to either own any generation or serve any end-use customers.
 - **Just as with many other commodities – pork bellies, oil or stocks – individual traders (or power marketers) exist who buy power on the open market and re-sell it.**
- Unlike in other commodities markets, electricity cannot be stored; it must be generated and consumed at nearly the same time
 - **An intricate physical balance must constantly be maintained between the amount of power generated and the amount consumed**

Source: Electric Power Supply Association

ERCOT Wholesale Market: A Bilateral Market

MARKET PARTICIPANTS:

- **Qualified Scheduling Entities (QSE)**
- **Resource Entities (RES)**
- **Load-Serving Entities (LSE)**
- **Transmission and Distribution Service Providers (TDSP)**
- **Others**
 - Power Marketers
 - Aggregators



Private bilateral contracts – ~5% of total market

ERCOT accounting – 100% of market

ERCOT Wholesale Markets Overview

Bilateral Market

- Includes the bulk of all energy transactions in the wholesale market
- Includes all contracts for energy between retail providers and generators
 - Long-term contracts show up in daily energy schedules for the grid

Balancing Energy Services Market

- Includes energy that ERCOT buys to handle small, daily fluctuations in the grid
- Also referred to as the energy “spot” market, since the prices are not long-term, but for the next fifteen minutes

Ancillary Services Market

- “Keeps the lights on in Texas;” This is the energy that ERCOT buys so that the grid is stable; This market controls reliability

In the Ancillary Services Market and Balancing Energy Services Market, ERCOT procures (i.e., purchases) energy from Qualified Scheduling Entities (QSEs)

- ERCOT does not hold titles to energy purchases

Pricing capacity and energy

- **Market clearing price** – the highest price (or last price sold) per interval/per zone; incentive is to bid low in order to be “in the money”
 - **Market Clearing Price for Capacity (MCPC)** – last price sold for generation to be on call as needed in a particular interval/zone
 - **Market Clearing Price for Energy (MCPE)** – last price sold for capacity that was called upon – balancing energy – in that interval/zone

The PUC, the Independent Market Monitor, and ERCOT watch the wholesale markets carefully to ensure that QSEs are not “gaming” the market and manipulating the price of energy.

Qualified Scheduling Entities

A QSE is a market participant that is qualified by ERCOT in accordance with ERCOT Protocol Section 16 to submit Balanced Schedules and Ancillary Services bids and settle payments with ERCOT.

Only QSEs can schedule, bid and financially settle with ERCOT for energy and capacity
All Resources and LSEs must be represented by a QSE

Levels of QSE Qualification:

Level 1: Perform Inter-QSE trades only; does not have direct representation of Load Serving Entities or Resource Entities.

Level 2: Represent Load serving Entities; does not have direct representation of Resource Entities; may also perform level 1 activity.

Level 3: Represent Load Serving Entities and/or Resource Entities without providing Ancillary Services; may also perform level 1 and 2 activities.

Level 4: Represent Load Serving Entities and/or Resource Entities and provide Ancillary Services; may also perform level 1, 2 and 3 activities.

Resource Entities

Resource Entities (RES)

- Generation facilities capable of providing energy
- Loads capable of decreasing demand (LaaR)
- Can provide reserve capacity
- Must be represented by a QSE

Load-Serving Entities

Load-Serving Entities (LSE)

Provide electrical service to Retail and Wholesale customers

LSE Types:

- **Competitive Retailer (CR)**
 - REP: Any entity that sells electricity to customers in Texas in a competitive area
 - Opt-in Entity: Municipality or Cooperative that offers Customer Choice
- **Non-Opt-In Entity (NOIE)**
 - Municipality or Cooperative that does NOT offer Customer Choice

Must be represented by a QSE

Transmission and Distribution Service Providers

Transmission and Distribution Service Providers (TDSP)

- Local distribution / electric delivery company
- Own and maintain transmission and distribution lines
- Work with ERCOT in retail switching process
- Provide meter data to ERCOT for Settlement
- Rates for service remain regulated by PUCT

Other Market Players

Power Marketers

- Buy and sell electricity at wholesale
- No certificated service area
- Either authorized by FERC to sell electricity at market-based rates or registered with the PUC as a power marketer

Aggregators

- A buyer's agent who represents a group of customers who have banded together to buy electricity
 - For example, groups may form from religious group, neighborhood association, employer, or by the aggregator's efforts alone
- Can recruit members from competitive areas
- Must be registered with the PUC

How QSE's Schedule Resources and Load with ERCOT

Balanced Schedules

For each Interval of a QSE schedule:

- Quantity of resources (generation or purchases) and obligations (load or sales) must **balance**
- Bilateral transactions must **match** (quantity, QSE, Zone)
- QSEs may use their supply or purchase balancing energy services through ERCOT to meet obligations (limited to QSE's with required collateral posted)
- ERCOT does not require QSEs to be balanced within each Congestion Zone. However, not being balanced within each zone may result in congestion charges (payments required to re-dispatch generation to manage transmission overload/imbalance)
 - The cost of relieving congestion within the zones is uplifted to all loads in ERCOT.

Schedules for wind QSEs are based on an 80% probability forecast provided by ERCOT. Wind QSEs are not charged for schedule deviations.

Each QSE representing a Resource or Load-Acting-as-a-Resource (LaaR) must submit a resource plan

- Plan of how generation resources will operate
- Due to ERCOT by 4 pm of the day-ahead period
- Used by ERCOT to determine resource adequacy
- Validated against balanced schedules

Credit Management

The competitive market opened new credit risks in the event that market participants leave the market and default on obligations.

- **Financial transactions for the market are transacted and settled through ERCOT by Qualified Scheduling Entities (QSEs)**
 - ERCOT collects funds from those who owe money
 - ERCOT then sends funds to those who are due money
 - ERCOT manages the credit requirements for the ERCOT market for these transactions
- **Key drivers of credit exposure in the ERCOT Market**
 - Price and volume volatility
 - Significant exposure can occur before it is identified by ERCOT and collateralized
 - BES prices can fluctuate dramatically and unexpectedly
 - Volumes (MWh) taken from the BES are not within ERCOT's control
 - When a QSE is troubled, ERCOT market exposure may increase substantially in a short period of time if the QSE is “cut off” for credit reasons from its bilateral energy providers and continues to serve its end users (e.g. customers)
 - Credit exposure can only be ended by moving end users to another entity, such as the Mass Transition process
 - The PUCT designates Providers of Last Resort (POLRs) to whom end users are transitioned in a Mass Transition

Credit Management - Defaults

Losses to date

- Losses have been incurred in the market as a result of credit events
 - Losses in 2003 \$ 15.0 million
 - Losses in 2005/2006 \$6.0 million
 - Losses in 2008 \$4.2 million
- After each credit event or series of events, actions were taken to reduce credit exposure.
- All losses are borne by the market. ERCOT, Inc. does not bear the loss.

Grid Operations: Managing Reliability

“Keeping the lights” on by ensuring:

- **Adequate transmission capacity**
- **Adequate reserves (Ancillary Services), “just in case”**
- **Adequate instructions are provided to participants**

The ERCOT power operations system **monitors and analyzes all grid components every 2-4 seconds for status, loading and output**



ERCOT directs the safe and reliable operation of the power system in conjunction with transmission control centers of the TDSPs

Ancillary Services

Regulation Reserve – immediate

- “Regulation Up” and “Regulation Down” – used to control power output of resources in response to small changes in system frequency in order to maintain the system frequency within predetermined limits.

Responsive Reserve (RRS) – within 15 seconds

- Set at 2,300 MW for all hours under normal conditions

Non-Spinning Reserves (NSRS) – within 30 minutes

- Off-line or reserved capacity, or load resources (interruptible loads), capable of deploying within 30 minutes for at least one hour
- Intended to cover the contingency of losing resources or under-forecasting load. Or during extreme temperatures

Replacement Reserves (RPRS)

- Resources planned to be off-line, but available
- Deployed for Capacity Insufficiency, Zonal Congestion or Local Congestion

Black Start

- Widespread black out event
- Started without support of the power grid
- Contracted by ERCOT every two years

Reliability Must-Run (RMR)

- Resolves local system reliability
- Contracted by ERCOT

Out-of-Merit Capacity (OOMC)

- Capability of providing Balancing Energy Service
- Otherwise not selected because of the place (or absence) in the Merit Order bid stack

Out-of-Merit Energy (OOME)

- Provision of balancing energy to solve local congestion, or when no market solution exists

Balancing Energy (Merit Order)

- Energy deployed by ERCOT every 15 minutes
- Deployed when load forecast is higher or lower than scheduled
- Also deployed to resolve Congestion
- Market Clearing Price for Energy (MCPE)

ERCOT Reserve Margin: 12.5% Target

Reserve Margin is the percentage by which available capacity is expected to exceed forecasted **peak** demand across the region

Reserve Margin = Capacity less Demand, divided by Demand

Reserves must be available to ensure reliability in case of:

Extreme temperatures

Unexpected major generation outages

In 2002, the ERCOT Board approved a **minimum planning reserve margin target of 12.5%** for the ERCOT region

Reserve Margin – May 2010

2010 Report on the Capacity, Demand, and Reserves in the ERCOT Region

Summer Summary

Load Forecast:	2010	2011	2012	2013	2014	2015
Total Summer Peak Demand, MW	64,052	65,206	66,658	68,265	69,451	70,517
less LAARs Serving as Responsive Reserve, MW	1,062	1,062	1,062	1,062	1,062	1,062
less LAARs Serving as Non-Spinning Reserve, MW	0	0	0	0	0	0
less Emergency Interruptable Load Services	336	370	407	447	492	541
less BULs, MW	0	0	0	0	0	0
less Energy Efficiency Programs (per HB3693)	242	242	242	242	242	242
Firm Load Forecast, MW	62,412	63,532	64,947	66,514	67,655	68,672
Resources:	2010	2011	2012	2013	2014	2015
Installed Capacity, MW	66,228	64,372	64,372	64,372	64,372	64,372
Capacity from Private Networks, MW	4,803	4,803	4,803	4,803	4,803	4,803
Effective Load-Carrying Capability (ELCC) of Wind Generation, MW	793	793	793	793	793	793
RMR Units to be under Contract, MW	688	0	0	0	0	0
Operational Generation, MW	72,512	69,968	69,968	69,968	69,968	69,968
50% of Non-Synchronous Ties, MW	553	553	553	553	553	553
Switchable Units, MW	2,848	2,848	2,848	2,848	2,848	2,848
Available Mothballed Generation, MW	0	0	0	0	0	0
Planned Units (not wind) with Signed IA and Air Permit, MW	0	978	2,003	2,653	3,409	4,059
ELCC of Planned Wind Units with Signed IA, MW	0	30	43	95	115	115
Total Resources, MW	75,913	74,377	75,415	76,117	76,893	77,543
less Switchable Units Unavailable to ERCOT, MW	158	0	0	0	0	0
less Retiring Units, MW	0	0	0	0	0	0
Resources, MW	75,755	74,377	75,415	76,117	76,893	77,543
Reserve Margin	21.4%	17.1%	16.1%	14.4%	13.7%	12.9%
(Resources - Firm Load Forecast)/Firm Load Forecast						
Other Potential Resources:	553	13,691	21,252	23,402	25,813	31,757
Mothballed Capacity, MW	0	5,022	5,022	5,022	5,022	5,022
50% of Non-Synchronous Ties, MW	553	553	553	553	553	553
Planned Units in Full Interconnection Study Phase, MW	0	8,116	15,677	17,827	20,238	26,182

Resources Counted toward the Reserve Margin

Installed operational units

- ERCOT currently counts 8.7% of wind farms' capacity toward reserve margin

Reliability Must Run (RMR) units

Private Network Resources

Direct Current (DC) Ties

- Capacity that can be imported through links to neighboring grids

Switchable Generation

- Units that can be switched to an adjacent grid

Planned units with signed interconnection agreements and air permits

Loads Acting as a Resource (LaaR)

- Market-based load participation program

Mothballed units

Congestion Management: Key Terms

Transmission flow studies

Used to group load and generation transmission points into groups of similar impact on flow across the major transmission paths that reach limits during established system contingencies (load, generation dispatch, outages).

Commercially Significant Constraints

Major transmission paths that form the means to establish what is called Commercially Significant Constraints or CSCs

These CSCs then become the basis to forming the congestion zones.

Congestion Zones and CSCs

Four Congestion Zones

Five Commercially Significant Constraints (CSCs)

- South to North
- South to Houston
- North to Houston
- West to North
- North to West

ERCOT Objective:

Keep flows under limits or else:

- Equipment may be damaged
- System may become unstable



Local Congestion (INTRA-zonal)

Occurs within a congestion zone

Cannot be resolved with Zonal balancing energy

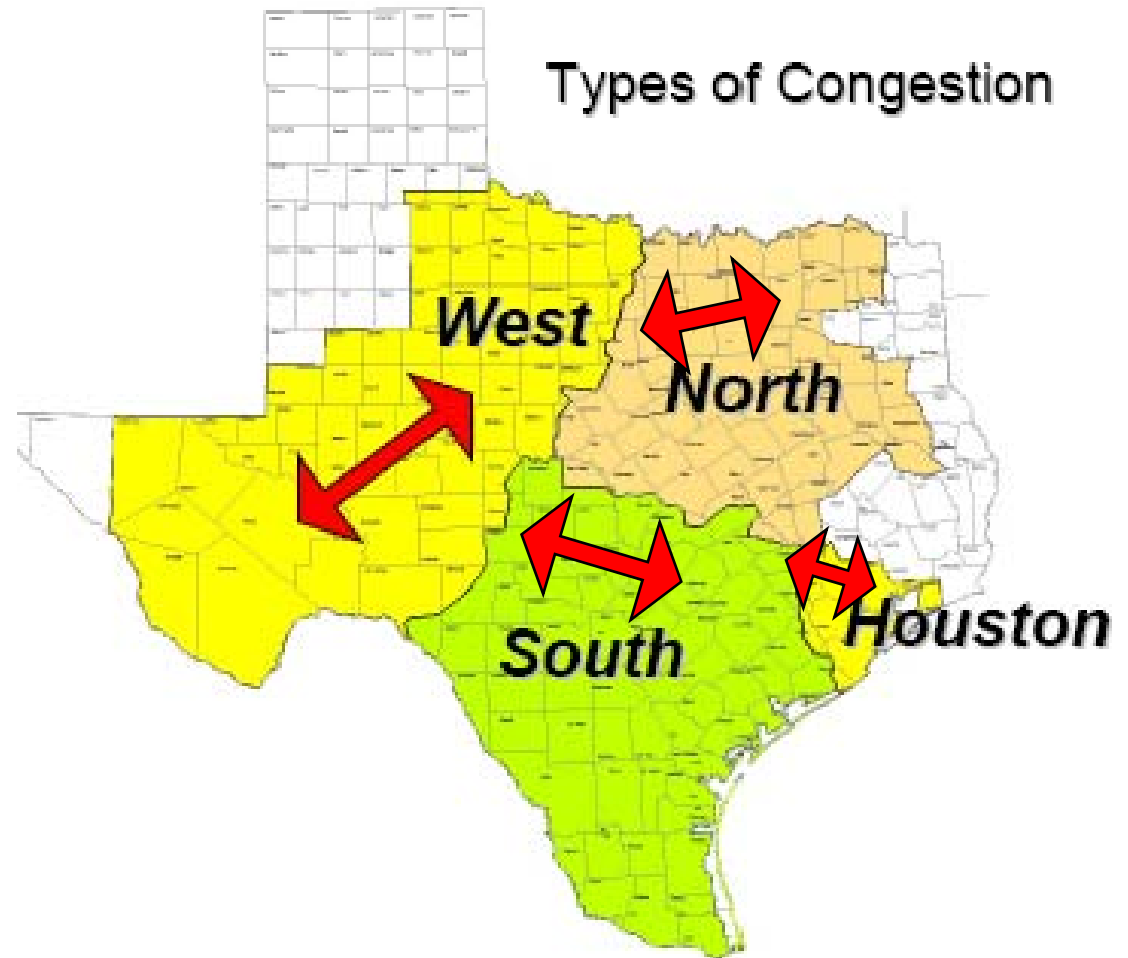
Unit-specific deployments and OOM Energy are used

COSTS

Total ERCOT cost Uplifted at Load Ratio Share

All QSEs with load pay for local congestion if it exists anywhere

No effect or charges on QSEs without load



Zonal Congestion (INTER-zonal)

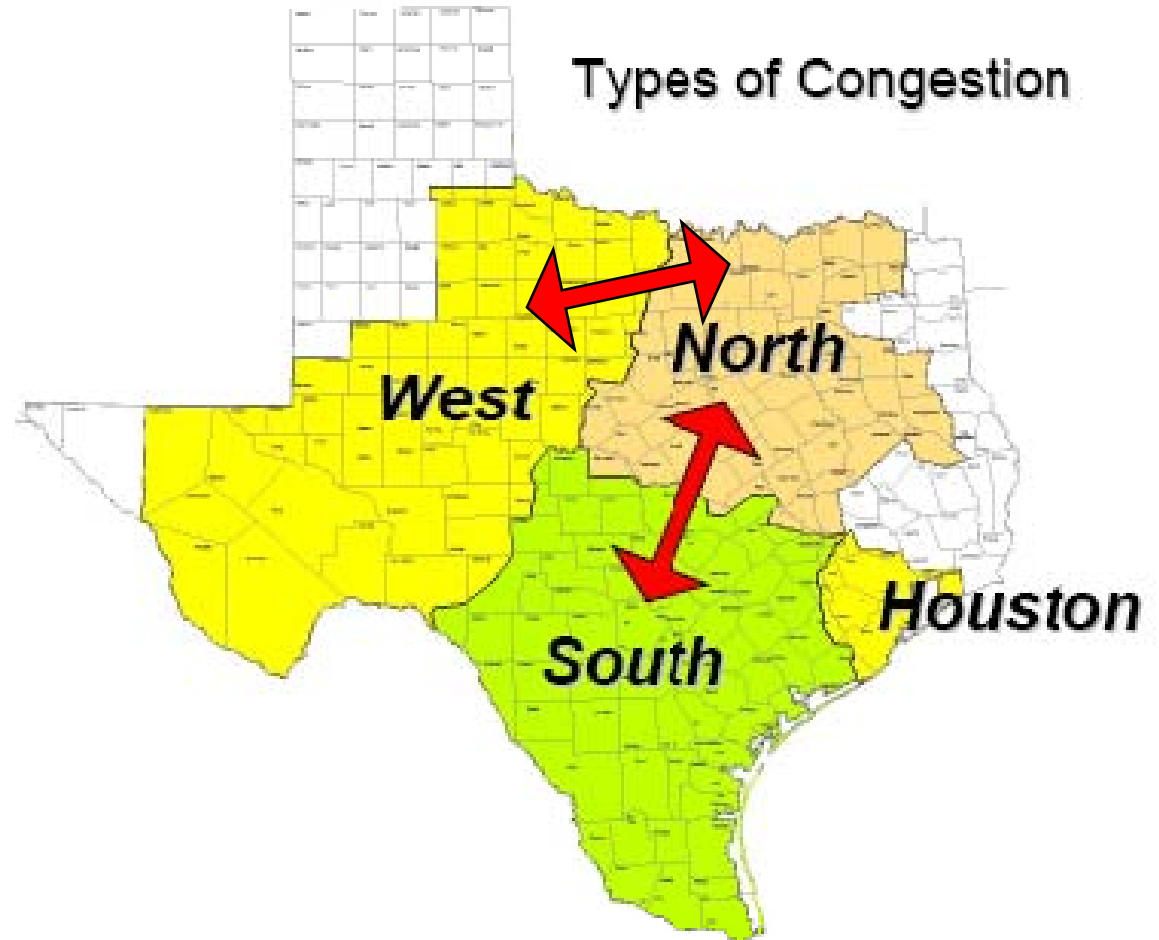
**Occurs between
congestion zones**

**Resolved using Zonal
Balancing Energy
(Merit Order)**

COSTS

**Direct Assignment to
ALL QSEs with
schedules impacting
congested CSCs**

**Cost = Schedule Impact
on each CSC Shadow
Price**



Transmission Congestion Rights

Transmission Congestion Rights (TCRs)

Financial instruments

Can be a hedge against congestion charges

Revenues from TCR auctions go to QSEs by Load-Ratio Share

TCR Auction Distribution:

Annual - 25%

Monthly - 75%

Who participates?

A **TCR Account Holder** is a registered market participant qualified to bid for and own TCRs in ERCOT's annual or monthly auctions, or has acquired such rights in secondary markets for purposes of participating in ERCOT's financial settlements for congestion credits

Section end page



How the Retail Market Works

Board Orientation

July 2010

ERCOT's Role in the Retail Market

- Maintains the Centralized Registration Database
 - *ERCOT's role as the neutral registration agent for the customers has been cited as a major reason for success of this market.*
- Serves as the transaction clearing house for all retail transactions
- Participates in the Stakeholder Process
- Communicates issues to the Retail Market
- Compiles the information on market metrics
- Addresses data discrepancies and dispute resolutions
- Acts as Flight Administrator for Retail Qualification and Testing

The Retail Market: REPs

Retail Electric Provider (REP):

- Sells electric energy to retail customers in the areas of Texas where the sale of electricity is open to retail competition.
- A REP buys wholesale electricity, delivery service, and related services, prices electricity for customers, and seeks customers to buy electricity at retail.
- REPs must register with the PUC.
- REPs must complete ERCOT testing of their electronic interface system prior to serving customers.
 - ERCOT generally has four testing periods per year.

Retail Market: TDSPs

Transmission and Distribution Service Providers (TDSPs)

- Own and operate transmission lines—which provide high-capacity transport of electricity—and distribution lines—between energy sources and individual homes and businesses.
- Build new lines to meet the growing demand for power in Texas.
- Maintain transmission and distribution lines to ensure continued system reliability, such as repairing older lines and trimming trees that could cause power outages.
- Following storms, restore power and other damage to equipment.
- Read meters and collect usage information

Oversight

- TDSPs are regulated companies, each providing power in their service area
- TDSPs are overseen by the PUC for construction of new lines and setting of prices

Compare Offers on 'Power to Choose' Web Site

The Public Utility Commission manages the education program for consumers regarding competitive choice in the retail electric market.

“Power to Choose” site, www.powertochoose.org:

- Allows consumers to compare offers in their area, learn about electric choice and why to switch

Texas Electric Choice
EDUCATION PROGRAM

SHOP. SWITCH. SAVE.

ABOUT ELECTRIC CHOICE REASONS TO CONSIDER SWITCHING COMPARE YOUR CHOICES

The Official Electric Choice Web site of the Public Utility Commission of Texas

Welcome to the Texas Electric Choice Web site, where you can learn about electric competition in Texas and obtain information to help you make informed decisions about your electricity service and Retail Electric Provider. Select from the categories above to learn about electric choice and the options available for you in the marketplace.

Go Directly To Offers

Switching from Incumbent Utility

	% of Load ¹		% of ESI IDs	
	at <u>5/31/10</u>	at <u>5/31/09</u>	at <u>5/31/10</u>	At <u>5/31/09</u>
Residential	53%	48%	51%	46%
Small Non-Residential	80%	77%	57%	53%
Large Non-Residential	76%	73%	78%	75%

¹ - Percent of Deregulated (Non-NOIE) ESI IDs and Load. Usage based on monthly settlement results.

Wholesale Energy Settlement: Load Profiles vs. Smart Meters

Wholesale energy settlement

- The process of matching financial debits for retailers' purchases of wholesale power to credits for the generators who sell that power through the ERCOT energy market
- Since the ERCOT market opened in 2002, residential and small commercial customers have been settled on statistical estimates of their usage – **called load profiles.**

Advanced meters

- December 2009 – ERCOT launched financial settlement process for “smart meters”
- By 2014, about 7 million retail customers in Texas will have advanced meters installed that will record their energy usage every 15 minutes around the clock.
- Meter settlement will eventually replace the use of load profiles in the ERCOT retail market – ***effectively taking the estimation out of the equation.***
- Smart meters allow both customers and retailers to benefit financially from lowering energy usage during high-price periods. Retail products that take advantage of this new technology may include:
 - **Time-of-use rates**
 - **Real-time price options**
 - **Load-control devices that allow demand response** (reducing energy consumption remotely or automatically based on price signals)

Settlement and Billing Process

ERCOT's Daily Settlement Procedures:

- Validate Settlement Statements for publishing
- Create and publish Invoices (Weekly)
- Facilitate Invoice Payment Processes (Weekly)
- Participate in UFE Analysis
- Dispute Research and Resolution
- Provide Settlement information (ERCOT, PUCT, Market Participants)

ERCOT settles for services procured to manage the Texas power grid

- Capacity Settlement
- Energy Settlement

ERCOT's Role in Settlements

- **Settle with each QSE**
 - Hourly intervals for capacity services
 - 15-minute intervals for balancing energy and congestion
- **Publish billing determinants, settlement statements and invoices**
- **Collect and remit all charges and payments via electronic funds transfer**
- **Provide dispute research and resolution**
- **Manage revenue neutrality**

ERCOT Remains Revenue Neutral

All payments for Market Services will have a corresponding cost allocation.

Common forms of cost allocation

- Obligation
- Direct Assignment
- Load Allocation
- BENA

Charge types are grouped into payments and cost recovery for market services.



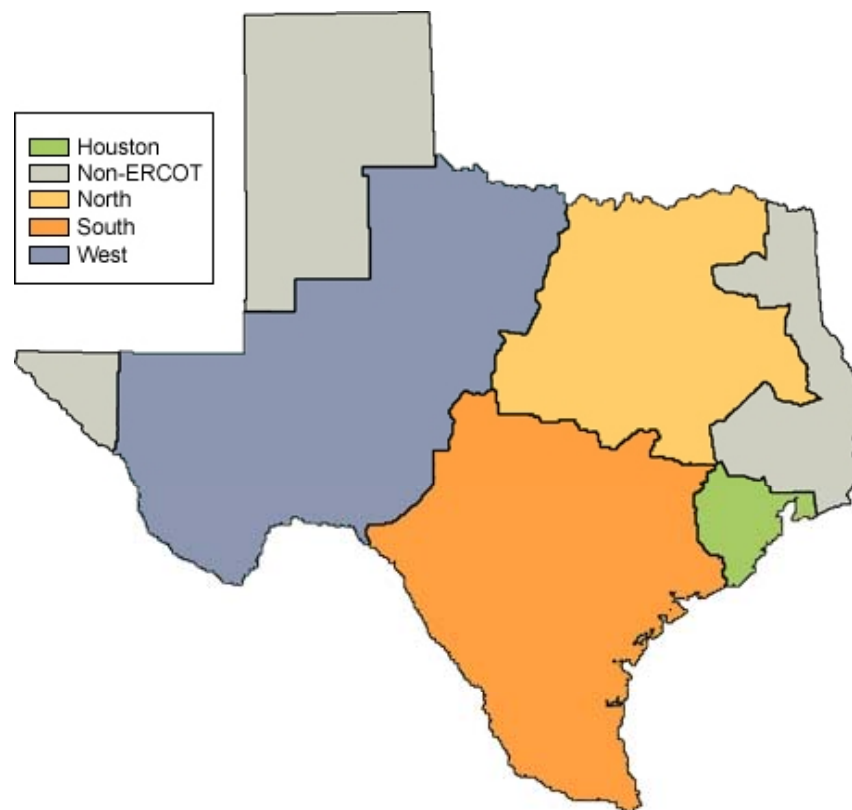
Transition to Nodal Markets, Zonal vs. Nodal Operations

Board Orientation

July 2010

Current Zonal Market

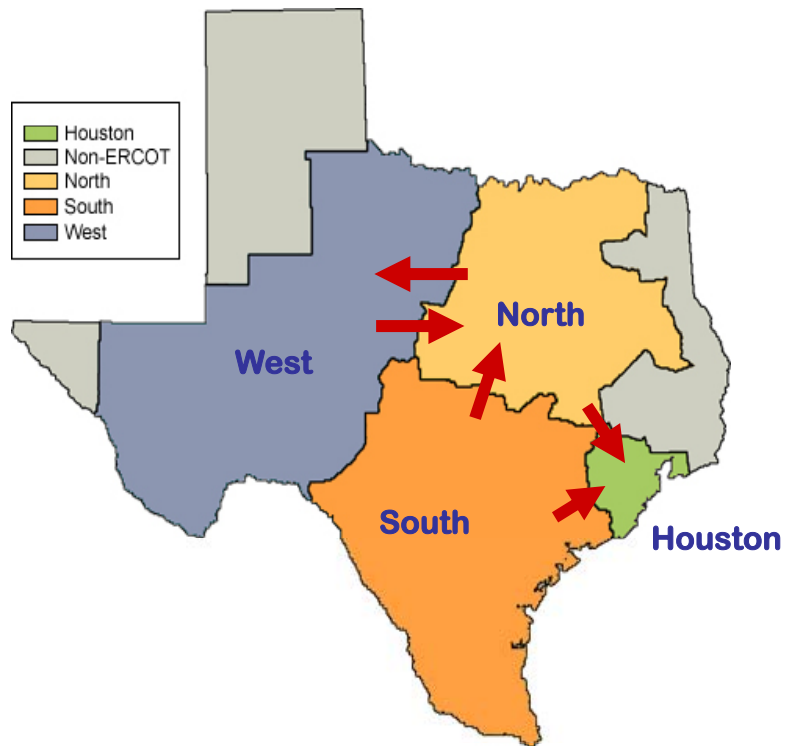
- Zonal Model (Congestion Management Zones)
- Four congestion zones, four wholesale price points
- 5 CSCs for inter-zonal congestion management
- Congestion costs directly assigned or uplifted
- ERCOT provides portfolio level deployment instructions to QSEs.
- TCR is the current mechanism to hedge financial risks of congestion management rents.



ERCOT Zonal Market Model

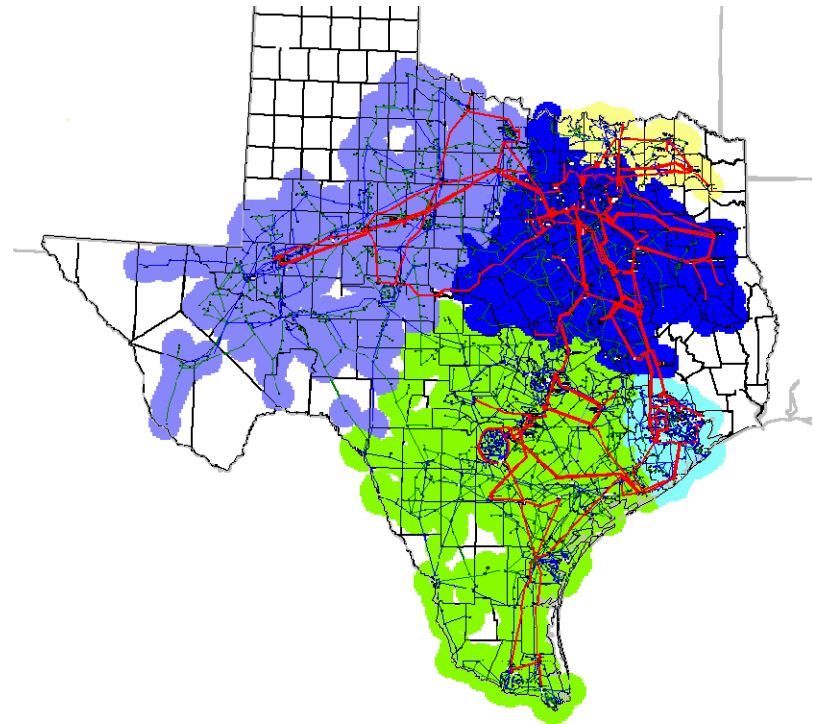
Zonal Congestion

- Congestion between zones (CSC)
- Managed with Portfolio Balancing Energy deployments by zone



Local Congestion

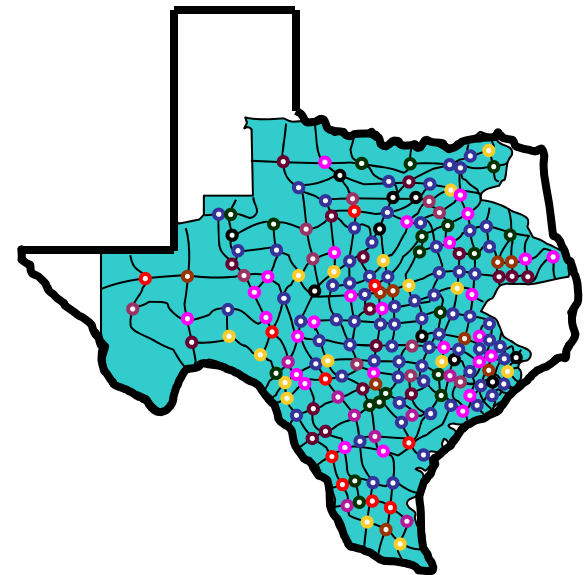
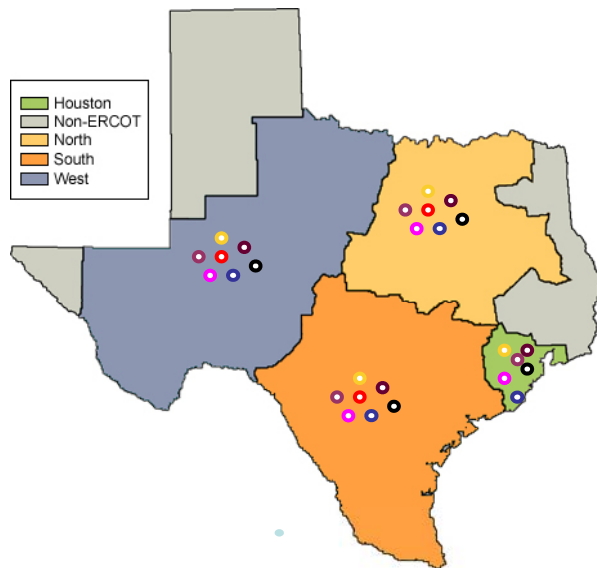
- Congestion other than CSC
- Managed with local Balancing Energy deployments by Resource



Drivers for Change: Zonal Inefficiencies

Zonal Market Model	Physical Operation
Portfolio scheduling, bidding, deployment	Unit by unit, bus by bus, line by line

- Portfolio schedules have to be disaggregated and deployments issued to individual units
- ERCOT must “guess” the unit-by-unit response



Drivers for Change

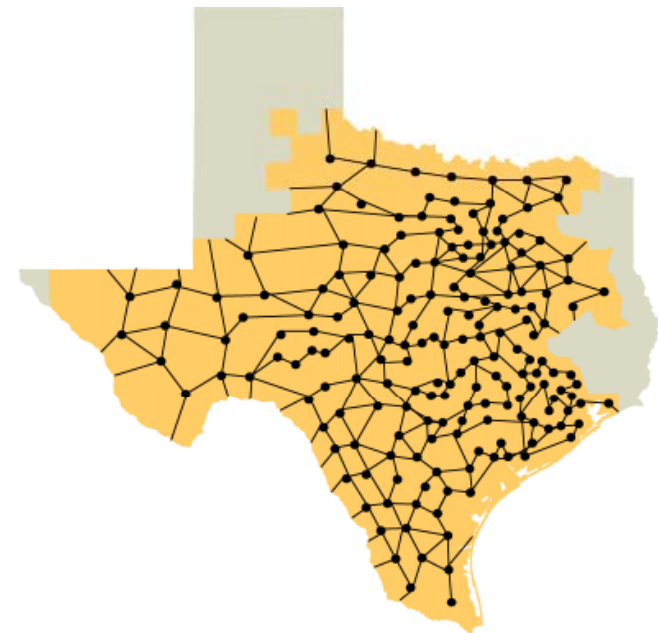
Zonal Market Model	Physical Operation
Local congestion costs are uplifted to all QSEs representing load.	No market incentive to reduce local congestion; this probably results in more congestion management activity.

Everybody pays for local congestion.

Background

In September 2003, as part of Project 26376, the PUCT ordered ERCOT to develop a nodal wholesale market designed to:

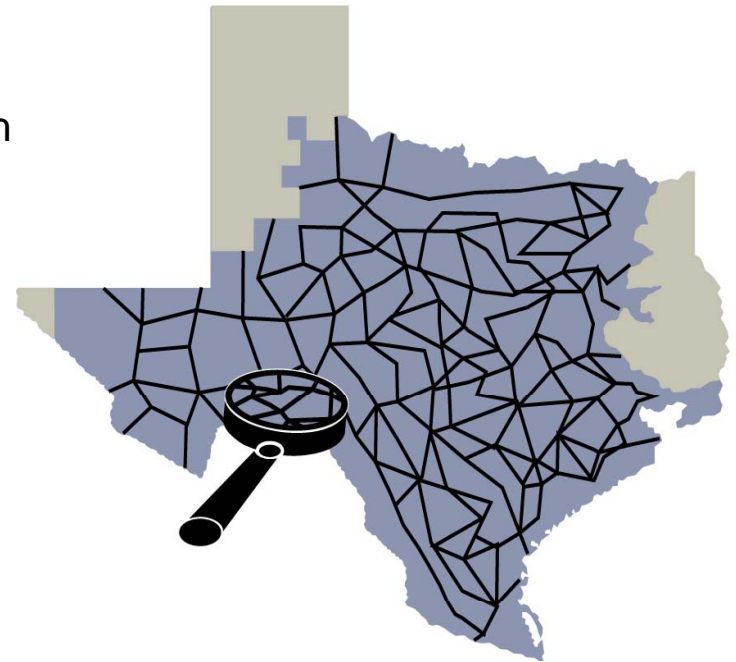
- Reduce local transmission congestion costs
- Provide better price signals for locating generation and transmission
- Develop a day-ahead energy market
- Address other wholesale market concerns



The LMP Foundation

- Locational Marginal Pricing (LMP) provides:
 - Market transparency
 - Observable consequence of behavior
 - Direct assignment of local congestion costs
 - Balance of reliability and economics
 - Strong market signals
 - Efficient ERCOT instructed unit-level dispatch

- Market Participants Impacted:
 - Qualified Scheduling Entities (QSEs)
 - Load Serving Entities (LSEs)
 - Retail Electric Providers (REPs)
 - Municipally Owned Utilities
 - Electric Cooperatives
 - Transmission Service Providers (TSPs)
 - Distribution Service Providers (DSPs)
 - Resource Entities
 - Power Marketers/Traders
 - Aggregators



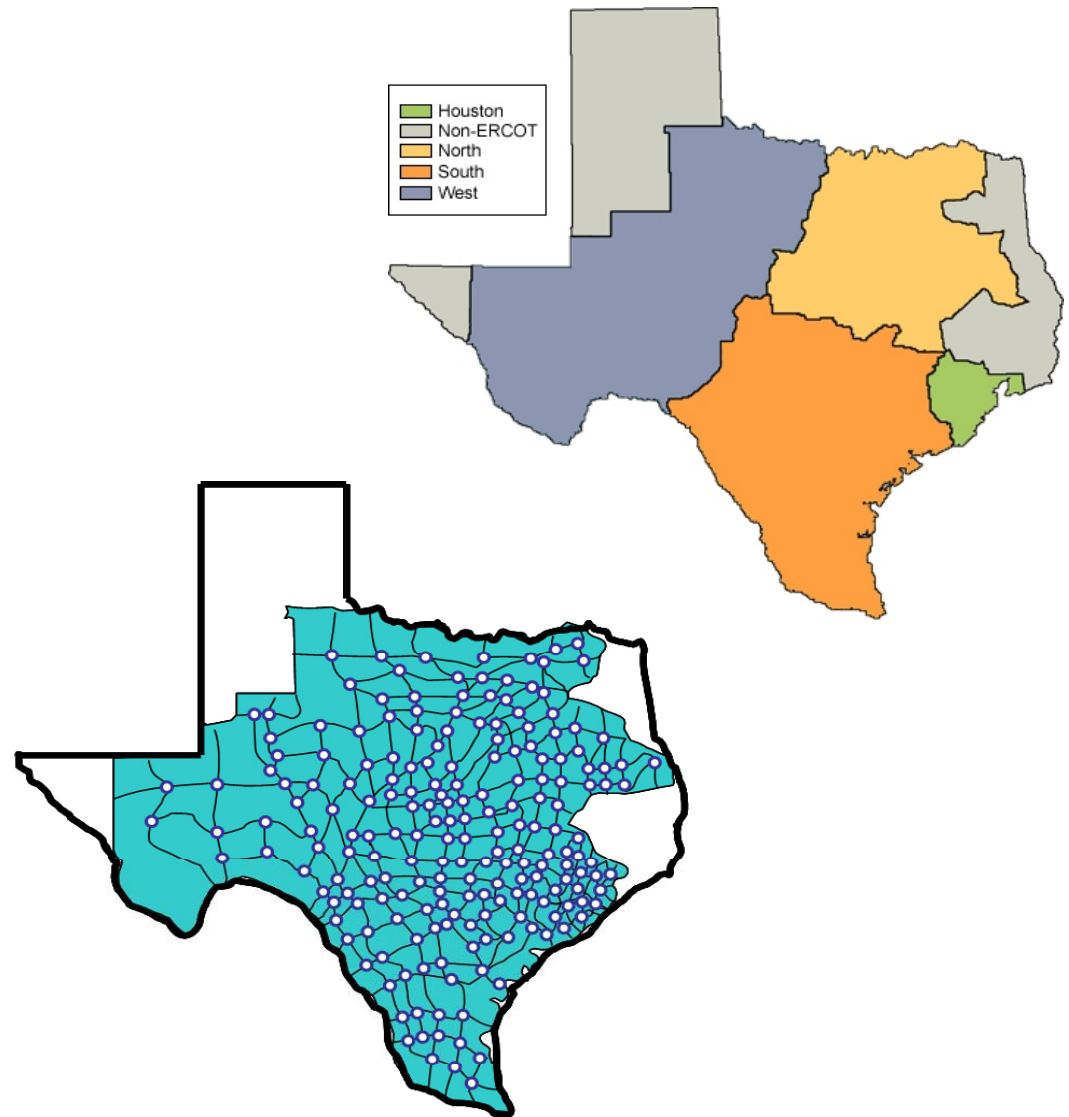
Texas Nodal Market Implementation

Zonal Model	Nodal Model
<ul style="list-style-type: none">• Great flexibility for market participants• Simpler market model – 5 prices and 5 CSCs• It's easy for market participants to sign bilateral contracts	<ul style="list-style-type: none">• More precise price signals• Directly assigned local congestion costs• Mathematically, lower production costs

Settlement Points

- **There are three types of Settlement Points:**
 - Resource Nodes
 - Load Zones
 - Hubs

- **LMPs are used to calculate Settlement Point Prices.**



Settlement Point Pricing

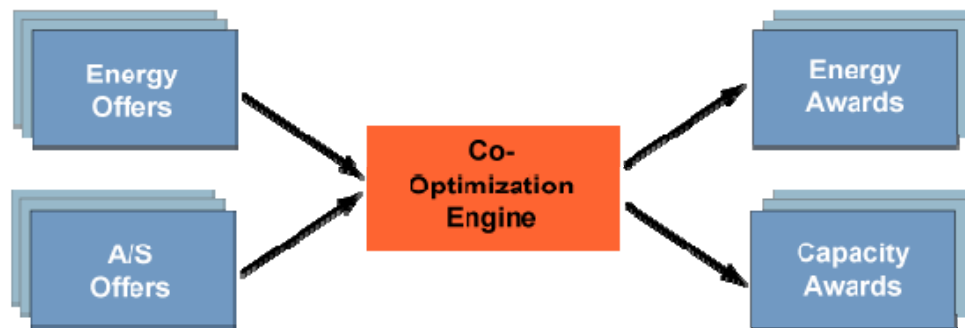
Load Zones – NOIE Load Zones

- All NOIEs must be assigned to an appropriate *Competitive Load Zone*, unless they had made a one-time choice to establish a NOIE Load Zone and notified ERCOT in writing of that choice *six months* before the Texas Nodal Market Implementation Date.
- ERCOT shall uniquely identify NOIE Load Zones. NOIEs may *participate in only one* NOIE Load Zone, and all Loads served by that NOIE must be contained within that Load Zone.
- Each group of NOIEs who are parties to the same *pre-1999 power supply arrangements* and that has a 2003 peak Load in excess of 2,300 MW and any other NOIE that has a *2003 peak Load in excess of 2,300 MW* is automatically a separate NOIE Load Zone.

What's Changing with Nodal – Day-Ahead Market

Day-Ahead Market

- Provides opportunity for parties to participate in a centralized market to optimize around their bilateral contracts
- Facilitates Qualified Scheduling Entities (QSEs) in finding other trading partners, due to centralized market
- Gains efficiency because we'll clear for energy and capacity at the same time



Reliability Unit Commitment (RUC)

- RUC ensures there is enough generation capacity in the proper locations to reliably serve the forecasted load and transmission congestion
- RUC is similar to today's OOMC and RPRS
- RUC will use “make whole” payments to ensure a generator is adequately compensated for its costs
- ERCOT will run a day-ahead RUC (DRUC) and an hourly RUC (HRUC)

What's Changing with Nodal – Real-Time

Real-Time

- ERCOT will run security constrained economic dispatch (SCED) every five minutes (instead of 15 minutes), using offers by individual Resources and actual shift factors.
- SCED determines the most economical dispatch of individual Resources across the grid
- Generation will be settled based on the LMP of the node where generator is located.
- Load will be settled based on a load zone price that is a weighted average of LMPs in the load zone.

Congestion Revenue Rights (CRR)

- A CRR is a financial instrument
- CRRs are defined by a MW amount, settlement point of injection and settlement point of withdrawal
- CRR owners pay or get paid the product of the CRR MW amount and the LMP difference between the CRR injection and withdrawal Settlement Points
- CRRs are auctioned by ERCOT monthly and annually; CRR auction revenues are returned to loads

Direct Allocation of Congestion Revenue Rights

- ERCOT shall allocate Pre-assigned Congestion Revenue Rights (PCRRs) to eligible NOIEs (Non-Opt-In Entities).
 - PCRRs may be PTP Options or PTP Obligations.
 - NOIEs must choose the Capacity Option or the Refund Option for their PCRRs.
- ERCOT shall allocate McCamey Area Flowgate Rights (MCFRIs) to eligible QSEs representing wind-powered Generation Resources in the McCamey Area.

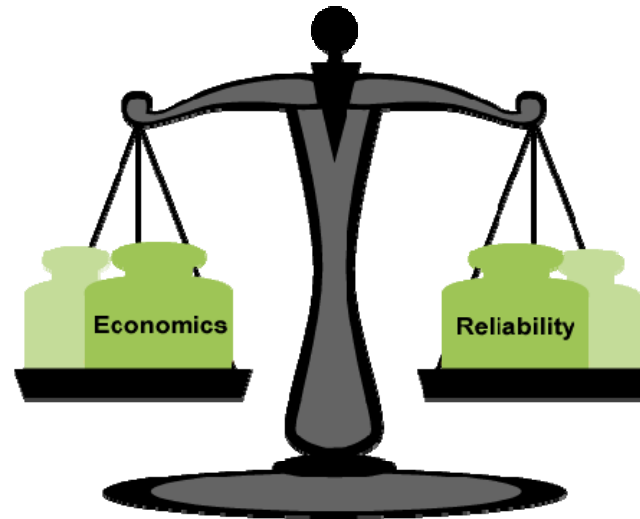
Summary of Economics and System Reliability Settlement

Day-Ahead Market:

- Energy Purchases
- Energy Sales
- A/S Capacity Purchase
- A/S Capacity Sales
- Congestion Rents

Real-Time Market

- RTM Energy Imbalance
- Congestion Rents not in DAM
- Supplemental A/S Market



Day-Ahead Period:

- RUC Commit/De-commit

Real-Time Market

- RUC Commit/De-commit

Contract Reliability Services:

- Voltage Support
- Governor Control
- Black Start
- Reliability Must Run
- Emergency Power

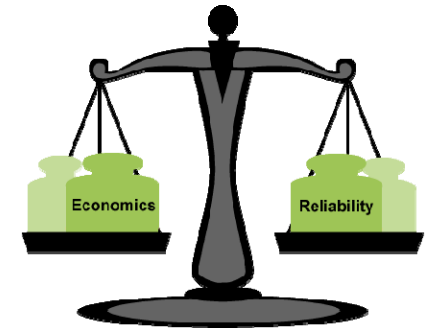
Summary of Nodal Market Uplift Settlements

Reliability Unit Commitment:

- RUC Decommitment
- RUC Make Whole
- RUC Clawback
- RUC Capacity-Short
- RUC Capacity Credit

Other Reliability Services:

- Voltage Support Service
- Governor Control Service
- Reliability Must Run
- Black Start Service
- Emergency Power Service



Other Uplift:

- Real-Time Revenue Neutrality Allocation
- Base Point Deviation Payment
- Day-Ahead Make Whole

Take-Aways

- Reliability and economics are balanced
- Wholesale electricity pricing in ERCOT will be LMP
- Market behaviors are more visible
- ERCOT dispatches at the resource level
- New markets, new tools, new opportunities and new risks