



# ERCOT Emergency Interruptible Load Service

**AEIC Load Research Workshop**

**Presented by: Carl Raish**

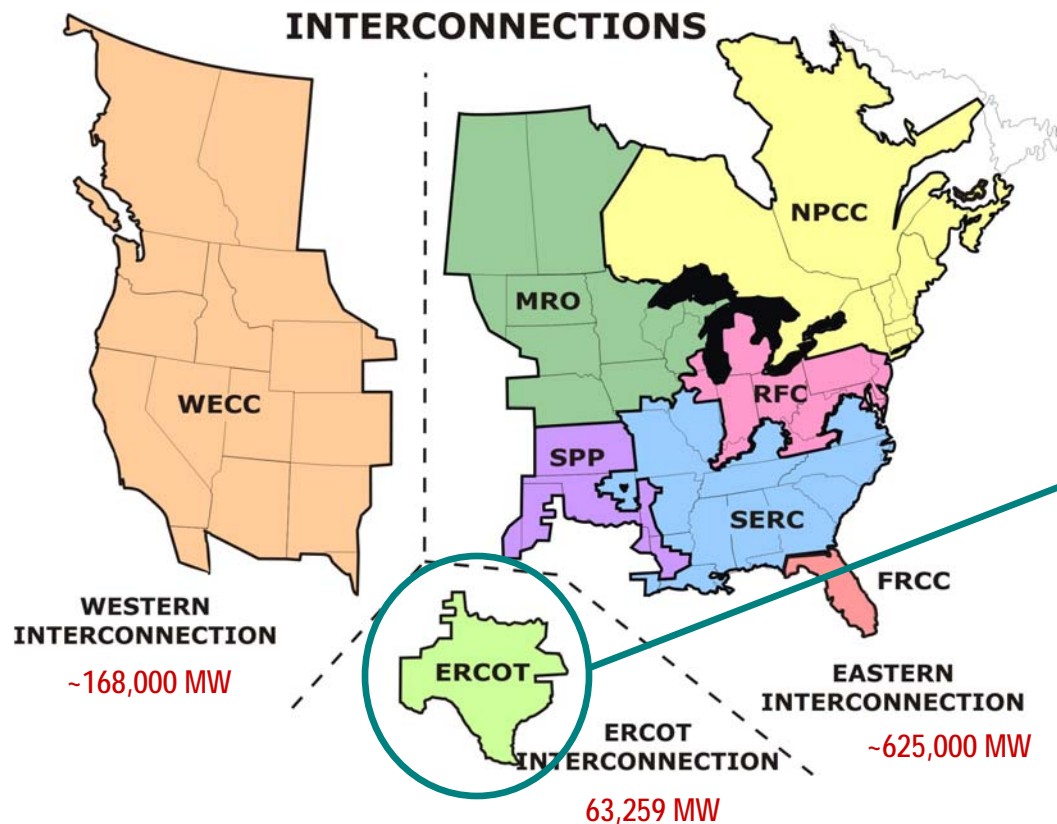
**February 26, 2008    San Antonio, Texas**

# Agenda

- 1. Overview of the ERCOT Market**
- 2. Load Participation in ERCOT**
- 3. EILS Background Information**
- 4. Load Profiling Role**
- 5. EILS Program Status**
- 6. Q & A**

# North American Interconnected Grids

NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION (NERC)



- **The ERCOT grid:**

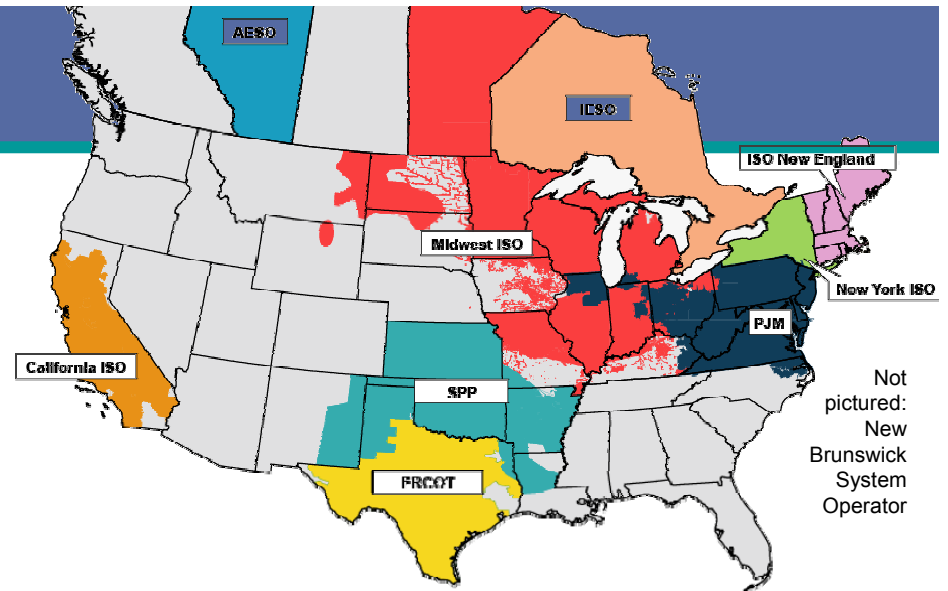
- Covers 75% of Texas land
- Serves 85% of Texas Load
- 38,000 miles of transmission lines
- >550 generation units
- Physical assets are owned by transmission providers and generators, including municipal utilities and cooperatives

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

# Electric Grid Operations

- **Grid operations**

- ERCOT is one of 10 North American independent system operators (ISOs)
  - ISOs serve 67% of U.S. population

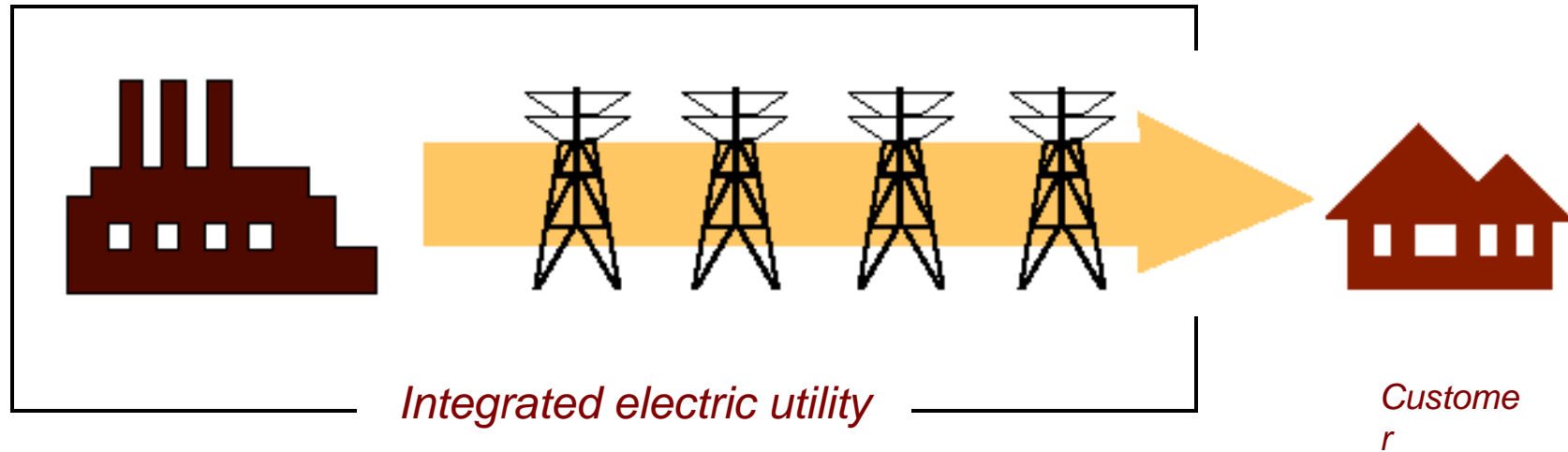


- **ERCOT directs traffic on the grid to maintain reliability**

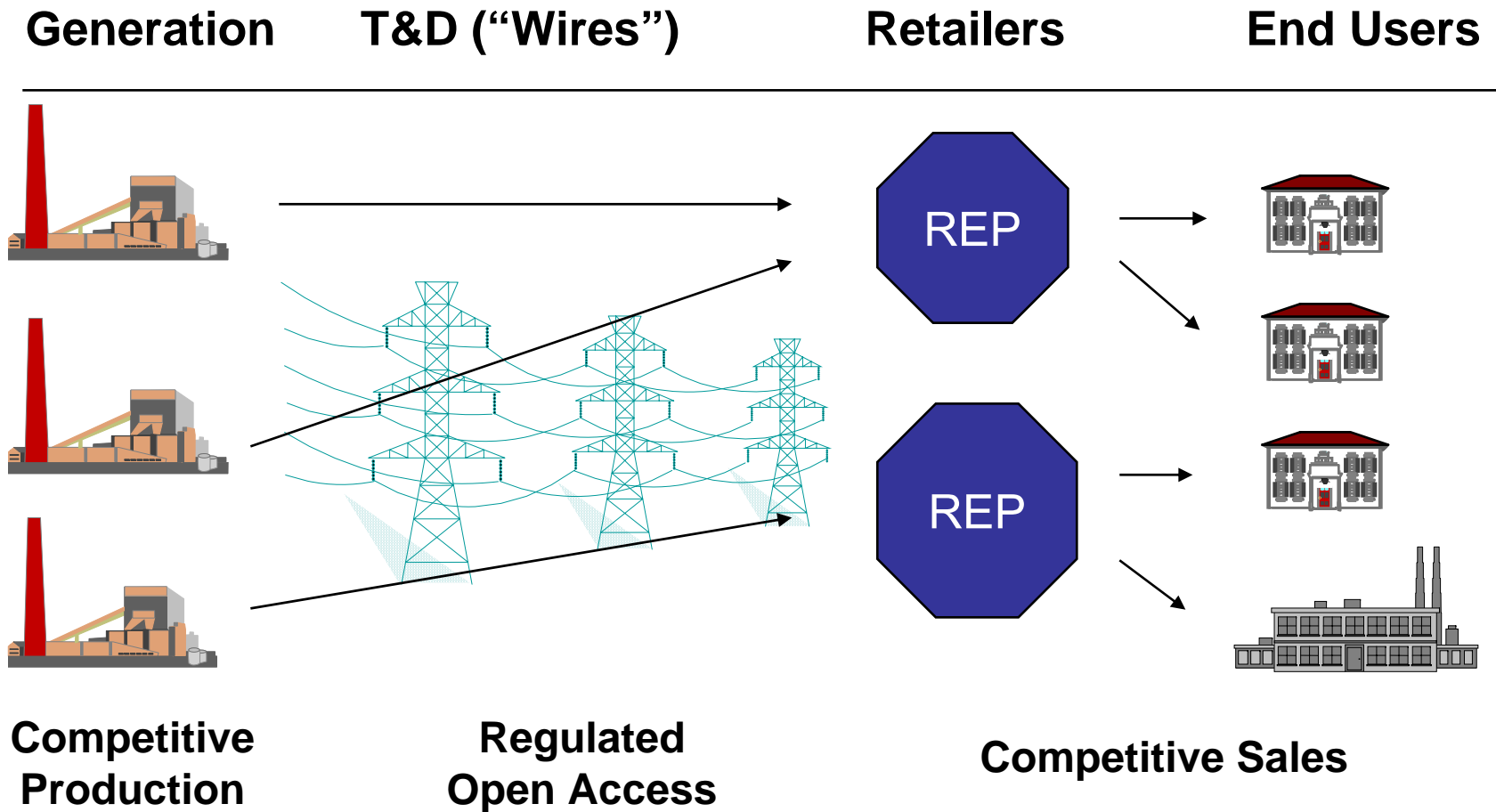
- ‘Air traffic controller’ of the electric supply
  - Coordinates scheduling of power by market participants
  - Analyzes grid conditions continuously in real-time
  - Dispatches generation to ensure power production matches Load at all times
  - Secures extra generation capacity to meet reliability requirements
  - Coordinates planned outages of generators and transmission lines
  - Relieves transmission system congestion
  - Coordinates emergency actions & recovery
  - Operates markets to meet regional energy & capacity requirements not met through bilateral arrangements

# The Old World: Pre-2002

- **Each utility was vertically integrated, from generation to customer service**

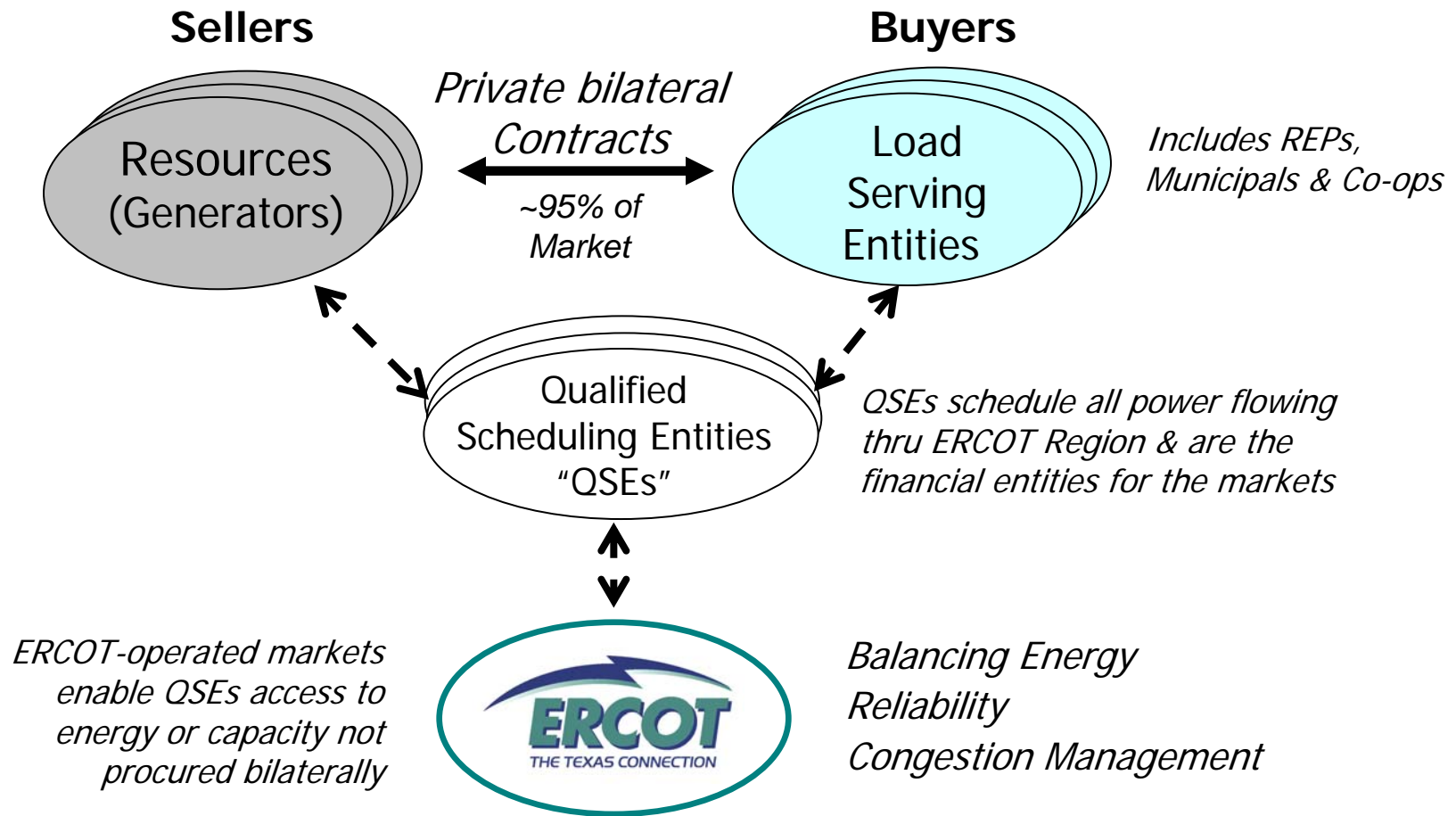


# The ERCOT World: A Competitive Market



*Vertically integrated municipally-owned utilities and electric cooperatives comprise about 24% of the customer Load in the ERCOT Region. They may opt-in to retail competition.*

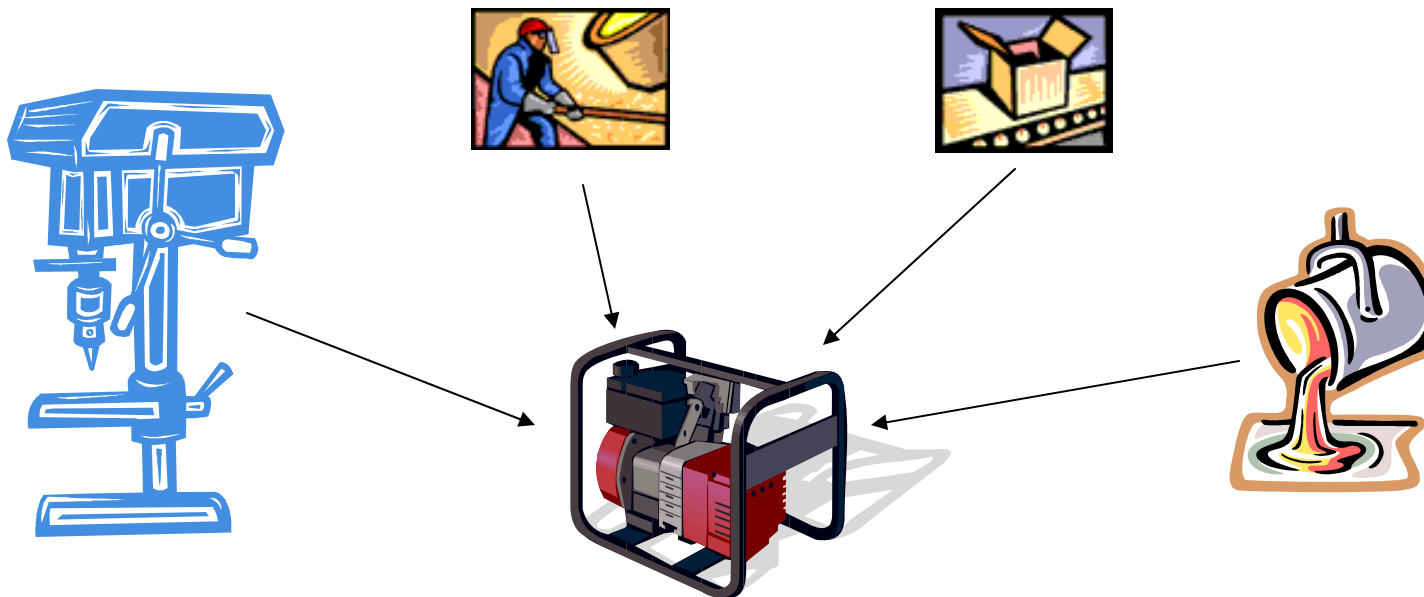
# The ERCOT Market



ERCOT is the independent organization assigned to administer the wholesale and retail markets for this power region.  
ERCOT is a 501(c)(6) nonprofit corporation.

# Load Participation in ERCOT

- **Load Acting as Resources (LAAR)**
  - Load capable of reducing or increasing the need for electrical energy
    - Day ahead capacity which can bid into Ancillary Services
      - Regulation Reserves (instantaneous)
      - Responsive Reserves (UFR & 10 minute VDI response)
      - Non-Spinning Reserves (30 minute response)
    - Registered and qualified by ERCOT / scheduled by a QSE
    - Telemetry required
    - Hourly bid stacks
    - Approximately 1500 MW is actively being bid/self provided



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  - Price response to high market clearing prices
    - Applicable to IDR metered customers
  - No formal process for quantifying amount of Load



# Load Participation in ERCOT

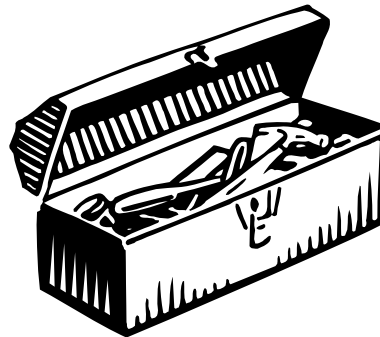
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- **Demand Response and Load Profiling**
  - Current Load profiling (adjusted static models) eliminates retailer incentive to offer DR
  - ERCOT has market rules in place to profile demand response programs (using lagged dynamic profiles) BUT...
    - Settlement system changes have not been implemented
    - Retailers have not been able to justify the Load research sampling costs
  - Advanced metering initiative has created renewed interest among retailers in offering DR
    - Transitional period still poses challenges for how to settle Demand Response



# Emergency Interruptible Load Service (EILS)

## Purpose of EILS:

- Provide ERCOT Operations with an additional emergency tool to lessen the likelihood of involuntary firm Load shedding (a.k.a. rolling blackouts)



*'Another tool for the operator toolbox'*

- A new ancillary service which ERCOT started procuring Feb. 1, 2008

# Emergency Interruptible Load Service (EILS)

## What EILS is:

- **Service provided by Loads (customers) willing to interrupt during an electric grid emergency in exchange for a payment**
- **Last resort prior to firm Load shedding (rotating outages)**
- **Deployed ONLY in the late stages of a grid emergency**



***“Controlled interruption of prepared customers vs. uncontrolled interruption of unprepared customers”***

# Emergency Electric Curtailment Plan (EECP)

## **Alert (pre-EECP) – When reserves fall below 2500 MW**

- Start Reliability-Must-Run units
- Instruct generation owners to suspend testing
- Deploy non-spin reserves
- Dispatch quick-start capacity



## **Step 1 – When reserves fall below 2300 MW**

- Instruct all available generation to come online
- Secure emergency power from neighboring electrical grids through direct-current ties

## **Step 2 – When reserves fall below 1750 MW**

- Drop LaaRs
- Transfer load to neighboring grids through block-load transfers
- Issue a media appeal for voluntary energy conservation

Added Feb. 1, 2008

## **Step 3 – When reserves continue falling or to maintain system frequency at 60 Hz**

- Drop Emergency Interruptible Load if available

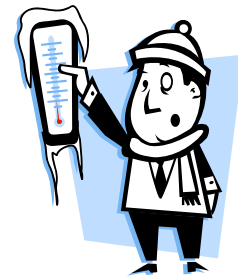
## **Step 4 – To maintain system frequency at 59.8 Hz or greater**

- Instruct local utilities to implement rotating outages to reduce load

# Firm Load Shedding History

- **Firm Load shedding has been ordered by ERCOT twice in the last 18 years:**

- Dec. 22, 1989
  - Extreme cold during morning peak
  - Deployed 500 MW for 30 minutes
- April 17, 2006
  - Extreme heat during afternoon peak
  - Deployed 1,000 MW for almost 2 hours



- **During 2006 / 2007 ERCOT had 13 EECF days which did not require firm load shedding**

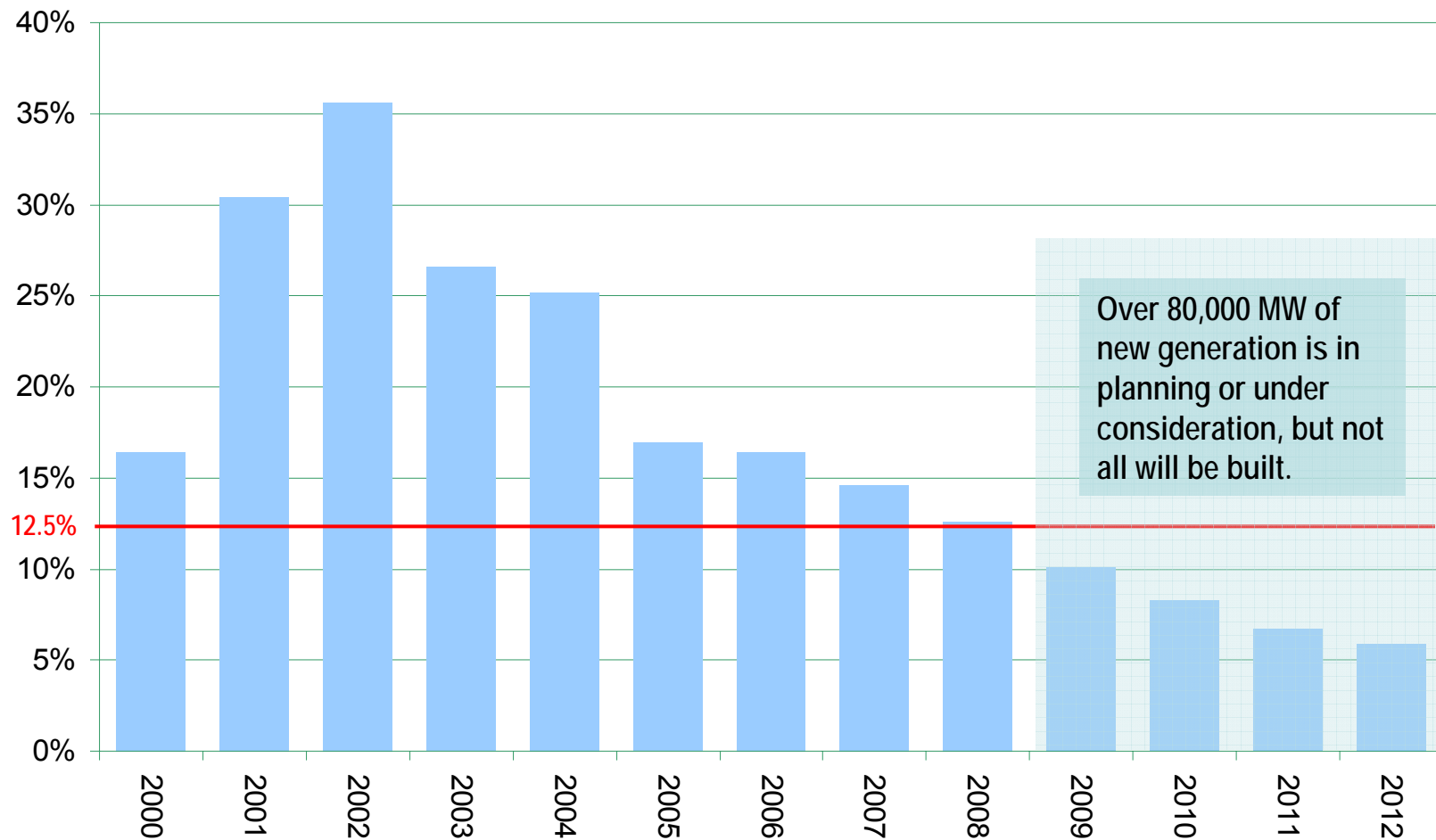
## A quick review of April 17, 2006

- **20% of generation fleet (14,000 MW) out of service on planned maintenance**
- **ERCOT Load forecast missed daily peak by nearly 10%**
  - DFW temperatures exceeded weather forecast by 5 degrees F
    - 100 degrees vs. usual high in low 80s
- **Five major unit trips during peak hours**
- **Emergency Electric Curtailment Plan (EECP) initiated**
  - All available generation, private network and maximum DC Tie supply deployed
  - LaaRs deployed
  - 1,000 MW of firm Load shedding (*rotating outages*) ordered by ERCOT
    - Approx. 2% of Load tripped at distribution level over 2 hour period
  - Public appeal for conservation issued & remained in effect thru 4/18

# Reserve Margins 2000-2012

Percentage difference between projections for peak demand and available generation/resources

**Target for reliability: 12.5%**



## Procurement



- ERCOT can procure up to 1000 MW including self arrangement
- Four-month Contract Periods 3 x per year
  - One or more time periods within a contract period as defined by ERCOT
- Annual Cost Cap of \$50 million covering the months of February through January
  - Procurement amount variable by Time Period and Contract Period to maximize benefit
- Separate bid stacks for each Time Period
- Pay as Bid (not a clearing price)
- Funded by uplift to Market based on Load Ratio Share
- Maximum of 2 deployments (or 8 hours) per Contract Period

# EILS Overview

## Bidding Requirements

- IDR metering required
- Minimum bid amount 1 MW
  - Aggregated bids allowed
- Minimum base Load must be specified
- May bid differently in different time periods
- Customers within NOIE and Private Use Networks can participate
- QSE must be capable of receiving an ERCOT Verbal Dispatch Instruction
- A LaaR premise may not bid the same Load simultaneously into EILS and another Ancillary Service
  - May bid the LaaR into EILS
  - May continue to bid the LaaR as AS and bid incremental Load into EILS
  - May bid the LaaR as AS in one time period and EILS in another



## Event Initiation

- ERCOT Operations orders an EILS deployment via a phone call to the all-QSE hotline
- 10-minute deployment period begins when QSEs have received the instruction in this call



– QSEs must then contact their committed EILS Resources (clock is ticking)

- EILS Resources must shed at least 95% of their committed Load within 10 minutes of QSEs' receipt of the instruction

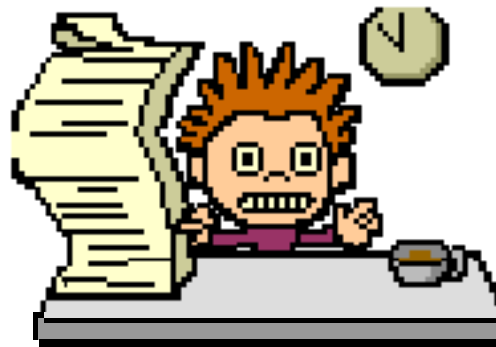


## Event Termination

- EILS Resources must keep their committed Load off until released
- ERCOT Operations will release EILS Resources after LaaRs have been recalled and generation providing Responsive Reserves has been restored
- EILS Resources have 10 hours to return to service after release



# How does the Load Profiling Team get Involved with EILS?



# Load Profiling Roles

- **Prescreening**

- Baseline determination

- All premises in the Resource must have the same baseline methodology

- Provide suggested upper limit bid amount based on historical usage and minimum base Load

- **Performance during the Contract Period**

- Availability

- Event Performance

- Determined at the Resource level for aggregated bids

# Load Profiling Roles

- **Prescreening**

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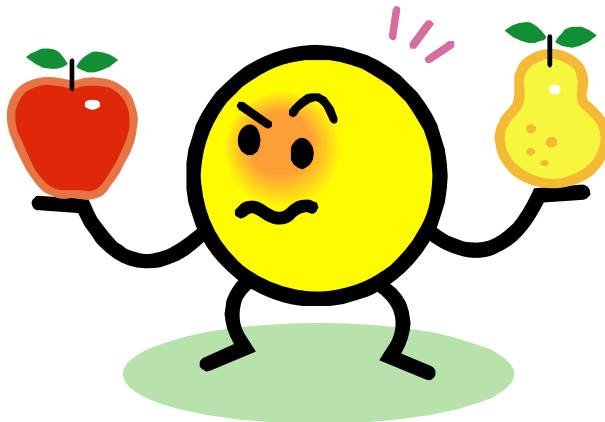


# Baseline Determination

## Two baseline options:

Default Baseline - Applicable to weather sensitive and/or time sensitive Loads

Alternate Baseline – Applicable to randomly fluctuating Loads



# Default Baseline

## **Default Baseline - Applicable to weather sensitive and/or time sensitive Loads**

**The primary goal of the default baseline is to accurately estimate an EILS Resource's level of electric energy consumption under "business as usual" conditions at any given moment in time**

- The default baseline Load estimate at the moment of EILS deployment will be compared to the actual Load during the event to quantify the Load reduction

$$\text{Baseline Load} - \text{Actual Load} \geq 0.95 \times \text{Bid kWh}$$

- Actual Load data is IDR 15-minute data
- Comparisons for beginning and ending intervals based on the fraction of the interval during the event allowing for 10 minute response to EILS notification

# Default Baseline

- **“Business as Usual” model will be developed for each premise**
- **Preliminary model developed using historical interval data to make baseline assignment**
  - Preliminary and updated model parameters provided to QSE on request
  - Updated model will be used for the baseline when an event occurs ... baseline will be a back-cast
  - Event, notified unavailability and outlier usage periods will be excluded from model updating
- **Models developed parallel methodology used for ERCOT profiles**
- **Model inputs will include weather, calendar, sunrise/sunset data**

<http://www.ercot.com/mktrules/guides/loadprofiling/current.html>



# Default Baseline Model

$$kWh_{d,h,int} = F(\text{Weather}_d, \text{Calendar}_d, \text{Daylight}_d)$$

**where** **d** is a specific day,  
**h** is an hour on day **d**,  
**int** is a 15-minute interval during hour **h**,  
**kWh** is the estimated Load for a specific 15-minute interval,  
**Weather** represents weather conditions on the day and preceding days,  
**Calendar** represents the type of day involved, and  
**Daylight** represents solar data, such as the time of sunrise and sunset



Model is developed in 3 stages

- daily energy
- hourly energy
- 15-minute interval



# Alternate Baseline

- **If the default model is an unreliable predictor of the interval Load, the alternate baseline methodology will be used**
  - Applicable to randomly fluctuating Loads, e.g. industrial batch processing type Loads
  - Goal is to provide such premises with an incentive to take such Load off-line and/or to prevent such Load from coming on-line during an EILS event
- **EILS Resources assigned to the alternate baseline must**
  - Reduce Load to a level at or below its declared Minimum Base Load within 10 minutes of notification, and
  - Keep actual Load at or below that level for the duration of the event

# Load Profiling Roles

- **Prescreening**

- Baseline determination

- All premises in the Resource must have the same Baseline methodology

- Provide suggested upper limit Bid amount based on historical usage and minimum base Load



# Suggested Bid Upper Limit

- **ERCOT will review the historical interval data to determine an bid upper limit amount that would have been supported for the baseline assignment**
  - This upper limit is provided for information purposes only
- **Bidder must anticipate future Load levels during the upcoming contract period and bid accordingly**
- **Bid upper limit is determined by the Load availability calculation which is different for the two baselines**
  - Availability calculation is also part of post-contract period performance evaluation

# Load Profiling Roles

- **Prescreening**

- Baseline determination

- All premises in the Resource must have the same Baseline methodology

- Provide suggested upper limit Bid amount based on historical usage and minimum base Load

- **Performance during the Contract Period**

- **Availability**



# Default Baseline Availability Factor

- **ERCOT will determine whether the committed Load was available for interruption at least 95% of the hours in the contract period**
  - Availability Factor = percentage of total hours that committed Load was available
  - If (Actual Load - Minimum Base Load  $\geq$  MW bid quantity) the interval is considered available
  - Exempted intervals:
    - Intervals during which any step of an EECF is in effect
    - Scheduled Periods of Unavailability
      - Up to 2% of hours in a Contract Period, with a notice requirement of five Business Days in advance
- **Availability factor will be calculated at the aggregate level for aggregated EILS Resources**
  - Individual Loads summed over all participants and compared to the bid as above
- **Payment will be reduced if availability factor drops below 0.95**
  - If availability factor is 0.95 or greater, it will be reset to 1.0

# Alternate Baseline Availability Factor

- **ERCOT will determine whether the committed Load was available for interruption for the contract period**
  - Availability factor = [(average Load – minimum base Load) / bid quantity]
  - Average Load is computed across intervals in the contract period
    - Exempted intervals:
      - Any hours than any step of an EECF is in effect
      - Scheduled Periods of Unavailability
        - Up to 2% of hours in a Contract Period, with a notice requirement of five Business Days in advance
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# Load Profiling Role

- **Prescreening**

- Baseline determination

- All premises in the Resource must have the same Baseline methodology

- Provide suggested upper limit Bid amount based on historical usage and minimum base Load

- **Performance during the Contract Period**

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- Event Performance

- Determined at the Resource level for aggregated bids



# Event Performance

- **The Event Performance Factor (EIPF) is the arithmetic average of the Interval Performance Factors (IPF) for the entire curtailment event**
  - The IPF for the Default Baseline is computed as follows:  
 **$IPF = (\text{Baseline Load} - \text{Actual Load}) / \text{Bid kWh}$**
  - The IPF for the Alternate Baseline is computed as follows:  
 **$IPF = \text{Minimum base Load} / \text{Actual Load}$**
  - If  $IPF < 0$  then  $IPF = 0$ , if  $IPF > 1$  then  $IPF = 1$
  - The fraction of the first and last intervals of the curtailment event is incorporated in the IPF calculation
- **IPF will be calculated at the aggregate level for aggregated EILS Resources**
  - Individual Loads summed over all participants and IPF calculated as above
- **Payment will be reduced if EIPF drops below 0.95**
  - If availability factor is 0.95 or greater, it will be reset to 1.0

# Program Status

## Contract Period -- February 1 through May 31, 2008

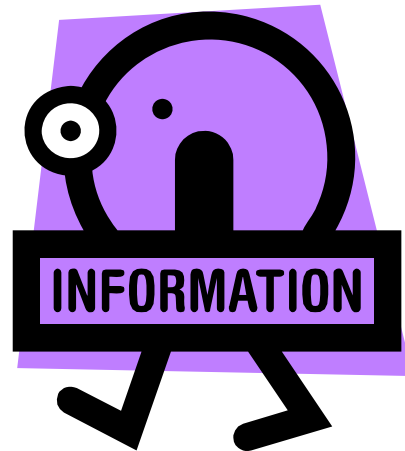
	<b>Business Hours</b>	<b>Non Business Hours</b>
	8am - 8pm Mon-Fri	All Other Hours
<b>MW Procured</b>	262	185
<b>Total Dollars</b>	\$2.6 million	\$2.7 million
<b>Dollars per MWH</b>	\$9.73	\$7.86
<b>Individual Bids</b>	5	5
<b>Aggregated Bids</b>	5	2

## Next Contract Period – June 1 through September 30, 2008

- **Will introduce new time periods to accommodate temperature sensitive Loads**
- **Will allow statistical alternatives (sampling) as alternative to 100% IDR metering to allow small customer participation**
  - Ercot approved M & V plans will be required
  - ERCOT will recommend/approve sampling plans

## Link for Additional EILS Information

<http://www.ercot.com/services/programs/load/eils/index.html>



# Q & A

