Demand Response in ERCOT

Presenter: Diana Ott Rios
Email : diana.rios@ercot.com
Phone: 512-248-3934

Overview of ERCOT Market

ERCOT – How we came about

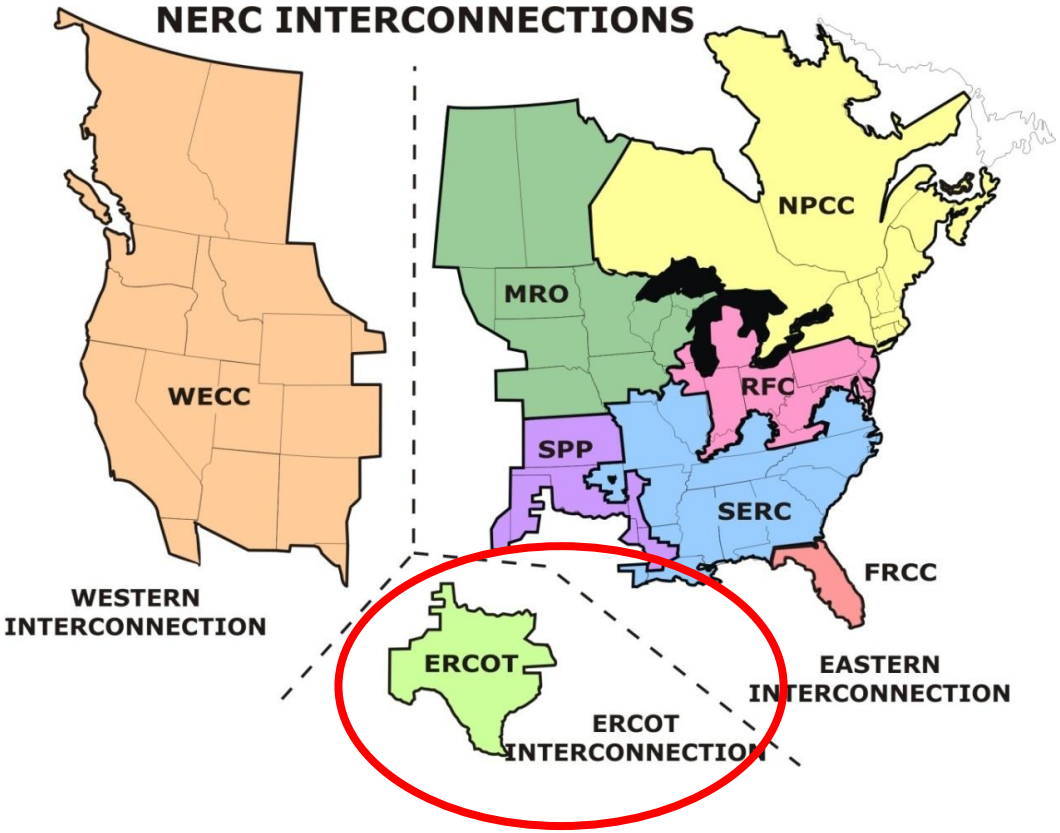
The Texas Legislature restructured the Texas electric market in 1999 by unbundling the investor-owned utilities and creating retail customer choice in those areas, and assigned ERCOT four primary responsibilities:

- System reliability – planning and operations
- Open access to transmission
- Retail switching process for customer choice
- Wholesale market settlement for electricity production and delivery

Membership-based 501(c)(4) nonprofit corporation, governed by a board of directors and subject to oversight by the Public Utility Commission of Texas and the Texas Legislature.

Members include consumers, cooperatives, generators, power marketers, retail electric providers, investor-owned electric utilities (transmission and distribution providers), and municipal-owned electric utilities.

U.S.- Canadian Bulk Power Grids



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

- The ERCOT Region is one of 3 grid interconnections in USA-Canada
- The ERCOT grid:
  - Covers 75% of Texas land
  - Serves 90% of Texas load
  - 68,305 MW all-time peak (Aug. 3, 2011)
  - >43,000 miles of transmission lines
  - >550 generation units
  - Physical assets are owned by transmission providers and generators, including municipal utilities and cooperatives

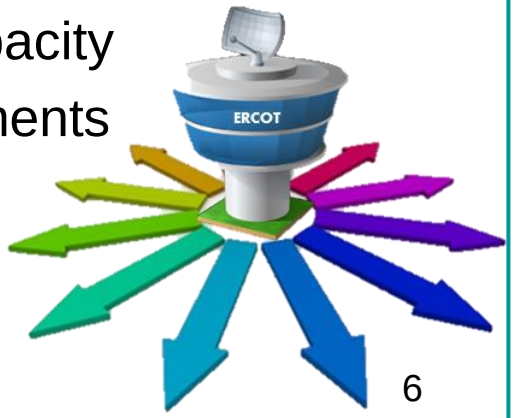
ERCOT – Quick Facts

- 24 million consumers
- Competitive-choice customers: 75% of load
  - More than 7 million electric-service ID's (premises)
  - AMI meters on nearly 100% of competitive - choice customers
- More than 74,000 megawatts (MW) capacity for peak demand
  - One megawatt of electricity can power about 200 Texas homes during periods of peak demand.
- Energy used in 2014: 340 billion kilowatt-hours
  - A 2.5 percent increase compared to 2013
- Market participants: More than 1,100 active entities that generate, move, buy, sell or use wholesale electricity
- Perform financial settlement for the competitive wholesale bulk-power market
- Administer retail switching for 7 million premises in competitive choice areas

ERCOT Grid Operations

ERCOT directs traffic on the grid to maintain reliability

- **'Air traffic controller' of the electric supply**
  - Coordinates scheduling of power by market participants
  - Dispatches generation to ensure power production matches Load at all times
  - Secures extra generation capacity to meet reliability requirements
  - Analyzes grid conditions continuously in real-time
  - Coordinates planned outages of generators and transmission lines
  - Relieves transmission system congestion – Nodal Market Dec 2010
  - Coordinates emergency actions & recovery
  - Operates markets to meet regional energy & capacity requirements not met through bilateral arrangements



Demand Response in ERCOT Region

Demand Response in ERCOT Region

- TDSP Load Management Programs
- Voluntary Load Response
- 4CP (Transmission Costs)
- Load Resources
  - Non-Controllable (NCLR)
  - Controllable (CLR)
  - Loads In SCED
- Emergency Response Service
  - 10-Minute ERS
  - 30-Minute ERS
  - 10-Minute Weather-Sensitive ERS
  - 30-Minute Weather Sensitive ERS

TDSP Load Management Programs

- Programs designed to help TDSPs meet their Annual Energy Efficiency Goals set by the PUCT.
- Available
  - From 1-7 pm weekdays (except holidays)
  - June – September months only
- Dispatched by ERCOT instruction as early as EEA Level 2
- Programs vary slightly across TDSPs
- Approx. 222 MWs

Voluntary Load Response

- Price Responsive Customers
  - Customers respond voluntarily when real time energy prices go high
  - Special Demand Response incentives from REPS—as simple as a communicating programmable t-stat to more sophisticated dispatchable products
  - Follow us on Twitter and Facebook
  - ERCOT App

- ERCOT conducting ongoing studies to determine:
  - How much (MWs)
  - Trigger mechanisms

What is 4CP?

- The Four Coincident Peaks in ERCOT are the highest-Load 15-minute settlement intervals in each of the four summer months (June, July, August, September)
- These intervals are the basis of various Transmission & Distribution (T&D) charges for much of the ERCOT Load
  - Non-Opt In Entities (Muni's and Co-ops), at the boundary meter level
  - Retail Choice customers with peak demand ≥700 kW (Interval Data Recorder meter required)

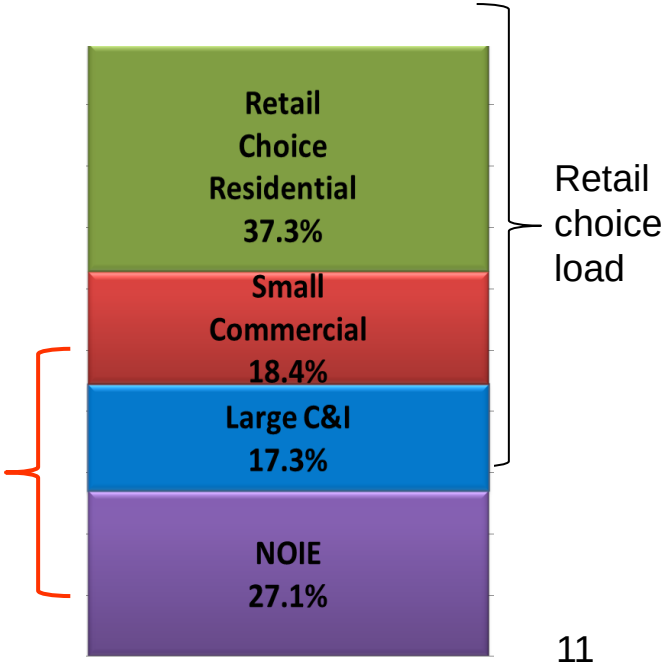


Chart represents percentages of Load at IE 1700 on Aug. 3, 2011, ERCOT's all-time system peak

"Large C&I" = IDR Required

Load Resources

Load Type	Service	Requirements	Description/Notes
Non-Controllable Load Resources (NCLR)	Responsive Reserve Service (RRS)	• Interval metering • Telemetry • Under-Frequency Relay (instantaneous trip) plus 10-minute ramp capability • ERCOT Qualification	• Industrial Loads • 232 LRs with 3154 MW of total registered capacity • LRs limited to 50% of total RRS • Dispatched during Energy Emergency Alert (EEA) or automatically due to frequency drop
Controllable Load Resources (CLR)	Regulation Service Responsive Reserve Service	• Interval metering • Telemetry • Ability to move load in both directions in response to AGC-type signals • Governor-type frequency response • ERCOT Qualification	• Industrial Loads and storage devices with sophisticated control systems and ramping capability • Must move automatically in both directions • Very limited participation

Beginning June 1, 2014

Controllable Load Resources	Energy Only or Non-Spinning Reserve Service	• Interval metering • Telemetry • Ability to follow SCED Base Points • ERCOT Qualification	• Existing CLRs or • Aggregated Commercial and Residential Loads (ALRs) • Energy Bids considered by SCED • May set SCED clearing price

Emergency Response Service (ERS)

What is Emergency Response Service?

- An additional emergency tool for ERCOT operators to reduce the likelihood of involuntary firm load shedding (a.k.a. rolling blackouts)
- Deployed ONLY in the late stages of a grid emergency as a last resort prior to firm load shedding (rotating outages)

"Controlled interruption of prepared customers
vs.
uncontrolled interruption of unprepared customers"

When will ERS be needed?

- Emergencies can occur at any time:
  - Cold weather months -- due to natural gas curtailment & higher than expected forced outages
  - Shoulder months -- due to unforeseen weather events & large amounts of scheduled maintenance
  - Traditional summer peaks
  - Anytime, as may be caused by:
    - generation outages (scheduled, forced or both)
    - transmission outages beyond likely contingencies
    - extreme weather events
    - multiple simultaneous contingencies
- ERS may be more likely to be needed in off-peak or shoulder months than during traditional summer peaks

Firm Load Shedding History

Firm Load shedding has been ordered by ERCOT three times since 1989:

- 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
- February 2, 2011
  - Extreme cold
  - 8,000 MW of generation lost
  - Firm load shedding 5:43 AM – 1:07 PM ranging from 500 MW to 3,500 MW
  - Deployed Load Resources until 1:57 PM
  - Deployed ERS (EILS at the time) until 10:01 February 3

Other Emergency Events

Deployed ERS for Emergency Events

- August 04, 2011
  - Loss of Large Generation
  - Deployed ERS from 15:44:31 until 18:09:42
- January 6, 2014
  - Sudden Loss of Generation
  - Deployed ERS-30 and ERS-10
    - ERS-30 deployed at 7:03:26
    - ERS-10 deployed at 7:07:27
    - Recalled both at 7:53:16

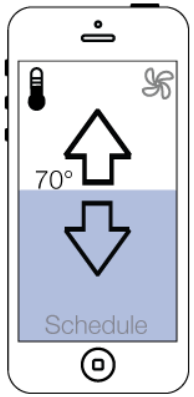
ERS Service Types

Non-Weather-Sensitive 10 and 30 minute ERS

- 10-Minute Deployed as early as EEA Level 2
- 30-Minute Deployed as early as EEA Level 1

Weather-Sensitive ERS 10 and 30 minute ERS

- Only available for June-September SCT
- 10-Minute Deployed as early as EEA Level 2
- 30-Minute Deployed as early as EEA Level 1
- QSE can modify the population of a WS ERS Load over the contract term



Types of Resources in each Service Type

Non-Weather-Sensitive ERS:

- Loads
  - Residential
  - Commercial
- Back-up-Generation capable of being deployed within specified ramp rates
- Distributed Generation capable of injecting energy within specified ramp rates

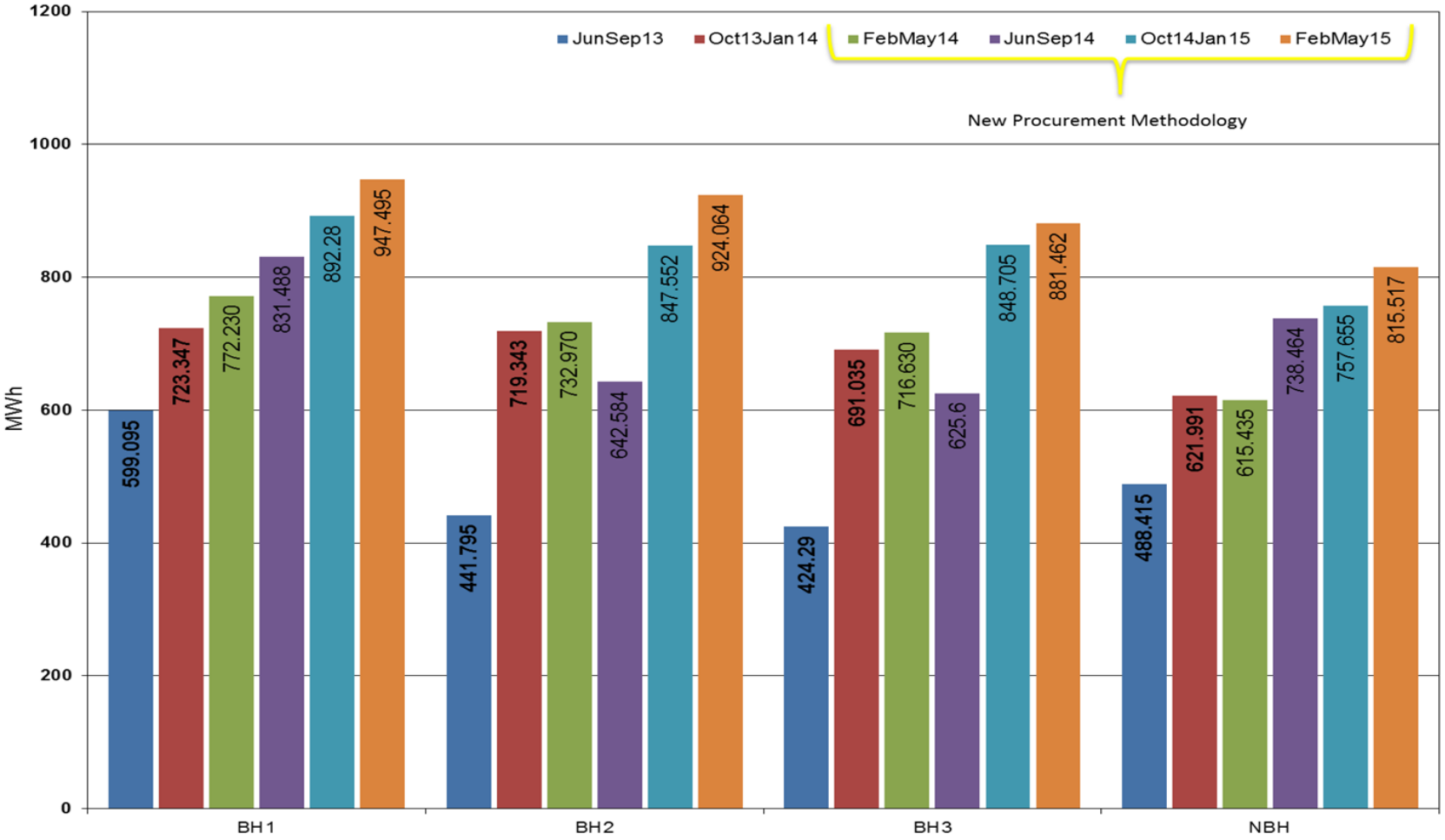
Weather -Sensitive ERS: *Loads with demand response capability that varies by weather*

- Must qualify as weather-sensitive based on the accuracy of the regression baseline evaluation methodology and meet minimum accuracy standards established by ERCOT
  - Residential - exclusively
  - Commercial - exclusively

ERS Changes to Procurement Methodology

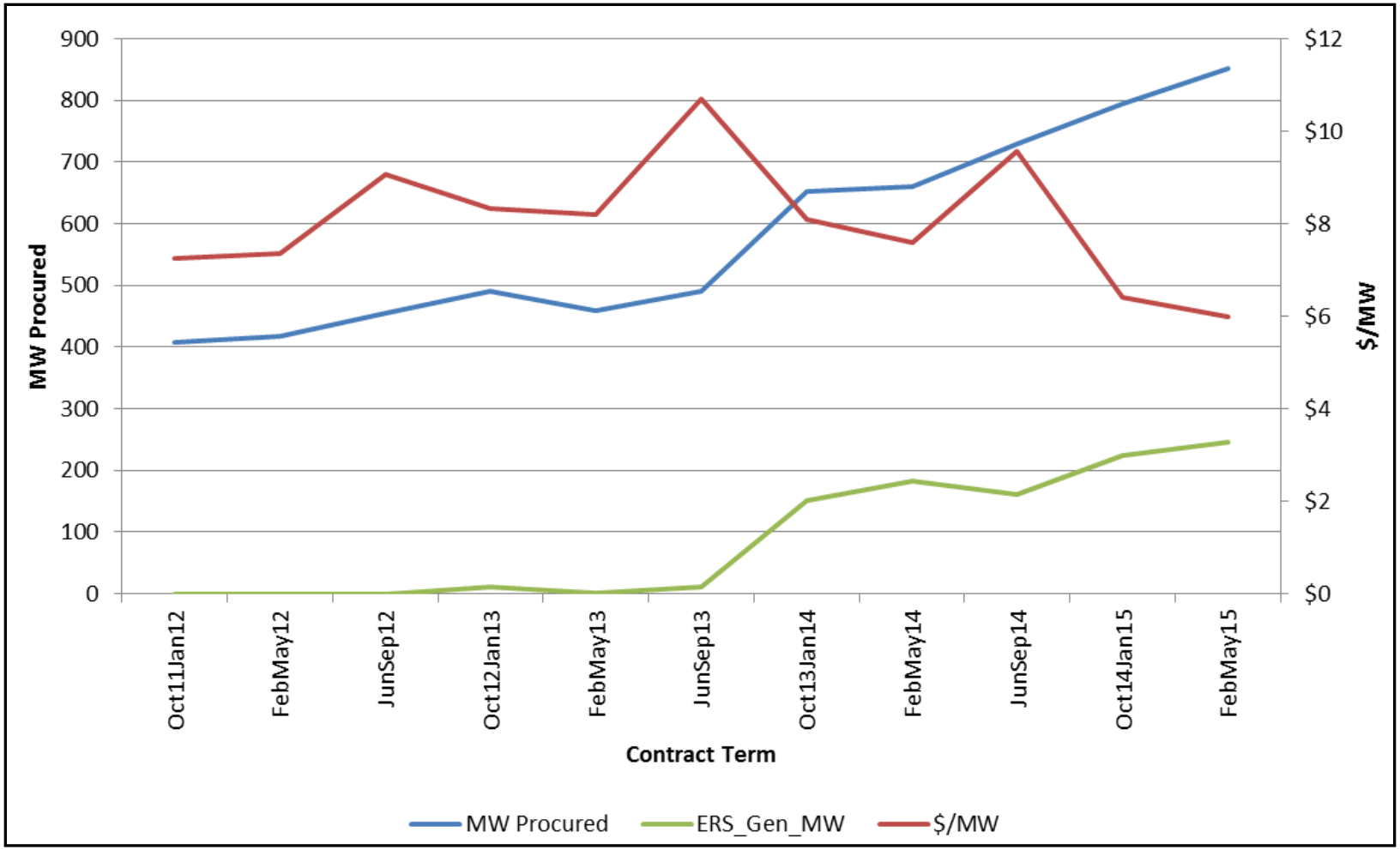
- Beginning Feb-May 2014 ERCOT moved away from **pay-as-bid** to a **market clearing** process.
- The new procurement methodology was implemented to better allocate the $50 million per year expenditure limit to each of the twelve time periods in the program year according to the expected relative need for the service in each time period.
  - Key factor used in the allocation is the potential risk of ERCOT entering into an EEA during the time period
- Observed a sizable increase in the amount of procured capacity
  - For summer peak hours in 2014, ERCOT observed a 50% increase in the number of participating resources from 2013 to 2014
- Observed a reduction in the average cost per MW per hour

ERS MW Procurement



For summer peak hours in 2014, ERCOT observed a 50% increase in the number of participating resources from 2013 to 2014

Weighted Average MW Procured vs Average Cost per MW



ERS Program observed a reduction in the average cost per MW per hour

Offering Requirements

- Interval metering required
  - In ERCOT systems from TDSPs
  - Provided by QSE
- Minimum offer
  - Aggregations of sites allowed
  - 100 kW for Non Weather- Sensitive
  - 500 kW for Weather- Sensitive
- Offers may vary by time period
- QSE must be capable of receiving an ERCOT Verbal Dispatch Instruction and capable of receiving XML instructions
- Load Resources may participate in ERS but cannot be dually committed to ERS and another Ancillary Service

ERS
Approved Baselines

ERS Approved Default Baselines

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

- **"*Drop-by*" baselines:**
  - Regression
  - Mid 8 of 10
  - Matching Day Pair
  - Control Group – Residential Only

- **Baseline Methodology:**
  - First three baselines include a scalar day-of-adjustment
  - The default baseline Load estimate at the moment of ERS deployment will be compared to the actual Load during the event to quantify the Load reduction
    - Baseline Load – Actual Load ≥ 0.95 × Offer MW
  - Actual Load data is IDR 15-minute data
  - Comparisons for beginning interval based on the fraction of the interval during the event allowing for 10 or 30 minute response to ERS notification
  - Last partial interval is not used in Performance Calculation

ERS Approved 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 ERS event

ERS Resources assigned to the alternate baseline must:

- Reduce Load to a level at or below its declared Maximum Base Load within the allowed ramp time (10 or 30 min) once notification is received
- Keep actual Load at or below that level for the duration of the event

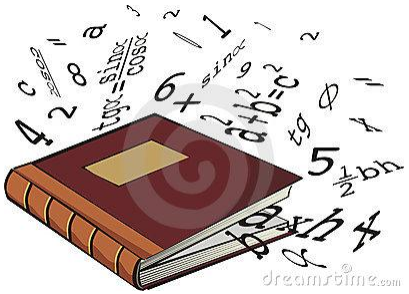
ERS
Performance Requirements

QSE Portfolio Performance Evaluation

Payments for ERS are based on QSE Level combined with Resource Level Performance Requirements

- **Non Weather-Sensitive ERS is paid to the QSE based on:**
  - QSE Level Availability,
  - QSE Level Event Performance, and
  - Resource Level Test Performance Results
  - Payment reductions are applied for different under-performance

- **Weather-Sensitive ERS performance and compensation to participants are based on the variable amount of load reduction actually provided**



QUESTIONS