



Introduction to ERCOT Wholesale Markets & Opportunities for CHP

2010 Combined Heat and Power Partnership Meeting

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ERCOT Region

75% of Texas land area

Includes Houston, Dallas, Fort Worth, San Antonio, Austin, Corpus Christi, Abilene and the Rio Grande Valley

Does not include:

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

85% of Texas load, 22 million Texans served

40,000 miles of Transmission Lines

more than 550 Generation Units

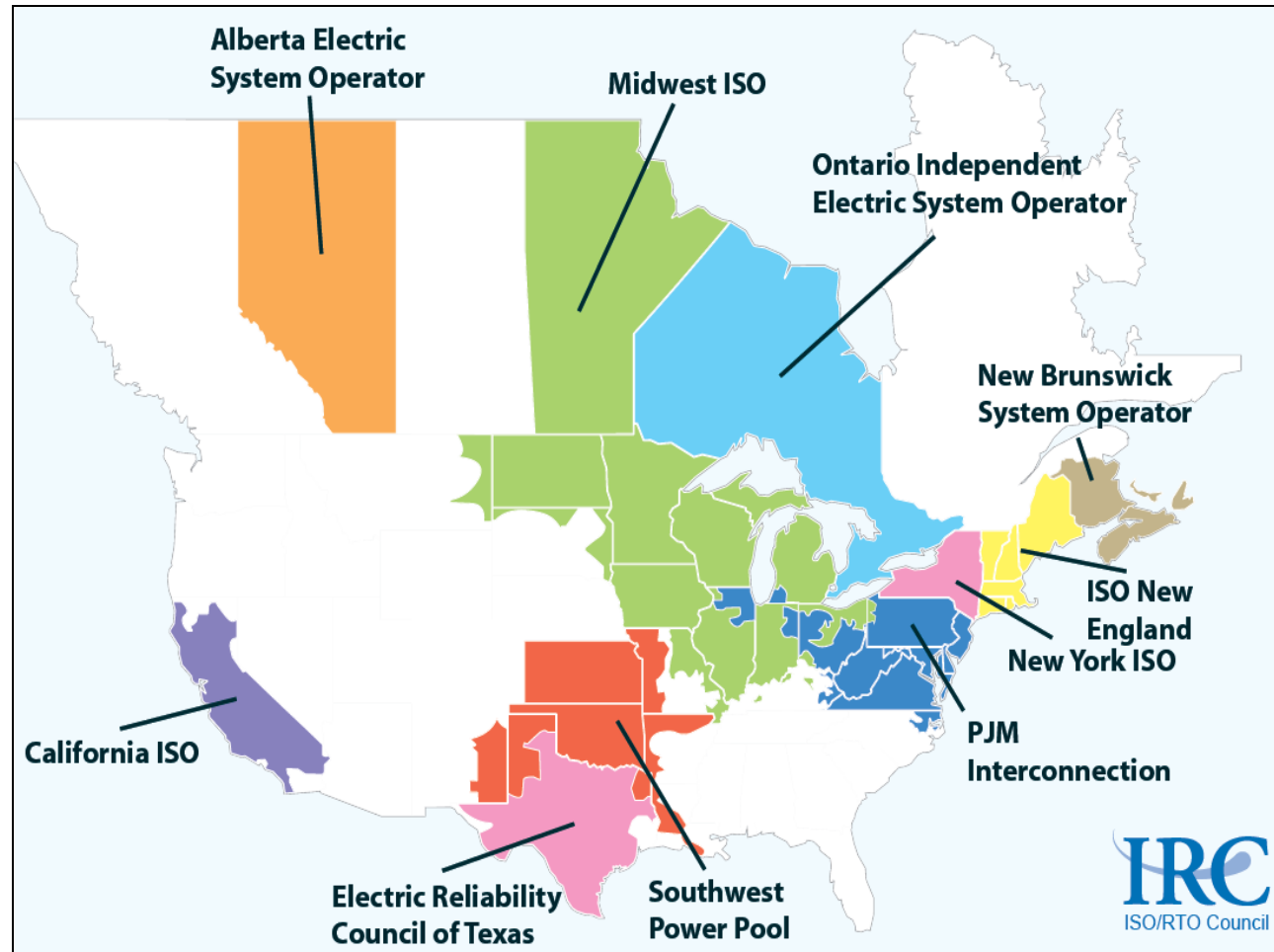
65,776 MWs – peak set 08/23/2010

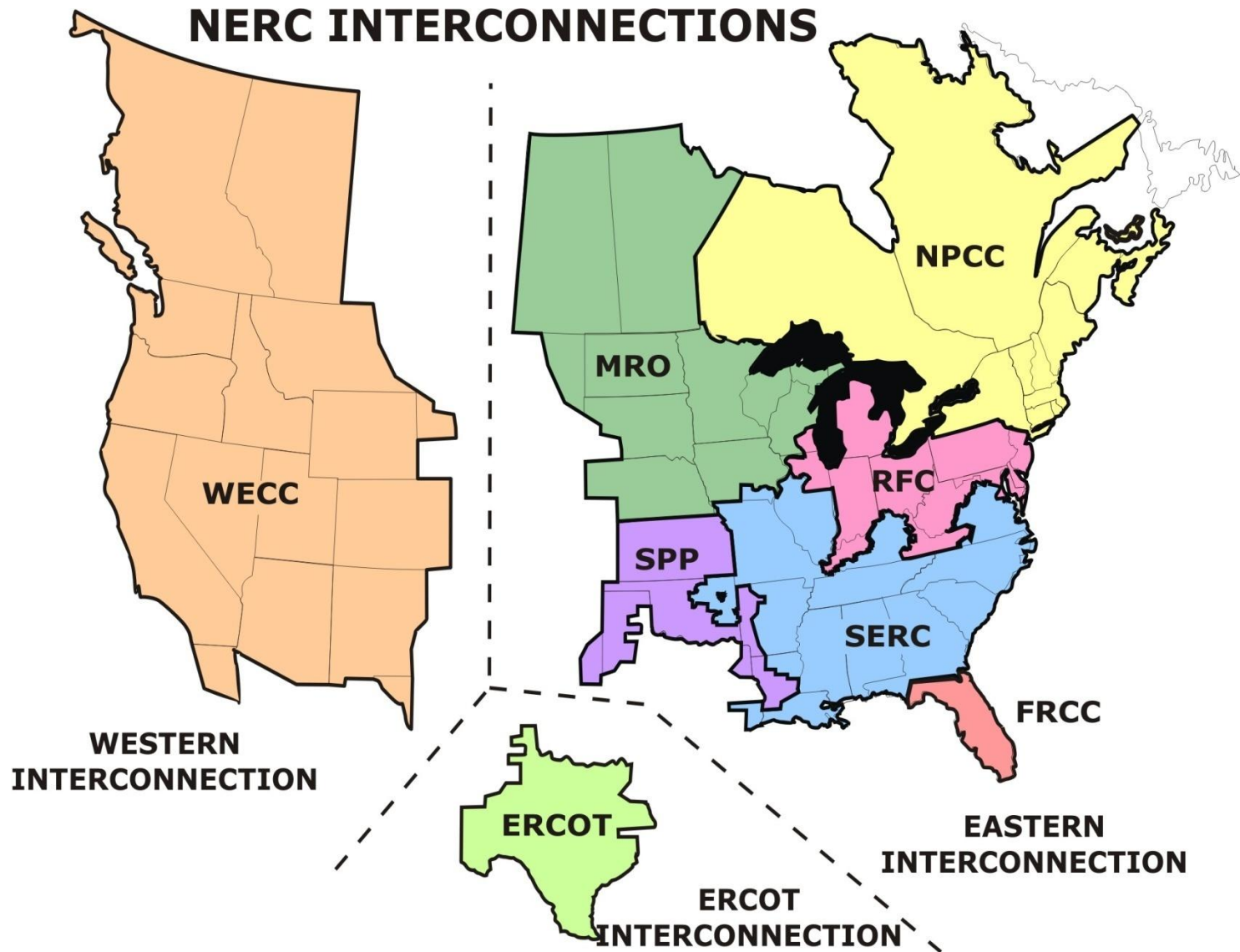


ERCOT Designated Independent System Operator

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

10 Independent System Operators / Regional Transmission Operators in North America



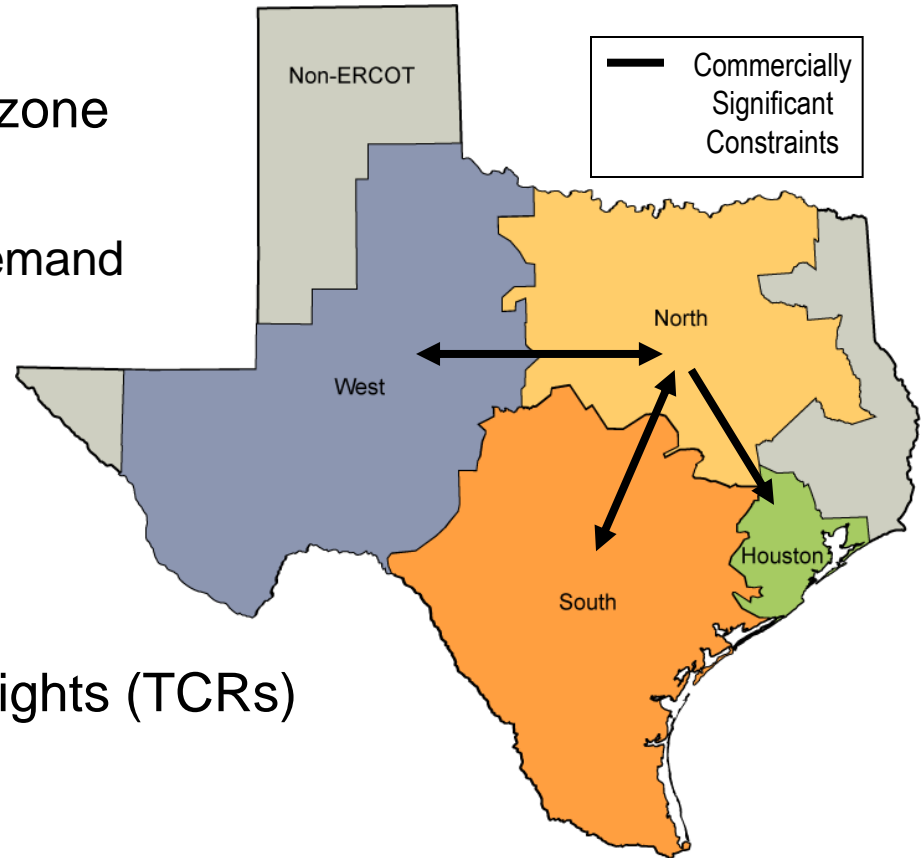


Zonal Balancing Energy

- Balancing Energy offers by zone
- Portfolio based dispatch
 - Balance generation with demand
 - Manage Zonal Congestion
 - Zonal prices for energy

Zonal Congestion Costs

- Costs are directly assigned
- Transmission Congestion Rights (TCRs) available for hedging

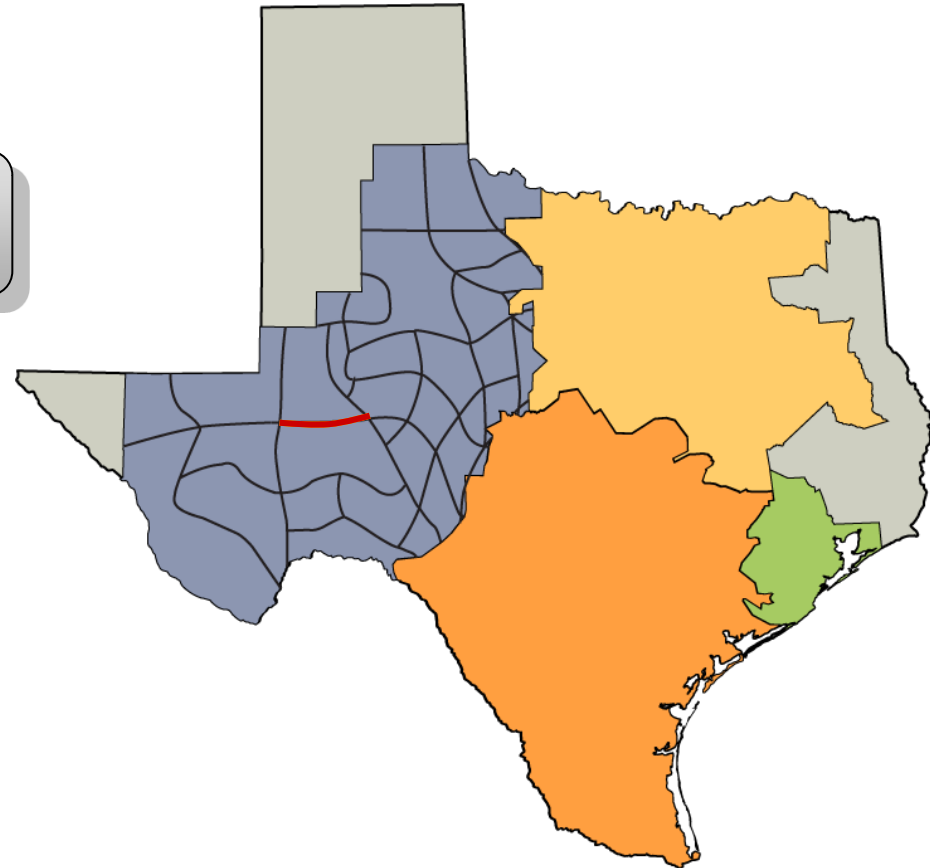


- **Shortcomings of Zonal Design**

Not all congestion is Zonal

- **Local Congestion**

- Cannot resolve with Zonal Balancing Energy
- Not market based



Shortcomings of Zonal Design

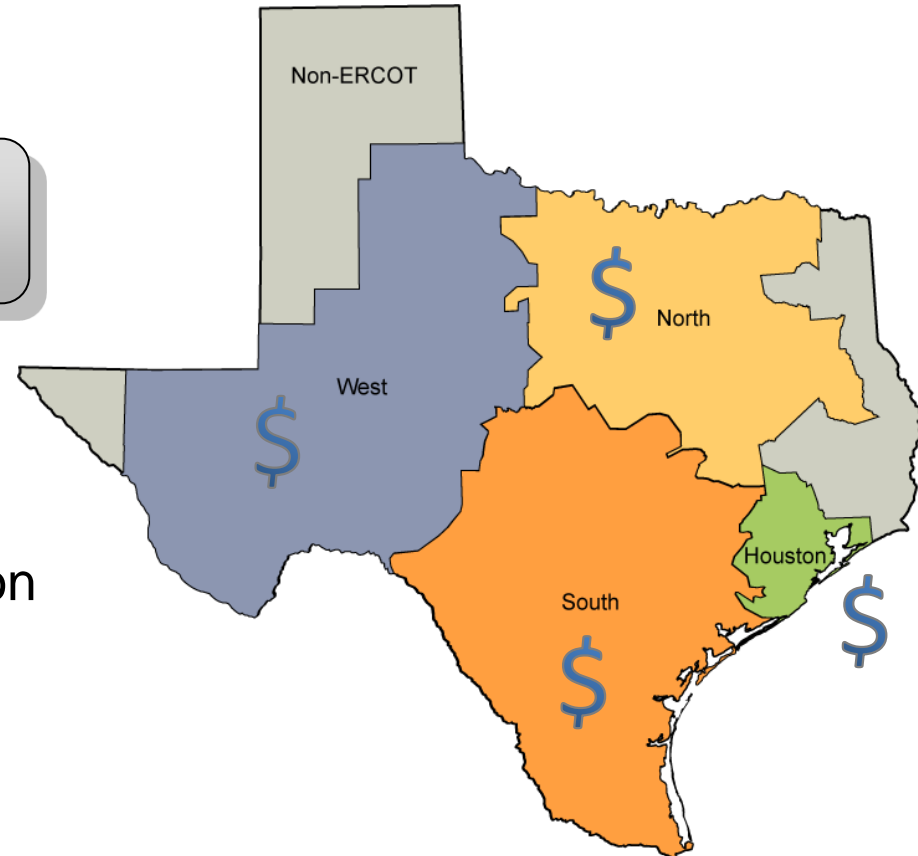
Prices do not reflect Local Congestion

Energy Pricing

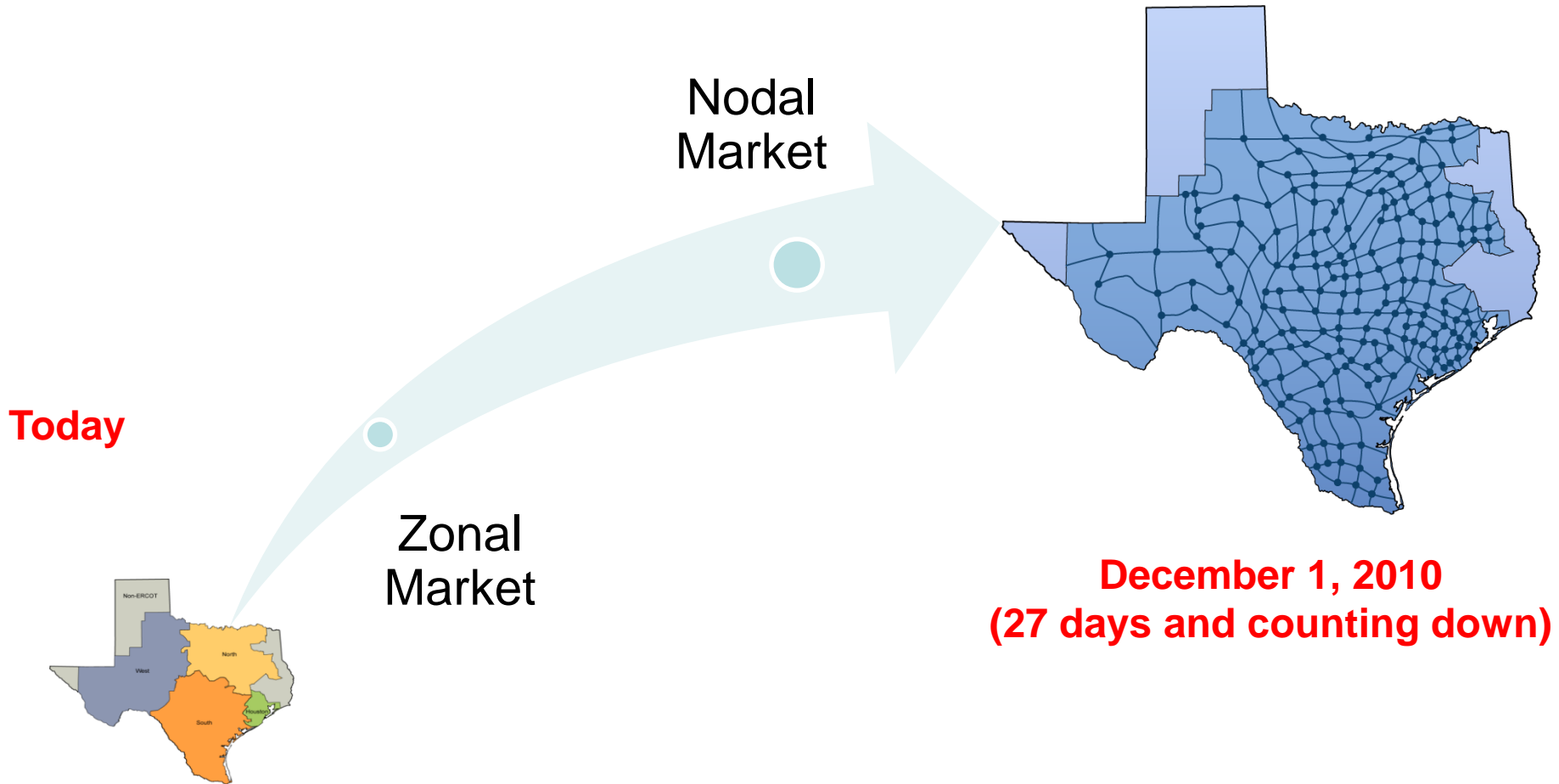
- Prices determined only for zones
- Prices only reflect Zonal Congestion

Local Congestion Costs

- Costs are uplifted to load
- No hedging mechanism



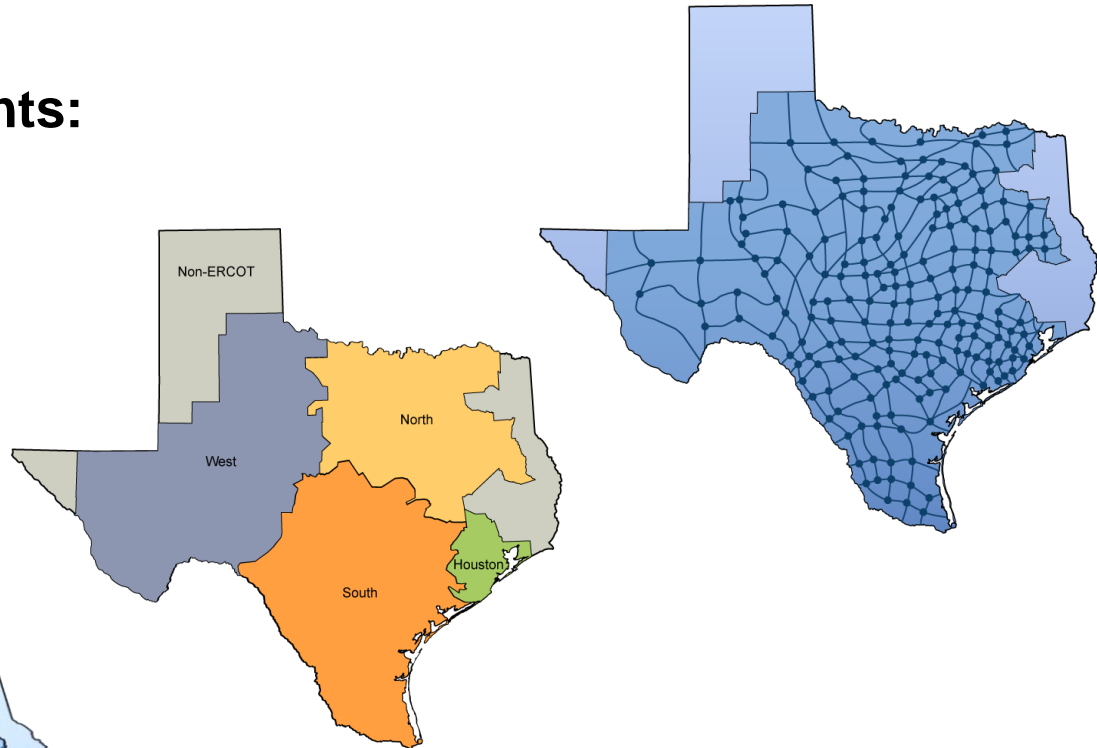
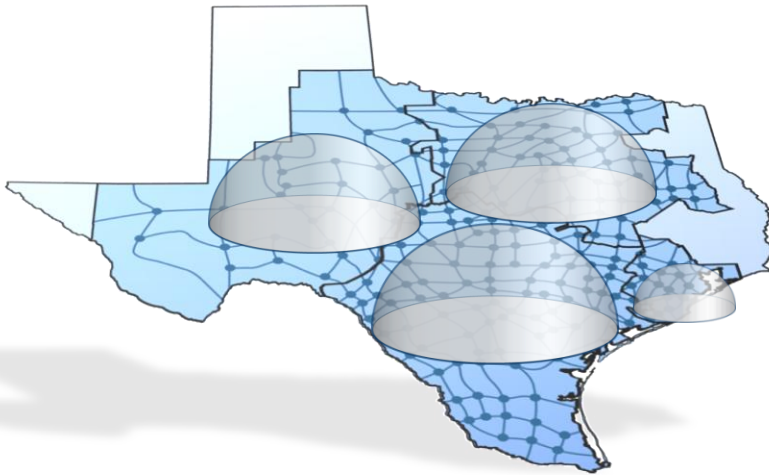
ERCOT's Changing



Nodal Real-Time Energy Settlements

Types of Settlement Points:

- Resource Nodes (500+)
- Load Zones (13)
- Hubs(6)



• **Settlement Point Prices are calculated from Locational Marginal Prices at each Electrical Bus.**

• **There will be more than 8200 LMPs**

ERCOT's Primary Responsibility is Reliability

- Match generation with demand
- Operate transmission system within established limits

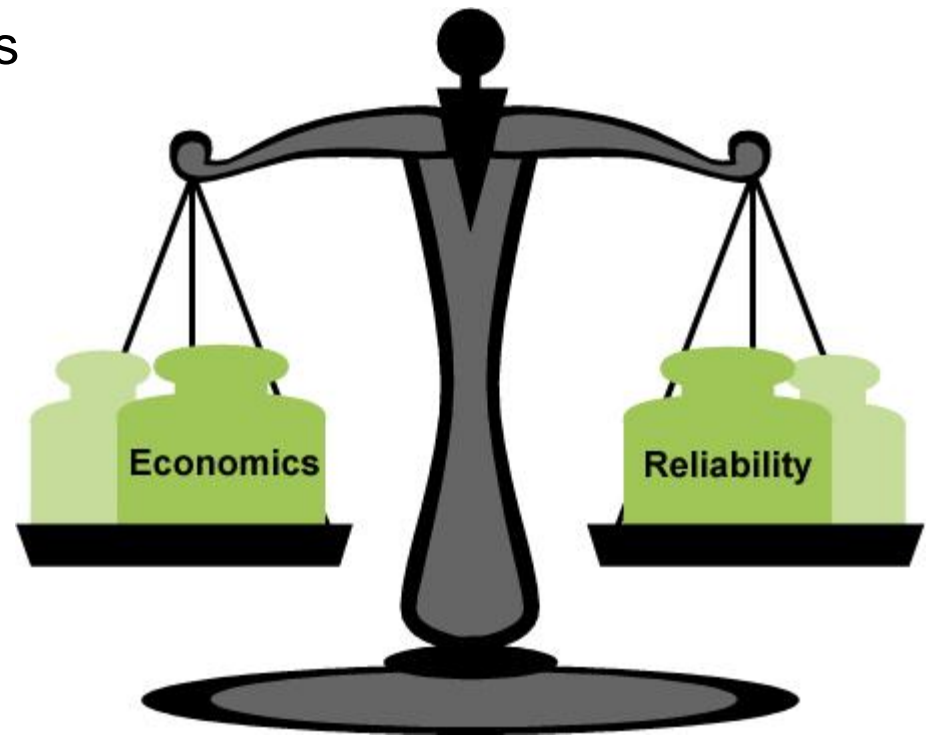


ERCOT facilitates competitive markets
to help achieve reliability.

Reliability and Competitive Markets

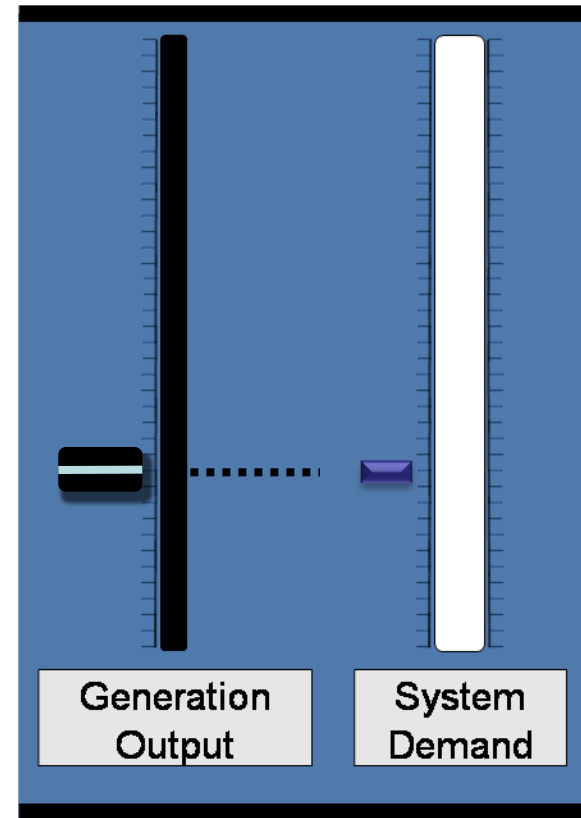
- Markets support reliability
- Reliability makes the markets possible

ERCOT finds the balance between Reliability and Economics.



Energy and Capacity

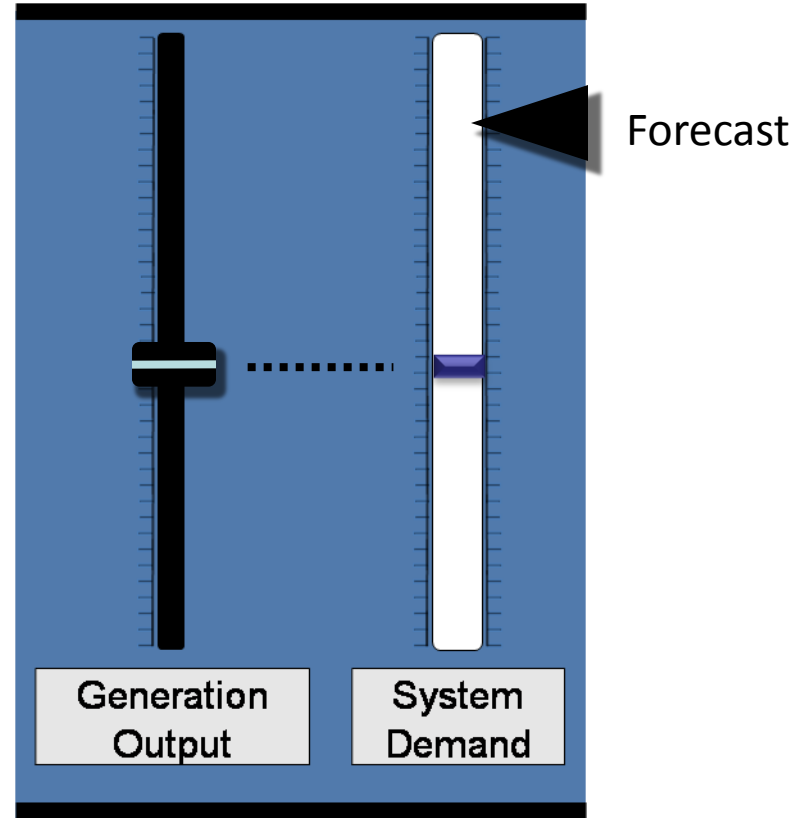
ERCOT dispatches Energy to follow the system demand.



Energy and Capacity

Capacity

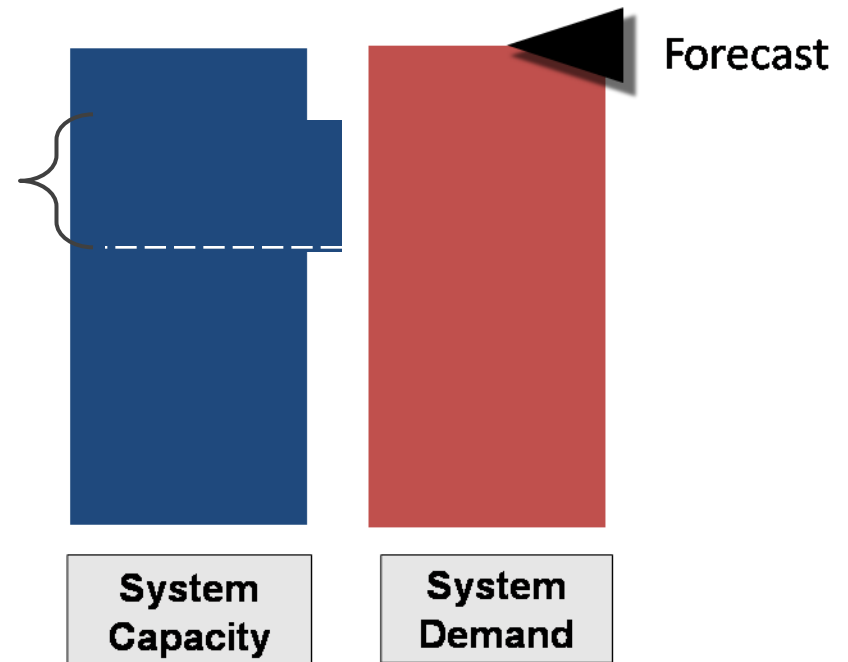
ERCOT must also ensure sufficient Capacity is on-line to meet the forecasted demand.



More about Capacity

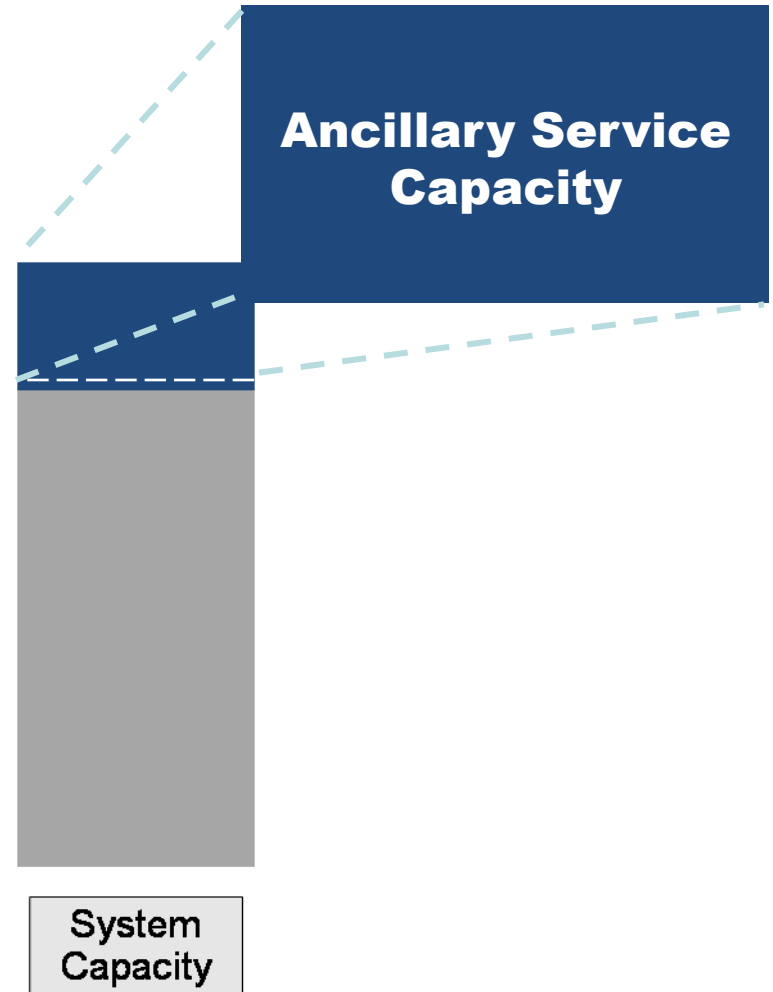
Capacity Reserved for Ancillary Services

Ancillary Service Capacity is reserved for responding quickly to changing conditions.



Ancillary Service Capacity

- Acquired through competitive markets



Nodal Ancillary Services

•A service necessary to support the transmission of energy to Loads while maintaining reliable operation of the Transmission Service Provider's (TSP's) transmission system using Good Utility Practice

- Regulation Up
- Regulation Down
- Responsive Reserve
- Non-Spin Reserve

- Voltage Support Services
- Black Start Service*

May be Self Provided, traded with other QSEs, or purchased in **Day Ahead Market**

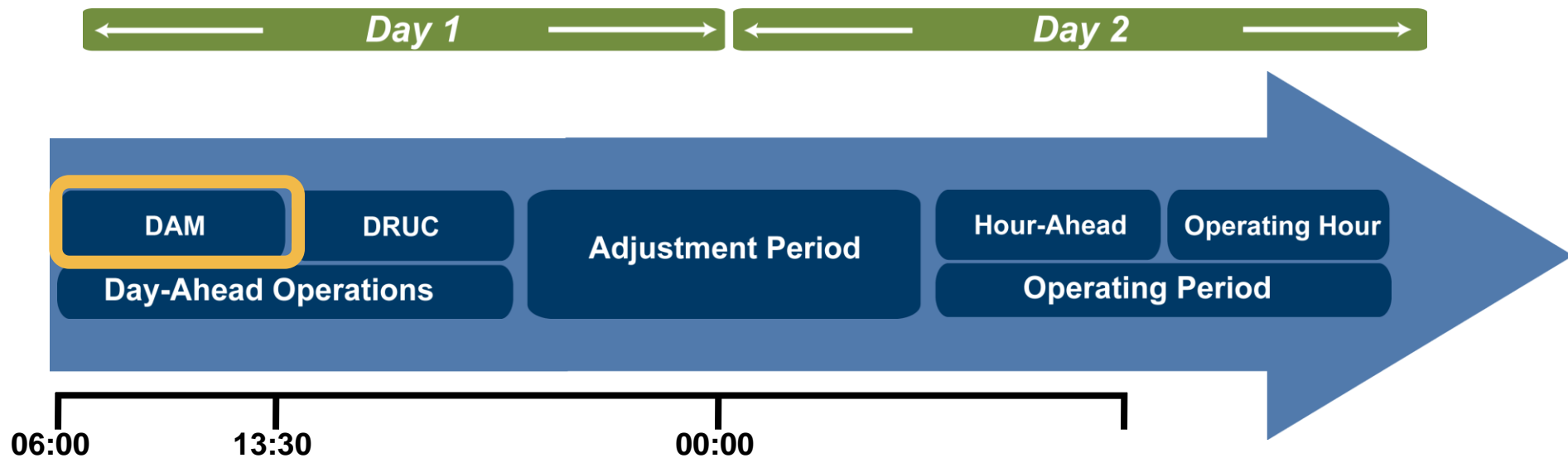
- May be provided by **Generation Resources** or **Load Resources**

Purchased by ERCOT and uplifted to all Load

Day-Ahead Market

When does the Day-Ahead Market occur?

- Market opens at 0600
- Clearing Process begins at 1000
- Results posted by 1330



The Nodal ERCOT market rules allow demand side Resources to provide Ancillary Services:

Resource Type	Service that can be Provided	Requirements
Non-Controllable Load Resource (Non-CLR)	Various Ancillary Services: <ul style="list-style-type: none"> • Responsive Reserve Service • Non-Spinning Reserve Service 	<ul style="list-style-type: none"> • IDR meter • Under-frequency Relay • Telemetry • ERCOT Qualification
Controllable Load Resource (CLR)	Various Ancillary Services: <ul style="list-style-type: none"> • Regulation Up Service • Regulation Down Service • Responsive Reserve Service • Non-Spinning Reserve Service 	<ul style="list-style-type: none"> • IDR meter • Telemetry • Automatic Governor Control (AGC) like control • ERCOT Qualification

So How can CHP participate in ERCOT's Wholesale Markets?

Depends on:

1. Size of generation (MWS)
2. Can your Generation be Modeled onto the ERCOT Network Model?
3. Registration Status

How ERCOT views Generation

- Generation greater than 10 MWs
- Non-Modeled Generator
- Distributed Generation (DG)

Participate In ERCOT Wholesale Markets

- If Generator is > 10 MWs and not registered with the PUCT as a self-generator then it **must** be registered with ERCOT as a **Generation Resource**
- Generator ≤ 10 MWs **may** register with ERCOT as a **Generation Resource**
- To Participate in ERCOT's Wholesale Markets (A/S, Energy, RUC, or SCED)
 - **Generator Must** be registered with ERCOT as a **Generation Resource**

Generation Resources (An ERCOT defined Term)

- *A generator capable of providing energy or Ancillary Service to the ERCOT System and is registered with ERCOT as a Generation Resource. The term “Generation Resource” used by itself in these Protocols does not include a Non-Modeled Generator.*

Participate In ERCOT Wholesale Markets

- If generator > 1 MW but ≤ 10 MWs **must** be registered as **either** a **Generation Resource** or a **Non-Modeled Generator** (unless registered with PUCT as a self-generator)
- **Non-Modeled Generator (An ERCOT defined Term)**
 - *A generator that is:*
 - (a) *Capable of providing net output of energy to the ERCOT System;*
 - (b) *Ten MW or less in size; or greater than ten MW and registered with the PUCT according to P.U.C. SUBST. R. 25.109, Registration of Power Generation Companies and Self-Generators, as a self-generator; and*
 - (c) *Registered with ERCOT as a Non-Modeled Generator, which means that the generator **may not participate** in the Ancillary Service or energy markets, RUC, or SCED.*

Distributed Generation (DG)

- *An electrical generating facility located at a Customer's point of delivery (point of common coupling) ten megawatts (MW) or less and connected at a voltage less than or equal to 60 kilovolts (kV) which may be connected in parallel operation to the utility system.*

DGs are split into 2 categories

1. $DG \leq 1 \text{ MW}$
2. $DG > 1 \text{ MW}$
 - not registered with ERCOT
 - registered with ERCOT
 - » Registered as a Non-Modeled Generator
 - » Registered as a Generation Resource

Note: 1 MW is DG Registration Threshold

Generation Resource

- Provide Ancillary Services (offer into the Day-Ahead Ancillary Services Market)
 - Various A/S
 - » Regulation Service Up
 - » Regulation Service Down
 - » Responsive Reserve Service
 - » Non-Spinning Reserve Service
 - Receive market clearing price for capacity
- Participate in the Real-Time Energy Market (Energy Offer Curve)
 - Receive LMP at resource settlement point

Generation Resource

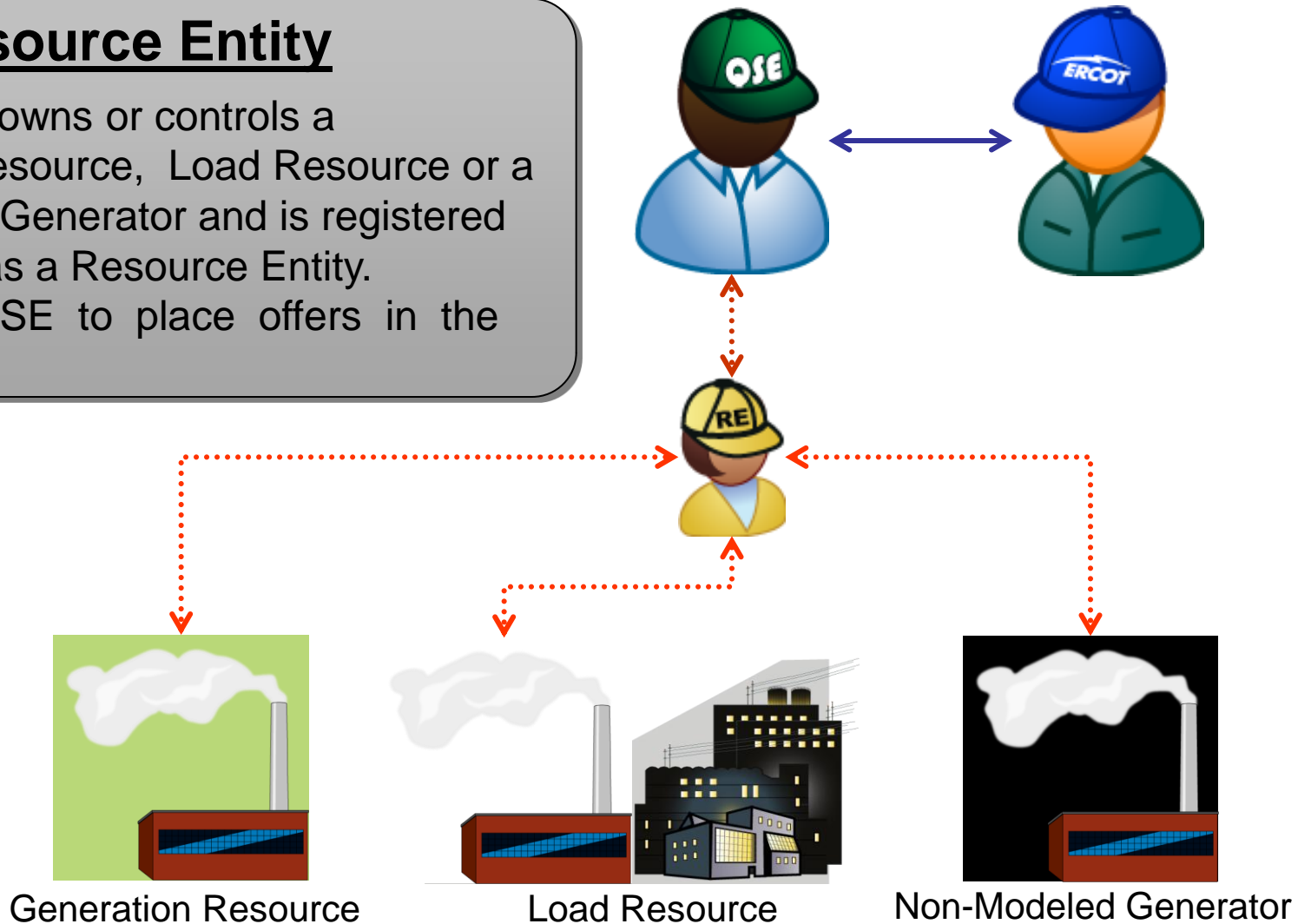
- Register with ERCOT as a Generation Resource
 - Complete Resource Asset Registration Form (RARF)
- Relationship with Qualified Scheduling Entity (QSE)
 - All communications are between ERCOT and QSE
 - Dispatch/Deployment through QSE
 - All financial settlements with QSE
- ERCOT Polled Settlement Meter (EPS) installed
- Meet telemetry requirements (ICCP Handbook)
- Meet performance criteria
- Qualified to provide Ancillary Services
 - separate test for each service
- Required to provide Primary Frequency Response

Distributed Generation

- $DG \leq 1 \text{ MW}$
 - is below the Registration Threshold
 - Settled as negative load (reduction of load aggregated under a Load Serving Entity)
- $DG > 1\text{MW}$ Registered as Non-Modeled Generation
 - Energy delivered to ERCOT from a Non-Modeled Generators shall be settled as Real-Time Energy Imbalance Payment or Charge at a Load Zone.
- $DG > 1 \text{ MW}$ Registered as a Generation Resource
 - Needs to meet all the requirements of a Generation Resource

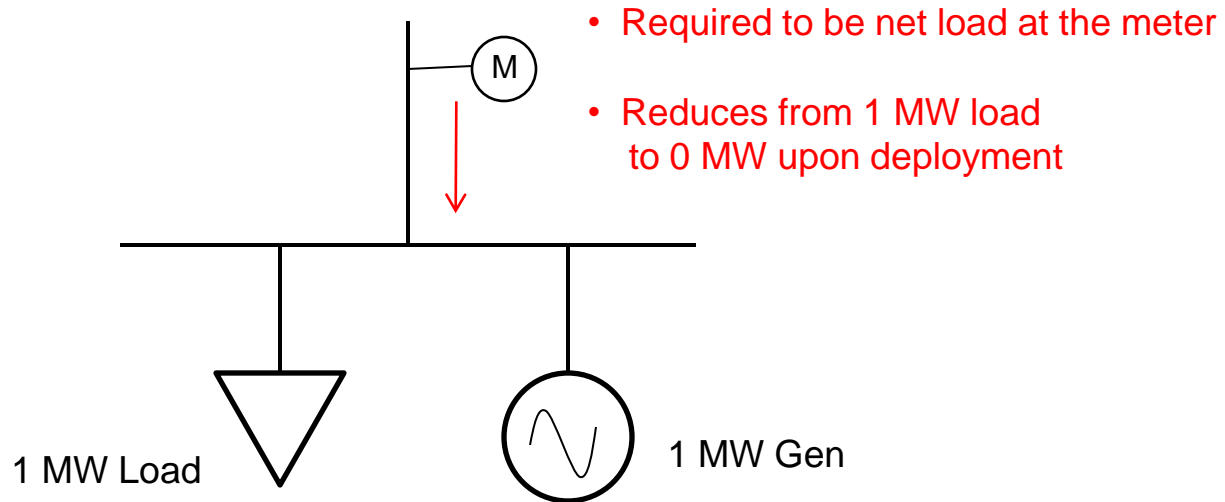
Resource Entity

- An Entity that owns or controls a Generation Resource, Load Resource or a Non-Modeled Generator and is registered with ERCOT as a Resource Entity.
- REs need a QSE to place offers in the DAM



Emergency Interruptible Load Service (EILS)

*A special emergency service consistent with subsection (a) of P.U.C. SUBST. R. 25.507, Electric Reliability Council of Texas (ERCOT) Emergency Interruptible Load Service (EILS), used during an Energy Emergency Alert (EEA) Level 2B to **reduce Load** and assist in maintaining or restoring ERCOT System frequency. **EILS is not an Ancillary Service.***





'Another tool for the operator toolbox'

EILS is:

- **Service provided by loads (customers) willing to interrupt during an electric grid emergency in exchange for a payment**
 - “Controlled interruption of prepared customers vs. uncontrolled interruption of unprepared customers”
- **An additional tool for ERCOT Operations, deployed ONLY in the late stages of a grid emergency**
 - Last resort prior to firm load shedding (rotating outages)
- **EILS Resources may be individual Loads or aggregations**
- **Must have:**
 - 15-minute interval metering or statistically valid sample approved by ERCOT
 - Capability of interrupting at least 1 MW of load on 10 minutes notice at any time during the committed hours

How EILS Works

- **EILS Resources must be represented by a Qualified Scheduling Entity (QSE) with a wide-area network agreement with ERCOT**
 - Must have 24/7 operations that can receive the verbal dispatch instruction
 - QSE (not ERCOT) is responsible for notifying the customer
- **QSEs representing selected EILS Resources are paid a capacity payment to be available for interruption**
 - No additional payment from ERCOT if deployed
- **ERCOT's only financial relationship is with the QSE**
- **Payment to the EILS Resource (customer) is a private contractual issue between the customer and the QSE**
- **Participants are paid as bid if ERCOT accepts their offer**
 - Historically, payments have ranged from ~\$7 to ~\$11 per MW per Hour



Contract Periods & Time Periods

- **EILS is procured for 4-month Contract Periods**
 - February thru May
 - June thru September
 - October thru January
- **Participants may bid to provide the service for one or more Time Periods:**
 1. Business Hours 1: 8AM to 1PM Monday-Friday*
 2. Business Hours 2: 1PM to 4PM Monday-Friday*
 3. Business Hours 3: 4PM to 8PM Monday-Friday*
 - * Except ERCOT Holidays
 4. Non-Business Hours: All other hours
- **Time Periods are designed to allow flexibility in for customers during traditional business hours**



- **ERCOT Operations orders an EILS deployment via a phone call to the all-QSE hotline**
- **EILS Resources must reduce load according to their commitment and baseline assignment within 10 minutes of the QSE's receipt of the instruction**
 - Must maintain this performance until released
- **ERCOT Operations will release EILS Resources after the emergency is over via another hotline call**
 - Must be back online and ready to perform within 10 hours of the release
- **EILS Resources are subject to a maximum of 2 deployments (or 8 hours) per Contract Period**
 - If a deployment event is still in effect when the 8th hour expires, EILS Resources must remain offline until recalled by ERCOT Operations

Questions?

