Demand Response and ERCOT Grid Reliability

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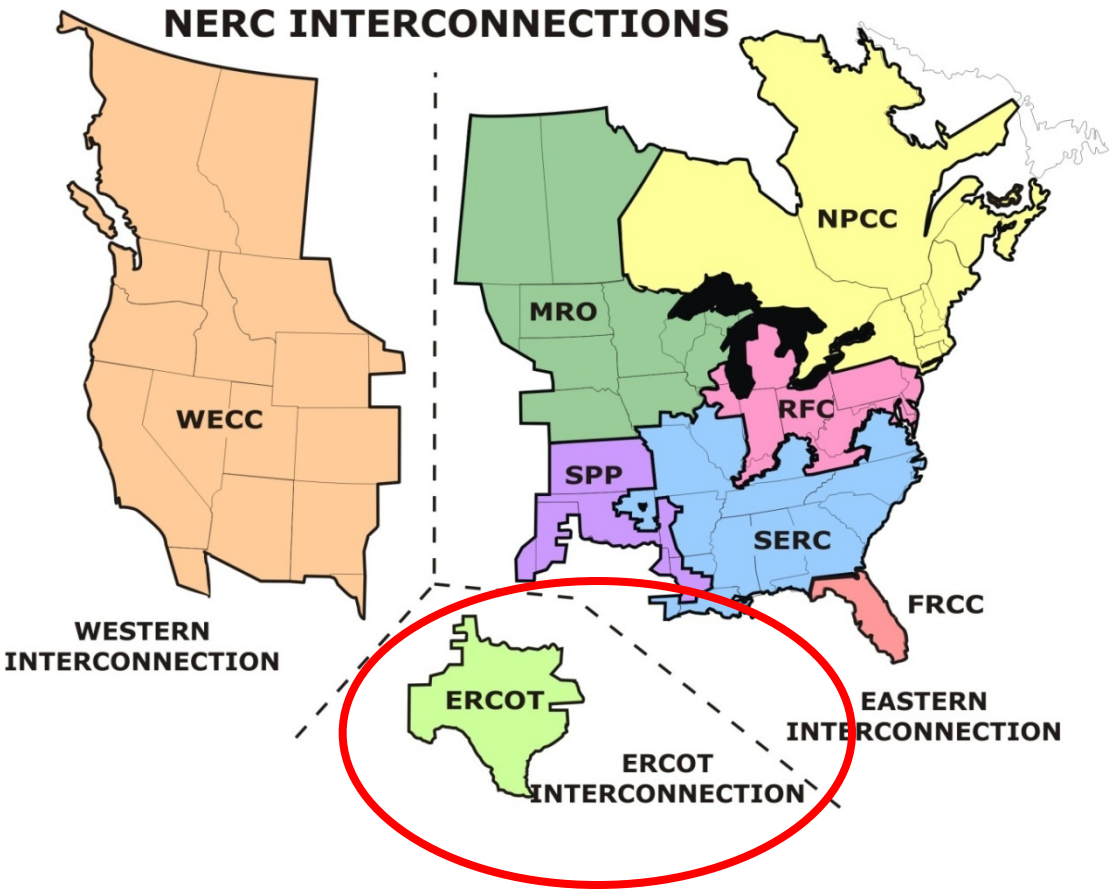
North American Bulk Power Grids

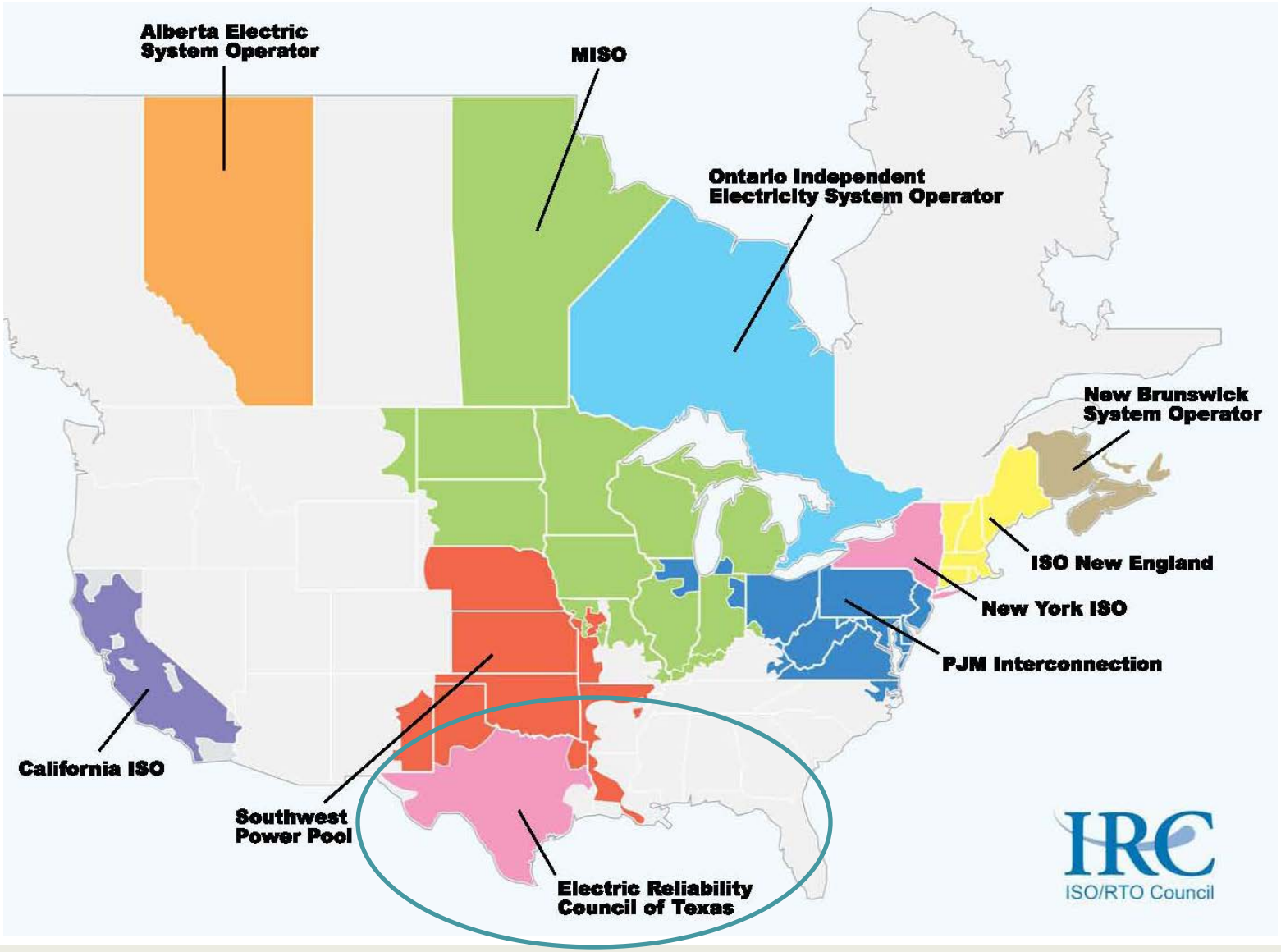


ERCOT connections to other grids are limited to direct current (DC) ties, which allow control over flow of electricity

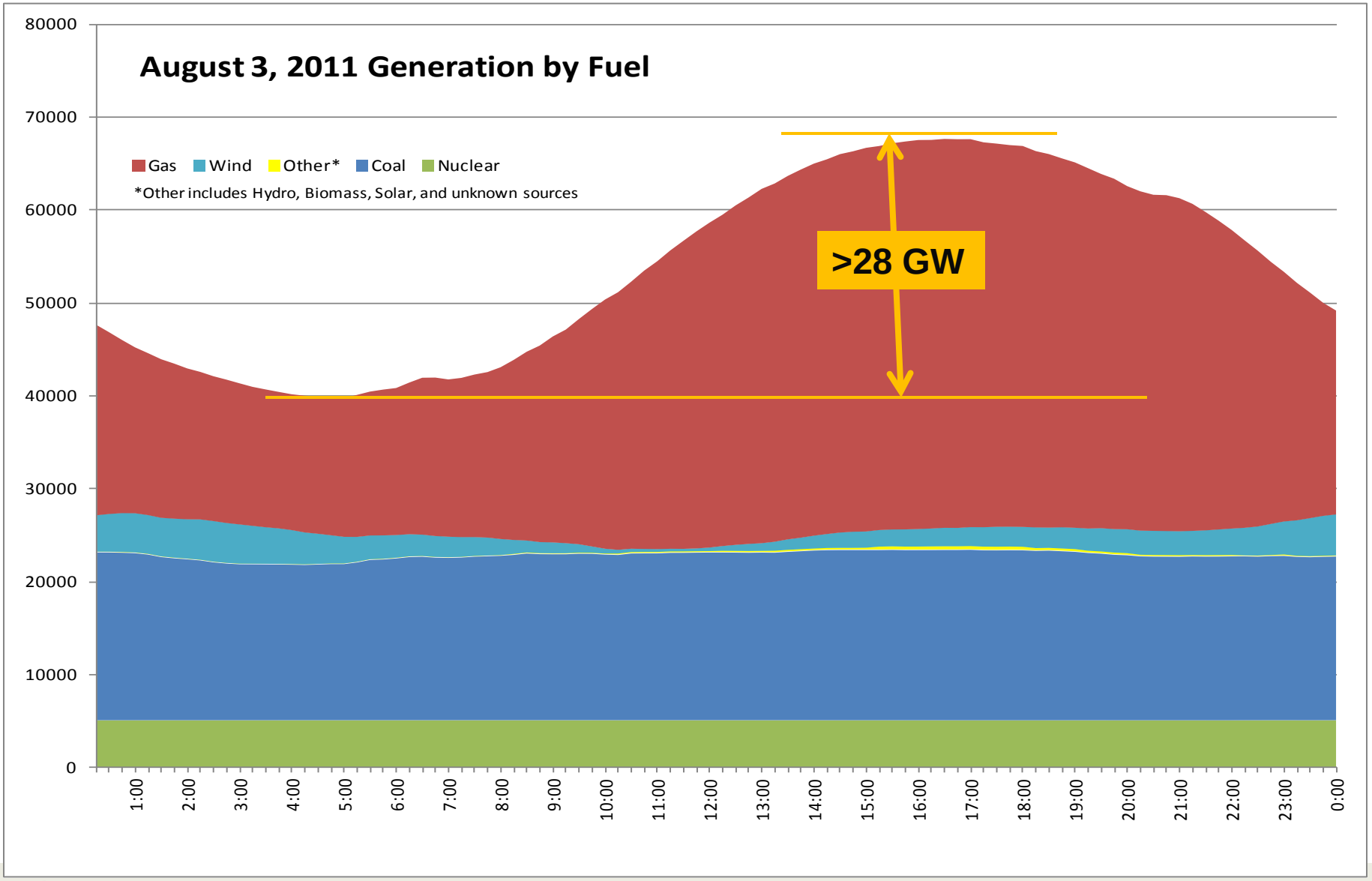
- The ERCOT Region is one of 3 grid interconnections in USA-Canada
- The ERCOT grid:
  - Covers 75% of Texas land
  - Serves 85% of Texas load
  - >40,000 miles of transmission lines
  - >550 generation units
  - Physical assets are owned by transmission providers and generators, including municipal utilities and cooperatives

North American ISOs and RTOs

Independent System Operators and Regional Transmission Organizations are the 'air traffic controllers' of the bulk electric power grids



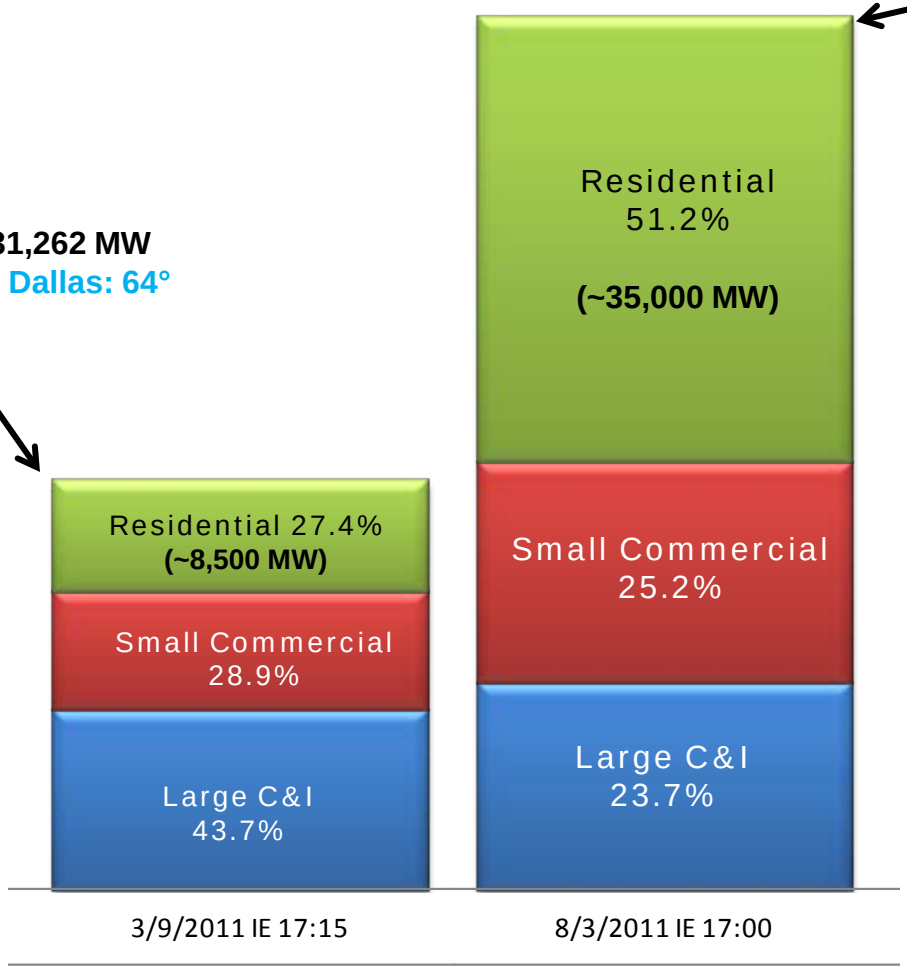
Peak Load Fuel Mix



Off-peak vs. on-peak load by customer type

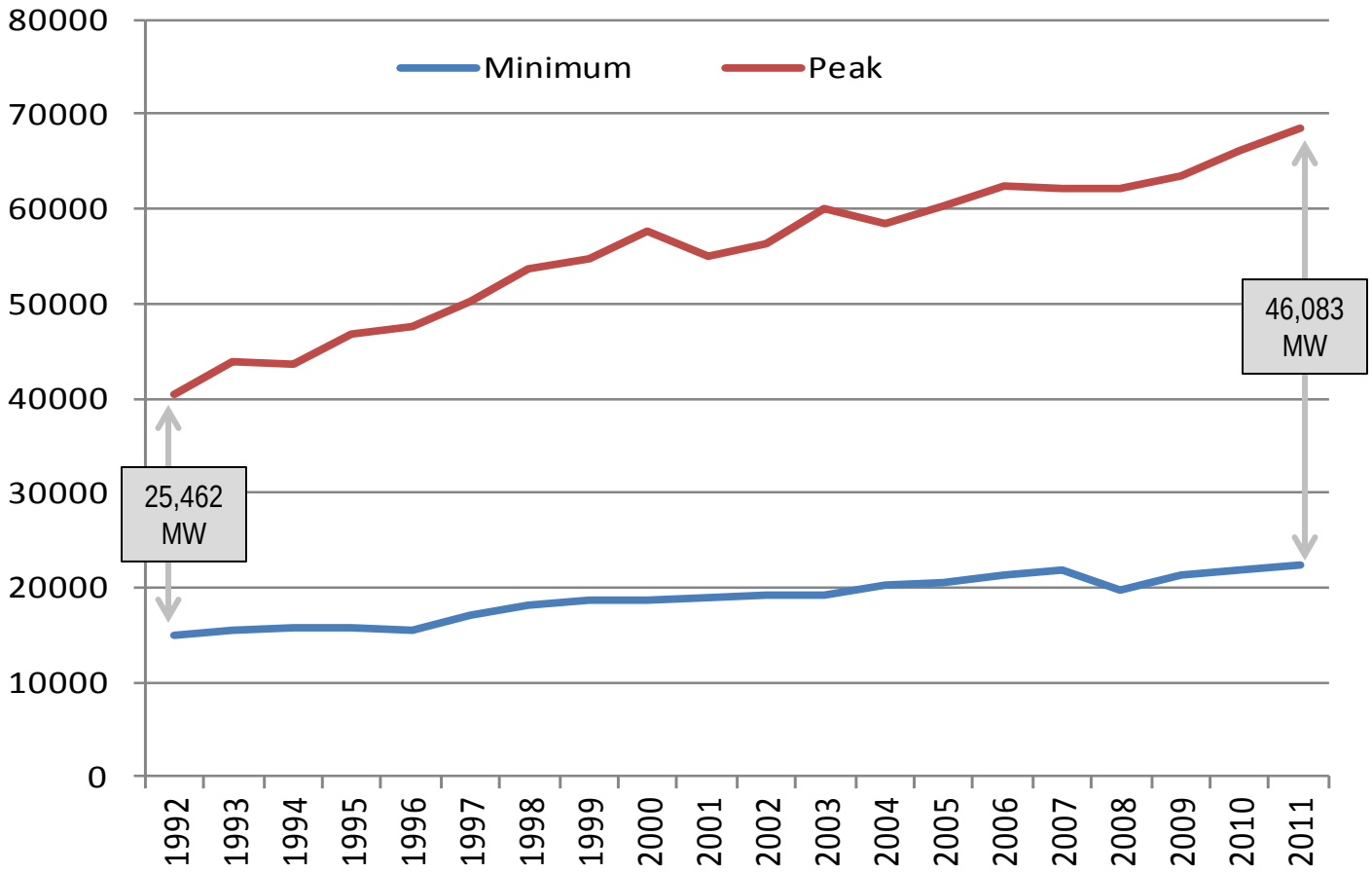
Wednesday
March 9, 2011
5:15 PM
ERCOT Load: 31,262 MW
Temperature in Dallas: 64°

Wed., Aug. 3, 2011
5:00 PM
ERCOT Load: 68,416 MW
Temperature in Dallas: 109°



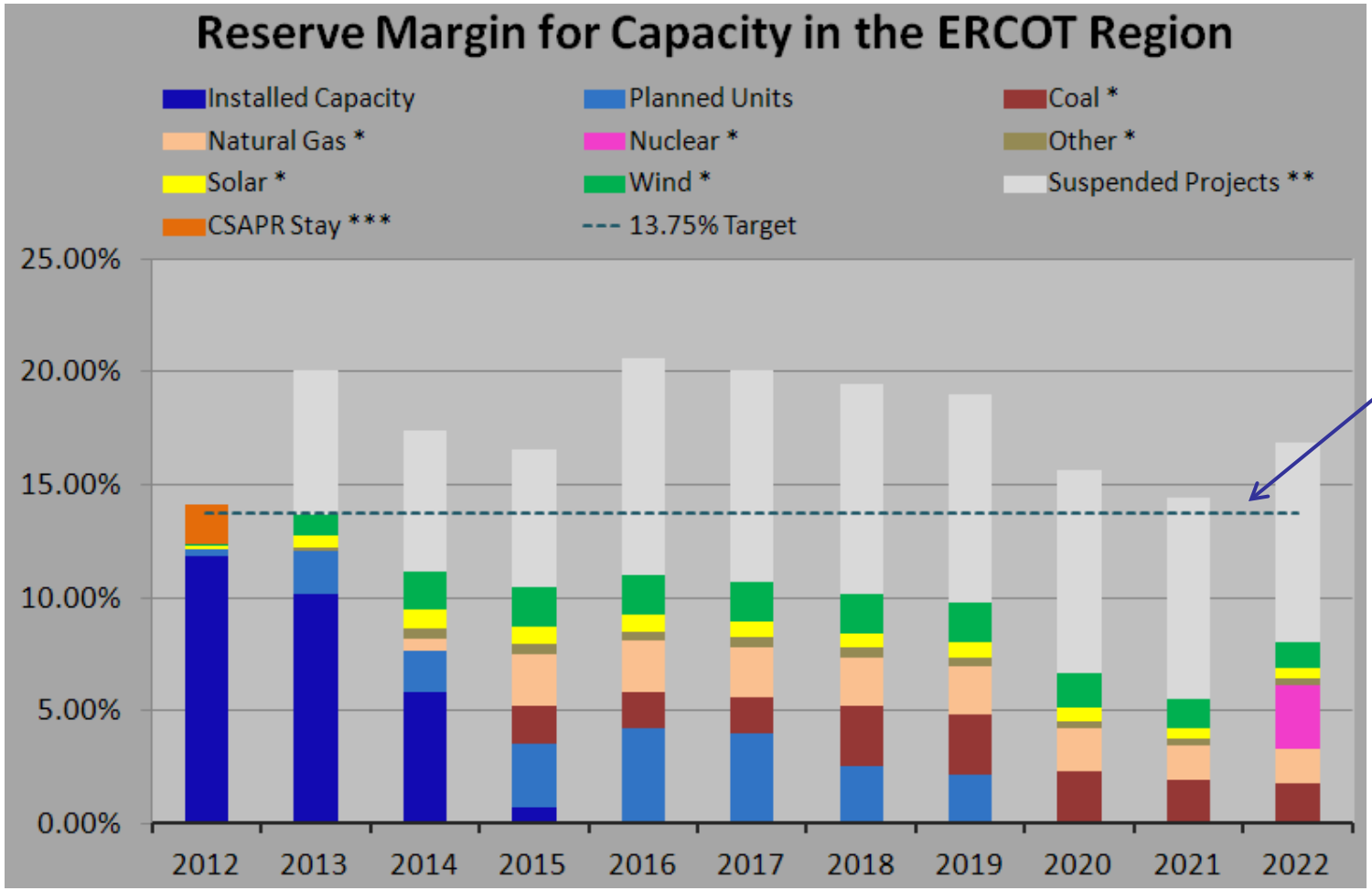
- **Customer class breakdown is for competitive choice areas; percentages are extrapolated for munis and co-ops to achieve region-wide estimate**
- **Large C&I are IDR Meter Required (>700kW)**

2 decades of peak vs. minimum demand



Annual system peak hours vs. lowest load hours

Resource Adequacy



* Projects undergoing full Interconnection studies - may be cancelled or delayed beyond the commercial dates shown

*** Monticello 1&2 – 1130MW (as a result of a federal court's order to stay EPA's CSAPR)

Definitions of Demand Response

- **'The short-term adjustment of energy use by consumers in response to price changes or incentives.'** (FERC)
- **'Changes in electric use by demand-side resources from their normal consumption patterns in response to changes in the price of electricity, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized.'** (NERC)
- **'A temporary change in electricity consumption by a Demand Resource in response to market or reliability conditions.'** (NAESB)

- **Common threads: A change in Load in response to a signal**

DR potential in ERCOT

- **FERC estimated >18 GW of DR potential in Texas by 2019**
  - 'Full participation scenario' assumes default dynamic pricing tariff
  - Attributed to high peak demand
  - This would represent 20-25% of total ERCOT peak

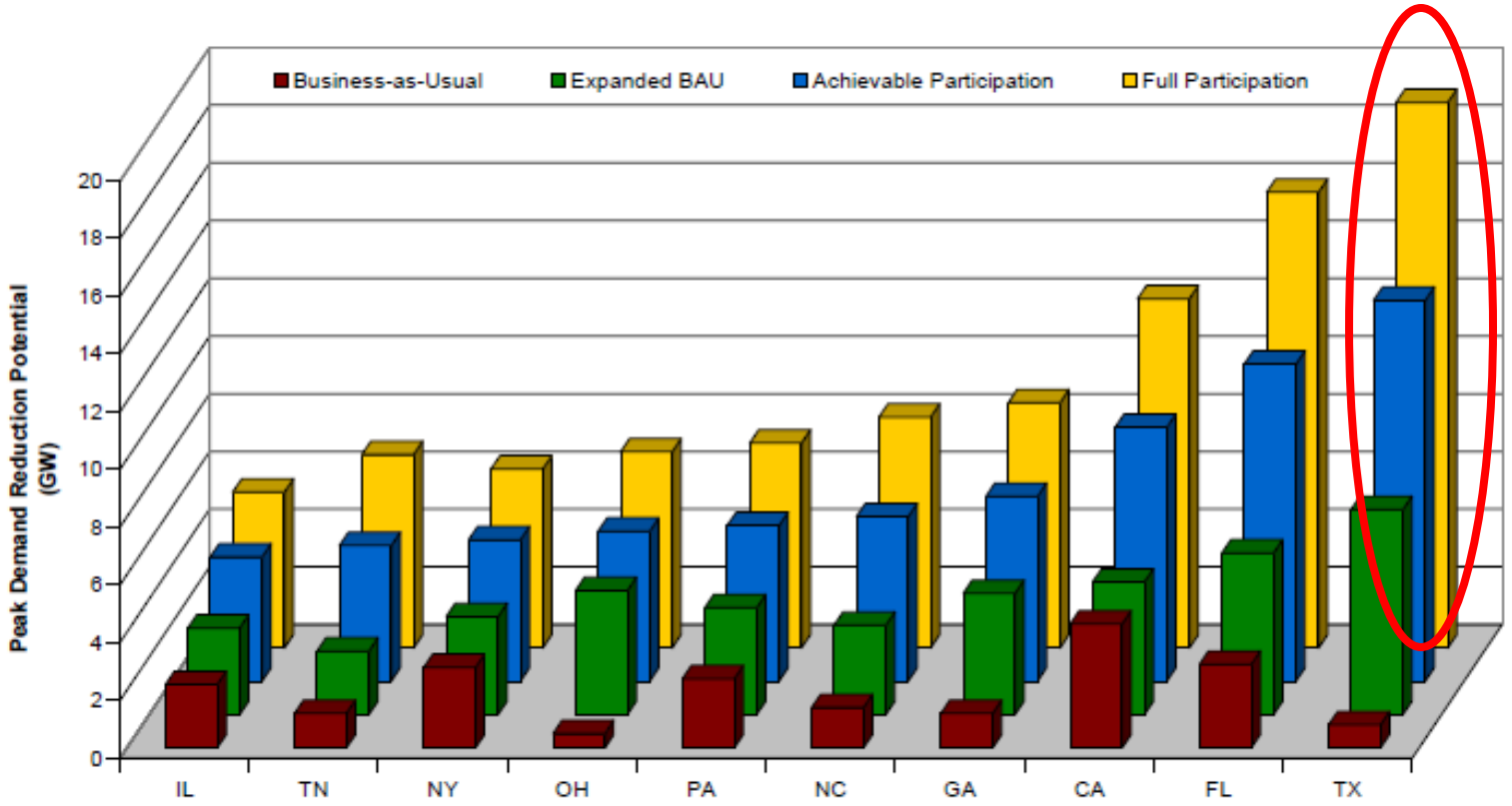


Figure 16: Top Ten States by Achievable Potential in 2019 (GW)

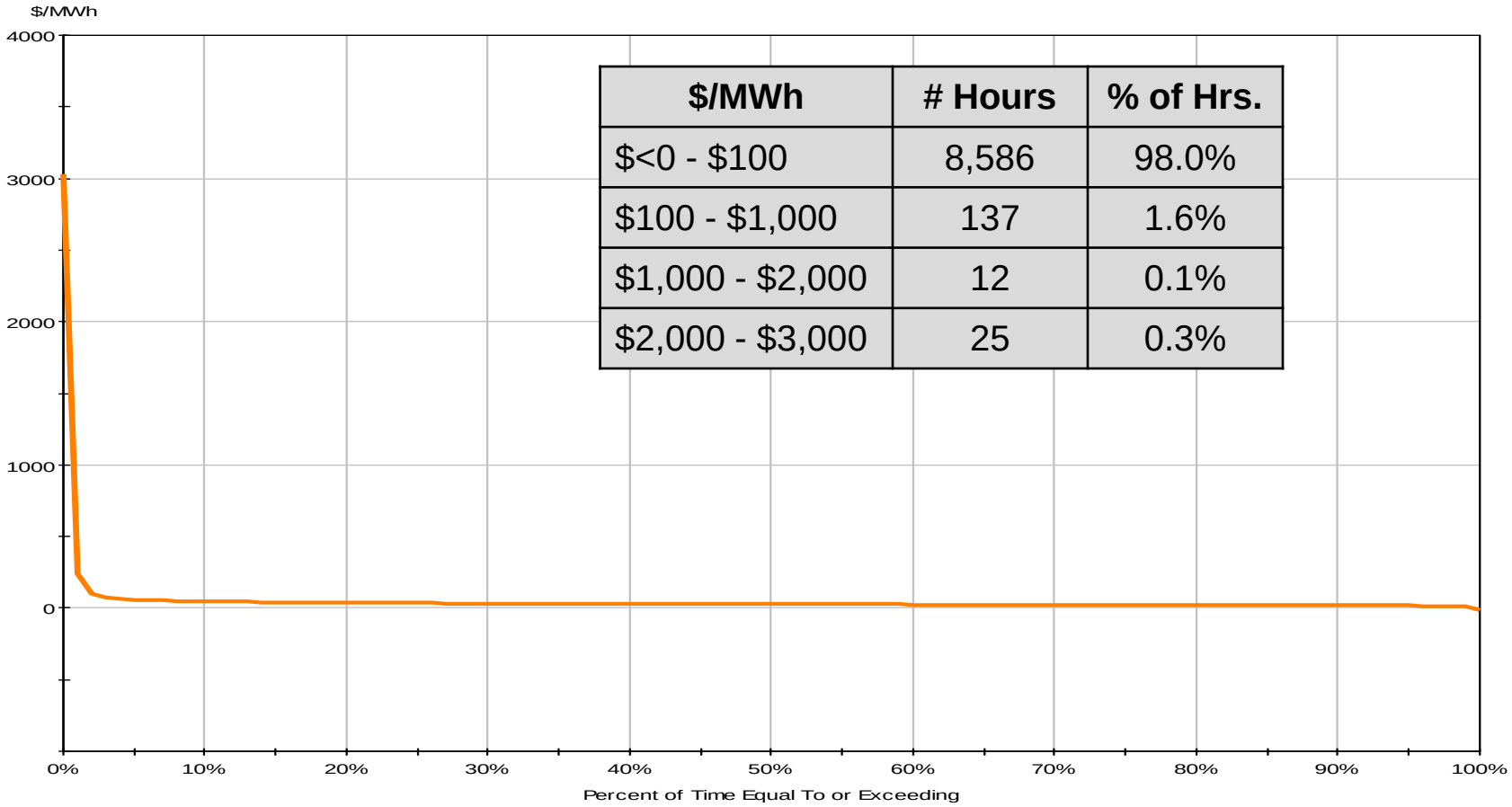
Source: FERC 2009 National Assessment of DR, page 42

ERCOT DR Summary

Load Type	Service	Requirements	Description/Notes
Voluntary Load Response (VLR)	Load reduction in response to Market Price, 4CP signals or other factors	• Metering • Load reduction technology • Retail contract with demand response incentives	• Economic: not dispatched by or reported to ERCOT ISO • May include dynamic pricing (Time of Use, Critical Peak, Real-Time Pricing) and/or centrally dispatched load control
Load Resources (LRs)	Responsive Reserve Service	• Interval metering • Telemetry • Under-Frequency Relay • Load reduction technology • ERCOT Qualification	• Industrial Loads • 207 LRs with ~2500 MW of total registered capacity • Limited to 50% of total RRS (1400 of 2800 MW) Dispatched during Energy Emergency Alert (EEA) or automatically due to frequency drop
Controllable Load Resources (CLRs)	Regulation Service Responsive Reserve Servoice	• Interval metering • Telemetry • Ability to receive AGC-type signals • Governor-type frequency response • ERCOT Qualification	• Industrial Loads with sophisticated control systems and ramping capability • 1 CLR (~20 MW) currently enrolled
Emergency Response Service (ERS)	10-minute special emergency service open to DR and DG	• Interval metering • Load reduction technology • ERCOT Qualification	• Mid- to large commercial & industrial Loads; open to residential • Procured 3 times per year for 4-month Contract Terms • Dispatched during EEA • >500 MW enrolled depending on Time Period

Price duration curve

- **Since Nodal market launched (Dec. '10), high prices and grid shortage conditions are much more closely aligned than before**



$/MWh	# Hours	% of Hrs.
$<0 - $100	8,586	98.0%
$100 - $1,000	137	1.6%
$1,000 - $2,000	12	0.1%
$2,000 - $3,000	25	0.3%

North Load Zone Settlement Point Prices, 2011 (typical of all 4 major Load Zones)

Calculating available DR for this summer

- **Peak DR under ERCOT dispatch (MW we know):**
  - Load participation in Responsive Reserves ~900-1300 MW
  - Projected totals for ERS and TDSP DR programs: ~685 MW
- **Other DR (MW we don't know):**
  - Load curtailing in anticipation of 4CP tariff intervals
    - 11,000+ large customers plus all Muni's and Co-ops
    - Behavior is well-baked into ERCOT load forecasting
  - Real-time pricing & critical peak response
    - Initiated by customer or thru direct load control by REP/third party based on retail agreements
    - Could increase if price cap goes from $3000 to $4500 in August
  - Voluntary customer response to media appeals
    - ERCOT and PUC asked for help on 14 days in Summer 2011

Questions?