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

August 3, 2011 Generation by Fuel

Gas | Wind | Other* | Coal | Nuclear

*Other includes Hydro, Biomass, Solar, and unknown sources

>28 GW
Off-peak vs. on-peak load by customer type

- **Residential**: 27.4% (~8,500 MW)
  - March 9, 2011, 5:15 PM
  - ERCOT Load: 31,262 MW
  - Temperature in Dallas: 64°

- **Small Commercial**: 28.9%
  - 3/9/2011 IE 17:15

- **Large C&I**: 43.7%
  - 8/3/2011 IE 17:00

- **Residential**: 51.2% (~35,000 MW)
  - ERCOT Load: 68,416 MW
  - Temperature in Dallas: 109°

- **Small Commercial**: 25.2%

- **Large C&I**: 23.7%

- 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

- Minimum (blue line)
- Peak (red line)

- Minimum: 25,462 MW
- Peak: 46,083 MW

Energy Efficiency Forum May 23, 2012
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
• 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
<table>
<thead>
<tr>
<th>Load Type</th>
<th>Service</th>
<th>Requirements</th>
<th>Description/Notes</th>
</tr>
</thead>
</table>
| 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 Service | • 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

<table>
<thead>
<tr>
<th>$/MWh</th>
<th># Hours</th>
<th>% of Hrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$&lt;0 - $100</td>
<td>8,586</td>
<td>98.0%</td>
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<tr>
<td>$100 - $1,000</td>
<td>137</td>
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<tr>
<td>$1,000 - $2,000</td>
<td>12</td>
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<tr>
<td>$2,000 - $3,000</td>
<td>25</td>
<td>0.3%</td>
</tr>
</tbody>
</table>
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?