Project 42636 - Panel 1

Dan Woodfin
Director, System Operations

August 15, 2014
Power Generation must match Load Demand
Economic Dispatch

• Every five minutes, ERCOT sends a signal to each online generator that is participating in the ERCOT market (through the generator’s Qualified Scheduling Entity (QSE)) telling each generator how much power to produce.

• In general, this set of generator output levels is the lowest cost way to meet the system load for that five minute interval.

• The optimization uses the offer curves submitted for each generator.

• If the lowest-cost set of generator output levels would result in an overload of one or more transmission constraints on the system, the economic dispatch optimization will select a different, higher-cost set of output levels that is the lowest cost set that does not overload any transmission constraints.

• This process is called a security-constrained economic dispatch (SCED).
What are Ancillary Services?

• In general, Ancillary Services (AS) are services that are supplemental to the energy market which are needed to maintain system reliability
  – The five-minute generation dispatch alone does not ensure that appropriate resources are available to acceptably balance generation with load

• Ancillary Services are procured to ensure that sufficient resources with the appropriate characteristics are available to balance any additional variability and maintain the system frequency through a variety of potential conditions
Proposed Change in Ancillary Services Framework

**Current AS Framework**
- Based on capabilities of conventional steam generating units
- Unique services bundled together due to inherent capabilities of conventional units
- Mix of compensated and uncompensated services
- New technologies are cobbled on, with difficulty

**Future AS Framework**
- Technology neutral
- Market-based
- Based on fundamental needs of the system, not resource characteristics
- Unbundled services
- Flexible for new technologies
- Pay for performance, where practical

Transition Plan TBD

Now 3+ Years
Typical August Generation Output

Monday 08/05/2013
Tuesday 08/06/2013
Wednesday 08/07/2013
Thursday 08/08/2013
Friday 08/09/2013
Saturday 08/10/2013
Sunday 08/11/2013

Aggregate Hourly Generation (MW)

- Gas
- Other
- Coal
- Nuclear
- Wind
Typical March Generation Output

Aggregate Hourly Generation (MW)

- **Other**
- **Gas**
- **Wind**
- **Coal**
- **Nuclear**

<table>
<thead>
<tr>
<th>Monday 03/03/2013</th>
<th>Tuesday 03/04/2013</th>
<th>Wednesday 03/05/2013</th>
<th>Thursday 03/06/2013</th>
<th>Friday 03/07/2013</th>
<th>Saturday 03/08/2013</th>
<th>Sunday 03/09/2013</th>
</tr>
</thead>
</table>

Monday 03/03/2013
Tuesday 03/04/2013
Wednesday 03/05/2013
Thursday 03/06/2013
Friday 03/07/2013
Saturday 03/08/2013
Sunday 03/09/2013
Energy by Fuel Type

2003
- Natural Gas: 39.7%
- Coal: 46.4%
- Nuclear: 12.0%
- Wind: 0.8%
- Water: 0.2%
- Other: 0.9%

2008
- Natural Gas: 37.1%
- Coal: 43.0%
- Nuclear: 13.2%
- Wind: 4.9%
- Water: 0.2%
- Other: 1.6%

2013
- Natural Gas: 37.2%
- Coal: 40.5%
- Nuclear: 11.6%
- Wind: 0.1%
- Water: 0.9%
- Other: 9.9%
Project 42636 - Panel 2

Warren Lasher
Director, System Planning

August 15, 2014
As Filed – The CREZ Transmission Plan

Red lines are new 345-kV double circuit ROW

Dotted red lines are new 345-kV single circuit ROW

Final Cost: ~$6.9 B

Designed to Accommodate ~18,500 MW of wind generation (~11,500 MW of incremental wind generation)

Completed on-time by the end of 2013
Additional Higher Wind CREZ Scenario

This plan was developed to accommodate Scenario 3 with an additional ~6,400 MW of wind generation (~24,800 MW of total wind generation in West Texas)

Red lines are new 345-kV double circuit ROW

Dotted red lines are new 345-kV single circuit ROW

Green line is a 2000-MW HVDC ROW

Estimated Cost ~$2 B
The Challenges Continue

- Panhandle wind development
  - Minimal nearby synchronous generation and no local load
  - With high levels of wind penetration, these conditions lead to voltage stability and grid strength challenges

- Solar developer interest in far Southwest Texas
  - Limited nearby high-voltage transmission
Project 42636 - Panel 3

Paul Wattles
Senior Analyst, Market Design and Development

August 15, 2014
Weather impacts on load by customer type

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

(ERCOT’s peak day)
5:00 PM
ERCOT Load: 68,416 MW
Temperature in Dallas: 109°

37,000 MW of weather-sensitive load -- 54% of peak

- 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)
- 15-minute settlement interval demand values
## DR available for ERCOT dispatch (summer peaks 2014)

<table>
<thead>
<tr>
<th>Service</th>
<th>MWs</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Resources providing Responsive Reserves</td>
<td>1400</td>
<td>Capped at 1400 MW (half of total hourly Responsive procurement of 2800 MW)</td>
</tr>
<tr>
<td>Emergency Response Service</td>
<td>725</td>
<td>Includes 10-minute and 30-minute ERS; and ERS Generation (primarily distributed diesel) Significant % of ERS demand response is assisted by backup generation</td>
</tr>
<tr>
<td>TDSP Load Management Programs</td>
<td>220</td>
<td>Summer peak hours only Dispatched concurrently with ERS through agreements between ERCOT and TDSPs Unknown % backed up by generation</td>
</tr>
</tbody>
</table>

2,300 MW of dispatchable DR = 3.4% of ERCOT summer peak
Estimates of DR Potential in ERCOT

Sources:
- “ERCOT Investment Incentives and Resource Adequacy, Brattle Group, June 2012
- “National Assessment of Demand Response Potential,” FERC/Brattle Group, 2009