Aggregated DERs and the ERCOT Wholesale Markets

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The interconnected electrical system serving most of Texas, with limited external connections

- 90% of Texas electric load; 75% of Texas land
- 71,110 MW peak, August 11, 2016
- More than 46,500 miles of transmission lines
- 570+ generation units

ERCOT connections to other grids are limited to ~1,250 MW of direct current (DC) ties, which allow control over flow of electricity
Independent System Operators and Regional Transmission Organizations are the ‘air traffic controllers’ of the bulk electric power grids. (69kV and up)
ERCOT Markets

<table>
<thead>
<tr>
<th>Service</th>
<th>Eligible Resource Types</th>
<th>Aggregations?</th>
<th>Telemetry?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsive Reserves*</td>
<td>Generators, Load Resources (LRs) on under-frequency relay</td>
<td>Needs work</td>
<td>Yes</td>
</tr>
<tr>
<td>Regulation-Up*</td>
<td>Generators, Controllable LRs (CLRs)</td>
<td>Needs work</td>
<td>Yes</td>
</tr>
<tr>
<td>Regulation-Down*</td>
<td>Fast-acting, limited-duration resources</td>
<td>Needs work</td>
<td>Yes</td>
</tr>
<tr>
<td>➢ Fast Responding Reg-Up/Down (FRRS)*</td>
<td>Fast-acting, limited-duration resources</td>
<td>Needs work</td>
<td>Yes</td>
</tr>
<tr>
<td>Non-spin*</td>
<td>Generators, SCED-qualified CLRs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Security-Constrained Economic Dispatch (SCED)</td>
<td>Generators, CLRs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Emergency Response Service (ERS)</td>
<td>Demand response, distributed generation</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

- Minimum capacity offer in ERCOT’s markets is 100 kW
  - Exception is Weather-Sensitive ERS (500kW)

* Ancillary Services (FRRS-Up and FRRS-Down are subsets of Regulation Services).
Aggregation Experience to Date

• ERS was created by PUC Rule as an operational backstop for emergency conditions
  – Not an Ancillary Service, intentionally open to aggregations, no telemetry requirement

• In the Ancillary markets, rules are in place for Aggregated Load Resources (ALRs) to provide Non-spin and participate in SCED
  – Non-spin has a 30-minute deployment requirement
  – SCED issues base point instructions every 5 minutes
  – Market participants agreed to accept 15-minute advanced meter data as basis for performance evaluation
  – No resources have qualified or participated to date
Potential Aggregations in FRRS

- Fast Responding Regulation Service
  - Qualification test requires 8-minute performance instead of full hour for conventional Reg
  - Must perform within 60 cycles (1 second)
    - ERCOT dispatches specified MWs when frequency falls outside of ±0.025Hz band
    - Automatic full response if frequency ≤59.91Hz or ≥60.09Hz
    - High-speed data recorder required at resource site
  - Distribution-connected resources are eligible (several are currently in progress)
  - Aggregated DERs in FRRS will require more work
    - For example, rules not yet written for telemetry and performance validation
Hypothetical Aggregated Resource in FRRS

QSE sends telemetry via Inter-Control Center Protocol (ICCP); multiple data points every 2 seconds

ERCOT sends dispatch signals to QSE

QSE transmits ERCOT instructions to resource

Need high-speed data recorder(s) to validate telemetry and resource performance – these rules are not yet written

Grid frequency triggers auto-response

Aggregated Resource

Qualified Scheduling Entity (QSE)
Questions?