Electrical Grid 101

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Electricity: Just-In-Time Commodity
State Federal Jurisdiction
Wisconsin 2016 Electric Service Territories

Source: Public Service Commission of Wisconsin
RTOs and ISOs
MISO Control Room

Source: MISO
Interconnection Requests - MISO’s DPP

Diagram:

Cycle 1
- Application Deadline
  - M1 Satisfied
  - Pay M2
- DPP Phase 1
  - Approx. 140 Days
- DPP Phase 2
  - Approx. 80 Days
- DPP Phase 3
  - Approx. 135 Days
- GIA
  - Approx. 150 Days
- MISO Files GIA

Cycle 2
- Scoping Call
- DPP Phase 1 + DPP Phase 2 + DPP Phase 3 + GIA = ~ 505 Days
- Site Control Required prior to entry into Phase 3
- Higher Queued Assumptions

Acronyms:
- BD: Business Days
- IC: Interconnection Customer
- IF: Interconnection Facility
- D1: Application Fee
- D2: DPP Study Funding Deposit
- FS: Facilities Study
- POI: Point of Interconnection
- GIA: Generator Interconnection Agreement
- SIS: System Impact Study

Notes:
1) Effective September 19th, 2018, for new cycles, Affected System, Stability, and Short Circuit Studies are required only for DPP phase 2 and DPP phase 3.
2) M3 and M4 will be adjusted based on previously paid M3 and M4 for Provisional Requests.
3) Phase 3 studies are only required if the Phase 2 studies are not completed by the time of the study.
### What’s happening in the MISO queue

<table>
<thead>
<tr>
<th>Source: Clean Grid Alliance</th>
<th>11/20/19</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Queue Size</strong></td>
<td>** PJM (MW)**</td>
</tr>
<tr>
<td>-----------------------------</td>
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</tr>
<tr>
<td>Coal</td>
<td>40</td>
</tr>
<tr>
<td>Nat Gas</td>
<td>18,360</td>
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<tr>
<td>Solar</td>
<td>47,615</td>
</tr>
<tr>
<td>Wind</td>
<td>15,651</td>
</tr>
<tr>
<td>Battery Storage</td>
<td>5,728</td>
</tr>
<tr>
<td>Hybrid</td>
<td>9,623</td>
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</tbody>
</table>

**87% of the MISO queue**
Operations: The Grid and Intermittent Generators

Source: MISO RAN Report Dec 2019
Improving Control and Efficiency of the Grid

Example technologies:
• Dynamic Line Ratings
• Flow Controls
• Topology Control
Say goodbye to
Thomas Edison’s Electric Industry
Demand Response and Efficiency

Source: NREL
Battery Price Drop Between 2010 & 2018 = 85%

Lithium-ion battery price survey results: volume-weighted average

Battery pack price (real 2018 $/kWh)

2010: 1,160
2011: 899
2012: 707
2013: 650
2014: 577
2015: 373
2016: 288
2017: 214
2018: 176

Note: The data in this chart has been adjusted to be in real 2018 dollars.
State Federal Jurisdiction
The End
…& the Beginning

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