2019 OMS DER Survey Results
BACKGROUND
DER Survey Successfully Conducted a Second Time

• DER survey first conducted in 2018
• Feedback from stakeholders and OMS members used to make improvements to 2019 survey
  – More useful responses
• End of Year 2018 data requested
• Robust participation throughout entire footprint
Two components to survey are used to collect data

Data Table Examples

<table>
<thead>
<tr>
<th>Residential</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wabash Valley Power</td>
<td>Type: Solar PV</td>
<td>Size Category: 2</td>
<td># of Installations: 23</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residential</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV</td>
<td>Size Category: 1</td>
<td># of Installations: 27</td>
<td>Total MW: 0.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-Residential (C&amp;I)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility Name:</td>
<td>Type: Solar PV</td>
<td>Size Category: 3</td>
<td># of Installations: 4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-Residential (C&amp;I)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV</td>
<td>Size Category: 4</td>
<td># of Installations: 2</td>
<td>Total MW: 3.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-Residential (C&amp;I)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Biogasifiers</td>
<td>Size Category: 4</td>
<td># of Installations: 4</td>
<td>Total MW: 4.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-Residential (C&amp;I)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>Size Category: 1</td>
<td># of Installations: 1</td>
<td>Total MW: 0.9</td>
</tr>
</tbody>
</table>

Questions

1. Visibility into DER and how it is achieved:
   a. Is your utility considering future investments that will increase visibility into DER operations? If yes, please describe future investments under consideration:
      - [ ] Yes
      - [ ] No

2. Check all current processes used to obtain DER visibility:
   -[ ] AMI
   -[ ] Interconnection Requests
   -[ ] Production Meter
   -[ ] SCADA
   -[ ] DERMS/ADMS
   -[ ] Other

2. What are the drivers behind DER growth in your territory? Please explain drivers and where possible, connect this response to your data submission. [Complete the survey data tables as part of this question].
Over 85% of MISO Load Responded

- 48 LSEs responded to the survey
- Respondents represent 86% of MISO load
- Increased participation from 2018 survey
2019 SURVEY RESULTS
Over 4.5 GW of DER in Footprint

~1.2 GW of Residential

- Residential Capacity

~3.4 GW of Non-Residential

- Non-Residential Capacity
Residential installations tend to be smaller

DER Capacity by Size and Class

- Residential
- Non-Residential
COMPARISON TO 2018
DER Increased while trends remained same

- Residential capacity increased by 170%
- Non-residential increased by 62%
- Non-residential is still the dominant class of DER within MISO
The variety of DERs remained similar

2018 DER Mix

- Solar PV: 39%
- Wind: 11%
- Microturbine: 5%
- Internal Combustion: 0%
- Hydro: 0%
- Gas Turbine: 0%
- Battery Storage: 2%
- Demand Response: 11%

2019 DER Mix

- Solar PV: 43%
- Wind: 15%
- Microturbine: 5%
- Internal Combustion: 5%
- Hydro: 5%
- Gas Turbine: 2%
- Battery Storage: 2%
- Demand Response: 14%
- Biodigesters: 11%
- Other: 0%

*Biodigesters were included within the microturbine category in the 2018 survey.*
WRITTEN RESPONSE ANALYSIS
Q1: Visibility into DER and how it’s achieved

- Over half (25) of the total respondents are considering future investments into DER visibility
- Interconnection requests remain primary source of utility information on DERs
- Three respondents use all options
- Eleven respondents considering investment into some form of Distributed Energy Resource Management System (DERMS)
Q1: 2018 Survey DER Visibility Processes

2017 DER Visibility Processes

Number of Processes

Types of Visibility Processes

- Telemetry: 1
- Interconnection/reg: 24
- SCADA: 10
- Production Meters: 7
- DERMS: 0
- AMI: 5
- Survey: 2
Q2: Drivers behind DER growth

<table>
<thead>
<tr>
<th># of Respondents</th>
<th>Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Customer preferences</td>
</tr>
<tr>
<td>9</td>
<td>Rate design</td>
</tr>
<tr>
<td>8</td>
<td>Declining DER cost</td>
</tr>
<tr>
<td>7</td>
<td>State Policy</td>
</tr>
<tr>
<td>7</td>
<td>Federal Tax Credits</td>
</tr>
<tr>
<td>6</td>
<td>Environmental concerns</td>
</tr>
<tr>
<td>5</td>
<td>Limited/no growth</td>
</tr>
</tbody>
</table>

- State laws continue to be a big driver
- Last year only 4 utilities listed customer preferences as a driver, versus 12 utilities this time
- Low natural gas prices may be discouraging some DER, and encouraging others (customer-owned CHP)
Q3: DER’s impact on transmission system

• Most respondents have not experienced transmission-level impacts
  – 40 respondents have seen no impact
  – 3 have (same # as 2018 survey)*

• Many respondents are investigating potential future impacts, some making proactive modifications

• 8 respondents do not foresee near-term issues

• 5 respondents are actively monitoring for expected issues
  – Reviewing interconnection and T-D coordination
Q4: Forecasting DER Growth & DER impact on other forecasts

- Part A: Twenty-seven do not explicitly project DER growth; 16 do

- Part B: Of the respondents that answered this question, 15 stated DER impacts their Module E submission to MISO, while 8 stated it did not
  - Six count DER as load reduction
  - Twelve utilities incorporate information into transmission planning
Q6: Currently approved DER pilots

<table>
<thead>
<tr>
<th>TYPE OF PILOT</th>
<th>TOTAL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>BATTERY STORAGE</td>
<td>6</td>
</tr>
<tr>
<td>SOLAR + BATTERY</td>
<td>6</td>
</tr>
<tr>
<td>SOLAR PV OR ROOFTOP SOLAR</td>
<td>5</td>
</tr>
<tr>
<td>COMMUNITY OR SHARED SOLAR</td>
<td>4</td>
</tr>
<tr>
<td>DEMAND RESPONSE</td>
<td>2</td>
</tr>
<tr>
<td>SMART THERMOSTAT</td>
<td>2</td>
</tr>
<tr>
<td>MICROGRID</td>
<td>2</td>
</tr>
<tr>
<td>VIRTUAL METERING</td>
<td>2</td>
</tr>
<tr>
<td>ELECTRIC VEHICLES</td>
<td>1</td>
</tr>
<tr>
<td>NATURAL GAS GENERATOR</td>
<td>1</td>
</tr>
</tbody>
</table>
Q7: MISO DER Workshop Attendance

- Over 50% of respondents were able to attend 1 workshop
- 19 attended every workshop
- 13 attended no workshops