Integrated Distribution System Planning Components

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Integrated Distribution System Planning Training for Midwest/MISO region
October 13-15, 2020
Distribution planning across the U.S. addresses 3 key overlapping areas of focus to meet customer needs:

- Reliability & Resilience
- DER Integration & Utilization
- Safety & Operational Efficiency
Distribution Evolution Revisited

What is the structure & composition of the grid needed today vs 2030+?
How do we need to plan differently?

Stage 1: Safety, Reliability & Resilience
- Customer Rate Options, Bill Management Information & Decision Tools
- Customer Onsite Self-Supply & Resilience
- Electrification
- Community Solar+Storage
- DER Services for Power System

Stage 2: DER/Customer Microgrid Integration
- Operational Efficiency Improvements
- Reliability Improvements
- Resilience Foundational Measures
- Aging Infrastructure Refresh
- Annual Asset & System Planning

Stage 3: Community Microgrids & Distributed Markets
- 3rd Party Community Multi-user Microgrids
- DER export energy sales at scale
- Distributed energy scheduling & dispatch
- Grid storage for resilience
- Distributed computing and controls
- Alternative Distribution Designs

Time

System Complexity

Customer Engagement

Source: P. De Martini
Planning for the Next 10+ Years

Distribution systems are becoming exceedingly complex

<table>
<thead>
<tr>
<th></th>
<th>Yesterday</th>
<th>Today</th>
<th>Tomorrow</th>
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<tbody>
<tr>
<td>Power Flow</td>
<td>One-way</td>
<td>Inadvertent 2-way</td>
<td>Scheduled reverse flow</td>
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<td>Solar+Storage</td>
<td>Load modifying resource</td>
<td>Grid Services</td>
<td>Exported energy for resource adequacy</td>
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<tr>
<td>Electrification</td>
<td>Load growth</td>
<td>Managed load</td>
<td>Grid storage</td>
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<td>Microgrids</td>
<td>Customer BTM back-up</td>
<td>Customer BTM microgrids</td>
<td>Community microgrids (“minigrids”) by design</td>
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<td></td>
<td>generation</td>
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<td>DSM</td>
<td>Energy efficiency &amp; peak</td>
<td>Grid services</td>
<td>Grid interactive buildings (thermal &amp; electrical storage)</td>
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<td></td>
<td>load management</td>
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<td>Grid edge</td>
<td>Customer meter</td>
<td>BTM DER</td>
<td>BTM DER &amp; Building Technologies (incl. Alexa?)</td>
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<tr>
<td>Ecosystem</td>
<td>LSE, DistCo &amp; Customer</td>
<td>LSE, DistCo, Aggregator, DER provider &amp; Customer</td>
<td>LSE, DistCo, Aggregator, DER provider, MG Operator, EV Charging/Vehicle mfg, Building automation provider &amp; Customer</td>
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Distribution System Planning Inputs

Distribution Planning Increasingly Dependent Upon IRP/Bulk Power Use of DER and Local Sustainability & Resilience Planning

Source: P. De Martini
Integrated Distribution System Planning

Source: DSPx Guidebook, Vol. 4 (final draft), 2020
Distribution Investments Are Interdependent

Most distribution capital investments contribute to achieving multiple objectives.
Modern Grids are comprised of several interdependent layers building upon each other to address customer & societal needs

**Distribution investment categories:**
- Enable community and customer resilience solutions
- Enhance reliability & provide additional resilience functionality
- Improve customer reliability
- Foundational safety, resilience & service quality requirements
Considerations

Multi-objective planning requirements & significantly different uses of the distribution system are driving an increasingly complex planning process

► What are the appropriate planning objectives and criteria for your grid of 2030?
► How should the uncertainty of the pace and scope of change be addressed?
► What is the appropriate investment prioritization model?
► What level of collaboration is required to ensure we can achieve the desired objectives with a resilient, safe electric grid?
► What level of oversight & transparency is required to ensure objectives are achieved and stakeholders buy-in?
Resources for More Information

**DSPx Guidebook 2020**
https://etal-publications.lbl.gov/sites/default/files/dsp_state_examples.pdf

**Distribution System Planning**

**MN PUC IDP Docket**
https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=eDocketsResult&userType=public&docketYear=&docketNumber=&documentType=&docketType=&submissionNumber=&documentId=&onBehalfOf=&sortById=&resultsPerPage=&keywords=irp#%7B300EA766-0000-CF18-89A0-A92861BB0B0%

**HECO Integrated Grid Planning**
https://www.hawaiianelectric.com/clean-energy-hawaii/integrated-grid-planning
Thank you

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