Modernizing the Grid and Enabling Distributed Energy Resources

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Heather Sanders
Principal Manager
Integrated Grid Strategy & Engagement
Distributed energy resources can become grid resources, integrated with traditional infrastructure.

<table>
<thead>
<tr>
<th>Traditional distribution infrastructure solutions</th>
<th>Distributed energy resource solutions – combined portfolio</th>
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<tbody>
<tr>
<td>• Voltage regulators</td>
<td>• Energy efficiency</td>
</tr>
<tr>
<td>• Conductor upgrade</td>
<td>• Demand response</td>
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<tr>
<td>• Breaker, bus, lead upgrade</td>
<td>• Energy storage</td>
</tr>
<tr>
<td>• Transformer upgrade</td>
<td>• Solar PV</td>
</tr>
<tr>
<td>• New circuits</td>
<td>• Other distributed generation</td>
</tr>
<tr>
<td>• Substation upgrade</td>
<td></td>
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<tr>
<td>• New substation</td>
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</tbody>
</table>
A modernized distribution planning process identifies grid needs and DER solution attributes

*Deferral framework and competitive DER procurement produce lowest cost solution*

**Develop forecasts, assumptions & scenarios**
- Integrated forecast
- Load
- Distributed Generation
- Demand Response
- Energy Efficiency
- Electric Vehicles

**Perform distribution planning assessment**
- Thermal
- Voltage
- Protection

Locational distribution needs and associated traditional solutions

**Determine DER operational requirements (attributes)**
- Screen projects through a deferral framework to ensure system reliability
- Identify feasible DER locations and associated attribute requirements
- Quantify range of locational deferral benefits

**Identify areas where DERs have greatest benefit**

**Perform competitive sourcing for DER deferrals**
- Existing hosting capacity
- Operational requirements
- Performance metrics and validation
- Other relevant information
DER portfolio solutions fulfill required performance attributes, however are not entirely equivalent

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<th>DER portfolio solution</th>
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<tr>
<td>Availability</td>
<td>Accessible when required</td>
<td>Competing priorities for use can affect availability, may be serving customer needs or wholesale market</td>
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<tr>
<td>Dependability</td>
<td>Installed for specific use and perform function as specified</td>
<td>Depends on other factors such as weather, time of day, and customer process demands</td>
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<tr>
<td>Durability</td>
<td>Well-defined and understood asset life</td>
<td>Customers may decide to exit voluntary programs, fail to maintain resources, or move</td>
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<tr>
<td>Flexibility</td>
<td>Increased operating options due to inherent capacity margin</td>
<td>Maximizes utilization of existing infrastructure, however limits operating possibilities</td>
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</table>

*DER portfolios bring different dynamics than traditional infrastructure*
Grid reinforcement and modernization is required to maintain reliability and realize DER operational capability.

*DER installation for customer use increases grid operation complexity; when DER portfolios are relied on as part of reliability, that complexity escalates.*

**Monitor**
- Situational Awareness
- Resource output / status
- Power flow and direction
- Voltage
- Circuit configuration

**Analyze**
- Forecasting (short and long-term)
- Distribution load flow analysis (short and long-term)
- Interconnection tools
- Grid state estimation

**Control**
- Distributed and centralized
- ISO dispatch coordination
- Auto circuit reconfiguration
- Capacitor bank switching
- DER operations disatpch

**Optimize reliability**
- Power flow optimization
- Voltage optimization
- Adaptive, bidirectional protection

**Optimize economics**
- Real-time market operation layer on top of reliability optimization

**Customer objectives**
- Small volume of DER providing grid services
- Increasing reliance of DER providing grid services
- Reliance of DER providing grid services, prioritized by DER costs
Thank you

To access SCE’s Distribution Resources Plan (DRP), SCE’s Distributed Energy Resources Interconnection Map (DERiM), and additional information, please visit the CPUC’s DRP website at: [http://www.cpuc.ca.gov/PUC/energy/drp/](http://www.cpuc.ca.gov/PUC/energy/drp/)