Outline

Smart Grid Vision

State of the Industry

Industry Transformation is Needed

Our view: San Diego Gas & Electric, a Sempra Energy utility
Vision

Electric grid evolves

- Ubiquitous communications backbone
- Operational technologies
- Information technologies
A smart, integrated grid

- Detects and fixes emerging problems
- Incorporates measurement, diagnostics and feedback
- Re-routes power flows
- Enables loads and distributed resources
- Uses modern tools
Good for the Environment

Enables renewable and clean energy

Enables Vehicle-to-Grid interface

Reduces spinning reserves

Supports customer choice
Utility of Today

Electro-Mechanical

Heavy use of old radio technology

Few sensors

Limited automation
Utility of the Future

Digital

Advanced communication

Self healing

Lots of sensors

Automated control

Smart Meters
Three paths to starting a regional smart grid

Organic – business as usual
- Huge capital expenditures as assets retire
- New technologies lead to declining costs

Utility of the future
- Spread costs across several projects

Smart Meter
- Communication infrastructure is key
- Digital electric meters are also sensors
SDG&E Smart Grid Drivers / Challenges

Aging Infrastructure

Maturing Workforce

Help Achieve / Integrate policy goals
  • Energy Action Plan Loading Order
  • Empower Consumers

Potential Challenges
  • Regulatory Changes
  • Cost
  • Complexity
  • Technology Advances
SDG&E Smart Grid Major Initiatives

Advanced metering infrastructure

Technologies improve operations

Distribution automation

Distributed generation

DOE and CEC funded Smart Grid Research
Smart Grid and OpEx 2020

Smart Grid

FAST
Smart Meters
CBM
OMS/DMS

OpEx 2020
GIS
# Integrated Timeline

<table>
<thead>
<tr>
<th>Asset Mgmt Initiatives</th>
<th>Drivers</th>
<th>Dependencies</th>
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<tbody>
<tr>
<td>Asset Investment Support</td>
<td>• Capital efficiency</td>
<td>Field and Smart Grid require GIS</td>
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<tr>
<td>GIS Platform</td>
<td>• Reliability</td>
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<td>GIS Data Conversion</td>
<td>• O&amp;M costs</td>
<td>Can be done now – but needs GIS down stream</td>
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<td>OMS / DMS</td>
<td>• Workforce demographics</td>
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<td>Condition Based Maintenance</td>
<td>• Can be done now – but needs GIS down stream</td>
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<td><strong>Field Force Initiatives</strong></td>
<td>• Cost-to-serve</td>
<td>Customer adoption</td>
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<td>Supervisor Enablement</td>
<td>• Customer convenience</td>
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<td>Forecasting &amp; Scheduling</td>
<td>• Mobile workforce</td>
<td>Timing is JIT based on Field Force (and Smart Grid)</td>
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<tr>
<td>Dispatching &amp; Mobile</td>
<td>• Sensors on assets</td>
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<td>Work Management</td>
<td>• Future flexibility</td>
<td>Required by virtually every initiative</td>
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<td>Electronic Design</td>
<td>• Scalable platform</td>
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<td><strong>Customer Care Initiatives</strong></td>
<td>• Enterprise solutions</td>
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<td>Operation Insight Analytics</td>
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<td>ICE Infrastructure &amp; Channel</td>
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<td>Care Rep of the Future</td>
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<td>Single View of the Customer</td>
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<td><strong>Smart Meter</strong></td>
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Summary

Industry knows what is needed
• Barriers exist – including risk, rates, standards, security

Some steps are underway
• Federal legislation
• Few large projects

Much work is needed
• More projects
• State regulatory
• Standards

SDG&E making large strides
• Smart Meter – Smart Grid
• OpEx 20/20 – Smart Grid
• Partnerships with industry groups
• Collaboration with many utilities

Active Standardization
• OpenAMI
• GridWise *2
• AutoDR / Open-Enterprise / USB
• Utility Intelligent Network
Thank You

Terry Mohn, Technology Strategist
Sempra Energy utilities