Grid and Regulatory Modernization and the Utility of the Future

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Grid Modernization

- **Grid modernization**
  - “Hands-on” comprehensive portfolio of initiatives focused on realizing Smart Grid / Grid of the Future vision
  - Deployment of incremental grid intelligence (technology), infrastructure (foundational, IT/OT), and engineering processes

- **Utility of the Future**
  - Long term utility vision adapted to projected business environment
  - It covers business, regulatory, grid and customer aspects

- **Regulatory modernization**
  - Required changes to existing regulatory frameworks to enable utilities and customers to fully take advantage of opportunities derived from grid modernization (Utility of the Future enabler)
Utility Of The Future Drivers

Need for new electric utility business models and regulatory frameworks

- Importance of cybersecurity
- Deployment of cost-effective DG
- Increasing adoption of energy management technologies
- Deployment of smart grid technologies, products and services
- Deployment of microgrids
- Rise of data analytics
- Expanded use of utility-scale renewables
- Increasing expectations regarding resiliency
- Customer interest for sustainable energy options
- Customer interest for greater control of energy use and costs
- Growth in energy products and services provided to customers by 3rd parties
- Increasing expectations for reliability and power quality
- Growing adoption of PEVs and BESS
- Expanded use of utility-scale renewables
- Importance of cybersecurity
Grid Modernization – Key Industry Trends (1)

- **DER integration**
  - Distributed Generation (DG), energy storage, demand response
  - Microgrids
  - Smart Inverters
  - IEEE 1547 Update

- **Business Models**
  - Distribution Resources Plan (DRP)
  - Reforming the Energy Vision (REV)
  - Rate unbundling (demand charges)
  - Service diversification and evolving customer expectations
  - Transactive Energy and future grid architectures
Grid Modernization – Key Industry Trends (2)

- **OT/IT convergence, grid analytics, increased visualization and real-time operation**
  - Advanced DMS/OMS
  - DER Management Systems (DERMS)
  - Distribution Automation (FLISR, VVO)
  - AMI and advanced sensors (distribution PMU)

- **Reliability/Resiliency**
  - Physical and cybersecurity
  - Weather hardening and aging infrastructure

- **Smart Cities**
Renewable Portfolio Standards (RPS)

29 States + Washington DC + 3 territories have a Renewable Portfolio Standard (8 states and 1 territories have renewable portfolio goals)

- Renewable portfolio standard
- Renewable portfolio goal
- Extra credit for solar or customer-sited renewables
- Includes non-renewable alternative resources

www.dsireusa.org / October 2015

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Key Modernization Driver – DER Integration

- High penetration of DG (mainly PV) is already a reality in several utility systems
- DG interconnection can have significant and diverse impacts in numerous business and technical activities of distribution utilities

Hawaiian Electric – Renewable Watch (Oahu)

CAISO – Wind and Solar Production

Source: http://content.caiso.com/green/renewrpt/20160921_DailyRenewablesWatch.pdf
Are We Heading in this Direction?

Grid Parity

- When grid parity will be reached is still uncertain and a matter of debate.
- Financial institutions like Morgan Stanley, Deutsche Bank and Barclays have forecasted it will happen in the next decade in many states of the US.

We see 47 states at Grid Parity by the end of 2016 with 30% ITC...
Grid Parity – Prices (1)

- PV distributed generation is experiencing significant growth
- Prices continue decreasing despite falling state/utility incentives

Source: Tracking the Sun IX: The Installed Price of Residential and Non-Residential Photovoltaic Systems in the United States
Source: https://www.carbonbrief.org/seven-charts-show-new-renewables-outpacing-rising-demand-for-first-time
Grid/Load Defection

- Average residential customer monthly bill today approx. $110 (Source: EPRI)
  - Energy = $70; Distribution = $30, Transmission = $10

- Utility model based on kWh sales, but with stagnant (or decreasing sales due to DER proliferation), rates might increase to pay for needed grid investments ("utility death spiral")
  - Result = Rate fatigue and grid defection (when and if feasible) unless VALUE demonstrated

A possible perfect-storm scenario of decreasing revenues due to DER proliferation could result in the so-called "utility death spiral." Source: Forbes.
Grid Modernization Initiatives: New Models (DSO)

Source: resnick.caltech.edu/docs/21st.pdf
Grid Modernization Initiatives: New Models (DSP)

- Market Operations
  - Rich information for consumers and suppliers
  - Diverse technologies, products and services
  - Transparency, flexibility, and efficiency

- Grid Operations
  - Secure, reliable and resilience
  - Flexible and dynamic
  - Economical and energy efficient

- Integrated System Planning
  - Diverse and distributed energy resources
  - Coordination with bulk system
  - Integration with market and operations drivers

Source: New York State Department of Public Service, WG-2: Platform Technology, July 2014
http://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/bd6cb06f9ad375dd85257d0f0053f76e/$FILE/Platform%20Technology%20(Working%20Group%202).pptx
What is the industry doing?

- **Long-term (focus on business processes, infrastructure and information systems, and regulatory and policy aspects):**
  - Utilities are updating applicable business processes and practices (e.g., engineering standards, annual planning cycle, load forecasting) to consider DG integration as an intrinsic component of their regular activities.
  - Utilities are upgrading distribution assets, information technology, communications, and enterprise system infrastructures to gather and process the data required to operate modern distribution systems with large penetration levels of DG (e.g., sensor, DA and PMU deployment).
  - Utilities are exploring new concepts to fully take advantage of the potential benefits of DG proliferation (e.g., microgrids).
  - Utilities are participating in industry activities to share experiences, and are training their engineers to analyze, plan and operate modern and future distribution systems.
DER – What are utilities doing?

Examples (California IOUs):

- SCE’s DER Interconnection Maps (DERiM): on.sce.com/derim
- PG&E’s Solar Photovoltaic (PV) and Renewable Auction Mechanism (RAM) Program Map: http://www.pge.com/b2b/energysupply/wholesaleelectricsupplier solicitation/PVRFO/pvmap/
California – Distribution Resources Plan (DRP)

- Policy and Vision
- Distribution Resources Planning Methodologies
- Integration Capacity
- Locational Benefit and Costs
- DER Growth Scenarios
- Demonstration and Deployment
- Data Access and Sharing
- Tariffs and Contracts
- Safety Considerations
- Barriers to Deployment
- DRP Coordination with GRC
- DRP Coordination with Utility and CEC Forecast
- Phasing of Next Steps (Future DRP cycles)

http://www.cpuc.ca.gov/General.aspx?id=5071

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Grid Modernization Strategy

- Grid modernization strategy must address challenges prompted by grid transformation drivers and take advantage of emerging opportunities
- Developing business and technology roadmaps
- Addressing and preparing for various scenarios
- Deploying pilot projects to test and prepare for changes
- Developing and applying industry standards
- Developing a skilled workforce

Speed and success will depend on clear and balanced regulatory policies to promote safe, cost-effective, and reliable deployment of technologies
Grid & Utility of the Future Framework

Source: http://magazine.ieee-pes.org/
Traditional Distribution Grid – No DG
Modern Distribution Grid – DG Proliferation
Single-Customer Microgrids (Nanogrids)
Secondary System Microgrids
Partial Feeder Microgrids

Diagram showing different microgrid configurations:
- Sub-transmission
- Distribution Substation
- Full Feeder Microgrid
- Single Customer Microgrid
- Neighbor Feeder
- Normally Open Tie
- Secondary System Microgrid
- Partial Feeder Microgrid
Full Feeder Microgrids

Sub-transmission

Distribution Substation

Full Feeder Microgrid

Single Customer Microgrid

Normally Open Tie

Neighbor Feeder

Partial Feeder Microgrid

Secondary System Microgrid

Single Customer Microgrid
Hierarchical Microgrids – The Future?
What is the US Next Generation Network (US NGN)?

The CIGRÉ U.S. NGN was established for young engineers who have begun to progress their career within the power industry.

- **US NGN Membership**
  - Power systems industry experience of 10 years or less
  - Students (FREE) or professionals (50% Reduction Young member)
  - Become a CIGRÉ US NGN member

- **Provide opportunities for technical and personal development**
  - Networking opportunities
  - Advance Technical Skills
  - Collaborate with peers across US and abroad
Ways to get involved

- Participate in webinars and tutorials
- Attend the Grid of the Future Symposium
- Participate in the International Paper Competition
- Join the NGN Executive Committee
- Expand Technical knowledge through CIGRE Working Groups
NGN Executive Committee

- Jessica Lau – Orange & Rockland Utilities
- Amanda Olson – Burns & McDonnell
- Chris Mertz – Dominion
- Cynthia Ocasio-Hassett – Worley Parsons
- Diana Lee – VELCO
- Jessica Lau – Orange & Rockland Utilities
- Josh Snodgrass – Duke Energy
- Jason MacLeod – Burns & McDonnell
- Kyle Thomas – Dominion
- Kojo Sefah – Flint Hills Resources
- Lauren Warkenthien – Leidos
- Ryan Quint – NERC
- Saeed Kamalinia – S&C Electric
- Yasan Alsmadi – AEP
UPCOMING EVENT

2016 Grid of the Future Symposium
30/10/2016 - 01/11/2016
Philadelphia, Pennsylvania - United States of America
Organization: CIGRE US National Committee (USNC) - EPRI

More information:
http://cigre-usnc.org/future-meetings/