Distribution Resilience Planning

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Electric Grid Resilience is a Top Planning Priority

2017 U.S. Billion-Dollar Weather and Climate Disasters

Source: NCSL 2017 “Hardening the Grid” Report
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
Electrification and distributed resources necessitate closer examination of the interdependencies among critical infrastructure and the distribution grid.

Context: Distribution grids in the United States are on average ~30-years old (of ~40-year asset life), with increasing demands placing significant challenges on a system that was not structured & designed for this new reality.
“Resilience” in an engineering context is the grid’s ability to withstand an impact from cyber and physical threats.
Assessing Resilience Threats

Threat assessments are integral to understanding the potential impact of various physical and cyber threats.

Source: Hawaiian Electric Resilience Stakeholder Working Group
Distribution resilience events involve various potential scales and scopes based on different events.

- Scale and scope of potential events inform requirements.

- Scale and scope shape the economic impact and related value of solutions.

- Need to unpack threats to gain insights into the nature of grid failures and potential structural/design options.
Bow-tie Threat-Risk Mitigation Analysis

Threat analysis provides input into a “Bow-tie” Assessment which is a process to identify potential vulnerabilities (“needs”) that will cause a specific failure and appropriate mitigations.

Challenges involve identifying the additional risk exposure from a range of threats and the system impacts given the increasing complexity of distribution systems along with the potential overlapping set of grid needs identified in the other planning analyses.
Resilience Dependency on Distribution Investment

Most distribution capital investments factor into overall grid resilience capability

Distribution Resilience Considerations need to be integrated into distribution expansion, upgrade & asset planning

- Systematic engineering analysis of grid architecture, design practices, observability, protection & controls
- Grid interfaces with and dependencies on DER & Microgrids need risk-based operational performance and security assessment

Blue shaded areas impact resilience & reliability
Modern Grids are dependent on a resilient foundation

Holistic View Required to Address Both Normal Conditions & Resilience Needs to Optimize Investments

Distribution investment categories:

- Enable community and customer resilience solutions
- Enhance reliability & provide additional resilience functionality
- Improve customer reliability
- Foundational safety, resilience & service quality requirements
Determining Resilience Solutions

- Policymakers, regulators, utilities and customers are considering and implementing various point & community solutions.
  - Community: Cyber-physical grid hardening, mini-grids, multi-user microgrids, etc.
  - Point Solutions: Back-up generation, energy storage, customer microgrid, etc.

- Specific solutions don’t necessarily solve all the needs – a portfolio is needed
  - Solutions usually address specific functional resilience needs
  - Solutions have different potential societal benefits based on type of event and severity

- How to determine an effective portfolio?
  - Structural analysis of existing system resilience (what is the current state?)
  - Architectural-Engineering analysis of potential solutions regarding resilience improvements (or not)
  - Least-cost engineering-economic analysis to determine portfolio of solutions

*Note*: Reliability economics don’t apply, and alternative economic methods focused on local societal and customer benefits are in development.
Roles and Responsibilities

Scale of potential impact shapes who will likely be involved in process.

Major Regional Event (e.g., Super Storm Sandy)

Major Local Event (e.g., CyberAttack, Ice storms, Localized Hurricane, Major Earthquake, etc.)

Localized Event (e.g., Tornado, Wildfire, Flood, etc.)

Isolated Distribution Outages (e.g., Momentary, Blown Fuses, Equipment Failures, etc.)

Consider how should roles, responsibilities and coordination be considered in an integrated, resilient distribution planning process.
Coherence Among Roles and Responsibilities Across Domains

**Legislatures, Governors / Energy Advisors and State Energy Officials**

- **Develop policy goals**
- **Require plans and objectives**
- **Fund improvements**
- **Require coordination and oversight** (ex: coordination & data-sharing among state agencies, eg, sharing cybersecurity information and practices, and conducting independent evaluations)
- **Facilitate specific risk mitigation strategies**
- **Develop further recommendations** (ex: establishing commissions, boards and state offices with specific charges)

**Public Utility Commissions**

- **Set substantive and procedural requirements for plans, including**
  - **Set objectives**, based on state policy goals and customer expectations
  - **Establish scope and timing requirements** based on priorities
  - **Establish metrics** to measure performance
  - **Determine cost recovery mechanisms**
- **Approve or accept plans** (cost recovery approval through and/or outside General Rate Case)

**Utilities**

- **Develop plans**
  - **Align objectives**
  - **Develop long-term strategy and short-term implementation plans** integrated with current planning processes
  - **Prioritize** short-term vs long-term needs through risk assessments
  - **Establish staged, technology deployment plans and cost estimates**
- **Implement approved plans**

**State Policy Makers and Implementers --- System Owners & Operators**
Hawaii Resilience Planning

State & Community Actions Toward Greater Resilience

- Hawaii Act 181, 2011 - Required development of a sustainability-resilience planning and coordination program to liaise among state and local government as well as private or non-profit organizations.
- PUC required resilience planning incorporated into system planning & rate making considerations
- Hawaiian Electric formed state/community resilience working group in 2019 to inform planning criteria and priorities
- Hawaii Act 200, 2018 – Enabled the development of microgrids as another solution for addressing resilience for critical facilities and communities.

Michigan Resilience Planning

Improving Resilience by Transforming Electric Grid

► Governor Ordered Michigan Statewide Energy Assessment Report, 2019

► Grid Security and Reliability Standards
https://www.michigan.gov/mpsc/0,9535,7-395-93307_93312_93593_95590_95596_95597-508672-00.html

► MI Power Grid Initiative
  ■ Improved Integrated Electric System Planning
    https://www.michigan.gov/mpsc/0,9535,7-395-93307_93312_93593_95590_95596-95599-508714--,00.html

  ■ Updated Utility Distribution Plans with a Resilience focus by September, 2021

Considerations

The majority of distribution grid investments affect a system’s physical and/or cybersecurity resilience capability

► How are potential threats being assessed and translated into planning considerations?
► Is there clear logical explanation of how a proposed investment directly or indirectly supports resiliency?
► Is there sufficient transparency in the distribution planning process to understand how resiliency is being addressed and reflected in investment plans?
► How are grid investments and customer/independent solutions like microgrids being considered as part of an overall resilience portfolio?
► Are all of the key stakeholders involved in an effective engagement process?
Thank you

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