Navigating Grid Modernization

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Meet the Presenters

» Eric Clement, PE (MN)
» Supervising Engineer - Distribution Engineering
» 15+ Years Engineering Experience

» Josh Guck, PE (MN)
» Grid Modernization Engineer
» 8+ Years Engineering Experience
Modernization in Perspective
Distribution: The “Forgotten” System

- Centralized Grid (Generation>Transmission>Distribution)
- Poles and Wires Philosophy
- Assets Approaching or Past Usable Life
  - Poles
  - Transformers
  - Protective Devices
  - Cable and Wire
- Lack of System Visibility
Traditional Business Model Disruptions

» System Reliability and Grid Resiliency
» Increasing Customer Engagement Expectations
» Increasing Penetration of Distributed Energy Resources (DERs)
» Transitioning Work Force
» Policy Changes
» Enormous Amounts of Data
2019 Manhattan “Blackout”

- 73,000 customers
- 5 hours to 100% restore; 5/6 in 3.5 hours
- Approximate SAIDI Contribution 4.832 minutes
- Compared to blackout of 9 million customers for over 24 hours in 1977
PG&E Fire Mitigation

» Santa Ana winds cause dry, extremely flammable conditions annually in California

» PG&E filed for bankruptcy in January 2019 due to lawsuits resulting from massive wildfires last fall

» As California goes, so does the rest of the country
Grid Modernization Across the Industry

- We are not aware of the benefits: 5%
- We have not looked closely at the benefits: 5%
- We have a general understanding of the benefits: 51%
- The benefits and business case are well defined and have been qualified: 18%
- The benefits and business case are well defined, but have not been quantified: 21%

Perceptions of Grid Modernization:

- Utility-wide strategic initiative: 29%
- Strategic initiative, not yet embraced by organization: 20%
- Compliance with policy mandates: 9%
- Engineers & Ops effort: 30%
- An IT effort: 7%
- Someone's pet project: 5%

“Source: BRIDGE Energy Group® – 2018 BRIDGE Index™”
Grid Modernization - Defined

- **Reliable** for its consumers
- **Resilient** against major system events
- **Secure** against physical and cyber-attacks
- **Visible** through increased data points
- **Adaptable** to new dynamic loads
- **Accessible** for prosumers who install distributed energy and energy storage resources.
Grid of the Future

- **DERs**
  - Consumers become “Prosumers”
- **Carbon Free Policy**
  - Is your utility prepared?
- **Electric Vehicles**
  - Huge demand potential
- **Behind-the-Meter Control**
  - Rate development strategy
- **Distribution Grid Crucial to Success**
Four-Stage Approach

1. System Evaluation & Framework Design
2. Communication, Network & Data Management Design
3. Technological Solutions & Field Implementation
4. Data Analytics Processing
1. System Evaluation & Framework Design

» Utility Uniqueness
  – Customer Profiles
  – Urban vs Rural
  – Model/Asset Data Accuracy

» Identify Utility Strategy
  – Cost-Benefit Analysis
  – Example – Cost of Minute of SAIDI

» Electric System Model
  – Build
  – Analysis

» Historic Reliability Analysis

» Load Growth Review

» Communication Infrastructure
1. System Evaluation & Framework Design

» Developed list of poor performing feeders in Duluth Area
  – Criteria based on contribution to company reliability metrics and outage causes
  – Selected Colbyville 240 feeder to pilot a Grid Mod plan

» Used knowledge of feeder to develop a list of possible reliability improvements
2. Communication Network & Data Management Design

» Communication options in your area (Radio, Cell, Fiber, etc. or Combination)
  – Grid Geography – Urban or Rural
  – Existing Infrastructure in Place
    • Available Capacity?
    • Latency Requirements?

» Large Increase in Data Points
  – Repositories
  – Systems that will utilize data (CIS, EMS, ADMS, etc)

» Strategy for Using the Data
2. Communication Network & Data Management Design

» COL-240 Project
– Combination of urban and rural
– Utilize multiple communication channels
  • Radio - Existing AMI network
  • Fiber - Existing infrastructure
  • Cell – Optional based on technology selected
– Data to be housed/hosted in multiple channels
  • EMS
  • 3rd Party Hosting
  • Physical Device
3. Technological Solutions & Field Implementation

» Framework from Step 1 drives this step
  – Technology Vetting
    • Research/Vendors
    • Pilots

» New Technology means New Processes
  – Provide Training to Operations
  – Develop User Manual to Ensure Processes are Documented

» Not all Solutions Involve New Technology
  – Load Balancing
  – Capacity Upgrades

» Asset Management Programs
3. Technological Solutions & Field Implementation

» COL-240 Project
  - AMI already deployed - Sensus
  - Reviewed Framework and Identified “Low Hanging Fruit”
  - Aclara Line Sensors
    • Cell Communication
    • 3rd Party Hosted Data

» S&C TripSaver II’s
  - No Comm
  - Data Stored Internal

» Line Capacity Upgrade
  - 2 Feeder ties RGV 253 and FRR 275

» Remote Operable Switches

» Load Balancing and Reconfiguration
4. Data Analytics Processing

» Management systems to help with extraordinary amounts of data
  - Advanced Distribution Management Systems (ADMS)
  - Meter Data Management (MDM)

» Processing Strategy
  - Reviewed
  - Analyzed
  - Acted Upon

» Training on New Processes

» MN Power Progress
Concerns/Issues

» **Technology Choices**
  – Microsoft Zune vs Apple Ipod

» **Communication choices**
  – 2G Network Obsolete

» **Cyber Threat**
  – Ukraine

» **Market adaptability**
  – Uber vs Taxi
Concerns/Issues

» Overload of information
  – How to filter what is needed to make decisions

» Increased capital investment
  – Rate increases

» Life Span Drivers
  – Computer chip failure
  – Technology obsolescence
  – Develop Asset Management and Preventative Maintenance programs
Benefits

» Asset Renewal
» Increased information and visibility to system state
» Improved reliability
» Improved customer experience
» Results driven choices for investment and operations
» Workforce efficiency improvements
MN Power Grid Mod efforts

» **Advanced Metering Infrastructure (AMI)**
  - Demand Side Management
  - Target Power Quality Improvements
  - Advanced Distribution Management System (ADMS)

» **Fault Location, Isolation, and Supply Restoration (FLISR)**
  - Reclosers
  - S&C IntelliRupters and IntelliNodes
  - Motor Operated Switches and Smart Sensors

» **Smart Sensors**
  - Phase Balancing
  - Improve Visibility on Rural Feeders
MN Power Grid Mod efforts

» **Asset replacement**
  - Target Low Maintenance Equipment and/or Better Technology
  - Preventative Maintenance Programming

» **Strategic Undergrounding**
  - Improve Reliability
  - Reduce Vegetation Maintenance Costs

» **GIS and Technology**
  - Use the GIS and Leverage Technology to Improve Our Planning and Reliability
GIS and Technology

» Service Requests
GIS and Technology

» Ground Line Resolution

Total Poles

247
Conclusion

- Modernize the Grid for 21st Century
  - Reliability
  - Resiliency
  - Security
  - Visibility
  - Adaptability
  - Accessibility
- Utilize the 4-Stage Approach
- Be Proactive
Questions

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