Advanced Grid Intelligence and Security

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- 20,600 MW Peak Load
- Customers: 3.5 M Electric, 2M Gas
- 800+ Substations
- 2,900 Feeders
- 615 MW Solar
- 6,556 MW Wind
Drivers for change

- Evolving energy policy
- Enable Distributed Energy Resources (DER)
- Improve reliability and power quality
- Ensure cybersecurity
- Metering capabilities
- Customer expectations
Yesterday’s Power System …

Central generation, one-way power flow, passive consumers
Distributed generation and storage creating two-way power flow
Our Approach

• Align stakeholders
• Develop an over-arching vision
• Research ongoing efforts
• Develop our roadmap
  – *May be state-specific*
• Develop financial path
Stakeholder Alignment

• The key to moving forward – align the needs of:
  – Customers
  – Regulators
  – Policy Makers
  – Shareholders

• Articulate the value proposition
  – Enable and integrate clean energy options
  – Empower customers with information and control
  – Improve power delivery efficiency & reliability
  – Ensure security
  – *Grid as platform for increased value delivery*
Internal Alignment

Executive Sponsorship & Steering

AGIS Initiative Leadership
- Distribution
- Business Systems
- Customer Care
- Enterprise Transformation

Initiative Delivery

Operating Company Leadership

Impacted Business Teams
Vision

Advanced Grid Intelligence and Security (AGIS) is a long-term strategic initiative to transform the electrical distribution business to enhance security, efficiency and reliability, to safely integrate more distributed resources, and to enable improved customer products and services.
Program Capabilities

• Grid visibility and control
  – Increased situational awareness
  – Faster outage restoration
  – Voltage optimization
  – Quantify hosting capacity

• Communications infrastructure
  – Secure, private, fast, 2-way network

• Cybersecurity
  – Best-in-class design
Program capabilities, cont’d

• Advanced Metering
  – Better data / rate design
  – More customer options

• DER Integration
  – Improved planning
  – Expedient, safe interconnections

• Storage and Emerging Technology
  – Increased renewables penetration
  – New products and services
Advanced Distribution Management System (ADMS)

• What it is
  – Real-time network modeling
  – Enhanced visibility and control
  – Platform that enables high-value apps

• Benefits
  ✓ Enhanced reliability
  ✓ Improved voltage control
  ✓ Enables more distributed resources
Fault Location, Isolation and Service Restoration (FLISR)

• What it is:
  – Automated circuit switching
  – Identifies faults, isolates and auto-restores
  – Reduces outage durations
  – Powered by ADMS software
  – Fault Location application calculates location of problems

• Benefits
  ✓ Enhanced reliability
  ✓ Improved customer experience
  ✓ Improved employee safety
Integrated Volt-VAr optimization (IVVO)

• What it is:
  – Better voltage control throughout the system
  – Energy efficiency and peak shaving capabilities
  – Powered by ADMS software
  – Enables higher penetration of distributed resources

• Benefits
  ✓ Voltage control for better power quality
  ✓ Environmental stewardship
  ✓ Renewables integration
Field Area Network (FAN)

• What it is:
  – High Speed Communications Network
  – Ties it all together
  – Standards-based, seeking interoperability
  – Secure

• Benefits
  ✓ Provides visibility and control path
  ✓ Enabler of field applications
Advanced Metering Infrastructure (AMI)

• What it is:
  – Powerful metering capability
  – Accessible via two-way communication
  – Provides more granular insight into use
  – Enables more products and services
  – Reliability and power quality insights

• Benefits
  ✓ Outage/restoration awareness
  ✓ Improved customer experience
  ✓ Awareness of energy use
  ✓ Improved products and services
DER Interconnection & Planning

- Corollary efforts to speed the interconnection process
- Improve distribution planning capabilities
  - Allow for scalability of DER
  - Integrate hosting capacity calculation

![Projected cumulative EVs count in All Xcel Energy service territories](image)
Panasonic Microgrid Project

• Partnership with Panasonic Enterprise Solutions and city of Denver
• 1 MW/2 MWh Li-Ion Younicos Battery Energy Storage System
• 1.3 MW Carport PV at Transit Station & 250 kW rooftop solar
• Feeder approaching ~20% PV penetration
• Performing multiple functions with the battery is key to making these systems more cost effective
Stapleton Project

- Located in Denver’s Stapleton neighborhood
- 6 utility-sited batteries
- 6 customer-sited, utility-owned, behind-the-meter batteries
- 2015: Feeder ~18.5% PV penetration
Modes of operation

• Both Systems:
  – Voltage Regulation
  – System Peak Demand Reduction
  – Energy Arbitrage

• Panasonic
  – Microgrid
  – Solar Ramp Rate Control
  – Frequency Response

• Stapleton
  – Compare and contrast utility-sited and behind-the-meter applications
  – Viewed as an enabler for more distributed generation
MN Belle Plaine project

• Grid deferral demonstration project
  – Using solar combined with battery rather than upgrading a substation
  – 2 MW, 6 MWH Battery
  – 1 MW PV
• Proposed October 2015
• Commission feedback:
  – Need more details
Timeline and Investments

• Program Development Timeline
  – Develop the strategy
  – Select the technologies
  – Communicating our plan

• Investment Timeline
  – Base Systems 2018+
    • Leverage Xcel Energy’s scale for base systems
  – Field Capabilities 2019+
    • Deploy at a rate commensurate with state priorities
Conclusion

• Align stakeholders, policy, and strategy
• Education is critical
• Leverage experience
  – Consultant
  – Industry leaders
• Participate in the dialog
• Participate in research and pilots that align with your goals
For more information

www.xcelenergy.com