

Overcoming Industry Challenges Utilizing Advanced Grid Infrastructure

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Today's Discussion Topics

- Industry Trends and Advanced Grid Infrastructures (AGI)
- "AMI 2.0" leverage to support AGI programs
- IIJA funding opportunities and strategies to secure funding





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Industry Trends in Advanced Grid Infrastructures (AGI)

Industry Trends and Drivers



 Renewable generation and energy storage are being deployed to reduce carbon footprint by replacing carbon-emitting generation—both renewable DERs and the grid are carbon-free and complement each other.



• The electric utility industry is preparing for the deployment of electric vehicles and fleet electrification.



 The electric utility industry is leading the way in supporting the communities they serve by adapting to and mitigating the impacts of severe weather events.



- Expanded and enhanced grids are essential to support beneficial renewables, electrification of transportation, and a resilient grid.
 - Optimal integration of DER and energy storage requires expanding and modernizing the grid infrastructure with significant capital investments.
 - Shifting load patterns dues to electrification requires new analytics.
 - Need for new solutions on the distribution grid to address new issues.

AGI Vision



AGI is leveraging the full capabilities of AMI 2.0 systems to realize distribution grid modernization. AMI 2.0 provides grid edge intelligence, system-wide distribution, digital communications network, and advanced capabilities such as grid modeling, reliability analysis, ADMS interface for DA devices and improved outage capabilities, improved customer options, and other capabilities.

What is AGI?

AGI leverages all intelligent grid devices/sensors onto a cohesive network to provide a management system that improves the customer experience, resiliency, and sustainability of energy delivery. > AGI System includes:

- Advanced metering infrastructure (AMI Smart Meters)
- Communication network FAN & WAN
- Distribution automation (DA) devices Reclosers, fault indicators, capacitor banks, switches, etc.
- Customer interfaces Portal, prepay, etc.
- Data analytics Reliability, modeling, etc.
- Distributed energy resources (DER)
 - Electric vehicles (EVs)
 - Battery storage
 - Wind
 - Solar
 - Demand response
 - Microgrids
 - Energy efficiency devices (load control, thermostats, etc.)
- Intelligent LED streetlights





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AMI 2.0 Supporting Advanced Grid Infrastructures (AGI)

AMI 2.0

More Than Meter-to-Cash

- High Resolution Sensors
- Edge Intelligence / Applications
 - ✓ High Impedance
 - ✓ Voltage / Load Localized
 - ✓ Location Awareness
 - ✓ Meter Alteration
 - ✓ Third Party Apps



AGI – Communication Network (WAN)

New technologies entering the market like Private LTE Cellular



Distribution Automation

- Communications between the Distribution equipment and the SCADA/DMS system is a major issue for recloser automation and can be solved with an AGI system.
- AGI communications enable the Intelligent Electronic Devices (IEDs) to communicate outages to the OMS.
- Communications can also be leveraged for more advanced restoration schemes (FLISR).

Fused Pole-top Recloser





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10

Distribution Automation

- AMI meters provide information on the voltage along the distribution line, measured at the residence.
- Conservation Voltage Reduction (CVR) is a reduction of energy consumption resulting from a reduction of feeder voltage.
 - Voltage optimization is achieved through the operation of substation voltage regulators in order to regulate the voltage at specific End of Line (EOL) points within the range set by national standards.
 - Efficiency gains are realized primarily from a reduction in the system voltage. This results in less energy being consumed by end-use equipment (lower bills).
 - CVR provides peak-load reduction and an annual energy reduction of approximately 0.5%-3% depending on the specific feeder.*



*Source: Evaluation of Conservation Voltage Reduction (CVR) on a National Level, US DOE

Data Analytics

Applying Advanced Analytics

- Access and Explore Data
- Preprocess Data
- Develop Predictive Models
- Integrate Analytics with Systems
- Machine Learning



Grid Modeling and Operational Analytics

- AGI will provide actionable data, from AGI data (meters & IEDs) and SCADA, then process with machine learning, and real time modeling to transform the management of the electric distribution system.
- Results will increase the reliability, resiliency, efficiency, energy equity and power quality across the distribution system with real-time information and situational awareness to:
 - Construct a Medium Voltage Connectivity Model Bottom-up
 - Detect xfmr and circuit overload and imbalance conditions
 - Perform real-time load monitoring and balancing
 - Reduce outage duration (improve SAIDI and CAIDI) and momentaries (improve SAIFI, MAIFI)
 - Improve power quality and customer satisfaction
 - Optimize hosting capacity locations for DERs
 - Maximize asset life and utilization



Distributed Energy Resources (DER) Support

• **DERs** are small-scale units of local generation connected to the grid at distribution level and include microgrids, PHV, EV, Wind, storage, etc.

Challenges –

- Hosting Capacity existing program for rooftop?
- Interconnection
- Control of generation supply on Grid stability
- Local distribution asset impacts

• AGI support with:

- Advanced AMI metering Edge Distributed Intelligence
- Control of DERs over DCN
- Analytics near real time Grid Modeling



Street Lighting

- Utilizes the AGI Digital Communication Network (DCN) backbone network Smart control nodes (photocell + optional sensors), LAN collectors/radio, Software
- Reduction of energy and maintenance cost Centralized Management System (CMS) identifies street light outages, energy consumption, lamp life and other key metrics
- Increased public safety from improved lighting controls
- Carbon reduction from reduced energy consumption – Dimming to 70% nearly doubles the avoided carbon due to avoided generation
- Gateway to a Smart City with multiple sensors like:
 - Air quality
 - Localized weather (e.g., temperature, humidity, and wind)
 - Flooding
 - Pedestrian or traffic counts





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Infrastructure Investment and Jobs Act (IIJA)

Resilience Funding Program Highlights:

Delivering Reliable, Clean, and Affordable Power to More Americans -Grid Resilience and Innovation Partnerships (GRIP)

Program Name (DOE)	Funding Amount
Preventing Outages and Enhancing the Resilience of the Electric Grid / Hazard Hardening (Sec. 40101 Grid Resilience Grants)	\$5 billion
Program Upgrading Our Electric Grid and Ensuring Reliability and Resiliency (Sec. 40103(b) Innovative Resilience Grants)	\$5 billion
Deployment of Technologies to Enhance Grid Flexibility (Sec. 40107 Smart Grid Grants)	\$3 billion

The entirety of the Infrastructure Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Law, Public Law 117-58, is available at: https://www.congress.gov/117/plaws/publ58/PLAW-117publ58.htm.



Grid Resilience Formula Grants Summary

- States, Territories, and Tribes via annual formula grant
 - \$2.3 Billion (approximately \$459 million per year for FY 2022-2026)
 - 15% cost share
 - Up to 5% can be used for Technical Assistance
- Legislation set specific 5-part formula based on population, area, probability of disruptive events, severity of disruptive events, and expenditure on mitigation efforts.
- States, Territories, and Tribes need to submit to DOE
 - Criteria and methods to award grants, a plan for distribution of funds, and evidence of notice and public hearing on the plan (Program Narrative)
 - Formula grant applicants will be required to submit applications each year, although grants may cover multiple-year deployments
- States, Territories, and Tribes may sub-grant to eligible entities for projects



18

Subgrant Cost Match Requirements

Matching Funds

- Any eligible entity that receives a subgrant under this program shall be required to match 100 percent of the amount of the subgrant.
- However, if the subgrant entity sells 4,000,000 megawatt hours of electricity or less per year, the required match will be one-third of the amount awarded to the subgrantee.

Small Utility Set-aside

 A State or Indian Tribe receiving a grant under the program shall ensure that, of the amounts made to subgrantees, the percentage made available to eligible entities that sell not more than 4,000,000 megawatt hours of electricity per year is not less than the percentage of all customers in the State or Indian Tribe that are served by those eligible entities.

Types of resilience investments permitted under the Grid Resilience Formula Grant program

Potential Investments include

- utility pole management
- hardening of power lines, facilities, substations, of other systems
- undergrounding of electrical equipment
- replacement of old overhead conductors and underground cables
- relocation of power lines or reconductoring of power lines with low-sag, advanced conductors
- vegetation and fuel-load management

- weatherization technologies and equipment
- fire-resistant technologies and fire prevention systems
- monitoring and control technologies
- use or construction of distributed energy resources for enhancing system adaptive capacity during disruptive events, including microgrids, and batterystorage subcomponents
- adaptive protection technologies
- advanced modeling technologies

Grants under Section 40101(d) CANNOT be used for: Construction of a new electric generating facility or large-scale battery-storage facility that is not used for enhancing system adaptive capacity during disruptive events; or cybersecurity

DOE GRIP Funding Opportunity Announcement (FOA) with IIJA (BIL) Funding

- Current FOA for GRIP for FY22 and FY23 covers 3 topic areas for corresponding BIL sections totaling \$3.818 Billion
 - 1. Grid Resilience Grants for Section 40101(c) **\$918 Million** (10 awards)
 - 2. Smart Grid Grants for Section 40107 **\$1,080 Million** (25-40 awards)
 - Grid Innovation Program for Section 40103(b) \$1,820 Million (4-40 awards)
 Requires cooperative agreement with DOE
- Next FOA of \$2 Billion to be issued in Q1 2024 for FY24
- 30% allocated to small utilities for Topic Area 1



Grant Assistance



- IIJA Funding application is a tedious process involving numerous forms, documentation, and financial information
- Funding should be tied to a strategic roadmap with program prioritization
- Quanta Technologies can help Utilities develop strategic roadmaps and secure funding for program realization

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