Presentation Agenda

- Automated Metering Infrastructure (AMI) Overview
  - Implementation Drivers
  - AMI System Overview
  - Project Status
  - Project Schedule

- Advanced Distribution Management System (ADMS) Overview
  - Benefits
  - Key Milestones
  - Next Steps
AMI Implementation Drivers

- **Business Benefits** –
  - Foundational technology
    - Will support Bill Redesign (Informational Demand), Smart City, Smart Homes and Volt-Var Optimization
  - Meters report back line side power status, voltage and phase information and renewable system voltage information
  - Automation for new service connects and disconnects

- **Customer Benefits** –
  - Customer can initiate and receive faster service connect, disconnect and re-connect
  - Customer can receive improved outage and restoration information on their mobile devices (ADMS)
More Than Just A Meter

Energy
- kWh – Delivered, Received, Net
- Demand, Time of Use and Load Profile

Billing and Operations
- Midnight self-read (default)
- 8-channel load profile (5, 15, 30 or 60)
- Minimum 45-days on board data storage
- Voltage, Temperature, Current, Reactive capable
- Alarm, Flag, Events

Accessibility
- Remote Configuration, Programming & Firmware Upgrade
- ANSI C12.19 Table Access

Applications
- Single phase ANSI Forms
- Single phase - 120V and 240V
- ZigBee – Home Area Network communication
AMI System Overview

Head-End System

Command Center

Integration

MDM

ADMS

Collector

IPv4/IPv6

Node

Node

Node

Node

Node

Node

Node

Node

Node
What are Nodes

Network Connectivity

- Gateway/Collector
- Router/Repeater
- Electric Meter
- Gas Module
- Water Module
- Distribution Automation
- Street Lights

- Advanced security
- IP standards-based
- Wi-SUN future-ready
AMI Project Status

- As of 10/3/19 we have installed 100,000+ AMI meters!
- Anticipated Completion 2022

AMI Meters Installed Per Day

Install Analysis

<table>
<thead>
<tr>
<th></th>
<th>Yesterday</th>
<th>Last 7 Days</th>
<th>Last 30 Days</th>
<th>YTD</th>
<th>All</th>
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<tr>
<td>Total Installed</td>
<td>479</td>
<td>2,962</td>
<td>12,579</td>
<td>95,995</td>
<td>104,156</td>
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<tr>
<td>Daily Average</td>
<td>479</td>
<td>423</td>
<td>419</td>
<td>339</td>
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ADMS – What is it?

- Advanced Distribution Management System
  - Real-time operational visibility – Operator Situational Awareness
  - Control/monitoring & outage management
  - Supports grid automation & optimization
  - Advanced analysis of current grid conditions
  - Foundation for Distribution Modernization projects
- All distribution field data leads to ADMS
  - Substation SCADA, AMR/AMI Meters, Grid Sensors & Field Device Controllers
- Future management of Distributed Energy Resources
  - Demand Response (DR)
  - Distributed Energy Resource Management (DERMS)
ADMS Project Benefits

- Improved distribution grid reliability
  - Proactive optimization of grid resources
  - Power flow visualization/voltage control
  - Fault location/short circuit analysis
- Increased asset utilization
  - Improved load balance/extending asset life
  - Prioritized maintenance/system reinforcement
- Increased customer satisfaction
  - Improved reliability/power quality
- Simplified operations system
  - Common application user interface & user/support training
  - Standardized support team skill sets
  - Shared hardware platforms
Business Benefits

- Evolving the capability of the distribution system
  - Voltage optimization & system reinforcement prioritization
    - Coordination of voltage control devices
      - Load Tap Changers/Capacitor Banks/Regulators & Inverters
  - Optimize Distribution Energy Resources
    - Compensate for growing Distributed Energy Resources production using forecasts
    - Defer/Reduce traditional distribution circuit upgrades by optimizing existing system
  - Use ADMS for select “behind the meter” equipment as a bridge to a future DERMS solution
Key Milestones

- October & November
  - Start User/Operator/DOCS Training
  - Finish Site Acceptance Testing
  - Parallel Operation

- December and January
  - User Acceptance Testing
  - TEP/UNSE Go Live
Next Steps

- More field devices for ADMS
  - Researching the use of the AMI drop-in network for supporting communications for field devices
    - Line sensors
    - Capacitor banks
    - Street Light control
- DERMS system for integration of devices on the customer side of the meter
  - Efforts underway to create a multi-year roadmap for DERMS integration