Superstorm Sandy Fuels Grid Innovation

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Today’s Agenda

- Impact of weather
- Outage Lifecycle Management
- Q&A
Billion-dollar Weather and Climate Disasters

Severe weather is the single leading cause of power outages and accounts for 87 percent of outages affecting 50,000 or more customers (U.S. DOE, Form OE-417).

Source: Economic Benefits Of Increasing Electric Grid Resilience to Weather Outages Executive Office of the President – August 2013
The costs of the new era of outages

10x Increase in large-scale outages

$20M A minute societal cost

$25-70B Average annual cost
A Strategic Surprise for the Power Sector

“Super storm Sandy constituted a strategic surprise for me and much of the Department of Defense.” – Paul Stockton

- Difficult logistics and poor communication between utilities, defense officials, state planners and first responders.
- Inadequate communication to customers, inadequate planning in vulnerable areas, poor visibility on the grid.
- Lack of attention on future “black sky” events worse than Sandy.
Why the Grid is Different After Sandy

“Technological innovation...combined with aging infrastructure, extreme weather events, and system security and resiliency needs, are all leading to significant changes” – NY PUC

- Closer federal engagement in extreme weather events and better coordination among utilities.
- Distribution automation grows to $3B next year. Three IOUs in CA to spend $700M on voltage regulators, capacitor banks, etc. ADMS could hit $1B.
- 700 megawatts of commercial storage; 1.8 gigawatts of microgrids, many with renewables.
- Comprehensive planning that encompass extreme weather, smart grid, distributed energy and utility business models.
Today’s industry challenges - Example

- 80% Extreme events
- 21 min
- 36% 5 of 6

- 1.8%
- $1.5M
Outage Lifecycle Management

OUTAGE LIFECYCLE MANAGEMENT

Grid Management
Advanced Distribution Management System

Workforce Management
Mobile Workforce Management

Business Analytics
Outage Reporting and Communication
The lifecycle of an outage

1. **Planning**
   - Forecast, plan and prepare resources with full visibility and scenario-based planning

2. **Prediction + Preparation**
   - Schedule and prioritize resources and keep stakeholders informed

3. **Assessment + Restoration**
   - Isolate, auto restore, deploy right crew to safely and efficiently restore remaining customers while keeping stakeholders informed

4. **Repair + Closeout**
   - Compliance, reporting and review helps build plan for next outage
1 Planning

Plan and prepare systems throughout the year

Plan and Prepare

- Build and maintain library of Historical Storm Models
- Build statistic reports for historical or different storm types
- Allows customer to register for notifications with preferences
Prepare restoration activities based on historical models and projections and schedule resources accordingly

### Project & Analyze
- Create projection models for restoration analysis
- Edit projections models with scenarios to understand impact of storm and resource planning

### Resource Planning
- Plan resource needs and locations
- Mutual assistance call outs and on-boarding
# Assess + Restore

*Isolate and restore automatically then deploy right crew to safely and efficiently restore remaining customers*

## Outage Analysis, work prioritization and dispatch
- OMS analyzes troubles calls form different sources,
- Identify faulted section through Fault location and Damage Assessment
- Self-healing can auto isolate and reconfigure grid
- Prioritize work and dispatch to crews for optimal restoration

## Notification
- Notify stakeholders and keep affected customers up to date throughout the event
4 Closeout

Post event Analysis & Reporting, Compliance, and plan for next outage

**Post Event Analysis and Reports**
- Post analysis of crew work, outage areas and issues
- Addition of information for trend reporting
- Post Event Reports

**Storm Classification**
- Build data for future preparation, back in to Preparation phase
OLM Benefits

- Provides a scalable platform that allows the same processes to be followed in blue sky days and major events.
- Improves situational awareness, in the control room, out in the field and across the organization.
- Improved resource planning that saves time and money.
- Common data across platform ensures common & accurate data is communicated to stakeholder and customers.
- Ensure compliance with regulatory requirements with full audit trail throughout the event.
- Reduced outage duration and improved reliability leading to improved customer satisfaction.