Research & Development at Con Edison

BNL Smart Grid Workshop
10.9.15
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Vision

Drive timely innovation technological solutions addressing strategic and operational needs of the corporation

- 1969 Chartered
- $15 Million Budget
- 100 Patents
Research & Development
A Shared Services Organization

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Peak Load Reduction Challenges

2016 Peak Load Curve for Network Feeders

- Transmission Feeder Capacity
- Projected Loading
Current R&D Battery Demonstration & Development Projects

• Development support for CUNY Zinc Manganese Dioxide Battery
  – Commercialized by Urban Electric Power

• EOS Zinc Air Battery Demonstration at Van Nest
  – 6 kW system
  – Evaluation of key performance metrics, benefits

• Transportable Energy Storage Demonstration (TESS)
  – 800 kWh, 500 kW system
  – Fully integrated system
  – Mobile load relief application
  – Provide connection at customer Vault
Collaboration With the FDNY and DoB

- Nov 2014: FDNY/Con Edison collaboration and project scoping
  - Con Edison team: EE & DM, R&D, Emergency Response
- Mar 2015: NYSERDA and NYC DOB formally join the project
- **True Information Gap Exists**: First responders’ safety guidelines needed to inform training and response procedures

- FDNY Primary Concerns:
  - Identification of effective and safe suppression agents (avoid exotic ones or ones requiring special equipment)
  - Gasses released in burn – material and rate
  - Current leakage through suppression agent to extinguisher nozzle
  - Propagation of fires within a rack and between racks
Other Battery Activities – None Provide First Responder Operational Guidelines

• Storage procurements and installations in other States
  – California: 1.325 GW utility and customer sided required by CPUC by 2024; staged procurement process underway
  – Texas: 5 GW utility sided proposed

• Private Lab Testing
  – Underwriters Laboratories, Factory Mutual, DNV GL, Exponent, and other private testing laboratories

• Government and private organizations
  – DOE and National Labs: Sandia and Pacific Northwest National Labs (ESS Strategic Plan—very general)
  – EPRI (Energy Storage Integration Council (ESIC))
  – State Organizations: NYBEST/NYSERDA, ESA, CESA
  – Firefighting Associations: NFPA, Fire Research Foundation (Lithium Ion Hazard Assessment RFP)
Project Deliverables and Timeline

• Testing and modeling reports
• First Responders Guidelines Document
• Supporting information for FDNY
  – Operational procedures
  – Training documents
• Expect to complete project activities by early 2016 to support BQDM project timeline
The First Gas Detector - Canaries!
Present and future Gas Detectors

Flame Ionization

Collector electrode
Polarizing voltage

Igniter Sample inlet Hydrogen supply

Infrared Controlled Interference Polarization Spectrometry

Tunable Diode Laser Absorption Spectroscopy

Schlieren Optics Methodology

Cavity Ringdown Spectroscopy

Differential Absorption Lidar

Transmit

Receive

BP Single-Mode Mid-IR Laser
Telescope Assembly
Detector

Meth Effluents
Two Emitted Wavelengths

Distance Range
With Sample
Without Sample
Manhole Event - Origin

What can cause an event

1. Salt
2. Salt Water
3. Heat
4. Gas, smoke
5. Spark
6. Explosion
Current R&D Efforts To Enhance Manhole Safety

- Secondary Network Arcing Fault Detection
- Alternative Cover and Vault Designs
- Enhanced Voltage Scanning
- Sparking Gas Detection
- Alternative Deicing
Prevention of Cascading Event
Using the DG Plug and LV Switch

- Stop a cascading from propagating through the network by isolating 1.2MVA
- Portable DG can be utilized to pick up isolated demand
- 5 locations, each of which can be isolated independently
  - 750 customers
  - 27 low voltage switches
  - 39 DG quick connect plugs
- Worked with DE, R&D and vendor to develop Low Voltage Switch and DG Plug
Gamification of Residential Demand Response

- Demand Response (DR) goal: Reduce customer load during times of peak electrical use
- coolNYC targets the ~6 million window air conditioners in our territory
- During a DR event Con Edison can increase the set point of the air conditioner ~few degrees for about 4 hours.
- The customer can opt out and override the utility control
Residential Demand Response at Con Edison: coolNYC

- Modlet allows the customer to:
  - View energy used by ACs
  - Control ACs by time or temperature

Modlet Makes window ACs controllable

View and control remotely via Internet

Customer
Earning Points...

- Participating in the coolNYC program
  - Signing up for the program
  - Setting up AC controlling modlet with wifi
  - Participating in each DR events (the longer the better)
What Did Our Customers Think about the Behavioral Incentives?

- Customer participation in events increased by 20% (even on hottest days)
- Program cost decreased by 20%
- Next steps: Expand use of the behavioral incentives in
  - coolNYC program and
  - Possibly other EE programs

*Note: Summer of 2014 was unseasonably cool*
Integration of Microgrids and Distributed Energy Resources (DER) - Goals & Objectives

• Customers Needs
  – Secure & reliable energy that is sustainability & resiliency
  – Energy efficiency & demand reduction

• Main objective
  – Create a dynamic grid system that can accommodate increased penetration of Microgrids & DER.

• Engineering Study
  – Explore the challenges and opportunities in defining and implementing Microgrids
  – Explore the potential benefits of using real-time monitoring and advanced control of Distributed Energy Resources (DER)
Use Cases – Carved Out Network Microgrid

• DER Technologies
  – CHP
  – Solar PV

• Load Types
  – 3-5 story multi-fam.
Use Cases – Overhead 13kV Autoloop Microgrid

- DER Technologies
  - Battery
  - Solar PV
  - Combustion

- Load Types
  - Residential
    - Single
    - Multi-family
  - Commercial Properties
Use Cases – Facility/Campus Microgrid

• DER Technologies
  – CHP (High Tension)
  – Solar PV (Low Tension)

• Load Types
  – Multi-Story Mix
    • Residential Tenants
    • Commercial Tenants
Project Deliverables

• Requirements Specifications
  – Microgrid Resources, Platform Design & Architecture

• Use Cases
  – High level functional description of use cases & solutions concepts

• Control & Power Systems Modelling and Simulation
  – Power Systems & Marginal Cost Benefit Analysis
  – Disconnect & Connect methodologies and protection

• Deployment Specification Options (NYSERDA)
  – Integrate of existing telecommunications systems, substation devices, control center and enterprise applications
  – Functional architectural considerations
Geomagnetic Disturbance Phenomenon

Coronal Mass Ejection

Solar Flare

CME

Interaction with Earth's Magnetic Field

Maxwell Eq. & Earth Cond. Model

Grid Model

GIC
Geomagnetically Induced Current Modeling

Objective: Evaluate and address modeling gaps and practices through real world application of advanced GIC modeling techniques through calibration of the Con Edison GIC network model.

Project Tasks
- System data collection
- Component model development
- Network model calibration
- Software tool verification
- Model validation assessment
- Parametric sensitivity analyses
UAVs – Military and Civilian

NASA weather drone

Assessment

Inspection

Emergency response

Commercial delivery
UAV Lidar Imaging for Corridor Inspection and Vegetation Management
Damage assessment of the future

Severe weather – utility assets impacted

Damage Assessors Dispatched

UAV, Satellite, & ground Imagery dispatched

Computer Vision Synchronizing and Job Creation

Post-Storm Damage Assessment

Field crews repair, restore and report work done & ERT

Work scheduling and dispatch

Work order generation and compilation / integration
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Thank You!

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