2016

Electric Research & Development
Report and Project Status Sheets

Matter Number 10-00779
Prepared for the Public Service Commission
by Consolidated Edison Company of New York, Inc.
4 Irving Place, New York, NY 10003

April 2016
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INTRODUCTION

Con Edison and Orange and Rockland Utilities ("the Companies"), continue to maintain a high degree of focus on research and development (R&D), because R&D helps the Companies maintain reliability and control customer costs. The characteristics of our system, such as very large population, high load density, tremendous infrastructure density, high marginal costs for new infrastructure, and the demand for continuation of our renowned reliability present the Companies with technical issues that are unique in New York State and in the industry. These factors, and an increasing focus on customer experience and customer sited technology solutions for our service territories’ unique demographic, require us to be at the forefront of developing cutting edge power delivery improvements and the development of innovative solutions.

The Companies’ research program is focused on obtaining the greatest results for challenges unique to the Companies over various product delivery times. The Companies’ portfolio balances short term and strategic, as well as balancing a mix of small and large projects.

GOALS AND OBJECTIVES

The electric utility industry is responsible for supplying electricity in a safe, reliable, economic, and environmentally acceptable manner and with due consideration to sustainability and the conservation of natural resources. To fulfill this obligation, continuous improvement in every phase of the Companies’ operations is required. Success is dependent, to a great extent, on a sound research, development, and demonstration (R&D) program, with support and cooperation from our customers, the Companies, government, industry, and other electric utilities.

R&D works to provide technologies that support the long-term sustainability of our businesses. R&D does this by identifying, developing, demonstrating and providing advanced equipment, hardware, software methodologies, etc. to Company operations. R&D’s overall role and responsibilities involve formulating and implementing a research program which addresses the strategic and near-term needs of the Company’s electric transmission and distribution (T&D) systems, including building on R&D’s early work on customer engagement technologies and innovations into our operations, planning, and forecasting capabilities, enhancing system security and resiliency.

The following are guidelines used in establishing the Company's research programs:

- Develop advanced technologies and analytical techniques to improve efficiency, cost-effectiveness, reliability, resiliency, maintainability, and to extend the operating life of existing Company equipment.
- Develop advanced energy systems offering the potential of enabling customers to better manage and reduce their energy costs, while also reducing adverse environmental impact.
- Develop advanced technologies and techniques to increase worker and public safety and improve productivity.
• Develop advanced technologies and techniques to harden the infrastructure of the operating systems against adverse weather and improve cyber and physical security.
• Support environmental research that will aid in operating and planning the electric systems in a cost-effective and environmentally excellent manner.
• Develop and demonstrate new technologies that will permit our customers to use electricity more effectively and economically.
• Assess the merits and feasibility of highly innovative ideas and technologies that could lead to practical solutions, products, and new opportunities for future use on our systems.

ORGANIZATION

Since its formation in 1970, the Companies’ R&D Department has kept pace with the changing electric utility industry to ensure that continued progress is made in identifying research that will improve service, reducing cost to the consumer and minimizing the environmental impact of supplying adequate amounts of electric power. R&D has aggressively pursued new emerging technologies that improve the Companies’ operations, serve our customers, and help create new markets.

R&D operates in a collaborative and transparent environment with a cost-conscious mindset. Our strategy to meet the corporate cultural transformation is:

• We are open, fair, trusted and trusting, internally and externally:
  o Relying on and encouraging the talents of others within the Company
  o Conducting open discussions at our monthly staff meetings and departmental meetings that are held to address specific issues
  o Conducting timely and frequent outreach activities with internal customers and external stakeholders.
• Recognizing the substantial interest that customers and other external stakeholders have in every aspect of our business, we affirmatively and successfully engage with customers and external stakeholders in every aspect of our business:
  o Continually learning more about technological innovations in our industry and others
  o Benchmarking against other industry leaders
  o Seeking out new ideas across a broad spectrum of different industries, academia, policymakers, governmental agencies and research consortia
• With a cost-conscious mindset, all employees act like business owners
  o Identifying needs of the Company that may have solutions in R&D
  o Developing and deploying advanced technologies and analytical techniques to meet those needs
  o Developing and deploying advanced technologies to improve worker and public safety
  o Developing and deploying advanced technologies to improve Company efficiency
Effectively balancing our portfolio to meet both the immediate operational needs and longer-term strategic issues

Working to increase value and leveraging of our expenditures

Staffing and Departmental Organization

Under the leadership of its Director, CECONY’s R&D Department comprises two major sections: Electric, and Gas and Steam Research. R&D personnel come from both operating areas - with many years of company-specific experience, and from other industries and academia to provide broader experience. Each of our staff seeks to develop extensive internal contacts and a detailed understanding of our business and our needs, and a philosophy on what constitutes good R&D. Working collaboratively with other groups in the Companies, the staff establishes and implements the R&D program. The support of our internal customers, with their professional staffs and labor forces, helps keep R&D close to their needs and insures that solutions get implemented. Approximately 15% of the Companies’ staffing and labor costs on R&D projects are provided by company organizations outside the R&D department. This approach achieves cost savings, provides a customer focus, and maintains program flexibility.

Electric Transmission and Distribution research projects implement new technologies to enhance efficiency, improve safety, improve reliability and operating performance, and extend the useful life of electrical equipment and the mitigation of environmental impacts of this equipment. These projects also support the Companies’ Customer Service, Energy Efficiency/Demand Side Management, and Utility of the Future organizations by developing and helping to introduce better end-use technologies and by providing the planning tools required to understand and influence electricity demand to benefit the Companies and its customers enabling customers to better manage and reduce their energy costs. Included are R&D activities in the areas of electrical distribution, transmission, substations, power systems planning, operations, energy management and use, and computing applications.

The Technology Transfer program stresses the importance of maximizing return on our investment in research programs. Seminars, workshops, status reports, technical publications, research databases, and Public Affairs notices keep employees informed about and engaged with new and emerging technologies.

Program Development and Management

CECONY’s R&D Department, guided by corporate goals and objectives and in consultation with other Company organizations, determines technological R&D needs, develops the R&D plan, and establishes programs that implement the plan. Individual projects are funded either solely by the Company or jointly through various arrangements with federal and state agencies, industry group R&D organizations, technology incubators, other utilities, and manufacturers. With support from engineering and operations personnel, the R&D Department also establishes test sites and demonstration facilities for evaluating new technologies. Once commercial feasibility of a technology is established and demonstrated by adequate field trials, the technology is no longer
considered R&D. The R&D Department monitors initial implementation of new technology to ensure that expected benefits are achieved and potential implementation problems are minimized. It also monitors new technical developments that might be of future benefit to the Company and its customers.

R&D and other Company personnel represent the Company and articulate its needs on steering committees established to advise and direct industry-wide research through the Electric Power Research Institute (EPRI) and other consortia.

**Project Selection and Management**

The process of selecting R&D projects is guided by the experience of the professional staff and the Companies’ senior management with input from an array of design and operations workers and managers. The goal is to match the needs of the Companies’ operations to opportunities for solutions using advanced technology. The first step is to determine whether the project meets the New York State Public Service Commission’s definition of R&D. An analysis of candidate projects is then made, with potential advantages being reviewed against financial resources required for successful development. The probability of achieving commercial success in a reasonable time is also considered, and other R&D activities are reviewed for possible duplications. R&D projects must have a path to likely implementation should they prove viable. Project appropriation requests include specific metrics used to determine the success of the R&D project as well as an implementation plan defining how the product or process would be integrated into operations if the R&D effort is successful. A cost/benefit analysis is performed. Qualitative benefits are discussed, and every effort is made to apply quantitative analysis. Emphasis is placed on projects that show near and mid-term benefits, as well as long term programmatic issues that have significant impact on the Companies. This general approach facilitates a comparison of various candidate technologies and aids in project selection and prioritization.

Upon receiving funding approval, a project leader is selected, usually from the corporate area most affected by the research results, such as Electric Operations, Central Engineering, Customer Service, or Environment Health and Safety. The project leader takes responsibility for achieving objectives and facilitates technical coordination between Company organizations. The project leader and an R&D engineer share responsibility for administering the project and ensuring that reports are made at appropriate milestones.

The combined experience of the R&D engineer, project leader, and other personnel is a critical factor when developing the field evaluation and demonstration phase that many projects require before moving from the developmental stages to commercially feasible applications.

**Technology Transfer**

The Company continues to stress the importance of maximizing return on its investment in research programs. Seminars, workshops, status reports, technical publications and research databases keep employees informed and engaged with new and emerging technologies. Employees also have direct access to EPRI and other internet-based technology libraries, enabling on-line searches of databases,
including ongoing research projects, publications, products, experts, patents, etc. As the program has matured, more individuals throughout the Company have become aware of research information and products that are of value to them in achieving corporate goals and objectives.

**RESEARCH AND DEVELOPMENT PROGRAM**

The purpose of the Company's R&D program is to develop and demonstrate new processes/methods, technologies, and tools that will improve the electric system as well as its operating and business practices through both an internal program and external industry research organizations. R&D is driven by the goal to provide new technology options that don’t presently exist which fill near term operational needs and longer term strategic needs of the corporation. The program strives to provide proactive problem solving opportunities that have the potential for making step-changes or even quantum leaps in the way we do business. The near term operational goal is to demonstrate technologies that have been developed and are ready for deployment into the field. The medium term goal is to develop technologies that fill a need, improve performance, or enhance customer experience and the long range goal is to identify new technologies that presently don’t exist. Included within this goal are the following general concepts:

- Assess the impact of emerging technologies on business operations, competitiveness and profitability and deliver more innovative products.
- Anticipate changing technology needs driven by our internal business, by external regulation and by our customer needs. Based on these needs, develop and implement plans to bring new technology options to the company.
- Establish and maintain relationships, with high-value industry, incubators, and other groups and organizations to maintain contacts, gather strategic information and develop new partners for co-funding of research projects.

R&D pursues these goals and initiatives through a wide variety of external and internal programs and activities.

**Collaborative R&D**

The Companies continue their commitment to industry-group R&D programs and actively participate in the decision-making process of such national organizations as EPRI, NEETRAC, and CEATI. For projects that are of common interest to the Companies and the industry, particularly on large demonstrations, once the basic research and proof of concept have been completed, the Companies work collaboratively with various utilities, industry, government and private organizations located outside the state or even the nation. Con Edison’s flexible R&D program allows us to narrow the risk associated with initial development of technologies of specific importance to us. Other entities may then be willing to help us fund demonstrations of operational systems. The Companies have also found that manufacturers are not willing to undertake technology development on problems that are unique to us unless there is support in the form of funding the basic research and feasibility of proof of concept, and providing a reasonable market for
the product. This requires us to fund product development by ourselves or to look for partners with similar needs. Collaborating with other utilities, provides both financial leverage and market support. Many partners are outside of New York State and sometimes outside the United States. Collaborative organizations such as EPRI, NEETRAC, and CEATI provide a useful forum to help fund multi-million dollar demonstrations.

The Companies have budgeted $3.4 million in 2016 in support of industry group research. Forms E-1 and E-3 identify the estimated expenditures for industry group R&D programs, as well as total CECONY and O&R expenditures for internal and contractor programs.

**General R&D Support**

General and administrative R&D support includes those costs relating to research performed by the Companies that is not specific to a program area. Such efforts have widespread application and benefits throughout the Company and for customers. Other general R&D support includes administrative costs that support research and technical services in all other R&D program areas. R&D has budgeted $2.0 million in 2016 for general and administrative support of the electric R&D program.

**2015 R&D Successes**

In 2015 R&D’s notable successes include:

- Field demonstration of Arcing Fault Detection in Network Protector Relays and expanded testing of the technology incorporated into the existing NWP relays.
- Remote breaker racking systems approved by Substation Operations in place and effective for at least 80% of the Medium Voltage circuit breakers in area substations.
- A system to recognize and alert for Intentional Electromagnetic Interference attacks and a procedure to address these attacks have been installed at the ECC and AECC.
- Gamification demonstration which successfully increased residential Demand Response (DR) participation for ‘coolNYC’. Initial results showed a 20% lower opt-out rate than the control group.
- R&D, Civil Engineering, Electrical Engineering, and EPRI completed full scale testing of the model and methodology to more accurately calculate fault current mechanical forces in substation structures, which will significantly reduce the cost of civil work during substation upgrades and new construction. Further successes in the efforts underway to address the difficulties of identifying and locating dielectric fluid leaks from transmission lines. Two technologies advanced from lab proof of concept to lab testing on field equipment using surface wave generator/receiver to identify the disbonded coating that precedes a leaking pipe. Also optimizing Perfluorocarbon (PFT) tracer gas for leak detection, developing a next generation PFT, and using Infrared technologies for identifying leaks have made progress. A Transmission Manhole Oil Minder has been successfully demonstrated in the field and will be deployed in 2016.
• R&D has received funding from NYSERDA to expand on the work with the EE/DSM and the FDNY project to identify suppressant agents and building codes for various battery storage technologies.

• R&D continues working with three technologies on design of a 15 kV class fault current limiter – a Superconducting, a solid state, and a cold cathode technology. All are showing positive results – though currently only the cold cathode is likely to meet our size constraints.

• The Company is developing a Transportable Energy Storage System (TESS) for use on the distribution grid and this year received a ‘letter of no objection’ from the FDNY to safely pursue permitting for testing at our Astoria facilities.

• R&D has been supporting development of a ‘DG Quick Connect’ with 3G which provides for easy safe connection of DG into the network secondary grid and is applying to patent the technology. R&D continues to foster outreach to external agencies and organizations to explore synergies between Con Edison R&D and DEP, MTA, several NYS start-up tech incubators and is actively pursuing funding opportunities through such entities as NSYERDA, DOE, DHS and the national Labs.

Awards and Other Noteworthy Items

Two EPRI Technology Transfer Awards were received by Con Edison this for 2015 work:

• Substation Structures Dynamic Response to Fault Current Forces: The project was initiated at Con Edison’s Engineering request, and included collaboration from multi-disciplinary industry and academia experts that worked together for a period of three years. Modeling was performed by collaboration of Lehigh University (LU) and Florida State University (FSU) research teams, combining LU’s expertise in structural engineering and FSU’s experience in modeling of electromagnetic forces applied to substation bus during short circuit. Two third-party consultants, Windsor Bush Consulting and DiGioia Gray and Associates, experts in power systems and structural dynamics, also participated to verify methodology and the testing procedures. Engineers from Con Edison served the project in an advisory role as they have hands-on experience in substations design, construction and operation, as well as implementing substation upgrades. Implementation of project results in design of substations upgrades is expected to save Company about $5M over the next few (3 to 5) years.

• GIC Network Model Development and Analysis: Calculation of Geomagnetically Induced Currents (GIC) in transmission systems is a new science for which the behavior, scope and impact are not fully understood by the scientific community, and while there are few calculation methodologies suggested, none of them had been proven before to reflect actual GIC and their consequences with high accuracy. Modeling of equipment missing in earlier versions of software and NERC modeling guide, such as shunt reactors and phase angle regulators, was adopted by both, software developers and NERC standard drafting group, based on project team’s suggestions. Based on the new knowledge developed in the course of the project, EPRI initiated new project “Development of the Geomagnetic Disturbance Planning Guide” for the industry. The project results will be used for studies needed for NERC TPL-007 Reliability Standard compliance
R&D also received Team and EH&S Awards for our work with the FDNY on suppressant agents for Battery Storage technologies and a Team award for the Substation Structures Dynamic Response to Fault Current Forces mentioned above.

3 patents were awarded the company in 2015.

2016 Program
The 2016 internal and contractor R&D program is segregated into four (4) sub programs: transmission, distribution, substations, and customer. Program areas of focus, goals and objectives and some of the program elements underway are summarized for each area.

Transmission Program
Goals and Objectives
- Minimize environmental impact of dielectric fluid
- Maximize use of existing facilities
- Determine remaining life of existing cable system so that replacement strategies can be developed
- Develop replacement options

The Transmission research program is directed toward improving the reliability, upgrading the capacity, and extending the life of the Companies’ underground and overhead transmission systems. R&D activities in the area of transmission include: locating disbonded coatings on underground transmission pipes; development of techniques and equipment to expedite detection and location of faults in transmission feeders; examination of the present and expected performance of 138-kV and 345-kV cable systems; and implementation of state-of-the-art sensors, hardware and software, and projects to reduce the impacts of geo- and electromagnetic, and intentional electromagnetic events.

Distribution Program
Goals and Objectives
- Improve worker health and safety
- Increase productivity
- Improve public safety
- Meet or exceed environmental regulations
- Improve asset management
- Enhance system reliability and resiliency
- Enhance the customer experience
- Reduce costs/maintain competitiveness
- Improve data analytics and security

The Distribution R&D program focuses on developing, demonstrating and assisting in the early deployment of new technologies that will improve safety, system reliability and integrity, promote environmental excellence, and reduce costs of construction, maintenance and operation of the
distribution systems. R&D activities in the area of distribution include: manhole event mitigation, stray voltage detection and mitigation; real-time fault location system for primary distribution feeders; hardening of infrastructure against adverse weather, improved damage assessment systems, performing advanced development at the Distribution Cable and Joint Cable Center of Excellence located at the Con Edison Van Nest facility, with EPRI, to evaluate existing distribution assets and develop improved technologies, equipment and materials that can be used to replace aging infrastructure; and exploring partial discharge detection as a diagnostic for incipient failures and other anomalies in distribution cables, joints and transformers.

Continue participation in NEETRAC, an effective venue for collaboration on research, development, prototyping and testing the widening range of technologies and equipment that are becoming possible or are being developed by vendors. Using NEETRAC sustain technology transfer, participate in important standards development activities, and leverage R&D funds via federal and other funding and collaboration with utilities. Participation also enables the company to initiate expedited direct-placed projects whose focus and scope we exclusively define.

**Cable and Joint Center for Excellence** is an initiative to support our core wires business, including maintaining reliability and enhancing the workforce. The Center, at Con Edison’s Van Nest location, has been established to evaluate underground network feeders and develop improved solutions for necessary replacements. The Center consolidated the cable and joint autopsy programs that were previously dispersed among various operating groups. The Center analyzes condition assessment and remaining life techniques to better prioritize replacements and sustain reliable network service.

**Substations Program**

**Goals and Objectives**

- Reduce O&M costs
- Maximize use of existing facilities
- Improve safety
- Develop lower-cost, smaller-size, and more efficient, reliable, and environmentally acceptable equipment

The Substation R&D program focuses on reducing the O&M costs of substation equipment and extending the useful life of installed equipment. R&D projects in this area include the demonstration of advanced monitors to assess, both on-line and in real time, the condition (including the operating status) of power transformers, load tap changers and circuit breakers. Utilities in dense urban environment are experiencing increased fault current levels due to additional distributed energy sources as well as systems being operated at higher power levels than in the past. Projects include fault current mitigation technologies and arc flash projection.

**Customer Program**

**Goals and Objectives**

- Improve the customer experience
- Reduce costs/maintain competitiveness
- Integration of data collection
Customer Engagement projects focus on efforts to enhance the customer experience, lower costs. Included are assessments and demonstrations of new technologies that offer improved load control, non-intrusive analysis of customer load patterns, improved interconnection practices, and DER and EV facilitation.

**Additional Information**
Additional information on the Companies’ R&D program may be obtained directly through:

Margarett Jolly  
Director R&D Department  
(212) 460-3098  
jollym@coned.com
Combined Companies

Form E-1
Research and Development Program Plan Expenditures
($ 000)

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### Consolidated Edison Company of New York, Inc.

**Form E-1**  
Research and Development Program Plan Expenditures  
($ 000)

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* Orange and Rockland R&D expenditures are shared 70% by New York customers and 30% by New Jersey customers.
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Substation

NERC CIP TOOLS AND TECHNIQUES

SECURE REMOTE SUBSTATION ACCESS SOLUTIONS

SF6 FAULT CURRENT LIMITER (DEVELOP, DESIGN, ASSEMBLE, TEST & DELIVER PROGRAM)

ADVANCED SUBSTATION PROJECTS - (2015-2016 SS SIMULATOR; 2017-2018 - TBD)

BULK POWER SYSTEM TIVS

CONFER PHASE 2

D. MAC RAE SUBSTATION SIMULATOR

DEMONSTRATION OF NEW SF6 LEAKAGE REDUCTION SYSTEM AT WEST 49TH STREET

DEMONSTRATION OF REMOTE BREAKER RACKING SYSTEM

DESIGN, INSTALLATION AND INSPECTION OF TWO PERMANENT FALL PROTECTION SYSTEMS AT OSSINING SUBSTATION

DEVELOPMENT OF LINE GROUPS SYSTEM FOR BULK ELECTRIC SYSTEM FAULT ANALYSIS

EAST 13TH STREET INSULATOR ICING MONITORING

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CSN  92649  POET  10064342  TASK  0372

PROGRAM AREA  Administration

DURATION  On Going  ENGINEER  Labudzinski

PROJECT LEAD  Labudzinski

AUTHORIZED  $1,846,000  EXP. THROUGH 2015  $1,853,343

OBJECTIVE

Fund that part of the Company's patent search fees associated with products of R&D program.

BENEFITS

Royalty-free use of new technologies resulting in reduced O&M costs.

TECHNICAL STATUS

N/A
OBJECTIVE


BENEFITS

Engaging with these CEATI projects will allow Con Edison organizations to increase leverage of expenditures and improve technology transfer, and will complement ongoing work with EPRI and elsewhere. The projects presently underway include a broad array of subjects, and by virtue of our participation we expect enhanced knowledge development in transmission and distribution domains important to Con Edison.

TECHNICAL STATUS

In Progress - Thirty-nine projects completed and reports delivered as of 31Dec. Recent notable deliverables include: Benchmarking of Utility Condition Assessment Factors for Station Equipment; New Capability Applications Based On Svnchrophasor Measurement; and Distribution Planner’s Manual.
Objective of this program is to improve current practices, knowledge and technology used in power transmission and distribution. Con Edison engineers participate in nine interest groups and task forces in CEATI, that cover many aspects of distribution, transmission and substations equipment design, asset management, as well as system operation and planning. On each project there are assigned monitors/advisors to provide feedback and steer research in the direction that will bring most benefits. Project funding is leveraged by cost sharing among companies in the groups. In the course of research, CEATI conducts industry-wide surveys that provide venue for knowledge and best practices sharing among utilities.

BENEFITS

Engaging with these CEATI projects will allow Con Edison organizations to increase leverage of expenditures and improve technology transfer, and will complement ongoing work with EPRI and elsewhere. The projects presently underway include a broad array of subjects, and by virtue of our participation we expect enhanced knowledge development in transmission, substation and distribution domains important to Con Edison.

TECHNICAL STATUS

Technological innovation and increasing competitiveness of renewable energy resources, combined with aging infrastructure, extreme weather events, and system security and resiliency needs, are all leading to significant changes in how electricity is generated, distributed, managed and consumed. Con Edison is faced with changing regulations, developing technologies, and growing integration of energy and information services driven by the emerging Smart Grid, as well as Reforming the Energy Vision (REV) initiative. As these changes take place, we are challenged to cost-effectively allocate resources, appropriately deploy new technologies, and enhance the capability of our workforce as the changes are taking place. In addition, the need to sustain delivery of energy at lower costs is an overarching goal that must be achieved.

CEATI portfolio comprises 31 projects, most of which were identified and scoped in 2015, with planned project kick-off in 2016.
OBJECTIVE

Continue participation in NEETRAC, an effective venue for collaboration on research, development, prototyping and testing the widening range of technologies and equipment that are becoming possible or are being developed by vendors. Use NEETRAC to sustain technology transfer, participate in important standards development activities, and leverage R&D expenditures via federal and other utility funding and collaboration. A list of recent base-funded projects in which we have shared the benefits is attached for information. Participation also enables Con Edison to initiate expedited Direct-Placed projects whose focus and scope we exclusively define.

BENEFITS

Participation in NEETRAC will allow us to increase technology transfer and funding leverage, and complement ongoing work with EPRI and others. Baseline projects presently underway include a broad array of subjects, and by virtue of our participation we expect enhanced coverage of power delivery domains that are vital to Con Edison. The NEETRAC model for member-driven collaboration also helps to accelerate commercialization by meeting needs of a broader utility base.

TECHNICAL STATUS

In Progress – Sixteen projects completed and reports delivered as of 31Dec. Recent notable deliverables include: Comparative Quality Inspection of Distribution Transformers – Targeted Teardown; New Cutout Evaluation (Composite and Ceramic); and Queensboro Bridge Cable and Accessory Failures Forensic Analysis.
CIGRE Membership

CIGRE aims to:

- Allow engineers and specialists from all around the world to exchange information and enhance their knowledge related to power systems,
- Add value to the knowledge and information exchanged by synthesizing state-of-the-art world practices,
- Make the synthesis of CIGRE's work available to the decision-makers of the industry (CEOs, directors, managers, and regulators).

Access to knowledge and information on most recent developments in the state of the art and technical literature through:

- CIGRE e-library: technical brochures, scientific papers, symposia proceedings and other papers;
- CIGRE bi-monthly magazine Electra and monthly newsletter;
- Participation in CIGRE sessions.

TECHNICAL STATUS

The International Council on Large Electric Systems (in French: Conseil International des Grands Réseaux Electriques or CIGRÉ) is one of the world’s most authoritative professional organizations in the field of large power systems, since it was founded in Paris, France in 1921. CIGRE membership consists of international experts and leading organizations who exchange knowledge, share best practices and join forces for the Power System of Today and Tomorrow. In 2015, project provided Con Edison’s corporate membership in CIGRE.
TITLE  EPRI - ELECTRIC TRANSMISSION

CSN  92069  POET  10064342  TASK  0045

PROGRAM AREA  Industry Group

CONTRACTOR  Electric Power Research Institute (EPRI)

DURATION  On Going  ENGINEER  Fairechio

            PROJECT LEAD  Fairechio

OBJECTIVE

Membership in EPRI research and information programs provides current information on new electric research initiatives.

BENEFITS

Participation in industry research programs will help identify new technology applications which will aid in meeting corporate goals and surface new research initiatives.

TECHNICAL STATUS

Funding of EPRI's programs continues into 2016.
Membership in EPRI research and information programs provides current information on new electric research initiatives.

BENEFITS
Participation in industry research programs will help identify new technology applications which will aid in meeting corporate goals and surface new research initiatives.

TECHNICAL STATUS
Funding of EPRI's programs continues into 2016.
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<thead>
<tr>
<th>TITLE</th>
<th>INTERNATIONAL UTILITY WORK GROUP PARTICIPATION</th>
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<td>ENGINEER</td>
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<td>PROJECT LEAD</td>
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**OBJECTIVE**

The International Utility Working Group (IUWG) under the 3G System of the Future Program has a primary goal of benchmarking with dense urban load centers in Europe and the Far East.

**BENEFITS**

Immediate goals are to identify new technologies and designs that would support future system designs. This working group has already provided technical design input to our transfer switch plans, aided our discussions with the city on joint tunnel use and business development planning, and continues to evolve to more specific uses. Membership expansion is being pursued to increase our financial and commercial leverage with manufacturers.

**TECHNICAL STATUS**

In 2010, meeting was held in Tokyo, Japan.

2011 meeting was hosted by Commonwealth Edison in Chicago. Topics of discussion included Smart Grid, Asset Management, Risk Management, Intelligent Substation (with site tour), integration of renewable energy sources, aging transmission systems, and others.

In 2012, meeting was held in Sydney, Australia, and was attended by Con Edison, Commonwealth Edison (Com Ed), UK Power Networks, Ausgrid, China Light & Power (CLP), Shanghai Electric Power Company (SMEPC), Electricité Réseau Distribution France (ERDF), Kansai Electric Power Company (KEPCO), (TEPCO was unable to attend due to continuing restoration from the 2011 earthquake and tsunami). Topics discussed included disaster events (plan vs. actual), energy efficiency and demand response, earthquake response and recovery, electric vehicle technical issues, training on new equipment, world economic crisis impact on utilities and others.

2013 meeting was held in New York, Con Edison was hosting the event. Following topics were presented by participants and discussed by the group:

- Smart Grid - ConEd
- Partnership with Public Agencies - ConEd
- Lessons Learned - 2012 Olympics - UK Power Networks
- Trending/Regulation of T&D Rates - Kansai Power, SMEPC
- Distribution Automation - ERDF
- Transformer Aging Issues - CLP Power
- Optimizing Distribution Network Design - UK Power Networks
- Approaches to Energy Storage - SMEPC

2014 meeting was held in Shanghai, in April. Topics of interests discussed:

- Relationships with stakeholders-Media Relations - ConEd, UKPN
- Role of First Line Managers - ERDF
- Climate Change-Impact on Disaster Plans - Kansai, TEPCO, ConEd
- Robot and Drone Technology-SMEPC
- Achieving Safety and Environmental Excellence - ERDF, UKPN
- Procurement Process - AUSGRID
- Centralized vs. Decentralized DMS Strategy - ComEd

2015 meeting was held in Paris, France, hosted by ERDF, week of April 13. Topics of interest discussed:

- Developing a Zero Accident Culture-UKPN
- HR Challenges: Management of diversity in technical roles-ERDF
- Supply Sourcing: best practices in procurement-CLP
- Customer behavior: engagement and analysis; impact on rates-SMEPC
- Aging infrastructure and maintenance strategy-ConEd
- Smart grid data analysis-ComEd

2016 meeting to be held in Hong Kong, week of April 11.
Formerly the Northeast Clean Energy Council, the New England Clean Energy Council (NECEC) was formed as a regional business association with a goal of bringing together key stakeholders to help propel the clean energy industry and its role in the region's changing energy economy. The NECEC hopes to have an influence in future policy discussions and business initiatives, and through its industry connections to assist small clean energy companies to find their place in the emerging markets. As the Northeast's premier cleantech business organization, the NECEC formed a Strategic Partner Network (SPN) to help leading corporations formulate their business strategies in the cleantech community, as well as providing a platform for investment and strategic partnerships, to foster open innovation and in a collaborative environment.

**BENEFITS**

Con Edison participation in the Strategic Partner Network will both drive enhanced coverage of Con Edison's R&D initiatives, as well as widen our base of key partners, thereby helping to increase innovation, and improve the quality and sharing of knowledge and commitment to change.

**TECHNICAL STATUS**

Con Edison is faced with changing regulations, developing technologies, and growing integration of energy and information services driven by the emerging Smart Grid and REV initiatives. Our challenge is to effectively allocate resources, deploy new technologies, and enhance the capability of our workforce to deal with the changing energy environment.
OBJECTIVE
The Company is looking for ways to determine the technology management best practices used by other utilities and other industries involved in research and development.

BENEFITS
The benefits is to have tools available for development and continuous improvement of R&D metric, access to R&D program data of other utilities for comparative analysis, strengthening of our understanding of emerging technologies and a network of peer contacts.

TECHNICAL STATUS
Participated in the Research Technology Management (RTM) Forum, an organization comprised of 12 of the largest utilities in North America. Monthly conference calls and webinars are held to discuss best practices for technology management within and outside the utility industry.
Determine Factors Contributing to Pipe-Type Cable Failures

The new leaning will consist of the following:

- Understand and characterize failure mechanisms of pipe-type cables other than thermo-mechanical bending
- Evaluate the influence of cable system service and design factors on the identified failure mechanisms and the difference in cable performance between cable designs and ages
- Determine expected cable insulation life based on the studies

Tasks:
1. Conduct a workshop of pipe-type cable experts to refine approaches and to provide information on failure mechanisms.
2. Investigate effect of impregnated oil mix, gas formation and thermo-mechanical bending on insulation strength of cable. Perform laboratory tests and material analysis.
3. Document the methodology, tests undertaken, and result.

The results will enable cable industry to better understand pipe-type cable insulation behavior over service life and update maintenance and operation procedures, if needed. This will prevent future inadvertent feeder failure, which increase reliability of our transmission system and improve safety. Without completion of the research work of identifying the root causes of the cable failure, a cost avoidance cannot be determine or calculate.

Some of the Con Edison's pipe-type cable systems have been in services more than 60 years. Research data shown that life span of pipe-type cable installation can last up to 200 years. However, recent pipe-type cable failures showed insulation degradation in particular plan and profile locations. We want to investigate the mechanisms that lead to the insulation degradation acceleration of the pipe-type cable system.
OBJECTIVE

Severe Geomagnetic Disturbances (GMD) can drive transformers across large geographic regions into half-cycle saturation – resulting in increased reactive power losses, heating of transformer structural components, as well as causing transformers to act as harmonic sources. Assessment of potential GMD vulnerabilities as well as the evaluation of potential mitigation strategies requires system planners to perform a series of complex studies outside of the traditional planning process. Additionally, assessment method and tools have evolved at a fast pace in order to address the upcoming regulatory requirements. As such, there exists a strong need for practical guidance applying these new assessment methods and tools and performing required studies needed to meet the upcoming NERC TPL-007-1 standard.

The ultimate goal of this R&D effort is to provide a reference source providing instruction and guidance for performing GMD vulnerability studies in accordance with the TPL-007-1. This resource will provide guidance on conducting the multiple congruent studies that are not generally commonplace in standard planning and operation practices. Additionally, while the analyses have been incorporated into commercially available tools, there is limited guidance and examples illustrating the application of these tools. This project will fill this gap by producing a single reference providing guidance on conducting these various studies associated with vulnerability and mitigation assessments along with supporting webcasts/workshops to facilitate transfer of the knowledge and experience derived to date in this area.

BENEFITS

Expected benefit is higher reliability of results of the studies for GMD events, and they will be in-line with Industry adopted practical Guide. It is also expected that Guide will support development or revision of the GMD response procedure that will be cost-effective and adequate.

TECHNICAL STATUS

Technical update was issued by EPRI in December of 2015. The report serves as a guide for utility planners on the detailed application of GMD assessment tools, data collection and preparation, system and component modeling practices, and application of findings within standard planning practices. It contains sections on calculating geomagnetically induced currents (GICs), performing transformer thermal impact studies, performing power flow studies, planning and evaluating mitigation options, and performing harmonic assessments. The work is expected to continue in 2016.
TITLE  DISBONDED COATING DETECTION FOR UNDERGROUND PIPE FEASIBILITY STUDY

CSN  92432    POET  10046626    TASK  0045

PROGRAM AREA  Electrical Transmission / Planning

CONTRACTOR  DNV, University of Akron, Texas A&M

DURATION  5/17/2012  to  12/2016  ENGINEER  Wong

PROJECT LEAD  Bauer, M

AUTHORIZED  $ 250,000  EXP. THROUGH 2015  $208,552

OBJECTIVE

Various HPFF feeders on the Con Edison transmission system, especially feeders M51-M52 and 18001-02, have experienced dielectric fluid leaks that were caused by the shielding effect of disbonded coating on the pipe. When the coating is not adhered to the surface of the pipe, water can penetrate under it and support galvanic corrosion of the pipe surface. This condition is one that cannot be overcome by the application of cathodic protection because the coating prevents cathodic protection current from reaching the pipe surface. Disbonded coating only occurred to the pipes that were coated with coal tar enamel or somatic (asphalt) coating. Since the 1980's Con Edison has been using extruded polyolefin coating on which similar problem has not been developed.

BENEFITS

Potential benefits from improved system reliability and labor productivity are sizable.

1. Improve overall transmission network reliability
2. Increase customer satisfaction
3. Enhance environmental excellence

TECHNICAL STATUS

DNV and University of Akron had delivered the final report delivered on Nov 2013. University of Akron had completed the development of a mathematical model for Detection of Disbonded Coating for Buried Steel Pipes. The model is based on AC signal in soil/coating/metal interface. DNV final report consisted of literature search of commercial available survey methods for corrosion detection which might lead to possibility of coating disbondment detection.

In 2015 Akron University completed to build the mathematical model in the laboratory and validated the accuracy. The team then moved to Texas A&M and continue to work to build the pipe line interface to simulate the Con Edison underground pipe system environment. Also the team is working on creating pipe sample using the same coal tar coating for long term corrosion and coating delamination simulation in a setup environment similar to New York region weather.
TITLE  EHV Feeder Hudson River Crossing Vibraton Validation

CSN  99845  POET  21797875  TASK  0001

PROGRAM AREA  Electrical Transmission / Planning

CONTRACTOR  EPRI

DURATION  12/10/2015 to 12/2017

ENGINEER  Wong

PROJECT LEAD  Robert Shuman

AUTHORIZED  $ 150,000  EXP. THROUGH 2015  $135,000

OBJECTIVE

Aeolian vibration is an important factor that must be considered in designing an overhead transmission line. Aeolian vibration causes fatigue failure on overhead line components and expose the line to the risk of failure. For a bundle conductor line, spacer dampers are generally used for controlling Aeolian vibration. The control efficiency of these spacer dampers depends on the design, installation and arrangement of spacing between spacer dampers along the span.

In 1998, one phase of one of the feeders spanning the Hudson River from Verplanck to Stony Point experienced a failure at the insulator connection believed to be due to the galloping effect. The weather conditions of wet snow and wind at the time were conducive to galloping. Mitigation planning efforts started thereafter and by 2009 a plan was in place to reinforce the system against galloping. Anti-galloping Pendulums and anti-Aeolian vibration spacer-dampers designed and recommended by industry experts were installed on both circuits by the spring of 2012. Near the completion of the pendulum assembly installation, it was observed that several of the spacer-dampers had shifted and/or were damaged and it was realized that a new vibration problem was occurring. This new problem was deduced to be Aeolian vibration occurring between the pendulums. It was further deduced that the spacer-dampers were not doing their job of mitigating the Aeolian vibration between pendulums. All shifted or damaged spacer-dampers were removed and replaced with another type of damper (Stockbridge dampers) for interim measure until the permanent fix was developed and implemented. Visual inspections have been made at regular intervals since the removal of the shifted/damaged spacer dampers and no further shifting or damage has been observed. It was decided that a vibration study of those feeders would be required from a technical standpoint to develop a permanent solution.

The analysis of the vibration performance of the Hudson River crossing is extremely complex. The river crossing has to perform well not only for Aeolian vibration but conductor galloping as well. With the new algorithms developed in the bundle conductor research and additional new laboratory tests, it may improve the understanding of the conductor motion of river crossings.

The objective of this project is to confirm the adequacy of the spacer damper, detuning pendulum and vibration damper arrangement of the Hudson River Crossing by first analyzing the arrangement using the algorithms developed in the bundle conductor vibration research and by conducting tests in a vibration laboratory to further validate the vibration performance of the arrangement.
BENEFITS

- Assist transmission line engineers in the selection of suitable spacer dampers and in the proper design of overhead lines for Aeolian vibration
- Reduce the risk of line failures from Aeolian vibration, saving maintenance and restoration costs
- Enhance the reliability of overhead lines and thus their availability to customers
- Improve overhead line safety to the public

TECHNICAL STATUS

We are working on confirmation of the existing bridge spacer damper, galloping control device and damper arrangement and all other line parameters for the Hudson River crossing and scheduled to be completed by end of 1st quarter 2016. The next task will be to review and analyze data collected by the EPRI vibration sensors.
TITLE  
EHV TRANSMISSION FEEDERS INSULATOR RISK ASSESSMENT

CSN  
92706  
POET  
10046626  
TASK  
0099

PROGRAM AREA  
Electrical Transmission / Planning

CONTRACTOR  
EPRI

DURATION  
7/22/2011 to 12/2016

ENGINEER  
Wong

PROJECT LEAD  
Wong, A.

AUTHORIZED  
$ 313,000

EXP. THROUGH 2015  
$ 294,147

OBJECTIVE

Task I - Evaluate the failed insulator strings removed during 2011 and 2012 outages to determine the failure mode.

Task 2 - Perform Daytime Discharge Inspection to identify the sections that exhibit suspect discharge activities.

Task 3 – Analyze Shield Wire Coverage by using software program to analyze the shield wire placement to determine if installed configuration provides adequate coverage and recommend design changes if needed.

BENEFITS

A reduction in unplanned outages on overhead transmission lines that serve the load in New York City will allow for increased reliability, a decrease in O&M expenditures for emergency restoration, and a lower cost of generation for our customers

TECHNICAL STATUS

Con Edison has experienced lightning strikes on the overhead transmission system resulting in damage insulators and sustained feeder outages. Mechanical and electrical testing of removed insulators from Feeders Y94 and Y88, Buchanan to Ramapo Substations had revealed hidden cracks in the porcelain that may be present in the general insulator population. Present maintenance practice is only capable of identifying visibly damaged insulators and cannot identify hidden defects. Insulators are inspected at the same time as are the structures on a five year cycle. Removal from services and laboratory mechanical and electrical testing is an alternative but is an expensive and time consuming process. An expedited in service inspection program for insulators is required to ascertain the possible number of insulators with hidden defects in a timely basis. Composite insulator will also be included in the survey including the damaged Y94 wood pole bypass insulators.

In 2015 we completed analysis of 11 tower lines and 1455 structures and recommendation of one percent population inspection for 2016. Demonstration of the Ricochet Tool and Daycor and Infrared inspection of five feeders between Buchanan and Millwood Substation in 2015.
CON Edison Research and Development Project Status Report

TITLE  EXPANDED USE OF PHYSICAL OPERATING MARGIN SOFTWARE

CSN  92116  POET  10064342  TASK  0075

PROGRAM AREA  Electrical Transmission / Planning

CONTRACTOR

DURATION  2/17/2005  to  12/2016

ENGINEER  Sagareli

PROJECT LEAD  KOENIG M.

AUTHORIZED  $ 250,000  EXP. THROUGH 2015  $ 217,366

OBJECTIVE

The project objective is to obtain, develop and apply additional Physical Operating Margin Software modules to Transmission Planning applications, and to increase System Operations' familiarity with the capabilities and functionalities with a view toward possible future use of -RT (real time) versions of this software by System Operations and other company organizations.

BENEFITS

Improved planning and operational information for Transmission Planning and System Operations.

TECHNICAL STATUS

V&R periodically upgrades their software to improve the speed, the online risk monitor display, line tripping mechanism, software for Online Risk Monitor and implement other enhancements, including more detailed collaborative model of the Con Edison NYPA & LIPA interfaces. Additional training on new POM features and functions is being conducted yearly; in 2014, seven Engineers from Transmission Planning attended workshop at the Con Edison offices.

2015 workshop was held in May, in Con Edison offices, with 14 Engineers from NYPA and Con Edison in attendance.
OBJECTIVE

Corrosion tests will be performed on joint casing with corrosion tapes or epoxy. These casings will be exposed to conditions similar to the field or manhole conditions to determine the life expectancy of the corrosion protections.

Tasks:

• Conducting an aging test to provide aging conditions on different methods used to protect the joint casings from corrosion.
• Determining the life expectancy of each corrosion proof method
• Final report to include methodology and testing results.

BENEFITS

The main benefit of this initiative is improved environmental performance by proactively detecting disbonded coating and preventing dielectric fluid release to the environment. In addition, this initiative will enhance the reliability of our transmission system. Potential benefits expected from this pilot demonstration include: significant reduction in the operation and maintenance costs during normal and emergency conditions, greater flexibility in the Company’s strategic options, effective resource allocations, and increased customer satisfaction.

TECHNICAL STATUS

Various HPFF feeders on the Con Edison Transmission System have experienced dielectric fluid leaks that were caused by the shielding effect of disbonded coating on the pipe. When the coating is not adhered to the surface of the pipe, water can penetrate under it and support galvanic corrosion of the pipe surface. This condition is one that cannot be overcome by the application of cathodic protection because the coating prevents cathodic protection current from reaching the pipe surface. Disbonded coating only occurred to the pipes that were coated with coal tar enamel or somatic (asphalt) coating. Since the 1980’s Con Edison had been using extruded polyolefin coating on which similar problem has not been developed. Coating delamination or coating blistering are produced by environmental conditions and they can be exacerbated by inadequate cathodic protection design, there, the correct application and monitoring of these coatings under working conditions is mandatory for a reliable pipeline system.
Coating can be damaged by handling during pipe storage, transportation, installation, developed later in service by transient over-voltage, by high operating temperature, by external agents such as chemicals in the ground, by dig-ins, in addition, external parts adjacent to the pipe line such as valves and casings.
TITLE  Induced Voltage Study for EHV feeder with Gas pipe crossing

CSN  99867    POET  21726097    TASK  0001

PROGRAM AREA  Electrical Transmission / Planning

CONTRACTOR  EPRI

DURATION  10/23/2015  to  10/2017

ENGINEER  Wong

PROJECT LEAD  Arnold Wong

AUTHORIZED  $ 70,000

EXP. THROUGH 2015  $ 50,000

OBJECTIVE

To study the induced voltages impact of crossing between Con Edison EHV overhead feeders with gas transmission main crossings, and assess possible electrical faults from dropped conductors.

1. Review literature on shared right-of-ways among utilities.
2. Develop the most current algorithms for analyzing and evaluating the impact of shared right-of-way between power lines and pipelines and, between power lines and railroads.
3. Review the EPRI Corridor software module for modifications.
4. Develop the study cases for Con Edison EHV feeders with gas transmission main crossing.
5. Beta test the EPRI Corridor module.

BENEFITS

Results generated from the R&D project will be applied by Engineering to ensure safe and reliable co-existence among all facilities on the right-of-way. By sharing the same right-of-way among different utilities, the requirement of land will be reduced. The R&D project results will improve safety of field personnel and the public and ensure that high reliability and availability of all systems are maintained.

TECHNICAL STATUS

Transmission line owners and operators are under increasing pressure to share the use of their right-of-way with other utilities such as pipelines and railroads. Facilities sharing a common corridor with transmission lines can result in voltages and currents at the power-line frequency and harmonics being coupled onto their systems. The voltage that is coupled to a pipeline or rail system appears from a conductor to earth, or between two conductors, such as from rail-to-rail in a railroad track. The couple voltage may present a personnel safety hazard for system maintenance or operating personnel, or may compromise the compatible operation of equipment that is connected to the passive conductors. The current that is coupled onto the passive conductors may result in component failure. Several different coupling mechanisms can contribute to the resulting voltage or current on a pipeline or a rail system conductor. The effects of transmission lines on the safety and performance of these systems are of concern to the affected parties in shared right-of-ways.
We are working on development of the most current algorithms for analyzing and evaluating the impact of shared right-of-way between power lines and pipelines and, between power lines and railroads. The next step is to review the EPRI Corridor software module for modifications.
TITLE  Infrared Energy Pattern Analysis for Dielectric Leak Locating Demonstration

CSN  99989  POET  21126118  TASK  0001

PROGRAM AREA  Electrical Transmission / Planning

CONTRACTOR

DURATION  10/3/2014  to  6/2015  ENGINEER  Wong

PROJECT LEAD  Mark Bauer

AUTHORIZED  $ 120,000  EXP. THROUGH 2015  $ 97,963

OBJECTIVE

Two feeder routes have been selected where different monitoring methods will be employed to validate the non-intrusive detection scheme.

A.  Demonstrate the use of hand-held, vehicle-mounted, and helicopter-mounted sensors for different feeder environments.

B.  Explore the technique effectiveness in varying environments including urban and wetland locations.

C.  Perform a demonstration and validation of the sensor detection results.

BENEFITS

Enhanced leak locating technology will result in the following:

1.  Reduced environmental impact by decreasing clamp time for leaks and minimizing the loss of fluid to the environment.

2.  Improved overall transmission feeder reliability.

TECHNICAL STATUS

Currently Con Edison uses Gas Chromatography instrumentation to pinpoint dielectric fluid leaks. This pinpointing process is often hindered by PFT entering nearby facilities such as electric duct banks, sewers, and subway tunnels. In addition, protection plates in shallow areas often cause migrating PFT to be diverted, complicating pinpointing of the exact location of leaks as well. This new leak detection technology utilizes Infrared Energy Pattern Analysis (IR-EPA) to investigate suspect pipe areas. The objective of this project is to demonstrate the use of the IR-EPA system to detect specific temperature patterns created by underground dielectric fluid leaks from electric transmission feeders and eventually pinpoint the leak locations. The feeder surveys and helicopter patrol were completed on 2nd quarter 2015 and failed to pinpoint any leak. The IR-EPA sensors were originally designed for water pipe and required a ten degree F difference from surrounding to be detected. We required the sensors can detect five degree F threshold for future dielectric leaks. Project is scheduled to be closed out in 1st quarter 2016.
TITLE  Inspection Plan For Overhead transmission feeders - UAVs demonstration

CSN   99914    POET  21525566    TASK  0001

PROGRAM AREA  Electrical Transmission / Planning

CONTRACTOR

DURATION  6/23/2015  to  12/2016

ENGINEER  Wong

PROJECT LEAD  Frank Mangiamele

AUTHORIZED  $ 150,000

EXP. THROUGH 2015  $ 16,058

OBJECTIVE

UAVs demonstration near Pleasant Valley Substation, Farmer Field Road:

Task A.  Replica of Transmission Tower Inspection using real time HD still and video
Task B.  Replica of Transmission Line Inspection using thermal sensor imagery, real time HD still, and video
Task C.  LiDAR demonstration for vegetation management and right-of-way inspection
Task D.  Setup the UAVs program for TLM maintenance
Task E.  Setup the UAVs program for engineering’s LiDAR and thermal sensor application
Task F.  Setup the UAVs training program for TLM member to prepare for 2016 readiness

BENEFITS

1.  The first major benefit is the accuracy of the mandated maintenance of overhead transmission structure.
2.  The second major benefit is enhanced safety for TLM members.

TECHNICAL STATUS

Unmanned aerial vehicle system (UAVs) technology can be used to improve electric utility operations for both planned and emergency work.  This R&D project will study the benefits and advantages, both operational and economic, of using UAS technology for TLM and Engineering when coupled with different monitoring and recording technologies.

The UAS equipment used in this R&D project will be upfitted with sensing or detecting devices such as digital cameras or LiDAR sensors to inspect electric utility structure and transmit the data to a computer in real time for immediate processing.

The study of the capabilities and use of UAVs for TLM operations will demonstrate how safety can be enhanced, both for utility workers and the general public when compared to manned aerial technology.  This R&D project will also analyze the cost differentials between the use of manned and unmanned aerial technology.

In Sept 2015 we had demonstrated the UAV overhead inspection by replication of two mandated inspection with UAV; the detailed lattice tower inspection and feeder patrol. In April 2016, we will setup the LiDar
demonstration for shielding wire coverage and equipment clearance, and training classes for linemen for operating the UAV readiness by 4th quarter 2016.
TITLE      Iris On the Move Biometric Identification System Demonstration

CSN        99950  POET     21380934  TASK     0001

PROGRAM AREA     Electrical Transmission / Planning

CONTRACTOR

DURATION     3/24/2015   to   4/2016

ENGINEER     Lee

PROJECT LEAD  Scott Gross

AUTHORIZED    $ 100,000  EXP. THROUGH 2015    $ 97,119

OBJECTIVE

System Operation would like to replace the Bio-Metric devices and the associated application before the required mandate of CIP (Critical Infrastructure Protection) Version 5. The required date is April of 2016. While there are many initiatives and new Security Enhancements scheduled for this year both on a Corporate Level as well as at the ECC and the AECC, System Operation would like to make the change to the new Bio-Metric Manufacturer at the same time as the Card Access system is being upgraded. Because the Bio-Metric Devices will function in tandem with the new Card Access, both manufacturers will need to coordinate efforts to allow the transmission of Data between both systems. By installing both systems at the same time will streamline the installation and coordination required.

BENEFITS

The installation of the new system will enhance the Bio-Metric system currently installed, meet the new OS requirements, and replace an old outdated system with a "State of the Art" system. The old system has been of recent concern as you must physically touch a device, spreading germs from one person to another. The new system will require no physical contact by an individual for authentication.

TECHNICAL STATUS

The IOM (Iris on the Move) bio-metric devices hardware has been installed. We are currently working through software issues on the devices implementation.
TITLE  Lighting protection analysis for overhead transmission feeders

CSN   99868   POET   21726096   TASK   0001

PROGRAM AREA   Electrical Transmission / Planning

CONTRACTOR

DURATION   10/19/2015 to 12/2016   ENGINEER   Wong

PROJECT LEAD   Arnold Wong

AUTHORIZED $ 75,000   EXP. THROUGH 2015 $ 35,700

OBJECTIVE

For a pair of 345 kV transmission feeders, determine the lightning performance using computer modeling and identify potential performance issues and suggested mitigation options to reduce susceptibility to lightning strikes

Task 1. Develop TFlash model for the two 345 kV feeders with all construction and hardware parameters

Task 2. Analysis of Potential Flashover Modes: Bakcflashover, Shielding failure, and induced flashover

Task 3. Review Mitigation Methods: improving shielding angles, improving grounding, and adding transmission line surge arresters (TLSA)

BENEFITS

The Con Edison overhead transmission system has been susceptible to line trips and insulator damage from lightning strikes, including a double circuit trip during the summer of 2015. Past strikes have resulted in feeder trips, insulator damage as well as dropping of the phase conductors. A lightning study will identify specific structures more susceptible to lighting strikes. Recommended mitigation measures will be proposed to improve the line lightning performance. Additionally, identification of poor performing structures location will be useful during fault locating. Results generated from the R&D project will be applied to reduce lightning strikes in the structures and conductors resulting in a safer and more reliable overhead transmission system.

TECHNICAL STATUS

Overhead transmission power lines use shield wires for lightning protection. A key factor in the performance of a transmission line is the shielding angle or the angle between the shield wire and the phase wire. Present best practice is to have a negative angle where the shield wire is placed outboard of the phase conductors, effectively placing the shield wires closer to the lightning stroke. Con Edison overhead transmission structures are built mostly with positive shield angles. Consequently, the ability of the shield wire to protect the lines from lightning is reduced. However, the reliability performance of the tower line is determined by other factors in addition to the shielding angle including adjacent structures, tower grounding, topography, etc. The projected lighting performance of Con Edison transmission structures is presently unknown.
TITLE    MITIGATION OF GEO AND ELECTRO MAGNETIC EVENTS

CSN     92111    POET    10064342    TASK    0071

PROGRAM AREA    Electrical Transmission / Planning

CONTRACTOR

DURATION   2/24/2010 to 12/2013    ENGINEER    Sagareli

PROJECT LEAD    Sambasivan

AUTHORIZED $ 475,000    EXP. THROUGH 2015 $ 374,227

OBJECTIVE

Addressing Bulk Electric Systems (BES) reliability concerns with regard to GIC and Electro-magnetic Pulse (EMP) Event or Intentional Electromagnetic Interference (IEMI) that have been at the core of the number of Congress, DHS and DOE documents, leading to development of the new NERC Standard, requiring assessment of the vulnerabilities, development of the monitoring, modeling and mitigation measures.

BENEFITS

Proactively addressing these issues will give Con Edison a reliable operation of BES during geomagnetic storms, a voice in the policies that are developed, as well as good understanding of any future mandatory requirements that may be considered for adoption.

TECHNICAL STATUS

• Project team participated in development of new NERC TPL-007 Reliability Standard, providing comments to Standard Drafting Team, leading to improved requirements beneficial to Company and Industry.
• GIC (Geomagnetically Induced Currents) monitoring equipment installed in 14 locations considered vulnerable by conducted assessment studies.
• Transmission system model was developed, expanded beyond Con Edison systems’ footprint, refined for higher accuracy, and validated against existing historical records.
• IEMI vulnerability survey conducted and monitoring equipment installed at Energy Control Center (ECC) and Alternative Energy Control Center (AECC).
• In 2015, IEMI hardening design and estimate were completed for AECC.
OBJECTIVE

For the existing leak detection process the following major areas will be studied:

1) Preparation - optimize the sampling rate and re-evaluate the absorption apparatus
2) Chromatography- evaluate column design
3) Detection- increase the sensitivity and output of the electron capture detector (ECO)
4) Presentation - improve visualization and formatting of chromatographic data

A new concept that will also be pursued under this initiative will be the investigation and demonstration of a handheld portable gas chromatograph (GC) for bar hole PFT detection.

BENEFITS

Enhanced leak detection and analysis will result in the following:

1) Reduced environmental impact.
2) Improved overall transmission feeder reliability.

TECHNICAL STATUS

The current generation of perfluorocarbon tracer (PFT) leak detection equipment was developed in the early 2000s. The existing PFT instrumentation clearly has the capability to detect PFT in the air. This is demonstrated by the measurement of the normal environmental background PFT, the instrument response to standard injections, and the instrument response during most leak events. However, there have been leak searches where the instrumentation did not detect PFT in the concentration that would be expected based on the observed conditions. For example, a substantial volume of PFT-tagged cable oil had been lost to the environment during the M52 feeder leak in March 2013, however the PFT measured in the atmosphere directly above the leak location did not reveal PFT concentrations to be significantly greater than what was being measured in the background readings for the general area. In addition, the analysis of bar hole samples taken very close to the leak location did not detect the presence of PFT in the samples. There have also been recent incidents where the PFT vehicle passed directly over a subsurface structure containing quantities of PFT tagged oil, but the instruments on the vehicle did not measure PFT concentrations significantly above normal backgrounder readings.
In these cases described above, the instrumentation did not respond in a manner that normally would have been expected. However, it is recognized that it is possible that unusual and unverifiable subsurface conditions may have existed that resulted in the unexpected movement of PFT through the subsurface at the leak locations. To determine if this is the case or if the existing PFT instrumentation has potential deficiencies that may be affecting the analysis of the readings, an effort to study and optimize the current sampling and analysis techniques is proposed.

In 2016, we will investigate the upgrade feasibility of the front end concentrator for the PFT GC.
OBJECTIVE

The objective of this R&D project is to demonstrate that the electrical discharge signal that is being generated inside the steel casing can be captured outside and recorded using non-intrusively technique. We will use a 345 kV joint assembly and install sensors outside the pipe. The partial discharge activity will be simulated by independent PD generator and captured by sensors installed outside the casings. Comparison of injected and captured signals will validate ability to capture internal PD and sensor accuracy.

BENEFITS

Any opening of underground transmission pipe-type system for inspection costs 0.6 million dollars and not included feeder outage time. The non-intrusive inspection technique will assist the decision of prioritize joint repair and eliminate inspection outage requirements.

TECHNICAL STATUS

Majority of the Con Edison underground pipe-type transmission system is over 50 years and still very reliable. As the system continues to age new monitoring techniques will be required to maintain a high level of reliability. "DGA" (dissolved gas analysis) is a non-Intrusive technique that is used to assess the electrical condition of static pipe-type cabling system while the system is energized. DGA has limitations on feeders with circulation. Additional technology needs to be developed to monitor feeders with circulations as well as cable accessories. In 2013 R&D worked with Engineering completed the specification of the partial discharge testing criteria and specification and vendor selection. In 2014 on-line partial discharge testing was performed for one HV HPFF joint which was scheduled to be opened and repaired. Result of the partial discharge testing was confirmed and the joint was repaired. Additional test for EHV HPFF joints and pot head terminations are scheduled for 2016 to further validate the accuracy of on-line partial discharge test.
OBJECTIVE

Task 1. Perform an on-line Partial Discharge measurement test for six existing feeders on the Queens side of the bridge to ascertain the cable and joint condition along the bridge.

Task 2. Install a real-time PD recording device on the transition joint for one of the HV feeder for a six months trial period. The transition joint had failed and a PD sensor lead will be installed during the repair that is scheduled for Aug 2015. The PD recording device will be self-powered and capable to provide remote reporting.

Task 3. Repeat the on-line Partial Discharge measurement test in three and six months intervals for trending purpose.

Task 4. Determine the transition joint PD recording device installation will become permanent based on historical data.

BENEFITS

Any opening of Queensboro bridge solid dielectric transmission joint, installed in a steel pipe, for inspection will cost company at least 2 million dollars including special scaffolding system assembly, and not including system outage time. The non-intrusive PD inspection technique will assist the decision of prioritize joint repair and eliminate inspection outage requirements.

TECHNICAL STATUS

Con Edison had installed six 138 kV High Pressure Fluid Filled Feeders (HPFF) that are going across the Queensboro bridge. In order to prevent dielectric fluid leaks into the river, Con Edison subsequently replaced the bridge sections of these feeders with solid dielectric (SD) cables and connected them to the existing HPFF cables with transition joints on both sides of the bridge. A total of six Solid Dielectric (SD) feeders in pipe were originally placed in service in 1997 traversing from Queens to Manhattan directly under the deck of the Queensboro Bridge. Each feeder has a joint located on the Queens anchor span and another joint located on the Manhattan anchor span of the bridge.

We had experienced a number of regular joints and transition joints failure in the spring and summer of 2015. The root causes of the failures were determined to be inadequate cable support in combination with
cable movement and load cycling, resulting in a failure of the bonding connection. The failed bonding connection then caused damage to the shielding, semi-conductive layer, and insulation. These signs raised concern about the status of existing cables.

In 2016 we are working on installing a real time partial discharge measurement system in one of the transition joint manhole to ascertain the joint condition.
TITLE
SURFACE WAVE TECHNOLOGY FOR DISBONDED COATING DETECTION ON UNDERGROUND PIPES
FEASIBILITY STUDY

CSN  92146    POET  20281602    TASK  0001

PROGRAM AREA  Electrical Transmission / Planning

CONTRACTOR  NASA

DURATION  7/25/2014  to  12/2016

ENGINEER  Wong

PROJECT LEAD  Mark Bauer

AUTHORIZED  $ 633,391  EXP. THROUGH 2015  $ 598,310

OBJECTIVE

Several recent leaks had been caused by the shielding effect of disbanded coating on the pipe. When the coating is not adhered to the surface of the pipe, water can penetrate under it and support galvanic corrosion of the pipe surface. This condition is one that cannot be overcome by the application of cathodic protection because the disbanded coating prevents cathodic protection current from reaching the pipe surface. Disbanded coating only occurs to the pipes that were coated with coal tar enamel or somatic (asphalt) coating. Since the 1980's Con Edison has been using extruded polyolefin coating on which similar problem has not been experienced. This R&D project will design, develop, and demonstrate a prototype radio frequency (RF) launcher/detector, and the signal processing required to identify and locate a pipe disbondment. The technology to launch an RF wave mostly in the pipe coating around a complete cylinder has not been developed.

BENEFITS

Potential benefits from improved system reliability and labor productivity are sizable.

1. Improve overall transmission network reliability.
2. Reduce environmental impact

TECHNICAL STATUS

JPL had successfully demonstrated a prototype launcher (microwave range) and receiver on a 4 feet aluminum pipe and acrylic coating and detection of a void on the coating. JPL is currently working on improving the instrumentation to capture the weak return signal and design of the first prototype of the special radar system. The result will be demonstrated in the test bed and Con Edison excavated pipe.
Title: Transmission Manhole Oil Minder

CSN  99974  POET  21164235  TASK  0001

Program Area: Electrical Transmission / Planning

Contractor: Cypress

Duration: 11/21/2014 to 8/2016

Engineer: Wong

Project Lead: Mark Bauer

Authorized: $375,000

Exp. Through 2015: $360,317

Objective

1. Develop and demonstrate the feasibility of a capacitance sensing detector capable of detecting of presence of dielectric fluid and water, and determining the volume percentage of the dielectric fluid.
2. The sensing system is battery supplied for 6 months.
3. Ability to provide a wireless transmit of detector output to drive/walk by from inside the manhole without the opening of the manhole cover.
4. Sensors will be tested in the vendor’s facility.
5. Sensors will be tested in Con Edison manholes for 6 months.

Benefits

Enhanced leak detection and analysis will result in the following:
1. Reduced environmental impact.
2. Improved overall transmission feeder reliability.

Technical Status

Currently Con Edison uses Gas Chromatography instrumentation to pinpoint dielectric fluid leaks. This pinpointing process is often hindered by PFT entering nearby facilities such as electric duct banks, sewers, and subway tunnels. In addition, protection plates in shallow areas often cause migrating PFT to be diverted, complicating pinpointing of the exact location of leaks as well. When the PFT locating process fails, a crew needs to be dispatched to inspect the manholes along the feeder route to check for dielectric oil leak. This requires local area traffic control and opening of manhole cover. This R&D project will address the above problems and by demonstrating the use of capacitance sensors system to detect the presence of dielectric oil inside the manhole and send remote notification locally without opening the manhole cover. The prototype will include two six feet capacitance sensing strips, and control systems. The sensing strips are comprised of one foot module and capable of differentiate between dielectric oil and motor oil, and water. The control system is capable to report the percentage of water vs dielectric oil inside the manhole, sending report on request, and provide local reporting via wireless communication. The objective of this R&D project is to provide manhole dielectric oil finding condition wireless locally without opening the manhole cover. First five units of oil minder are scheduled to be delivered by end of March, 2016.
TITLE Underground Transmission Feeders Digital Imaging Study

CSN 96250   POET 20876527   TASK 0001

PROGRAM AREA Electrical Transmission / Planning

CONTRACTOR

DURATION 3/5/2014 to 5/2017   ENGINEER Wong

PROJECT LEAD Arie Makovoz

AUTHORIZED $ 250,000   EXP. THROUGH 2015 $ 186,664

OBJECTIVE

Corporate Goals:
1. Maintain the reliability of our transmission systems and improve their efficiency and safety.
2. Improve the quality of our normal operating practices and readiness to deal with emergencies.

BENEFITS

The results of these tests will assist Transmission Feeders Engineering and Transmission Operations in the development of a long range strategy for the targeted replacement and/or modification of critical transmission assets.

TECHNICAL STATUS

Transmission feeders are a critical component of our electrical system. They comprise hundreds of cable sections connected by splices (joints) in underground manholes. Failures in these joints can cause extensive and expensive service outages and repairs. Therefore, periodic inspection of feeder joints for potential failure indications (shielding and insulation disruptions) becomes necessary.

Currently, the only feasible inspection method of feeder joints without service disruption has been conventional x-ray imaging, utilizing radioactive isotope sources with film as the imaging medium. There are several limitations to this approach including difficulties in interpreting image, limited dynamic range, long inspection times and lack of digital image for review and filing.

To address these issues, modern digital x-ray technology such as computed tomography, that provide three-dimensional images of structures, rather than the two-dimensional ones of conventional X-ray imaging will be developed, tested and, if succeed, implemented as service maintenance tool. The results of these tests will assist Transmission Feeders Engineering and Transmission Operations in the development of a long range strategy for the targeted replacement and/or modification of critical transmission assets.

In 4th quarter 2014 we had completed the 3-D imaging in the laboratory environment and validation completed in 1st quarter 2015. We will work on setting up 3-D imaging in the field in 4th quarter 2016.
Objective of this project is to reduce the cost and the time of the equipment required for compliance with NERC Standard, by employing new technology developed by project team with vendors - Softstuf and Fischer Block.

According to NERC's new reliability Standard PRC-002-NPCC-01, each transmission and generator owner shall provide Sequence of Events (SOE) recording capability by installing SOE recorders, or as a part of another device, such as SCADA, RTU, DCS or part or fault recording equipment for all system elements comprising Bulk Electric System, such as transmission lines, autotransformers, PARs, shunt capacitors and shunt reactors and others. To comply with this Standard, additional fault recording equipment and/or microprocessor-based relays have to be installed throughout our system at a cost about $10,000 per relay, plus associated engineering and labor costs. Softstuf electronic CT's will be installed at selected locations in the system, allowing non-intrusive (requiring no outages) installation. Fischer Block Smart Cover systems will be bench-tested in the lab environment. Data acquired from equipment during trial period will be analyzed for accuracy and recommendation on a company-wide installation will be made.

BENEFITS

It is expected that cost and time of equipment upgrade necessary for compliance with the NERC PRC-002 Standard will be reduced by 50% or more: cost of the new microprocessor relay is about $10,000, vs. about $3,000 per unit for proposed new technical solutions.

TECHNICAL STATUS

In 2015, twenty Electronic CT’s were delivered by Softstuf for installation throughout the system. The ECT is used to non-intrusively measure currents in secondary circuits just like split core CTs. The ECT connects to existing Con Edison DME (disturbance monitoring equipment), such as digital relays and DFRs.

The Fischer Block designed, produced and delivered Distributed Data Analyzer (DDA) system, which is comprised of a number of high-speed intelligent data sensors (SMART Covers™), each embedded in replaceable panel mount Test Switch covers and each recording the electrical signals, on a 24/7 basis, internal to the Test Switch. Parameters measured include volts, current, frequency, and time. Time synched
to the Coordinated Universal Time (UTC) clock to provide accurate time stamping and rate of change information for volts, current, and frequency.

Included in the DDA system is a networking feature which includes a central Data Storage Unit (DSU), providing a repository for the data collected by the SMART Covers™. This DSU contains a user definable trigger dependency table such that an event record (for a single event) can be constructed from the data-files originating from more than one SMART Cover™, providing the unique capability of obtaining Sequence-Of-Event Recordings (SOER), Fault Recordings (FR), and Dynamic Disturbance Recordings (DDR) from one simple system. Other measured parameters include synchrophasors and harmonic content.
TITLE  Enhanced EPRI Collaboration on REV

CSN  99850  POET  21775621  TASK  0001

PROGRAM AREA  Electrical Transmission

CONTRACTOR  EPRI

DURATION  11/30/2015 to 12/2016  ENGINEER  Doherty

PROJECT LEAD  J. Mark Drexel

AUTHORIZED  $ 33,000  EXP. THROUGH 2015  $ 33,000

OBJECTIVE
This funding will provide for an EPRI Principal Technical Leader for part-time support to assist Con Edison to file plans for implementation of technology, business models and rate alternatives to support the REV goals, including: Order Adopting Regulatory Policy Framework and Implementation Plan; Staff White paper on Ratemaking and Utility Business Models; and Distributed System Implementation Guidance.

BENEFITS
While achieving REV mandates requires establishing new perspectives on what constitutes a power delivery system, especially how it accommodates new participants and technologies, the resultant plans for technology, business models and rate alternatives to support the REV goals will ensure that foundational responsibilities for reliability and safety are maintained or advanced, that increased resiliency is fostered, that electricity continues to be affordable and contribute to economic prosperity, and the environmental footprint of the Company is improved.

TECHNICAL STATUS
In Progress – EPRI Liaison in place and sharing customer pricing and market options in development across the industry towards REV goals.
### OBJECTIVE
Fault location on our overhead and underground cable transmission system is very critical after the occurrence of transmission feeder faults. Our operating organizations would like to have the accurate fault location information immediately after the occurrence of a fault to restore the system immediately and also to save huge costs associated with transmission feeder patrolling.

Presently, to locate the fault, we use several methods, one of them is Web FL (sponsored by R&D), which uses the comtrade files extracted from the DFRs. This is an iterative method and for this program to work correctly, we need to access the files from the DFRs and a relay engineer has to apply these files to the program to get the results.

Schweitzer Engineering Lab (SEL) has now introduced a travelling wave based fault location in their microprocessor relays SEL 411L. This relay will be used in our transmission feeder applications and we would like to evaluate this before applying this method. SEL will perform a study of an underground conductor application using the SEL-411L traveling wave fault location feature to determine if its accuracy meets ConEd’s requirements.

### BENEFITS
The travelling wave based fault location is expected to be very accurate and the relay will have this information immediately after the occurrence of the fault. The information can be sent to the system operators through SCADA after the occurrence of the fault.

### TECHNICAL STATUS
A Fault Study Report submitted, documenting project results. An EMTP model was built based on ConEd’s X28 line. Test equipment was used to simulate various faults at different locations along the X28 line. This same fault data was injected into a pair of 411L’s to compare the model results to the Multi-End results in the 411Ls. Satisfactory accuracy of the method has been confirmed.
TITLE   EPRI/NYSERDA/DOE TRAVEL BY SYSTEM & TRANSMISSION OPERATIONS PERSONNEL

CSN   92388  POET   10064342  TASK   0275

PROGRAM AREA   Electrical Transmission/Planning
DURATION   On Going

OBJECTIVE
Facilitate application of new technologies by supporting employee attendance at industry meetings.

BENEFITS
Participation in industry research programs will help identify new technology applications which will aid in meeting corporate goals and surface new research initiatives.

TECHNICAL STATUS
N/A
Objective

Project Tasks –
Task A. Create restricted views for all transmission substations.
Task B. Create individual substation access authentication table via active directory.
Task C. Create access log for successful and failed attempt.
Task D. Create remote reporting for access violation.

Benefits

The first major benefit is the reduction of O&M expenses to maintain the RTU HMI computers by patching and keeping current with the Windows OS changes. The second major benefit is providing additional visual for substation operators.

Technical Status

Currently, the field operators use RTU HMI Computers to view the substation equipment status. These RTU HMIs are being disconnected due to outdated Operating System and patches. To continue to provide Bulk Power system display to the field operators in all transmission substations, we will use a software application TNVS (Transmission Network Visualization System) to provide the substation operators selective substation equipment status. TNVS will provide the NERC CIP V5 compliance by providing two factors authentication, and providing features for monitoring, tracking, and reporting access violation on TNVS.

We had deployed TNVS to Sprainbrook, Farragut, and W49th st Substation on March 1, 2016. The rest of bulk power substations will be completed by end of April, 2016.
**TITLE**  Demonstration of New SF6 Leakage Reduction System at West 49 Street Substation

**CSN**  99917  **POET**  21519907  **TASK**  0001

**PROGRAM AREA**  Electrical Transmission / Planning

**CONTRACTOR**  Siemens

**DURATION**  6/12/2015  to  11/2016  **ENGINEER**  Sagareli

**PROJECT LEAD**  Pat Di Lillo, Thomas Fredeman

**AUTHORIZED**  $ 150,000  **EXP. THROUGH 2015**  $ 15,125

**OBJECTIVE**

Objective of this project is to reduce amount of gas emissions by reducing leak detection time and providing advanced warning as soon as the leak is detected. This will be accomplished by the new intelligent monitoring system that monitors temperature and gas density and analyzes this data using special algorithms to predict the point at which the low gas alarm will be activated. We can then choose to schedule filling the equipment prior to an alarm. The amount of gas lost will be further reduced by re-piping the existing monitoring zones into smaller ones, which will permit finding leaks faster and thereby reduce the amount of gas loss.

**BENEFITS**

Emissions of SF6 gas are expected to be reduced by 30% or more.

**TECHNICAL STATUS**

Sulfur hexafluoride (SF6) gas occasionally leaks from our equipment into the environment and needs to be replenished. In addition to the detrimental environmental effects, the loss of SF6 is a reliability concern and an operating cost. The Company goal is to continue efforts to reduce the amount of SF6 gas lost from the system. The current goal is <= 15,000 lbs. emitted. Currently, SF6 gas emissions at the West 49th Street Substation are detected by pressure gauges with alarm points. Each three phase bus section and circuit breaker has its own designated alarm point. Alarms are triggered when the pressure in a particular bus section or circuit breaker approaches its specified “LOW” limit. Due to the large volume of a three phase bus section, the difference between nominal operating pressure and low alarm pressure will allow a large amount of gas to escape before the alarm is received.

In 2015, Siemens designed, manufactured and delivered gas density monitoring system. Company forces started installation of fixtures to split large zones of gas in bus sections in smaller volumes, which will allow quicker detection of leaks. Wiring and pipework fixtures installation are in progress, to be completed in 2016.
TITLE Design, installation and inspection of two permanent fall protection systems at Ossining Substation

CSN 92298  POET 20595936  TASK 0001

PROGRAM AREA Electrical Substations

CONTRACTOR

DURATION 7/29/2013 to 12/2014  ENGINEER Lee

PROJECT LEAD Geerlings, B.

AUTHORIZED $ 70,000  EXP. THROUGH 2015 $ 66,155

OBJECTIVE

This project will evaluate the use of an engineered permanent track-style rail fall protection system in the station. The rail will allow the operator to transverse from one end of the switchgear to another while being attached continuously.

BENEFITS

To access the 13kV links and portable ground studs on the bus sections, the Operator has to climb on top of the switchgear which is 12 feet off the ground. There are no acceptable anchor points to attach a lanyard to so fall protection can be utilized. Temporary horizontal rope lifelines have been used in the past but these are not designed to be a permanent application. Additionally, the rope lifelines install at the Ossining substation do not allow the operator to traverse from one side of the switchgear to another. As a result, the operator is required to climb down from one side, detach himself, reattach himself on another life line and climb back up to reach the other side of the switchgear. This movement can cause unnecessary vibrations and inadvertent operation of control handles potentially tripping equipment out of service. This project will evaluate the use of an engineered permanent track-style rail fall protection system in the station. The rail will allow the operator to transverse from one end of the switchgear to another while being attached continuously.

TECHNICAL STATUS

In 2015, we completed an installation of an engineered permanent track-style rail fall protection system in the station. The rail will allow the operator to transverse from one end of the switchgear to another while being attached continuously.
As Con Edison continues to install Disturbance Monitoring Equipment (DME), such as digital fault (DFR) and sequence event (SER) recorders, these devices continue to produce substantial amounts of data. Furthermore, with recent regulatory requirements more and more DMEs are being installed. The problem today is that these devices do not organize and provide data based on installed equipment (lines, feeders, breakers, transformers, capacitor banks). To address the problem, SoftStuf developed a new software technology to fully automate the process of preparing data for fault analysis. SoftStuf further integrated the new technology into the Wavewin software which provides the added benefit of reducing analysis time by allowing experts to use advanced components to calculate and confirm fault location information. The new technology is called Line Groups. SoftStuf will provide support services to help Con Edison implement Line Groups for their DME installations using the Wavewin Software. Con Edison has already procured a corporate license for the Wavewin software so no licensing fees are required. The provided support services include programming, configuration, testing, and training services.

**BENEFITS**

Line Groups are invaluable for automation and the organizational benefits for analysis are extraordinary. Time for calculating, confirming and trending fault location will be reduced from hours to minutes. Also, Line Groups enable automatic calculation of fault location using both single and double ended methods. Time for calculating and confirming fault location is further reduced. The collective benefits will provide measurable enhancements in CAIDI and SAIFI metrics as well as provide compliance with NERC DME data management and reporting requirements.

**TECHNICAL STATUS**

In 2015 SoftStuf submitted three milestone deliverables:

- detailed specifications and requirements for the system,
- Line groups development – on-demand process,
- Reports development – on-demand process.
Currently available methods to enhance insulator performance, such as booster sheds, shed extenders and coatings have been developed to improve insulator performance under severe wetting conditions. There is no significant data or documented experience that quantifies the performance of insulators and/or these added enhancements under icy rain and sever icing conditions. In addition there is no data on configuration and exposure factors that contribute to more frequent icing related flashovers at specific locations, and optimize our overall strategies and methodologies for cleaning, coating and/or otherwise enhancing specific insulators at East 13th St. and other locations on the Con Edison system, should they exhibit similar higher frequencies of icing flashovers.

**BENEFITS**

Information gained will be shared with EPRI and other utilities in an effort to develop improved methods to deal with the effects of rapid icing conditions on insulators.

**TECHNICAL STATUS**

Currently available methods to enhance insulator performance, such as booster sheds, shed extenders and coatings have been developed to improve insulator performance under severe wetting conditions. There is no significant data or documented experience that quantifies the performance of insulators and/or these added enhancements under icy rain and sever icing conditions. In addition there is no data on the effects of different cleaning methods and periodicity and/or the build up of pre-contamination on the performance of insulators under icy rain and severe icing conditions. The East 13th Street 138kV yard has experienced an elevated frequency of flashover events due to icing conditions. By adding insulator monitoring to selected insulators at East 13th St. we could obtain data that could help us identify configuration and exposure factors that contribute to more frequent icing related flashovers at specific locations, and optimize our overall strategies and methodologies for cleaning, coating and/or otherwise enhancing specific insulators at East 13th St. and other locations on the Con Edison system, should they exhibit similar higher frequencies of icing flashovers.

EPRI has developed and deployed insulator monitoring sensors and readout systems at other utilities. The project plan is to install a limited number of insulator sensors on selected insulators at East 13th St. and to monitor pre-contamination buildup and other contributors to icing flashovers, as well as to look at
the insulation performance trends prior to future flashovers. It is expected that the potentially rapid
nature of icing build-up might offer very limited time, on the likely order of 10 minutes, to respond to a
specific developing icing event, but it is hoped that optimization of cleaning frequencies and methods to
reduce pre-contamination, and closer monitoring of relative performance between selected insulators
will provide information that could be used to reduce the frequency of these events in the future. Data
will be reviewed over time to determine the effectiveness of any alterations to current insulator
maintenance practices and any enhancements made.

Following initial installation of the leakage sensors problems were noted with signal pick-up from the
original single base station. A 2nd base station for the insulator leakage current was installed.

In 2012, EPRI submitted final report on the project, and while overall feedback from the field was
positive, project team identified areas for improvement of the monitoring system, to make it more user-
friendly and reliable. The system provided valuable information on insulators condition during post-
Sandy re-energization of the E 13 street substation, which has critical role in providing reliable power
supply to Downtown Manhattan business area.

In 2013-2015, EPRI developed new, improved version of sensors and the base station; designed,
manufactured and delivered equipment to E13th street. Installation is planned for March of 2016.
Project’s objective is to provide expert support in developing specifications, design and test procedures of protection and control systems for East 13 Street Substation Storm Hardening project. It is envisioned that developed specifications will become a new standard for all future substation designs for our bulk power system. Project implementation approach includes two phases:

1. On-site visit with training and preparation of a draft procurement specification that includes a two day basic training on IEC 61850 for the Con Edison team; a three day on-site discussion to capture and review the current status of the specifications and to analyze the functional requirements for the IEC 61850-based substation; preparation of the specification elements essential from an IEC 61850 perspective for East 13 Street substation based on the requirements for this particular substation.

2. Support with procurement, testing and project execution: Preparation of the testing guidelines for devices and systems; Bids review; Selection of the devices, technical support throughout project execution.

BENEFITS

Consulting service from industry recognized expert will be essential in timely development and release of protection and control specifications and test plans, based on IEC-61850 Standard, which will improve system reliability and resiliency.

TECHNICAL STATUS

Modern substations comprise multifunctional Intelligent Electronic Devices (IED) for control and protection from various vendors, and due to differences in design and communication protocols, not always have seamless interoperability.

East 13th Street Substation Storm Hardening project will be using IEC 61850 Standard (Communication Networks and Systems for Power Utility Automation) in protection and control design. This would be the first time such a large project is done by any utility in the US using IEC 61850. This technology has been developed and recently used in Europe, and the project team needs to have the subject matter expert to
provide consulting services. The expert providing the service, is involved at both, CIGRE and IEEE working
groups on the development of IEC 61850 and IEEE 1588 (Precision Clock Synchronization Protocol for
Networked Measurement and Control Systems) Standards and the service requested is deemed to be
essential for project success.

In 2015, detailed specifications for new protection and control system were developed, which allowed
design to progress, based on IEC 61850 standard.
OBJECTIVE

Multiple equipment failures have been experienced recently during disconnect switching operations at the Ramapo, Pleasant Valley, and Sprain Brook 345 kV substations. In all three substations, the failures have been observed when de-energizing a specific dead-tank breaker model (HVB), featuring bushing mounted TRV (Transient Recovery Voltage) capacitors. The types of failures experienced in the three substations included burnt terminal blocks, damage to relay protection equipment, the heaters in the breakers (which are critical to their operation), as well as to the station alarm panels. The cause of the problem is due to high frequency transients generated during disconnect switch operation which then are transferred onto the breaker shell and the breaker's wiring through the TRV capacitors.

The objective of this project is to increase the reliability of 345 kV CB operation, by mitigating or completely eliminating equipment failures due to switching transients associated with TRV capacitors. Various mitigation recommendations have been developed in the course of investigations conducted by Central Engineering along with consultants and equipment manufacturer teams. Possible solutions include relocation of TRV capacitors, their total elimination on the premise that other substation equipment's capacitance will compensate for their function, or modification of their grounding. The grounding system modification is considered as a least expensive and lowest-risk solution, which will be implemented in all three substations that experienced failures. This project will modify the grounding to provide a better path to ground to prevent the transients from getting onto the breaker's shell.

BENEFITS

The benefits provided by this project increase our Bulk Electric System reliability, equipment availability and reduce forced outages of equipment due to damage to circuit breakers control circuitry.

TECHNICAL STATUS

Grounding for TRV capacitors was modified for all three affected breakers. Project team is monitoring breakers switching operations and auxiliary equipment to determine results of the modification.
TITLE       Participation in 2015 EPRI Cyber Security and Privacy Program PS183D - Information Assurance

CSN        99929       POET     21435325       TASK   0001

PROGRAM AREA  Electrical Substations

CONTRACTOR    EPRI

DURATION  4/22/2015 to 12/2015

ENGINEER     Sagareli

PROJECT LEAD  William Vesely

AUTHORIZED  $ 120,000

EXP. THROUGH 2015  $114,164

OBJECTIVE

Cyber security threats against power systems infrastructure targets are on the rise, and their sophistication is increasing every day. Tools used by the power systems' cybersecurity specialists must be updated constantly, to keep up with tools and methods used by cybersecurity criminals, so they can provide adequate protection to complex computer systems and networks employed by the power generation, transmission and distribution systems. Aside form computers, power systems operations rely on IED's - microprocessor based intelligent electronic devices, as well as other smart devices of growing "internet of things", which represent targets for cyber criminals. This increasing technological complexity requires constant research into new methods of cybersecurity and protection. This project focuses on security challenges that affect multiple operational domains, such as designing security into products, operational integration of security data from multiple domains in an integrated operations center, creating security metrics for the electric sector, and developing risk assessment methodologies that are designed for power systems.

BENEFITS

Expected benefit will be improved protection of our computer network and SCADA systems from cyber attacks, as well as privacy protection of the Company data.

TECHNICAL STATUS

In 2015, technical update/report was delivered; project will be continued in 2016-2017, as a base project in EPRI portfolio purchased under 3-year agreement.
OBJECTIVE

The demand for electric power is increasing faster than the construction of new delivery facilities. This shortage has created bottlenecks causing congestion and lowering system reliability. Power companies are desperately looking for quick solutions to overcome this problem. A cost effective option is to optimize the use of the existing system by searching for extra capacities that may be embedded in the original design.

Previous EPRI work had theoretically evaluated the feasibility of uprating an existing substation busbar with minimal changes. The feasibility study indicated that this substation busbar may be suitable for a higher current rating.

The objective of this proposed study is to verify the previous finding by undertaking numerical modeling simulations to determine the thermal and mechanical response of the existing busbar when subjected to an increased current. Based on favorable results obtained in this study, full scale tests may be required including testing of a complete busbar and enclosure to determine the long term performance of the configuration at elevated load currents.

BENEFITS

The results from this study will help Engineering to improve their specification and procurement practices and uprate ratings of existing busbar at minimal costs.

TECHNICAL STATUS

We are currently working on verification of busbar Information - The relevant information obtained in the theoretical study will be verified and confirmed. Any changes to the configuration will be noted and the effects on the theoretical rating will be analyzed. Once completed, the next step will be to determine specific busbar Configuration Information - Information to be collected includes, busbar enclosure dimensions, enclosure materials, connector type and materials, associated busbar hardware used, etc.
OBJECTIVE

With the high level of turnover and increased retirement of experienced personnel, it is becoming more challenging than ever to retain and transfer their knowledge and skills. With a training simulator at TLC, nearly every department in Central Operations will benefit from being able to see and operate real field equipment in a controlled environment. Currently, training is being done using text books, table top exercises and field visits.

BENEFITS

Substation Operators and Mechanics, as well as other Central Operations personnel will benefit from the training that replicates real field experience, in a safe and controlled environment. The simulator will facilitate knowledge transfer, and also will serve as a testbed for development and implementation of new ideas in substations design, operations and maintenance.

TECHNICAL STATUS

In 2015, design of the training simulator was completed. It is based on a typical 138kv string of circuit breaker with disconnect switches on both sides, connecting transformer to pothead or buswork. Disconnect switches and pothead support structure have been installed and circuit breaker was sent to ABB for refurbishment.
Based on an opportunity offered by the Department of Homeland Security and American Superconductor, Con Edison is finalizing plans for a combined demonstration of a superconducting cable and fault current limiting capability that would enable network to network interconnections and more effective sharing of assets between substations to improve the resiliency and reliability of the New York City grid. The program is developing for demonstration a new type of inherently fault current limiting superconducting cable, and will also include parallel development efforts for a 13kV 4000 amp stand alone fault current limiter.

- Con Edison is supportive of superconducting technology, because we see superconducting as a way to meet the special needs of dense urban utilities with regard to severe underground physical congestion routing between substations and future potential for size reductions of specific devices like power transformers.
- Superconducting technology could also support advanced substation and interconnection designs that would allow us to route larger amounts of power between substations, feeders and networks, improving asset utilization by helping us to make more effective shared use of resources.
- In particular, we are focused on a rapid development and deployment of new functionalities like fault current limiters, which we believe will be a critical enabling technology to support "open access", transmission capacity additions, protection of FACTS devices from close proximity faults, energy storage, and distributed and aggregate generation.
- A fault current limiter added in series with a superconducting cable can improve the superconducting cable's performance and enable smaller cable size supporting less costly retro-fit installations.
- Rugged, repeatable, quick recovery fault current limiters are also needed to give selected distributed generators an advanced option to remain available to serve peak loads following an external fault.
- Reducing fault currents will also reduce the mechanical and thermal stresses of "through faults" on all of the existing electrical infrastructure that these fault currents pass through.
- Cryogenics for devices of smaller size (less length) like fault current limiters and relatively short substation to substation interties would seem to be more like already commercial superconducting motors, synchronous condensers (SuperVAR) and MRIs than cables, and, once installed in a
substation, cryogenics could potentially be used in other ways to extend non-superconducting equipment ratings and life.

• We also believe in the need to accelerate fault current limiting functionality, and to that end support the development of a number of fault current limiting technologies at multiple voltage levels.

**BENEFITS**

The capability to share assets between substations would enable the current 3G-System of the Future architecture concept and greatly facilitate it's application and evolution into existing substation interconnection designs.

**TECHNICAL STATUS**

As a separate task within this project, Silicon Power was selected and approved by AMSC and DHS to complete design, assembly and testing of the first of a kind 13 kV 4000 amp stand-alone Solid State FCL device in accordance with the planned construction schedule.

In 2011 - Silicon Power assembled and tested SS FCL at independent lab KEMA. Device passed functional and thermal testing, but failed dielectric tests. Completion of design and construction of fully functional device is being planned as a collaborative effort with EPRI and interested utilities. AMSC successfully tested 25 m long prototype superconducting cable at Oak Ridge National Laboratory, and started manufacture of the 170 m long cable. Test results and project progress were presented at EPRI Superconductivity conference in October, as well as at the project meeting with DHS and Con Edison personnel.

In 2012, engineering design of the complete system, which includes superconducting cable with special terminations, cryogenic refrigeration system, circuit breakers, reactor, bypass cable and switches, bus work, protection and control systems, was completed for the purposes of obtaining construction permit from local Department of Buildings and procurement of equipment. All required documentation, including drawings and specifications, was submitted to the city of Yonkers authorities. Detailed design for construction will be completed after permit is obtained and purchase orders for the equipment are issued to vendors.

In 2013, detailed design of all equipment and its installation was completed and PO’s for equipment issued. New estimate based on detailed design and actual vendors quotes completed, which showed significant potential overruns.

In 2014, value engineering analysis led to project redesign, with some equipment PO’s suspended or cancelled. New cost-sharing agreement with AMSC was drafted.

In 2015, negotiations of the new cost-sharing agreement with AMSC continued.
**OBJECTIVE**

Con Ed is utilizing the 13th Street Substation as a pilot site to demonstrate the concept of a “Smart Substation” where the data integration and communications infrastructure will be installed to collect, store and analyze data from multiple monitoring technologies. This effort will focus on the development and implementation of algorithms, alerts and alarms that will utilize the collected data to improve reliability and reduce maintenance costs. In a substation there are transformers, breakers, switches, arresters, bushings, bus bars, relays, control panels, current and voltage transformers, battery systems, etc. A visual inspection may not point to the internal problems developing inside these assets. Hence, the need for continuous or frequent monitoring of key parameters and analysis of the monitored data to identify evolving problems before the situation gets out of control. Equipment failures can lead to outages on the network, thereby, impacting reliability and affecting customers directly or indirectly. Hence, it will be of immense value to monitor, and gauge the health of the assets and assess impending problems. If implemented correctly problem may be fixed at their infancy, downtimes can be reduced and reliability will be enhanced – the benefits will be manifold.

**BENEFITS**

Benefits provided by this project may be described as improved quality of information and situational awareness by allowing field forces and Engineering to see information analyzed by various algorithms, hence better quality of decision along with improved timing, which will lead to higher productivity and safety, as well as lower O&M costs.

**TECHNICAL STATUS**

In 2015, project scope was defined and Agreement with EPRI was executed; actual research and demonstration will be done in 2016-2018. Deliverables include reports and technology transfer workshops.
OBJECTIVE

In this project, we will develop and install a live test bed in the Cooper Square network. We will incorporate algorithms in an external network protector relay within the transformer vault. In addition, high capacity monitoring and recording equipment will be installed to gather comprehensive data sets for correlation to actual manhole events. This test bed will allow us to evaluate the capabilities of various algorithms to detect faults on the secondary system and evaluate the feasibility of using a network protector relay for arc fault detection and location. Broadband communications will be provided in the vaults to allow for continuous monitoring and two-way communication providing the capacity to adjust trigger settings as required.

BENEFITS

Advanced knowledge of arcing fault conditions will enable us to respond quickly averting hazardous situations and limiting damage to system equipment and potentially preventing incidents and public exposure to hazards caused by arcing fault events.

TECHNICAL STATUS

Algorithms to detect and characterize arcing faults on the secondary network have been developed for this project. We have successfully transferred the arcing-fault detection technology into the Network Protector relay including developing the strategies for reporting arcing-fault information and severity within the three-bit communication constraint on Con Edison’s existing RMS system. Simulated testing using recorded arcing waveforms have demonstrated the effectiveness of the new arc fault detection feature on the new relays.
The objective of this project is to bring AR technology developers and electric utilities together to assess the application of augmented reality solutions for the electricity sector. This project will: Hold a series of workshops that will bring electric utilities and AR technology providers together with the objective for utilities to understand the possibilities of the technologies and the AR technology companies to understand the working environment of electric utilities; Identify activities in utilities that would benefit from AR – then collaboratively develop use cases around priority activities; Develop a performance assessment protocol that can be applied to assess workplace performance with and without applying augmented reality technologies; Measure performance characteristics of select activities without the application of AR in order to establish a base line; Engage AR technology providers to adapt their technology for the identified activities and demonstrate the applications at host utility sites; Advance the standards associated with AR to promote interoperability and data integration – participate in efforts underway within the IEEE and IEC to accelerate the development of AR standards; Measure performance characteristics of select activities after AR application and compare to established benchmarks.

**BENEFITS**

Four different cases suggested by Electric and Central Operations, will provide various benefits for each case, and they may be described as improved situational awareness by allowing field forces to see information not readily available, hence - better quality of decision along with improved timing, which will lead to higher productivity and safety, as well as lower O&M costs.

**TECHNICAL STATUS**

Augmented reality (AR) technology overlays information in real-time onto a person’s view of the world through the use of mobile computing devices and graphics. AR goes beyond mobile computing and GIS technologies being used by utilities today. AR is developing rapidly and has the potential to improve the productivity and safety of electric utility crews.
TITLE  Assistive Tool for Hand-Digging Pole Holes Demonstration

CSN  99985  POET  21143007  TASK  0001

PROGRAM AREA  Electrical Distribution

CONTRACTOR

DURATION  10/9/2014 to 10/2015

ENGINEER  Doherty

PROJECT LEAD  Thomas Vincelli & Paul Kies

AUTHORIZED  $ 20,000

EXP. THROUGH 2015  $ 16,006

OBJECTIVE

Explore and demonstrate use of a vacuum excavator and air lance excavation tools for pole hole excavations. Funds provided by this appropriation will be used to acquire a Utilivac VE75 and two air lances; and use it in both planned and emergency pole replacements to demonstrate its effectiveness for use, discover how to use it in typical field conditions experienced at Con Edison, and measure and verify the expected benefits.

BENEFITS

Only a limited number of injuries resulting from hand-digging pole holes are being recorded, but it is fact that many soft-tissue injuries result from cumulative exposures that may ultimately manifest themselves in acute fashion. As such, the total number of injuries attributable at least in part to this strenuous task could be significantly greater. We seek to reduce risk of injuries, reduce costs of hand digging, and speed restoration. This project will help quantify the benefits prior to deployment.

TECHNICAL STATUS

Completed – Demonstration and subject matter assessment determined that tool is too cumbersome for overhead forces. Equipment was re-directed to Gas Operations organization where it is being used to explore feasibility of micro-excavation for certain gas infrastructure maintenance and repairs.
TITLE Con Edison Weather Forecast Verification Automation

CSN 90390  POET 21085054  TASK 0001

PROGRAM AREA Electrical Distribution

CONTRACTOR Intellovations

DURATION 9/5/2014 to 3/2016

ENGINEER Reichborn-Kjennerud

PROJECT LEAD Brandon Hertell

AUTHORIZED $ 78,000  EXP. THROUGH 2015 $ 58,000

OBJECTIVE

The Objective: To develop a customized automated system for parsing and storing current and historical data from various weather forecast services, comparing the accuracy of the weather forecasts and models, and expanding the possible parameters used for accuracy verification. The project shall consist of two phases.

Phase 1: Develop parser and database for each of the weather forecasting services to be tracked and verified. Develop automated forecast loader to capture and store forecasts from several sources and formats used by weather services. Load historical forecasts from various weather services. Develop automated aggregator and scoring system based on Con Edison scoring methodology to verify and score individual services' forecasts on daily timescale. Develop dashboard to access verification and individual performance scores for the various weather services.

Phase 2: Develop methodology to convert various forecast timescales into one common hourly scale for comparative accuracy analysis of forecasts. Refine aggregator and scoring system to hourly scale. Refine dashboard to hourly scale.

BENEFITS

This project has the potential to help the company improve its understanding and performance of several weather forecasting services, its weather forecasting capabilities, and its ability to communicate realistic and understandable impact projections for weather events that threaten our company and customers. This project will develop new automated weather forecast data capturing, archiving and verifying methods. The project will save on costs associated with current practices (estimated at $30,000 annually) and avoid additional hardware costs to manage large volumes of data. It will also allow us to enhance our weather and impact modeling tools faster and more effectively by constantly monitoring the accuracy of the weather forecasts the company receives. Implementing the project with Intellovations will provide a faster ROI than other solutions investigated.
TECHNICAL STATUS

Consolidated Edison currently utilizes spreadsheets to verify weather forecasts from several weather services. The forecasts are compared to dozens of observation sites across the Con Edison territory each month. These spreadsheets calculate and compare the accuracy of the weather forecast services. Entering of forecast details into the verification spreadsheets and generating reports are manual processes requiring 2 to 4 hours per day. Additionally, because of the complexity of the spreadsheets, adding new parameters to verify is difficult or impossible due to limitations of the spreadsheet application. The current verification design has exceeded the spreadsheet capability. Finally, data storage requirements have also exceeded local storage and data management solutions. To make better use of resources, expanded verification capabilities of additional weather parameters, and increase computational efficiency, Con Edison is seeking a vendor to develop an automated approach to capture forecast data, verify custom weather parameters, and resolve data storage issues for its verification work.

This forecast verification tool has been built and is currently being tested by the users. The user acceptance testing period is occurring in February of 2016 and the project should be finalized by the end of the first quarter of 2016.
TITLE       Decision Support Development for Enhanced Work Coordination

CSN        99848   POET    21788037   TASK    0001

PROGRAM AREA     Electrical Distribution

CONTRACTOR     ProceMX

DURATION  12/8/2015 to 12/2016

ENGINEER     Doherty

PROJECT LEAD  Delvin N. Stephens

AUTHORIZED   $ 197,000   EXP. THROUGH 2015   $ 60,000

OBJECTIVE

This project seeks to develop and demonstrate a management decision support system for enhanced work coordination of street excavation and other construction for electric and gas with municipal agencies (water, sewer, and road paving etc.) and other utilities’ work in the public right of way in order to minimize the impact of construction to our customers and to the streets and neighborhoods and also to reduce costs. This is to be accomplished by adding a level of intelligent automated decision support and helping to push needs for coordination to all owners of street work. Job owners will be alerted to changes in other jobs in the vicinity of their own job. By creating new features in MX, we will develop an intelligent agent that understands municipal and Company process rules for street construction jobs; interprets the meaning of the changes in jobs in nightly updates; and maintains integrated project schedules in each zone. Each municipality would have access to its own user interface. Municipalities could use MX for permitting as well as management of paving project schedules.

BENEFITS

Con Edison and other owner-operators of subsurface infrastructure beneath municipal streets have many jobs in planning and in progress in any week. These jobs frequently overlap in time or geography, and if not coordinated well, can result in unnecessary expenses and erode the quality of life for customers in the neighborhood. A Work Coordination Application has been rolled out for street work for some organizations, and it shows promise to improve customer quality of life and reduce costs. This project will develop a multi-commodity, multi-organization enhancement for that tool, and demonstrate its use in Bronx-Westchester.

TECHNICAL STATUS

In Progress - Trial version of Management Decision Support System for Enhanced Work Coordination of street excavation in Bronx-Westchester is deployed. Subject Matter Expert team assembled from responsible organizations to articulate how individual jobs are managed, and their cost models, and also how these can be coordinated with jobs from other departments and city agencies.
TITLE    Demonstration of Novel Electric Distribution Tools and Equipment

CSN     99891  POET     21667232  TASK  0001

PROGRAM AREA  Electrical Distribution

CONTRACTOR

DURATION  9/21/2015  to  12/2018  ENGINEER  Doherty

PROJECT LEAD  Kevin Oehlmann

AUTHORIZED  $ 100,000  EXP. THROUGH 2015  $ 5,237

OBJECTIVE

We seek to facilitate and accelerate the adoption of new tools and equipment by providing funding for their demonstration and field testing, thus enabling review and qualification for use on the system. In accordance with CI-290-5, Distribution Engineering will determine when field trial usage is required for new tools and equipment; verify that applicable environmental and safety considerations have been assessed and resolved; determine test procedure and duration; provide any needed drawings and specifications; gather feedback on trial usage; and in collaboration with Regional Engineering, Regional Electric Construction, The Learning Center, and applicable Standards Committee prepare a summary report of the trial and recommendation for deployment.

BENEFITS

Emerging new technology offers opportunities for improved system performance and employee safety and effectiveness with novel electric distribution tools and equipment, but the benefits cannot be quantified at this time. This project will engage Engineering and Operations people to identify opportunities for improvement and review novel tools and equipment in field trials to quantify the benefits and identify any potential hazards or risks from deployment. The field trials will thus be the foundation for application of the new equipment and will also inform plans for their deployment. Among the potential benefits are elimination of sole-source suppliers resulting in reduced equipment prices and improved quality due to competition.

TECHNICAL STATUS

In Progress - Two new equipments demonstrated at TLC – a pre-assembled switch switch crossarm and a 27kV polymer cutout. For the switches, feedback was generally positive; however there are several issues that need to be addressed before field deployment. For the cutout, feedback was positive and no issues were encountered.
TITLE    Drive-by Underground Structure Monitoring System

CSN      99915   POET  21520337   TASK  0001

PROGRAM AREA    Electrical Distribution

CONTRACTOR

DURATION  6/11/2015  to  8/2017

ENGINEER    Reid

PROJECT LEAD    Leslie Philp

AUTHORIZED   $ 120,000

EXP. THROUGH 2015   $ 11,618

OBJECTIVE

The goal is to develop a cost effective manhole monitoring system that will report back the presence of elevated temperature, combustible gases and abnormally high e-field in targeted structures. The project will be executed in two phases. The first phase would begin immediately and involves the development and testing of the transmitter system. This system would comprise of sensors, battery, antenna and Xbee power modules. Phase two covers the development and testing of the receiver system (Xbee power module, antenna, computer interface board) and the data management system. The concept is to have transmitter system detect and transmit data at specific time interval if certain thresholds are exceeded. A company vehicle will be retrofitted with the receiver system and collect the data when the vehicle drive by the structure. The data will then be reviewed for possible abnormalities in the structures

BENEFITS

The program primary objective is to reduce the number of MHEs and ENEs through the continuous monitoring of manholes and service boxes for specific gases, elevated temperatures and e-field strength. This approach will find defects or lessen the severity of MHEs before they become expensive problems thus allowing for scheduled repairs. As a result, if successful, the Company should realize significant savings with fewer property damages and/or injuries.

TECHNICAL STATUS

Manhole events (MHEs) and energized objects (ENEs) present a significant safety threat to the public and our employees, and continue to expose the Company to significant financial liabilities. Most manhole events develop overtime and are caused when an electric arc burns the cable insulation producing combustibles such as Carbon Monoxide and Hydrogen gas. These gases are continuously being generated until the lower explosive limit is reached resulting in an explosion. Because of the often long time arcing in a manhole takes to evolve into a full blown event, and the fact that specific gases are produced from the burning of the cable insulation, it might be possible to develop a cost effective early warning mobile detection system - via the use of gas and e-field sensors - that would alert us of impending fires, explosions and abnormally high electric field which could be an indication of stray voltage.
Update

Version 1 design of the system is finalized, using a Figaro TGS5342 carbon monoxide sensor and Analog Devices TMP36 temperature sensor as key indicators of possible conditions developing in an underground structure. The sensors are connected to an Atmel 328 microcontroller, which minimally process the data and send daily sensor readings back to the ConEd SCADA network through Verizon’s private network. The system is currently being manufactured and assembled. 3D printing will be used to make the initial prototype.

The software of the system is configured to read sensor values every hour and record only 1 reading every 24 hours. After 30 days the stored readings will be sent back to ConEd. Only upon conditions where the readings are above a pre-set threshold limit will the data be transmitted back to ConEd immediately. It will do so every hour until the conditions have been cleared. A polling program will be created and listen to the incoming messages from the structure monitoring devices. It will flag any high priority conditions and store all sensor readings to a SQL database.
A personally-worn monitor to measure and record ambient electric and magnetic fields would be valuable to quantify fields in ordinary work environments and to alert the wearer that a programmed threshold had been reached. In a predecessor project, EPRI developed and tested the proof of concept alpha device. This appropriation will fund, via EPRI, a collaboration to enhance the device to a beta version and perform further field tests prior to seeking a commercializer: development of the Beta version in Q4 2015-Q1 2016, field testing during Q2 2016, with final instrument design in Q3, 2016 and potential commercial availability of the monitor’s initial model (basic E and B detection at pre-set thresholds) by mid 2017.

BENEFITS

A personally-worn monitor indicating that ambient electric or magnetic field approaches a level that could conceivably interfere with an implanted medical device’s performance could be a valuable component of a comprehensive workplace safety program. This project seeks to develop a tool to monitor ambient electric and magnetic fields in Con Edison work environments and provide data to describe usual and unusual exposures, towards establishing practical thresholds of concern for workers who have medical implants.

TECHNICAL STATUS

In Progress – EPRI has begun advanced testing of guard-ringed sensor to mitigate build-up of static charge, and designing Beta digital board.
OBJECTIVE

The PADx is capable of increasing ABF reporting rates by 50% (from 60% to 90%). This project seeks to federate the PADx datastream into control center systems by integration of the data stream into XA/21-CDMS which requires reformatting of the communication protocol to DNP3. This project will fund development of the required DNP3 slave firmware for the PADx system and purchase of special multichannel PADx from ETI in order to test and certify the required functionality. The DNP3 firmware update will also be applied to a Yorkville PADx to collect real data for further testing and certification.

BENEFITS

Enhancement of PADx is one of several initiatives to mitigate help risk of Underground Distribution Transformer Failure, which has been identified as an Enterprise Risk. Performance of a demonstration system shows a 50% improvement in capturing data from transformers on feeders that are alive on backfeed (60% to 90%). The enhancement sought on this project will bring that datastream into standard control center systems, allowing deployment beyond the demonstration system in Yorkville Network. If successful, cost avoidance of $21,000 per year is envisioned by bringing the communication and data in-house. Additional cost avoidance is possible by extension of the system to other networks and reducing the manhours required to locate ABFs, but it cannot be quantified at this time.

TECHNICAL STATUS

In Progress - Enhanced tool developed and delivered to help locate and resolve backfeeds. Undergoing shakedown trials.
OBJECTIVE

The goal of this project is to evaluate the potential success of a utility scale molten salt energy storage asset at the Hudson Avenue site in Brooklyn. The feasibility study will address technical concerns as well as the business model, how the asset could be utilized by Con Edison, and other practical concerns such as permitting and regulatory requirements and constraints. The project will be executed by a team lead by Third Power and including Con Edison, E-J Electric, and Waldron Engineering. The following research phases will be undertaken, culminating in the final report which is the primary deliverable of the project: mechanical engineering analysis, electrical engineering analysis, operations and dispatch modeling, environmental impact and permitting analysis, cost and schedule estimation, and commercial arrangement and project finance.

BENEFITS

This feasibility study will provide an assessment of an asset that could be used to defer capital expenditures. Additionally, a project such as this one may reduce emissions if it enables the company to avoid dirty peaking power plants as well as improve reliability. Finally, the project is in line with the Reforming the Energy Vision initiative by the PSC since it allows for a more efficient usage of company assets by shifting the electric daytime peak into the low peak period.

TECHNICAL STATUS

The Hudson Avenue Con Edison facility is mostly retired and currently contains minimal activity on the site. At the same time, the company still incurs various costs related to the property. Pulling the site out of near-retirement will provide an opportunity for the site to serve our rate payers. The ReStore concept, a locally emissions-free grid scale energy storage resource, can address a number of the following challenges to the system including:

- Reduce peak load while making use of system resources off-peak to improve asset utilization and also avoid high emissions associated with peaking power plants
- In an area where load is fast growing, ReStore has the potential to allow for deferral of capital investment to cover the increasingly stressed infrastructure in Brooklyn
This study is close to completion. Both mechanical and electrical engineering analysis have been completed and a financial model showing estimated costs and the potential benefits leveraged have been built. The vendor is writing the final report in Q1 of 2016 and the report will be reviewed by Con Edison personnel and should be finalized by the end of Q2 2016.
The goal of this project is to exploit the existing hardware in a wide range of microprocessors and controllers that are already in use on Con Edison distribution system, in order to achieve intrusion detection and software integrity with negligible overhead and without any performance degradation. An additional goal of this project is to enforce the cyber security policy by implementing security controls at the hardware level using features that are already there in the devices that execute software. We will investigate using a platform profiling methodology to secure the smart grid infrastructure against cyber-attacks. Profiling is a form of dynamic programming analysis. Three different techniques will be evaluated - Hardware Performance Counters (HPC), Joint Test Action Group (JTAG) and External Network Profiling. The techniques will be tested on a number of Con Edison’s monitoring and control devices currently in use on the distribution system. The objectives include reporting integrity violations securely using the DNP protocol and implementing security controls that protect the confidentiality and integrity of information associated with a wide range of smart grid devices, capable of executing programs that process information.

Platform profiling technology will be developed to protect against cyber-attack on Con Edison distribution equipment. Demonstration will include cyber attack on the devices and defense using secure OS/firmware for target relays and data concentrators. Finalization of the platform profiling technology will include the necessary protocols (DNP) to connect the developed solutions to existing Con Edison infrastructure. Documentation for installing the platform profiling system on current (and similar) infrastructure will be provided. A report will also be provided on the demonstrated security vulnerabilities of the smart components.

In 2015, the team developed a HPC (Hardware Performance Counters) methodology that could potentially be stored in the boot ROM of the devices. This methodology is a low-cost technique to detect malicious modifications in the firmware of embedded systems by measuring the number of low-level hardware events that occur during the execution of the firmware. If implemented on manufacturer’s devices, the techniques can be used to remotely monitor the health of individual RTUs and generate alerts for any abnormal operation.
TITLE: DEMONSTRATE MANHOLE COVER RESTRAINT SYSTEMS

CSN: 99919  POET: 21506710  TASK: 0001

PROGRAM AREA: Electric Distribution

CONTRACTOR: Various


ENGINEER: Josephine Aromando

PROJECT LEAD: Mark Riddle

AUTHORIZED: $ 50,000  EXP. THROUGH 2015: $ 19,199

OBJECTIVE

Our aging infrastructure presents potential safety hazards related to cable insulation breakdown, salt intrusion from above ground, or other factors that cause an explosion to occur inside the structure. Flammable gases enter a structure when cable degradation occurs, and from third party sources, which over time may accumulate and increase in concentration if not adequately vented to the atmosphere. When the concentration reaches critical explosive limits, the introduction of an ignition source from arcing cables and the build-up of these gases inside the structure could potentially result in a massive explosion and release of energy. This results in the manhole cover violently ejecting from its frame, becoming airborne and having the potential for causing physical damage to the surrounding property, roadway, and injury to the public and company employees. The test will determine if the restraining system will significantly reduce the displacement of the cover. In addition will determine if the pavement (EO-10321-B) around the cover frame presents enough compressive force to keep the frame of the cover in place to make the method of restraint effective.

This effort will evaluate restraint cover methods and mechanisms by testing their ability to safely dissipate the potential energy resulting from an underground secondary event (UGSE) and their ability to minimize the energy inside the manhole during an emerging or ongoing secondary burnout or other manhole event. Both engineering and field personnel will evaluate the ease of locking, ability to reduce the damage that could potentially result from a violent expulsion, and the economic analysis comparing known restraint or locking technologies commercially available.

BENEFITS

A restraint system for manhole covers may help contain the energy resulting from a sudden cover ejection during a manhole event. Minimizing the impact of the cover ejection helps to reduce the potential risks involved, such as damage to property and roadways, and possible harm to the public. By containing this impact, safety to the public and protection of the environment could be achieved and associated costs could be greatly reduced.
TECHNICAL STATUS

Covers of various restraint designs were procured from two competing vendors in 3Q15. These covers will be subjected to blast tests performed at EPRI under a separate project (see CSN 99904 PERFORMANCE EVALUATION FOR VENTED RESTRAINED MANHOLE COVERS). The blast tests are expected to be completed by 1Q16. The behavior of these covers with restraint systems will be observed and documented in a final report at that time.
OBJECTIVE

As part of wide ranging actions towards efficiency enhancement, design, develop and manufacture submersible capacitor assemblies for low voltage network system power factor improvement. Demonstrate installation in selected networks including measuring and verifying conformance to design parameters. As the devices are demonstrated as being effective, develop protocols for necessary costbenefit analytics and decision processes.

BENEFITS

Development of a submersible capacitor assembly will significantly expand the options available to correct certain secondary network system deficiencies and would greatly enhance our ability to correct power factor and thereby conserve energy economically.

TECHNICAL STATUS

In Progress – Ten submersible low voltage capacitor assemblies were designed and fabricated. Inspection and testing revealed anomalies that have been corrected. Locations are being selected for field trial in conjunction with the Brooklyn Queens Demand Management program.
The objective of this project is to provide field forces with the ability to identify NWPs that would either failed to trip or failed to close when system conditions require it. By devising a scheme to automatically exercise the NWPs periodically, we can potentially identify the problemed NWPs pre-emptively and proactively make repairs. To accomplish this, we plan to upgrade the firmware on the existing non-communicating microprocessor relays at individual street feed locations. At multibank locations, we will install communicating relays, flashed with the auto-exercising algorithm, and associated cables. This algorithm will trip and auto-close the network protector which will be tracked on NetRMS with the use of the “B” and “M” flags indicating a NWP operation. The project will be performed in stages.

1. Develop the algorithm and obtain one set of the required hardware for laboratory bench testing.
2. Purchase the necessary equipment/firmware and install it at eighty-one (81) locations for the pilot project.
3. Monitor NetRMS and work with field forces to identify and repair failed NWPs.

If this project is deemed as a useful tool, R&D will seek to capitalize the cost of installation for system deploym.

**BENEFITS**

- Increase reliability by reducing the possibility of failures by:
  - Proactively identifying NWPs that fail to trip prior to feeder outages
  - Reduction in ABF occurrences and help achieve a reduction in feeder restoration times
  - Reduce additional faults on the feeder due to overvoltages
- Proactively identify NWP’s that fail to close allowing us to reduce overload conditions during the peak loads
- Reduction in O&M expenses by:
  - Minimizing chased ABF locations and allowing us to utilize our field forces on scheduled work
Eliminating CINDE testbox inspections for network protectors that successfully confirm auto operation and shift to condition based inspections/repairs.

TECHNICAL STATUS

Whether exposure to the environment, mechanical and/or electrical reasons, the NWP’s we have installed in the field can either fail to trip or fail to close when system conditions require it. A NWP that fails to trip is a potential source of an ABF. ABF’s are caused when a feeder is de-energized, whether it opened auto due to a fault or for maintenance, and one or more of the associated NWP’s fail to trip allowing the transformer to energize the feeder via the secondary network. These “ABF Events” result in multiple crews working to locate the failed NWP, prolonging feeder processing and restoration times, and damage to our equipment as a result of over voltages, all of which translate to a significant rise in O&M costs.

Engineering has completed the development and testing of the auto-exercise algorithm. Equipment group is targeting to install approximately 30% of the pilot population before the start of the summer period in 2016. This initial population will be evaluated during the summer period (June to September). The results will drive the schedule of the installation for the rest of the pilot population.
Secondary electrical manhole events can present a significant safety risk to the public and our workers. Many of these events can be attributed to the ignition of combustible gases that are normally generated when an electric arc causes secondary cable insulation to burn. These electric arcing faults normally draw insufficient current to reliably operate conventional protection to isolate the failure. The faults can arc for long periods of time, resulting in heat, smoke, and gases accumulating and causing smoke, fire, or even explosions at manholes. In previous R&D efforts, we have used real-time arcing fault data collected from Manhattan's Cooper Square network to correlate observed manhole events. Using the data collected, algorithms to detect and characterize arcing faults on the secondary network have been developed and integrated onto the network protector relay. These algorithms were tested in the test lab and determined to be effective at arcing fault detection. Prior to system wide deployment, a small scale field demonstration is needed to complete the technical capability evaluation under field conditions, finalize use cases, obtain operational experiences and develop installation and response procedures for the system.

In this project, we seek to complete the field demonstration in two ways. Because our data collection efforts have been limited to Manhattan thus far, we plan to expand the effort to Brooklyn where there are higher concentrations of high risk cable types such as Aluminum, 4/0 and lead cables. We seek to build and install fifteen (15) new Arc Fault cabinets in a selected Brooklyn network. The cabinet will contain network protector relays with the arcing fault detection enhancement and a data collection device to retrieve and store data and oscillography for the purpose of algorithm evaluation and improvement. Additionally, a number of existing in service network protector relays in Manhattan and Brooklyn will be flashed with new firmware which will include arcing fault recognition as well as the normal relay functions. These relays will bring up an alarm flag if an arcing fault is recognized.

**BENEFITS**

An underground structure event on average costs the company $20,000 and we normally have 150 of them per year. To avert even a small portion of these events would result in a substantial dollar savings for the Company as well as a decrease in risk and exposure.
TECHNICAL STATUS

We have continued the field demonstration of the enhanced relays. A total of 37 network protector relays have been re-flashed and 6 new arc fault cabinets have been installed in Brooklyn.
OBJECTIVE

Existing isolation switches require an additional structure, must be locally operated, rely on accessories for grounding, and do not interrupt fault current. The purpose of those switches is to provide a means to isolate faulted portions of feeders so that unfauluted portions can be restored. The more quickly this can be done and the more assets are kept in service, the less stress is exerted on other system components. A three position, remotely operable switch provides a quicker means of processing the faulted portion of the feeder, while adhering to associated operational procedures with the addition of cam-ops. By having a fault interrupting switch, the unfauluted portion of the feeder will not be affected by a feeder event, keeping as many company assets in service as possible when an event occurs.

Additionally, as part of the proposed initiative to require new 120V/460V customers to own, operate and install their internal distribution equipment, including network protectors and transformers, a method is needed to isolate and ground the customers from the grid for feeder work. The purpose of the second switch installation is to test a new method of isolating customer equipment making it possible to adopt the new initiative for customers to own and operate their own electrical equipment. A three-position submersible medium voltage switch and control cabinet installation is required in a company owned manhole outside the customer premises that allows for isolation from the customers equipment. For this proposed test pilot, the switch will be installed outside a customer location that has been identified with difficult access issues.

BENEFITS

An enhanced compact, submersible, primary (fault-interrupting or non-fault-interrupting) switch will improve network design resiliency and enhance restoration efficiency, helping to reduce feeder processing time and bottom-line costs.

The goal of this project is to create a 20kA 3 position switch that can remotely open, close, and ground a distribution feeder. In addition, we are also developing a 25kA switch which is also a three position switch with the same capabilities as the 20kA switch with the additional feature of interrupting a fault on a distribution feeder. This will be the first application of these types of switches on the Consolidated Edison distribution system. S&C has been awarded the contract to provide both switches and their associated control cabinets. The vendor has delivered the switches and associated control cabinets to the
Learning Center in Queens during the 3rd Quarter of 2015. The switch and control cabinet have been installed in an above-ground demonstration location at the Learning Center to train the Con Edison crews on its operation prior to any field installation. Once accepted, the team will move forward with the pilot installations in the field. The 20kA three position switch will be installed at a HTV location in order to allow Con Edison to process the feeder without the need to access our equipment inside the customer’s property. The 25kA fault interrupting switch will be installed on a feeder in order to isolate the overhead portion of the feeder from the underground portion. We are anticipating the installation of the switches by the end of the fourth quarter of 2016.
TITLE  DEMONSTRATION OF AT&T LOCATING INFORMATION SYSTEM FOR TASK #

INTEGRATION OF FOREIGN CREWS

CSN  92317  POET  20601278  TASK  0001

PROGRAM AREA  Electrical Distribution

CONTRACTOR  AT&T

DURATION  7/29/2013 to 8/2016  ENGINEER  Reichborn-Kjennerud

PROJECT LEAD  Tiao, A

AUTHORIZED  $ 100,000  EXP. THROUGH 2015  $ 41,950

OBJECTIVE

The AT&T Locating Information Services (LIS) will be used to track foreign crews assisting the Company during a storm response. These response crews come from different areas of the country where the electric system may not reflect the same design or equipment as that found on the Company system. The LIS allows this crew updated information so they can perform their work safely and in accordance with our design. With the LIS technology the Company can provide back and forth communication with foreign field crews and alert them to hazards. Crews can be assigned to a predetermined geofence.

BENEFITS

The Company will benefit from this system through better management of restoration efforts and the resulting cost reductions. Customers will also benefit as they will be returned to service faster. This technology can be integrated with the Company’s outage management systems to streamline addressing outages.

TECHNICAL STATUS

Initial tests of the locating services have been completed to demonstrate effectiveness at performing locates of personnel. During 2015 a more detailed technical test was completed to evaluate the accuracy of the locates and the ease of use of the web interface. Currently we are evaluating the value of the tool to determine if, given the accuracy and cost, it is worthwhile to test in operations.
OBJECTIVE

This project proposes the following validation/enhancement processes to improve the current load model development and make them suitable for field applications:

- Vertical validation process: using multi-year metered data to verify the trend and predictability of future demand profile of the metered customers based upon historical data.
- Horizontal validation process: using the developed demand profile to forecast the demand profile of metered data that are not used in the demand profile developing process and forecast the demand profile for the customers without smart meters.

The final software application will run algorithms to cluster smart meter data collected during the Stimulus Project and develop estimated demands for customers for major service classes to make load models for the entire year.

BENEFITS

Accurate load profile estimation and their resulting load shapes and daily peak load are important factors in scheduling, operation and control of the utility grid. Accurate models and analysis provide the basis for capital reinforcement projects and budgets. The results this project will help enhance our load modeling efforts and progress our goals toward providing a year round load model (Seasonal Load Models) that will help design for light load cases in our network systems. The load models are currently being expanded to help analyze the implementation of Distributed Generation on our distribution systems and accurate load models will be required to size them properly.

TECHNICAL STATUS

In 2015, this project is complete. Using AMI data collected during the smart meter pilot program in the Borden and Sunnyside networks we worked with University of Texas to develop a load profile forecast algorithm that increase the current forecast accuracy for coincident peak demand and provide seasonal load profiles for various customer service class and stratifications levels. The algorithm utilizes the recorded smart meter data to identify and group individual meters into clusters and in turn the clusters are utilized to develop load profile estimation in Distribution Engineering load flow program.
This project explores the promise of using ensemble weather models to provide more accurate long range forecasts. SUNY Stony Brook has built a new probabilistic approach to displaying and visualizing the output of several ensemble weather models to provide better guidance when forecasting storm tracks and some storm parameters beyond the typical 3-5 day window as far out as 10 days. The objective is to investigate the capability of ensemble weather models and develop tools or visualizations that provide short and long term forecasts of adverse weather and the probabilities thereof with Stony Brook University. Project activities include:

1. Use of GFS ensemble weather model (in addition to others as possible) to run with varying initial conditions to predict out 10 days ahead and develop visualizations for low pressure storm tracks and their probabilities of occurrence.
2. Incorporate a 30 year historical database of storms into the modeling process to strengthen the probabilistic aspect of the forecast by essentially training the model to pattern recognition.
3. Add wind and rain accumulation variables to the probabilistic track forecasts.
4. Verify the results of the ensemble model against actual storm events as they occur.
5. Develop a web-based product that can be used in an operational setting which displays the data listed above.

The tools will also allow us to monitor how the storm track changes as the storm and its impact nears our region as well as the likelihood of the occurrence of various high wind thresholds and precipitation values. The use of an ensemble weather model by the company meteorologists has the potential to improve our forecasting capability and communication of weather-related risk in the short and long term. This has the potential to provide future cost savings by allowing the company to be better prepared for adverse weather and make more informed decisions for mobilization levels and mutual aid resources.
TECHNICAL STATUS

The project activities laid out in the Objectives section have been successfully completed including the addition of multiple ensemble weather models.
TITLE IBM deep thunder model enhancements

CSN 92652 POET 20694105 TASK 0001

PROGRAM AREA Electrical Distribution

CONTRACTOR IBM

DURATION 10/24/2013 to 12/2015

ENGINEER Reichborn-Kjennerud

PROJECT LEAD Hertell, B.

AUTHORIZED $132,000 EXP. THROUGH 2015 $120,750

OBJECTIVE

The objective of this project is to develop and demonstrate new capabilities that will improve the usability of the Deep Thunder Impact Model. They include: 1) Develop user interface for the impact model that allows the user to input weather variables and perform sensitivity analysis. 2) Develop ability to toggle the large scale events on/off within the model's historical impact database. 3) Develop higher level regional model overview to see bigger picture trends but keep substation level model details.

BENEFITS

This project has the potential to help the company improve its impact forecasting capabilities and our ability to communicate realistic and understandable impact projections for weather events that threaten our company and customers. It is expected to 1) Enhance and improve the current usability of capabilities of the Deep Thunder Impact Model through user interface, 2) Increase event planning horizon, 3) Provide better planning and scenario analysis which will help us to better communicate impact and range of adverse weather, and 4) Improve the impact model predictions through the incorporation of multiple data sets.

TECHNICAL STATUS

The enhancements planned for this project as detailed above were completed. The model has been extended to work at the regional level, however the performance of this new model is currently being evaluated.
OBJECTIVE

The objective of this program is to evaluate whether thermal images of secondary structures, cables, and connections taken as part of an existing manhole inspection program, can be used to predict, prevent, and prioritize system repair and emergency response. It is believed that secondary infrastructure with a substantial differential temperature, to the ambient and surrounding equipment temperatures, is more likely to result in a smoking manhole, fire and/or explosion. If the test base proves successful in identifying these problems, the next step would be to migrate the use of thermal imaging to the entire inspection program.

BENEFITS

The average cost of a manhole event is $25,000; we have 2200 manhole events annually. The Infrared Secondary Inspection has the potential to locate and mitigate some of these events which will reduce the average costs and decrease number customer outages.

TECHNICAL STATUS

Field work, primarily current measurement and image capture during inspection, was completed in 2014. The measurements and images were analyzed and where issues were suspect the structures were revisited. The project successfully identified problems, such as overloads from untied mains. While analysis continues, the positive results lead to the incorporation of a line item contract cost option for this work during cycle 3 inspections.
OBJECTIVE
The purpose of this project is to study the chemical and physical impact of deicing alternatives on performance of aged power cables with the goal of identifying a suitable alternative for use on city roadways. The results from this study is expected to serve as input as we work with the city and community groups to assess alternatives.

BENEFITS
This project will seek to evaluate and identify alternative deicing materials for use within Con Edison underground system to mitigate the negative impacts of salt on our electric cables and Enhance public safety.

TECHNICAL STATUS
Traditionally, road salt has been an inexpensive, easy to spread, and effective deicing material to keep roads operational in winter conditions. Over the past several decades, the negative impacts of salt use have become apparent. In this project, NYU Polytechnic University investigated alternative deicing materials and deicing practices in other cities. The alternatives were investigated for their deicing efficiency, cost efficiency, infrastructure safety, environmental safety and availability. The researchers also completed electric conductivity tests for the various alternatives.
TITLE  Microgrids & DER - Engineering study - NYSERDA PON 2715

CSN      92335  POET  20619373  TASK  0001

PROGRAM AREA  Electrical Distribution

CONTRACTOR

DURATION  8/14/2013  to  6/2016  ENGINEER  Reid

PROJECT LEAD  Sniffen, M.

AUTHORIZED  $ 150,000  EXP. THROUGH 2015  $408,287

OBJECTIVE

Provide improved reliability and resilience by increasing situational awareness and the ability of the system and the operator t "react" to conditions. Explore possible ways to provide "back up" power services to critical customer loads. Improve cost effectiveness by leveraging synergies of load relief funding, Smart Grid funding, storm hardening initiatives and microgrid pilot program (including private funding).

BENEFITS

Implementing microgrid & DER analysis tools helps us to meet the increasing customer energy diversity & reliability needs. Microgrid & DER analysis tools may also prove useful during outage restoration efforts, as well as scheduled work. Con Edison could ultimately have a useful analysis tool that may meet many various current & future applications.

TECHNICAL STATUS

The NYSERDA PON 2715 has 5 tasks associated with the project effort. Listed below are the completed tasks and task that are currently in progress.

Task 1 – Technology Transfer Plan

Task 2 – Requirements Elicitation and Specification:

Carried out Requirements Solicitation Interviews with Con Edison, NYCEDC, NY DPS, NYSERDA, NYP, NYSSGC, and Smarter Grid Solutions to elicit and catalogue technical and commercial requirements;

Selected three generic case study locations and elicited stakeholders for comment and additional requirement specifications during a group workshop;

Task 3 – Solutions Concepts:

Held stakeholder engagement meeting with Con Edison and NYSERDA where the Requirements Specification report was assessed and further implications or priorities related to the Solution Concepts were identified.
Created a high level functional description for three case study locations and issued first draft of solutions concept document.

Task 4 – Modeling & Simulation:

The team has developed an agreed upon modeling framework and environment. One models have been selected for an engineering study. We have completed all modeling and simulation tasks, this included Data cleansing, verification and validation of the model, Simulations runs and Cost Benefit Analysis utilizing NYSERDA’s modified cost benefit framework.

Task 5 – Deployment Specifications Options

The team has completed a report that details options for deploying new technology. It describes relevant systems that could be impacts by the deployment on the distribution network and considers how potential solutions could be integrated with existing systems.

Task 6 – Final Written Documentation

Work in progress – The team is currently aggregating all reports into a final deliverable to NYSERDA. We expect this to be completed late Q1/early Q2.
OBSTRUCTION CLEARANCE USING ROBOTIC TECHNOLOGY FOR ELECTRIC CONDUITS / DUCTS

CSN  92014  POET  10046626  TASK  0001

PROGRAM AREA  Electrical Distribution

CONTRACTOR  ULC Robotics

DURATION  4/17/2012 to 12/2017  ENGINEER  Lee

PROJECT LEAD  LEE S.

AUTHORIZED  $ 485,000  EXP. THROUGH 2015  $ 74,047

OBJECTIVE

Approximately thirty percent of cable repairs caused by increased load, defective cable or a

BENEFITS

This project supports our mission to provide energy services to our customers safely, reliably and efficiently. Excavation costs to dig two 4 by 3 foot holes presently exceed two thousand dollars in man hours and equipment costs. Receiving a NOV for steel plate installations (noise or poor ramping) is now $1,800 per location. Restoration times on feeders and secondary obstructions would be reduced. The need for vendor services such as debris pick up or street restoration costs would be reduced significantly.

TECHNICAL STATUS

In 2015, the project team has been working with ULC Robotics to develop a tool that can clear obstructions such as a fused cable in an electric conduit from a cable burnout without excavation. The potential benefits of the device are excavation cost avoidance in cable replacements, reduction in restoration time and reduce impact to the public from excavation thereby improving customer service. The team has now developed a stand and floor mount assembly that could deploy the tool head to clear obstruction from an end line box in a customer basement. The assembly was tested successfully in a shop setup. The next step is to field trial the device to evaluate effectiveness and usability by our field crews.
TITLE    Remote control of network protector relay

CSN      92319   POET    20607929   TASK    0001

PROGRAM AREA    Electrical Distribution

CONTRACTOR

DURATION    8/12/2013 to 12/2015

ENGINEER    Lee
PROJECT LEAD  Zolotov. K

AUTHORIZED    $ 81,935
EXP. THROUGH 2015    $ 80,249

OBJECTIVE

This project will provide two-way communication between the underground transformer network protector and the Manhattan Control Center. It will provide data collection and control of the network protector using a cyber-secure communication system. The data collection will be performed via a communicating microprocessor network protector relay as well as sensors located within the network protector and the transformer.

BENEFITS

This project will provide the ability to control a network protector which will aid in quickly resolving system contingency overloads at the distribution transformer. Additionally, what is learned in this project could potentially be applied to create sub-networks, increasing operational flexibility during extreme weather conditions in networks like Brighton Beach where partial flooding currently limits operation of the entire network. Finally, this project will demonstrate functionality of a two-way communication infrastructure in a dense urban area (Manhattan) for future devices that are added to the system.

TECHNICAL STATUS

We have purchased, received, and programmed the SCADA equipment using Verizon underground antenna.. A new specification will be issued by our Distribution Engineering department which allows the crews to install this new technology without additional support.
TITLE   RMS-XA21 Arcing Data Integration

CSN   92289  POET   20566059   TASK   0001

PROGRAM AREA  Electrical Distribution

CONTRACTOR

DURATION  7/26/2013 to 8/2015  ENGINEER  Lee

PROJECT LEAD  Mike Donohue

AUTHORIZED  $ 45,000  EXP. THROUGH 2015  $ 28,246

OBJECTIVE

The objective is to modify the substation receiver and RMS user interfaces to enable arc fault data to be brought to Company personnel for review and action.

Digital Grid to:

- Create new receiver software and load into two (2) substation receivers.
- Test, monitor, and confirm software implementation.
- Build a polling service to collect arc fault data into a database and send automatically by FTP or email.
- Create a new data command for VDAMSIXA21 to initialize the data available from the two substation receivers.

Con ED Information Resources/ GE to:

- Modify the RMS to include arc fault data in the transmission.

BENEFITS

Arc faults can break down cable insulation, generate gas and lead to bolted faults resulting in smoking holes, manhole fires and manhole explosions. Any of these conditions represent a high risk to the Company in terms of employee/public safety, equipment damage and allocation of resources. By reducing any of these risks by early detection and mitigation through our arc fault detection system we would reduce Company costs and increase productivity substantially.

TECHNICAL STATUS

Con Edison is now polling for Arc Fault data from the modified substation receivers in Brooklyn only. The Manhattan arc fault locations are no longer being monitored, and we no longer need Digital Grid to provide us the information with weekly emails. We are still operating on the old VDAMS system, but we are ready with a data command for XA21 to initialize Arc Fault data from the receivers. Con Edison and GE have modified the VDAMS receiver file processing to read the Arc Fault bits and store in a single XA21 status point. We are waiting for CDMS XA21 to be rolled out to test the processing.
TITLE  Situational Awareness, Decision and Communications Tool in the Bronx-Westchester Control Room

CSN   99905      POET  21633454      TASK  0001

PROGRAM AREA  Electrical Distribution

CONTRACTOR  Arria NLG

DURATION  8/26/2015 to 12/2016      ENGINEER  Reichborn-Kjennerud

PROJECT LEAD  Maggie Chow

AUTHORIZED  $ 450,000  EXP. THROUGH 2015  $125,000

OBJECTIVE

Natural Language Generation (NLG) software will provide the operators with a tool to address some of the challenges described above. The software will automate the following: Pull data simultaneously from multiple sources, apply control room operator logic to determine and present to the operator in a natural language interface the impact and severity of the current and next event, and propose a draft action plan to restore system back to a normal state. The software will also produce reports in natural language for a variety of audiences (executives, operations, public affairs, and possibly eventually customers or outside stakeholders). The operator SME logic embedded into the software tool will allow for a standardized approach to analyzing control room data and presenting it to the operators. The embedded logic will be generic for both network and non-network systems applicable across the four regional control rooms. However, this project entails developing, testing and evaluating the tool in the Bronx-Westchester control room.

BENEFITS

The NLG software tool is expected to improve the control room operators’ situational awareness while reducing operator analysis time and the risk of operating errors. The software may free up the operator to focus on non-routine tasks, a benefit that may become even more critical as the company takes on the role of DSP operator resulting in a more complex system. By standardizing and embedding the operator SME logic into the software tool, a more uniform approach to analyzing and communicating data can be implemented while some of the challenges in achieving knowledge transfer can be addressed. The ultimate benefit to our customers and the company is to reduce the number and duration of outages by providing critical information in a timely manner. Our customers incur financial costs and inconveniences associated with outages. The company incurs a cost in the potential to trigger PSC customer and feeder outage penalties and a risk to damage the reputation of the company

TECHNICAL STATUS

During a system contingency the control room operators currently need to digest a large amount of information from various sources in order to understand the current abnormal state of the system,
the impact of the current system state and the next worst state, and how to bring the system back to the normal state. Although the Contingency Analysis Program (CAP) consolidates much of the relevant information, the operators must still view a dense full screen display for each network, which can overwhelm them with information. Some operators' ability to parse, analyze and act on this information is further challenged by the decreasing amount of experience in our control room today. The amount of information the operators must take in will likely increase as the penetration of distributed energy resources increases and the utility takes on the role of a distribution system platform (DSP) provider. Finally, the operators' attention is further drained by the need to produce a variety of communications to various audiences including operations, public affairs, and executives.

The information gathering and development phase of this project is underway and the tool is expected for testing and evaluation at the end of the second quarter of 2016.
TITLE Underground Splicing Machine Development

CSN 99920  POET 21501320  TASK 0001

PROGRAM AREA Electrical Distribution

CONTRACTOR ULC Robotics; Richards Manufacturing; NYU-Poly

DURATION 6/10/2015 to 12/2016

ENGINEER Doherty

PROJECT LEAD Maggie Chow

AUTHORIZED $ 400,000

EXP. THROUGH 2015 $233,062

OBJECTIVE

Our objective is a nontraditional solution: develop a machine that would live end cap the feeder in a manhole. The envisioned benefit results from bypassing positive feeder identification, and placement and removal of additional protective grounds around the worksite required for workers - since use of a splicing machine would not be subject to the same safety rules as required for workers. Machine tasks include (1) cut three single-conductor 500mcm 27kV extruded cables, (2) prepare source-side cable ends for live end cap per specifications, (3) install live end caps, (4) prepare and short load-side cable ends. In parallel, this project will develop a corresponding new pre-molded live end cap that better conforms to machine assembly and meets required performance standards.

BENEFITS

Envisioned benefits are improved reliability resulting from reduced stress and reduced feeder outage duration as a result of bypassing positive identification and placement and removal of additional protective grounds around the worksite, otherwise required for workers. While work management efficiencies might also be realized, quantification is not practical at this point. If this project is successful, data developed will be used to help quantify such predictions prior to deployment.

TECHNICAL STATUS

In Progress - Physical demonstration of table-top component modules accomplished. ULC was requested to integrate individual operators into an assembly - in progress.
TITLE    Enhanced Tool Development for Positive Identification of Network Feeders

CSN 99892    POET 21665708    TASK 0001

PROGRAM AREA   Electrical Distribution

CONTRACTOR   HV Diagnostics

DURATION  9/17/2015 to 12/2016    ENGINEER Doherty

PROJECT LEAD Joseph B McMahon

AUTHORIZED $ 40,000    EXP. THROUGH 2015 $ 32,160

OBJECTIVE

This project seeks to develop and demonstrate a digital tracing current reading device with ability to read identification tracing current created by our present Company equipment as well as tracing current created by newer digital devices. Ten assemblies will be fabricated by HV Diagnostics and distributed among Field Operating crews in Westchester and The Bronx for shakedown trial use.

BENEFITS

Ease of reading and accuracy of a digital display should save an estimated 15 minutes per feeder identification for ~730 feeders annually that’s $34,500 savings annually in B/W alone. In addition a Rogowski Coil attachment mitigates influence from other live feeders in busy structures that could provide $13,780 additional savings. Further savings are available but are hard to quantify at this point.

TECHNICAL STATUS

In Progress – New digital tracing current device was delivered and is undergoing shakedown trials in Bronx-Westchester.
OBJECTIVE

This is a feasibility and scoping project that will explore making live-end-caps and splices in-situ by machine in order to substantially reduce overall feeder outage duration, especially during adverse system conditions. We will engage Newton Labs, and perhaps other robotics SME's to evaluate typical man-made splicing steps at TLC and in the field, and to report on the feasibility and scope of work needed to develop a splicing machine that would assemble a splice absent a splicer in the underground structure.

BENEFITS

The envisioned benefits result from ‘folding’ the existing process - bypassing positive identification and placement and removal of additional protective grounds around the worksite required for workers, because use of a splicing machine would not require a worker to be in the manhole and therefore would not be subject to safety rules that would be otherwise required.

TECHNICAL STATUS

Completed – Completed phase zero requirements analysis and concept development. Follow-on project under way - Underground Splicing Machine Development: CSN 9992; Project & Task 21501320 0001
TITLE Underground Event Mitigation Enhancement for Secondary Boxes

CSN 99894  POET 21648460  TASK 0001

PROGRAM AREA Electrical Distribution

CONTRACTOR GelTech Solutions

DURATION 9/1/2015 to 12/2016

ENGINEER Doherty

PROJECT LEAD Darren Scarimbolo

AUTHORIZED $150,000

EXP. THROUGH 2015 $80,509

OBJECTIVE

Water additives have recently become available for suppression of fires and mitigation of collateral damage, and initial field results show promise. This project seeks to develop and demonstrate a flexible pouch that would: fill most free volume in a secondary box thus reducing the quantity of explosive gasses that fuel explosions; could be placed, filled, emptied and removed without unduly encumbering ordinary maintenance and operations; be durable enough to contain a water-FireIce mixture; and in the event of major fire, would release mixture to suppress fire. These funds will engage GelTech Solutions to design, fabricate and test a proof-of-concept pouch, and upon acceptance, manufacture prototype pouches for demonstration and test.

BENEFITS

Manhole events continue to be a public safety risk as well as a risk to Con Edison's reputation. Present methods of dealing with underground manhole events are largely reactive, and proactive methods are needed to reduce risk and help assure public and employee safety. In concept, a pouch would reduce the energy released in underground events by displacing otherwise free volume for accumulation of explosive gas mixtures, and as proposed it would also suppress some secondary fires. Both objectives contribute to reducing public risk. This project will determine if such a pouch is technically and operationally (cost, impact on day-to-day work) feasible.

TECHNICAL STATUS

In Progress - Phase 1 flexible pouch developed; filled with fire suppressant to fill free volume in secondary box and reduce quantity of flammable gasses that fuel explosions. Further tests planned and in progress.
The proposed project will employ communicating MPRs. The communicating MPRs are capable of two-way wireless communication via an external modem. This additional communication capability will allow for supervisory control and data acquisition (SCADA) which will provide control centers the ability to remotely monitor and operate the network protectors from XA-21. Control centers will be able to quickly identify culprit NWPs during an ABF condition. SCADA control of NWPs also allows for the proactive identification of defective NWPs, thus preventing potential ABFs.

**BENEFITS**

This project will seek to identify and repair defective network protectors (NWP) before they can cause an alive-on-backfeed (ABF) condition. The cost benefit associated with this project will be money saved, in the form of labor hours, by field forces to locate the culprit NWP during an ABF condition. This reduction in time will also help us meet our feeder processing KPI (of 14.5 hours). It will also help the company avoid the $5 million penalty for missing the 4.7 hour target for the average outage duration (network). It will also help the company avoid the $4 million penalty for missing the 2.5 customer target for the number of outages per 1000 customers (network).

Other benefits of this project are not quantifiable at this time. This project seeks to increase the accuracy of detecting second faults. Accurately detecting second faults or confirming there is only one fault during an outage will allow control center personnel to make more informed decisions when processing a feeder. The project also seeks to examine the possibly of locating second faults. Locating a second fault will allow field forces to repair this additional damage during the initial feeder outage. This would eliminate FOT events due to a second fault.

This project will examine additional capabilities and flexibilities that may be gained on managing our network system by having two way communication with our MPRs. The Reforming Energy Vision (REV) is leading to additional distributed resources being installed on our secondary networks. In the traditional utility model, power flows in one direction; from the utility to the customer. The addition of distributed resources on the customer side will generate and deliver power from the customer to the utility. This project will keep Con Edison in-step with the REV initiative by allowing us to examine ways we can accept this two way power flow while maintaining the high level of reliability customers have come to expect.
TECHNICAL STATUS

When an Area Substation breaker opens, as during a fault condition, current will begin to flow from the secondary network into the associated feeder. This condition is known as a backfeed. Depending on system conditions a feeder can remain alive-on-backfeed (ABF) anywhere from a few cycles to many hours. Troubleshooting ABF conditions delays the feeder process. In addition, backfeed conditions that follow a single line-to-ground fault can cause the voltage on the unfaulted phases to increase by as much as 73 percent. Distribution Engineering’s System Design group has shown that there is a correlation between this rise in voltage and faults on the unfaulted phases, known as second faults.

Network Protectors (NWP) are currently equipped with a non-communicating microprocessor relay (MPR). Non-communicating MPRs are designed to identify when a reverse power flow condition exists and automatically trip the associated NWP. When a NWP does not trip the feeder remains ABF.

In 2015 we began purchasing equipment for the project. The majority of the expenditures were for equipment that will be used in a laboratory environment. This technology will need to be tested before it is put into operation. Five (5) test stations are in the process of begin constructed. Once constructed, these test stations will be used to simulate a multibank installation. They will also be used to test the effectiveness of new types of equipment. After the technology and equipment has been proofed, additional equipment will be purchased and field installations will begin.
OBJECTIVE

The objective of this project is to quantify performance gains, identify structures for inspection, and develop automated tools to support this work. The plan is to have subject matter experts in analytics, including imaging, to review and develop studies and tools for use in 2016 for targeting inspections. As the data grows and our analytics improve, we will focus on new learnings from the data such as any other defects that can be discovered, as well as ways to automate our review process.

BENEFITS

Independent review adds to the merits of any proposed program or program change and ability to attain buy in. Every defect removed from the system improves safety and reliability. A single secondary defect has the potential to damage the immediate equipment as well as the surrounding equipment from the events energy.

TECHNICAL STATUS

Con Edison public safety programs have been successful at reducing events and their associated risk to the public, both from property damage and/or injury. Some of these public safety programs have been in place for well over a decade. Secondary System Analysis has had good success in researching and developing an enhanced inspection program that can potentially lead to the next level of performance gains. As we move forward with the Video Data Capture (VDC) program, we need an independent analysis of the VDC program and a review of the data and derivative tools to improve the ongoing practice.

An automated program has been created to extract all the images from one IR file. We have sent them sample findings that were detected manually to see if algorithms could be made to detect them automatically.
Previous event data recorder pilot program experience within Con Edison demonstrated that driver behavior can be influenced in specific ways that correlate to incidence reductions in various collision types. For example, the pilot period demonstrated an 80% reduction in rear end collisions that followed correction of a widespread at-risk behavior. The ability to directly observe driver behavior by way of the event recorders allowed leadership to verify that operators abided by expectations, and to provide specific feedback when operators deviated.

The SmartDrive recorders provide additional data streams not available in previous pilot efforts. Vehicle telemetric data will allow for more specific feedback to drivers post-event. This project will entail the deployment of 100 recorders for use over a 6-8 month pilot period. The deployment will be divided between fleet operators who have already been exposed to an event recorder-based initiative and those who lack such experience. Performance data will be collected and compared.

Implementation of the SmartDrive technology will provide a foundation for specific and actionable driver feedback. Regular feedback, and driver expectation of feedback, is expected to facilitate improved driver behavior. Reduction in the frequency/severity of risky behaviors is expected to precipitate reduction in collision frequency, mitigating the liability exposure that accompanies fleet operations in a congested urban environment. The project will also look to validate the expected qualitative benefit identified in this appropriation.

Vehicle operation throughout Con Edison’s largely urban and congested territory carries significant liability exposure by way of injuries (employee and public) and physical damages (vehicles, private property). New York City’s evolution of the driving environment to more heavily encourage shared use by pedestrians and cyclists is increasing the potential for high severity collisions. Such events are undesirable and impose significant and escalating costs, including auto related claims costs, while also carrying potential to negatively impact public perceptions of the company. The company has largely relied upon driver training and awareness messaging to influence behavior toward best practice operating approaches. However, such training often is not reflective of operations in congested urban...
environments, nor is there any guarantee that drivers will abide by the lessons. Event data recorders have proven to be an effective means of precipitating improved driver behavior and ultimately reducing collision incidence.

**Update**

Con Edison is currently in the contract negotiation process with Smartdrive, Inc. to pilot their technology offering. This consists of 100 SmartRecorders with cellular communications technologies in 100 Con Edison vehicles. In addition to the hardware pilot, Con Edison will also pilot their SmartDrive Safety Program with provides installation, training and Subscription services to their Assurance Pro Plan – cloud based server offering.

**Assurance Pro Plan**

- Risk prevention program that provides Con Edison with reviewed of 20 events / vehicle / month included (auto-offloaded and reviewed).
- Program details:- 20 second events – 10 seconds before, 10 seconds after the incident. Cellular offload.
- 5 On-demand events/vehicle/month pooled across vehicles.
- ECU connection for vehicle data in events
- Automatic Alerts
- Management Reporting
OBJECTIVE

This objective of this pilot project is to implement dynamic driving aids that can assist crews in avoiding historically dangerous corridors and provide real-time alerts to vehicles when approaching slow zones so that the crew may take extra care and/or take alternate routes. The project plan is to (1) perform crash analysis on Con Edison/NYC data and import dangerous corridors and slow zone information into SAMsix Right-of-Way Vehicle Fleet Safety system, (2) historical analysis of impact of dangerous corridor avoidance on Con Edison crews, (3) Implement proactive accident prevention procedures, e.g. alerts during job briefing, handouts and video (4) Demonstrate real-time alerts to crews approaching dangerous corridors or slow zones.

BENEFITS

Funds allocated for this appropriation will pilot new approaches to preventing traffic accidents and their resulting human and financial costs as well as promote safer streets and neighborhoods for Con Edison's customers, enhancing public relations. More specifically, Con Edison expects to realize reductions in the incidence of events involving vulnerable roadway users, as well as reductions in motor vehicle incidents overall through identification and avoidance of collision-prone locations.

TECHNICAL STATUS

Although Con Edison abides by high safety standards in all aspects of daily work, motor vehicle collisions were a daily occurrence in 2013. These events ranged in severity from minor dents to a widely reported pedestrian fatality. New York City Major Bill de Blasio has enacted Vision Zero, a traffic safety plan that aims to eliminate motor vehicle-related fatalities and serious injuries on NYC streets. Recently, a series of traffic bills have been signed into law as part of his "Vision Zero" plan. Among these bills are tougher penalties for reckless drivers, requirements to redesign dangerous intersections, and reduced speed limits near key areas throughout the city. These new mandates will add to the information streams that drivers must actively manage. Further, the visually apparent upward trend in the number of vulnerable roadway users (i.e. pedestrians and cyclists) pose significant exposures to the company in collision scenarios. These exposures include significant risk to reputation and financial impacts.
**Update**

The following deliverables have been completed under Phase I – Assistance to job planning and proactive accident prevention. Pilot development of an integrated heat map showing our employees potentially dangerous corridors utilizing available data sources:

- Crash analysis and import of dangerous corridors and slow zones
- Historical analysis of impact of dangerous corridor avoidance
- Routing capabilities from work location to job sites
- Merge street truck route data into the existing street database inside ConEd
- Use truck route data to avoid streets designated as non-truck routes
- With the various ESDA routing implementations, provide an option to allow feeder patrol type, car to destination and truck to destination.

**Next Steps**

Phase II of the Project Includes:

- Provide option to print turn-by-turn driving directions
- Provide option to print driving directions with or without a map included
- Give in-house administrators ability to clear queues
- Give "Show Directions " option its own icon
- Process additional data-NYC DOT, NYPD, NYC DOH
- Create a new layer with structure asset data – manholes, service boxes, poles, etc. to replace the current version of the structures on the feeder data, using data layers from existing ESDA system
OBJECTIVE

Criminal activity can be recorded with surveillance cameras. However, the recorded videos can only be used after a crime is discovered. Existing CCTV systems will only stop a crime if operators constantly monitor the video feeds. This is expensive and ineffective due to the number of cameras to monitor. Additionally, surveillance video is only useful after a crime has occurred and often times, the crime is detected days later. The Videofied system uses motion sensing cameras and instantly sends an alarm and video clip to a central monitoring station who will alert the Security Operations Center (SOC). The video clip will verify if there is criminal activity. If there is video verified criminal activity, the SOC will report a crime-in-progress to the police, not merely an alarm. This will allow the police to prioritize the 911 call and devote appropriate resources and tactics to the response, thereby increasing the probability of apprehension.

The purpose of this project is to determine if the Videofied System will support an existing and developing security need. Currently, Corporate Security investigators rely heavily on video surveillance systems to deter crime and conduct criminal investigations. However, the use of surveillance videos will only help after a crime has taken place. Corporate Security wants to research a more real time system that alerts investigators and law enforcement as soon as a crime takes place. The system will be deployed at high crime areas within Con Edison. Once the system is deployed, alerts will be sent to a central monitoring station. In the case of true alerts, law enforcement will be notified for an immediate response with the objective of making an arrest on site. Investigators will review the alerts to determine the number of false positives versus true alerts. In the case of false positives, investigators will research if environmental conditions caused the false positives and if the system cannot adapt to Con Edison’s needs.

BENEFITS

Currently, Corporate Security Investigators and law enforcement attempt to arrest thieves and recover the stolen materials. However, with the existing surveillance systems, investigators are often alerted hours or days after the crime. This lessens the chance of making an arrest and recovering stolen property. If the Videofied System can detect criminal activities as they occur, then it greatly increases the chances for law enforcement and Corporate Security Investigators to recover the stolen materials from
the criminal. Additionally, this stand alone system allows Investigators to rapidly deploy it to different locations as conditions develop, thus allowing for cost savings.

TECHNICAL STATUS

Corporate Security coordinated installation with the operating department. The system is installed at a gas gate station. Corporate Security was satisfied with the ease of installation and vendor support. We receive daily health and status reports.
TITLE    FDNY Battery Fire Safety Support

CSN    90420   POET    21280715   TASK    0001

PROGRAM AREA    Electrical Distribution

CONTRACTOR    Amped I

DURATION    1/28/2015 to 12/2015

ENGINEER    Reichborn-Kjennerud

PROJECT LEAD    Jin Jin Huang

AUTHORIZED    $ 15,000

EXP. THROUGH 2015    $ 2,160

OBJECTIVE

This project will complete testing of leakage current from a battery or charged plate to an extinguisher nozzle. The results of these tests will be used to provide information for the FDNY Critical Infrastructure Data System (CIDS) and the FDNY All Unit Circular (AUC). The CIDS provides site specific information (eg. number of batteries and chemistry of an installation) and the AUC contains the recommended procedure for addressing a specific battery fire.

BENEFITS

The key expected benefit is streamlining of the process to approve battery installations in buildings and parking garages in Con Ed territory for the company and for it’s customers.

TECHNICAL STATUS

Con Edison customers and the company itself currently plan to adopt battery storage in buildings and parking garages for a variety of purposes including peak load shaving, leveraging and firming of renewable resources, deferring capital improvements, and planning for possible generation retirement. In addition to the lead acid battery technology, which currently is commonly used in uninterruptable power supplies in our territory, other mature technologies are on the market including Lithium Ion, Sodium Sulfur, Sodium Nickel Chloride, and Vanadium Redox. Given the novelty of the above applications of batteries and the new chemistries, the FDNY requires input on some key basic pieces of information for fire suppression including safe distances at which suppression materials can be sprayed and the best material to use for suppression.

The current leakage test and a lead acid battery burn were both conducted outdoors at the FDNY training facility on Randall’s Island.
OBIECTIVE

We will adopt the Crowd Comfort Mobile Phone application and associated data storage server and web portal for:

1) Completing checklist inspection items at 4 Irving Pl. Each piece of equipment will be identified by a quick response (QR) code sticker to facilitate ease of reporting. The data will be stored on the Crowd Comfort servers and accessible on the web portal. Missed readings and out of range readings will be flagged.

2) The occupant reporting functionality will be implemented on a new floor (either 4 or 12) at 4 Irving Pl. Building occupants will be able to report comfort levels and any other issues through this chann.

BENEFITS

Qualitative: Reduced potential for lost records and missed readings, flagging out of range readings which may result in avoidance of equipment failures, potential for improved occupant comfort and satisfaction, potential for energy savings.

Quantitative: Potential cost savings

TECHNICAL STATUS

This mobile device-based facilities tool addresses two problems. First, Facilities Management currently completes regular inspections of building equipment such as fire extinguishers, eye wash stations, underground fuel storage tanks, and fire suppression systems on paper. The paper records are then scanned and uploaded to a website for storage. This process can be time consuming since the inspection order on the paper isn't always the most efficient route, coordination between the inspector and clerk is required, and audits require gathering of disparate data sources. Additionally, individual readings may be missed, some papers may never be scanned and uploaded, and out of range readings aren't necessarily flagged. Second, building occupant reporting of temperature or other issues to facilities can be done by phone call or computer, however there is no method of reporting by smartphone app. Furthermore, facilities is unable to view data for hot or cold complaints in aggregate to assess the overall
experience of occupants in an area of the building on any given day. If the result is overcompensation of temperature using excess heating or air conditioning, energy is wasted.

The CrowdComfort software has been implemented at 4 Irving Place. The occupant reporting module has been launched and Facilities Management is currently receiving occupant reports through this channel. The inspection tool is ready to be implemented once the scan tags are installed.
OBJECTIVE

Our aging infrastructure presents potential safety hazards related to cable insulation breakdown, salt intrusion from above ground, or other factors that cause an explosion to occur inside the structure. Flammable gases enter a structure when cable degradation occurs, and from third party sources, which over time may accumulate and increase in concentration if not adequately vented to the atmosphere. When the concentration reaches critical explosive limits, the introduction of an ignition source from arcing cables and the build-up of these gases inside the structure could potentially result in a massive explosion and release of energy. This results in the manhole cover violently ejecting from its frame, becoming airborne and having the potential for causing physical damage to the surrounding property, roadway, and injury to the public and company employees. The test will determine if the restraining system will significantly reduce the displacement of the cover. In addition, it will determine if the pavement (EO-10321-B) around the cover frame presents enough compressive force to keep the frame of the cover in place to make the method of restraint effective.

This effort will evaluate restraint mechanisms designed on samples of test covers by testing their ability to safely dissipate the potential energy resulting from a simulated underground secondary event (UGSE) in a controlled environment. Also under investigation is the ability of the cover frame and the pavement to present adequate compressive force during an emerging or ongoing secondary burnout or other manhole event. The EPRI test laboratory in Lenox, Massachusetts will simulate the field conditions necessary to evaluate the restraining system’s ability to reduce the damage that could potentially result from a violent cover ejection, and Distribution Engineering will economically compare known restraint or locking technologies that are commercially available.

BENEFITS

A restraint system for manhole covers has the potential to contain the kinetic energy resulting from a sudden cover ejection during a manhole event. Minimizing the impact of the cover ejection helps to reduce the potential risks involved, such as injury to the public and to company employees, damage to property and disruption of traffic. By conducting blast tests on covers with restraint systems, the behavior of the covers can be observed and approximated in a field environment for improved planning and deployment throughout the distribution system.
TECHNICAL STATUS

Contracts have been finalized and agreed upon in 4Q15 with EPRI. EPRI procured the necessary sensors and completed the test manholes while covers of multiple restraint designs were procured from competing vendors and shipped to EPRI. Calibration tests began in January subsequently followed by a number of simulated explosions of varying gas concentrations. Results of each simulation have been documented and recorded. EPRI is expected to complete their technical report by the end of 1Q16.
TITLE  TetraKO Manhole Fire Suppresant Testing and Evaluation

CSN  99986   POET  21143006   TASK  0001

PROGRAM AREA  Electrical Distribution

CONTRACTOR  EPRI

DURATION  9/24/2014  to  12/2017  ENGINEER  Doherty

PROJECT LEAD  Mark Riddle

AUTHORIZED  $ 125,000  EXP. THROUGH 2015  $ 740

OBJECTIVE
Engage EPRI to evaluate TetraKO, including simulating its use in fighting fires in underground structures and evaluating its effect on electrical apparatus such as cable. EPRI will also investigate under what conditions and by who the product could be applied and be useful.

BENEFITS
Enhance the safety and well-being of our employees by improving mitigation and control of secondary events in manholes and boxes, thereby reducing risk to employees and lessening potential for collateral damage and negative impact to the public. If results are satisfactory, necessary training will be developed and performed and FireIce and its associated delivery systems will be deployed for use.

TECHNICAL STATUS
In Progress - Initial Underwriters Lab standard tests were conducted with two fire suppressant products and results were less than expected. Test reports are pending and we expect to perform similar tests on a third product.
TITLE       Traffic Safety Study- Various Company Workout Locations

CSN        90387  POET    21076390  TASK    0001

PROGRAM AREA    Electrical Distribution

CONTRACTOR

DURATION  8/26/2014 to  12/2015  ENGINEER    Reichborn-Kjennerud

PROJECT LEAD    Gergory Rozin

AUTHORIZED    $15,000  EXP. THROUGH 2015    $13,228

OBJECTIVE

R&D will be working closely with EH&S to conduct traffic studies at various company facilities. This study will physically review the ingress and egress of our company vehicles and a review of the DOT configuration and legislation related to traffic patterns in the proposed areas. A report of proposed recommendations will be developed and used by Con Edison to help implement new ingress/egress schemes as needed. This report can also be used to petition the DOT to implement any necessary changes that may be beyond Con Edison's jurisdiction.

BENEFITS

The benefits to conducting a traffic study are currently qualitative, but the future measurable potential safety can be quantified. These proposed improvements will be designed into the vehicle ingress/egress at our workout locations. This quality of decision benefits both the company's employees safety, CECONY's potential liability, and the safety of the general public.

TECHNICAL STATUS

The traffic study observations by Sam Schwartz Engineering are complete and the final reports have been delivered. Currently the company is meeting internally and externally to work to implement those recommendations that can feasibly be put into place.
ADVANCED CONTACT VOLTAGE DETECTION & QUALIFICATION

CSN 12187  POET 20233657  TASK 0001

PROGRAM AREA  Electrical Distribution

CONTRACTOR  EPRI

DURATION  8/7/2012 to 12/2015

ENGINEER  Doherty

PROJECT LEAD  Zhou Zheng

AUTHORIZED  $ 40,000

EXP. THROUGH 2015  $ 39,150

OBJECTIVE

Explore, develop and apply alternate technologies for stationary and mobile stray voltage detection in the field using Con Edison technology development and testing, as well as recent vendor (NARDA Gen.2 and EPRI) technologies.

BENEFITS

The cost of mobile stray voltage detection is $12,000,000, covering 60,000 patrol miles annually. Qualifying missed detections will serve public safety and lead to quality performance standards in the contract. Moreover, development of another mobile technology provider could provide competition and drive current vendor costs down.

TECHNICAL STATUS

Suspended - Field testing with NARDA/L3 was successful to the extent of blind testing within an M&S plate and detecting one object and possibly missing one additional (a later detection not concurrent in time). Non-blind testing of known objects was also shown to be successful. EPRI and Con Edison developed a dual E-Field sensor and technique which could improve ENE locating and potentially be utilized in overhead areas. Work largely on hold due to ongoing patent litigation.
TITLE  Vehicle-Mounted Detection System for Burnout Gasses Development

CSN  99946  POET  21393884  TASK  0001

PROGRAM AREA  Electrical Distribution

CONTRACTOR

DURATION  4/1/2015 to 12/2016  ENGINEER  Doherty

PROJECT LEAD  Alexander Dornhelm

AUTHORIZED  $ 150,000  EXP. THROUGH 2015  $ 49,060

OBJECTIVE

This is a feasibility and scoping project that will acquire gas detection equipment; collect, analyze, and profile the atmosphere of approximately 1000 underground structures; and mobile-scan areas with higher histories of manhole events and record atmospheric gasses with GPS coordinates. The gases to be examined include CO, CO2, CH4, C2H2, C2H6, H2, and acetylene. The sensitivity of the equipment is key to acquiring useful data, with the ambient atmospheric gas concentrations expected to be in PPB levels. The specific equipment will be selected for the study based on sensitivity, mobility, data logging capability, and availability.

BENEFITS

If developed and deployed, the systems and analytics envisioned in this project have the potential to improve mitigation and control of manhole events; and to reduce collateral damage to other cables and equipment in the structure.

TECHNICAL STATUS

In Progress – during a recent initiative to test Electric Operations ability to quickly respond to manhole events, data on CO was collected. One notable observation, is that CO concentration drops rapidly with distance from the structure, even though CO is fairly heavy. We are also adding a Heath vehicle bar and atmosphere pump to one of our vehicles for interface with different sensors.
OBJECTIVE
The current method of connecting generators to the secondary grid during a network cascading event involves cutting existing secondary in a structure and splicing in quick connects which are compatible with our generators. After the event, the generator quick connects are removed and the cable is re-spliced. This connection method is timely, costly, inefficient, and is limited to certain structures where there are spare crab legs or enough splicing room. The driver of this project is to seek a more efficient method of connecting generators to the secondary grid in order to pick up customers that have lost power.

The objective of this project is to develop a device that will enhance the method of connecting generators to the secondary grid during a cascading event. By developing and installing the DG Plug at pre-determined locations, the crews will be able to connect generators without splicing in a shorter timeframe which will help with customer restoration efforts and be more cost effective by reducing the amount of cable splicing performed by the crews. The project plan is to install the DG plug at a pre-determined location in the Flatbush network.

BENEFITS
The DG plug will enhance ConEdison's response to customer outages by enabling a faster connection of generators to the secondary grid during a cascading event. The DG plug will also increase safety of our field forces by reducing the time they spend in underground structures during heat events. Finally, the DG plug will help with current storm hardening efforts for substations by providing quick connection points for generators during an extreme weather event.

TECHNICAL STATUS
The DG Plug design is complete has been constructed and tested. Some of the DG Plugs are installed in the trial demonstration location in Flatbush; the remainder of the DG plugs are expected to be installed by the end of 2016. All construction association with the installation of the plugs have been completed. The team has also filed for a patent on the DG Plug technology.
**OBJECTIVE**

The need for a fast switch was identified as part of the System of the Future efforts, and because of the potential size of effort was segregated and issued as a separate RADPAR.

The capability to switch loads between networks and transfer spare capacity between substations is essential to improving the existing asset utilization on the Con Edison system. A compact submersible switch would allow the transfer device to be installed within a vault under city streets, which would allow existing adjacent feeders and ducts to be used to create these transfer capabilities without physically extending both feeders involved in the transfer scheme back to a common location within a substation. A fast transfer capability could support a transfer scheme that would not require "break-before-make" momentary customer interruptions, and thereby would preserve our very high customer perceived reliability.

**BENEFITS**

By following this type of partnered design process we assure that this new type of transfer capability will be available to us as soon as possible for use in our already committed substation construction program. This new functionality could also be used to support short term load transfers that could selectively defer otherwise required station uprates and re-enforcements. Financial risk will be limited by close participation and monitoring of the design and development process by Con Edison personnel and predetermined technical milestones, specification and test requirements.

**TECHNICAL STATUS**

In 2013, after repeated failure of previously developed switch by DEBA company, 3G System of the Future group along with Distribution Engineering have selected the new model of “Elastimold” submersible switch to be used in distribution networks. Two switches with IGIN controllers have been installed in Randall’s Island network and their performance is being monitored and evaluated by 3G System of the Future group.

In 2015, design of a Canada Power multi-way switch on Randall’s Island that was installed earlier, was improved by adding handheld controller, supplemental power supply and a pressure and temperature sensor.
TITLE   Mobile Site Safety Storm Response Team

CSN    92205    POET 20401040    TASK 0001

PROGRAM AREA   Electrical Distribution

CONTRACTOR

DURATION 3/14/2013 to 3/2016

ENGINEER Lee

PROJECT LEAD Zhou Zheng

AUTHORIZED $ 45,000

EXP. THROUGH 2015 $ 21,461

OBJECTIVE

The objective of this project (phase 0) is to determine the feasibility of a program that equips Con Edison’s engineers with voltage detectors and laptop computers to respond to Electric Shock Reports with an aim to make the location safe and update decision makers about the true nature of the complaint so that field forces can be directed accordingly. To that end, there are several questions that must each be answered in turn to arrive at a final conclusion:

- Is there a voltage detector (preferably non contact voltage detector) that can reliably confirm the presence of an electric field on unshielded primary overhead wires and secondary wires and indicate the voltage level present?
- Can laptop computers be used, with the aid of a specially designed application, to captured pertinent information about the ESR location and transmits this information wirelessly to update a database?
- Are there any impediments or restrictions to Site Safety Tasks Force, comprising only engineers, responding to ESRs and making the locations safe by handling secondary cables?
- Will the project have the desired impact of speedy response to ESRs, reducing cost associated with Site Safety and reduce storm restoration time?
- Are all safety concerns addressed?

If all of the above criteria are met, then we will move to phase 1, which will involve actually standardization of the procedure to be followed by the Site Safety Response Team.

BENEFITS

The successful execution of this project will allow for more efficient management of company assets, reduced cost associated with Site Safety and shorter customer restoration time after a storm.

TECHNICAL STATUS

In 2015, we have finalized the down conductor detection algorithm. It can distinguish between a simulated 4 KV downed conductor and normally energized 27 KV overhead cables. 2 working devices have been constructed and are ready to be tested in actual storm conditions. Currently we are working
on the software interface to control and display the data from the sensing device. Additional features such as GPS tagging are being developed.
TITLE       Vehicle Based Imagery for Damage Assessment

CSN        90333   POET      20965924   TASK      0001

PROGRAM AREA     Electrical Distribution

CONTRACTOR     CleerGrid Innovations, Inc.

DURATION       6/9/2014 to 5/2015    ENGINEER       Reid

PROJECT LEAD    Thomas Langlois

AUTHORIZED      $ 150,000    EXP. THROUGH 2015      $ 150,000

OBJECTIVE
Funds allocated by this appropriation will explore a vehicle based imaging system approach to generating user-friendly 3D images of overhead infrastructure pre & post storm, e.g. poles, wires and equipment. The practical nature of acquiring these images using a vehicle will also be assessed. The project proposes to (1) acquire hardware and software and mount on a vehicle (2) Collect raw imagery data via a vehicle mounted image system of overhead infrastructure in pre and post storm damaged environments (3) Stitch together and geo-reference imagery data (4) Work with Overhead Subject Matter Experts to explore feasibility of performing damage assessments from 3D images. (5) Explore the future integration of 3D images into existing operations software package, i.e. SAMsix Electric System Damage Assessment.

BENEFITS
This project can expect to achieve a reduction in costs associated performing damage assessment, generating accurate resource allocations and OH construction validation of damage. This is due to increases in labor productivity and information quality. The 360 degree imagery gained from this project will be used as in-kind cost share for NYSERDA PON 2715 to support the creation of Computer Vision algorithms for assessing overhead infrastructure for storm damage.

TECHNICAL STATUS
This project is completed.

This project status on the milestones identified below are, (1) the team has procured the required hardware and software required image Con Edison overhead infrastructure. The system consisted of a Point Grey Lady Bug camera that contains 6 2MP cameras and an Immersive Media recorder mounted on a passenger vehicle. (2) The team demonstrated this system by imaging 20 miles of Con Edison’s Westchester service territory. The team plans to further demonstrate this system in our New York City service territory by applying for the proper permits and continuing to work with our internal Emergency management stakeholders. The team made attempts to image staged damage to overhead infrastructure and has held meetings with Con Edison subject matter experts on utilizing imagery for damage assessment.
Key Takeaways from Stakeholder Meetings

- Resolution of the imagery was likely satisfactory for post-storm damage assessment at a high level for many situations: pole down, wires down, etc.
- In routine maintenance, collection of this imagery could potentially be of use / synergistic if combined with thermal IR data collection
- Potential use for the imagery/data in GIS system improvement
- ConEd needed to think further about the business case
- Interest in hearing more about three-dimensional LiDAR applications, as business case seemed more clear for LiDAR-based imaging
TITLE  DER Hosting Capacity Approach and Method Development for New York State

CSN  99842  POET  21805597  TASK  0001

PROGRAM AREA  Electrical Distribution

CONTRACTOR  EPRI

DURATION  12/16/2015  to  12/2016  ENGINEER  Doherty

PROJECT LEAD  Thomas P. Mimnagh

AUTHORIZED  $ 75,000  EXP. THROUGH 2015  $ 50,000

OBJECTIVE

Engage EPRI to determine and describe the consensus on approach and methods recommended by the New York State Joint Utilities to be applied to DER hosting capacity in NY State.

BENEFITS

Achieving REV mandates requires establishing new perspectives on what constitutes a power delivery system, especially how it accommodates new participants and technologies, including determining and broadcasting DER hosting capacity. The funds provided by this project to support the REV goals will ensure that foundational responsibilities for reliability and safety are maintained or advanced, that increased resiliency is fostered, that electricity continues to be affordable and contribute to economic prosperity, and that the environmental footprint of the Company is improved.

TECHNICAL STATUS

In Progress - Working draft white paper being developed for Joint Utility’s review.
A major portion of the Integrated Grid framework is a methodology for evaluating benefits and costs of potential technical and policy pathways associated with an integrated grid, including the distributed resources themselves. EPRI's benefit-cost methodology strives to provide a framework that is transparent and reproducible in multiple jurisdictions, accounting for the unique characteristics of individual distribution systems, transmission grids, resource availability, markets, regulatory environments, and various electricity users. Employing comprehensive benefit-cost protocols ensures that DER impacts are viewed from a broad perspective and that the cost and benefit values generated comport with how utility revenue requirements are calculated, including derivation of retail rate implications. EPRI will model Williamsburg network in Open DSS and run multiple scenarios of DG placement and penetration levels. Following the modeling, EPRI will develop a conceptual framework to support design local energy markets.

This collaborative research project is intended to foster new learning among utility and end-user participants. Meeting the vision set out in the REV, requires resolving the following research questions: what market design will best achieve the desired outcomes? What defines a submarket; a substation and its interconnected feeders, an individual feeder? Answering these questions are a prerequisite to developing rules and protocols for how customers and the distribution system operator (DSO) will interact, and how these local markets interact with the wholesale markets.

EPRI has completed the process of modelling the Williamsburg network in Open DSS. Currently EPRI is running multiple scenarios of DG placement and penetration levels to understand the impacts on the distribution system. The project team is also developing a method to quantify the impacts to the distribution system and the cost avoidance associated with DG placement.
OBJECTIVE

EPRI will build a model which will predict the likelihood of residential customer adoption of solar. The model will include various demographic parameters (such as income, gender, age, education level achieved) as well as system parameters like the system size and the size relative to the customer load, system cost, customer property type, and community versus individually owned. EPRI will build a Con Edison specific model which includes survey responses from Con Edison customers as well as other participating utilities. The Con Edison customers will be heavily sampled to allow for the development of an adjustment factor, if needed, to account for differences in responses between Con Edison and other customers nationwide.

BENEFITS

This project holds the promise of creating a tool that provides useful information in building the residential solar generation forecast. An improved forecast may provide the following benefits: better estimate of the timescales when solar penetration along a given feeder may impact the distribution system, better understanding of how to design and market future customer programs which seek the implementation of customer distributed energy resources, a guide to staffing company positions which serve customer solar installations such as interconnect support, and better long term estimates of customer load forecast.

TECHNICAL STATUS

At the present time there are relatively few residential solar installations in Con Edison territory, however we do expect the number to increase over time. Although some of the potential impacts of residential solar, such as significant reduction in customer load or adverse impacts on the distribution system, are not anticipated in the immediate future, we lack a localized forecast for when these solar impacts may become significant. These solar impacts may affect many company activities such as distribution planning, staffing, and customer program design. A localized tool tailored to the specific Con Edison customer base can allow us to optimize company plans around residential solar adoption.

The customer survey and communications for this project have been designed and tested in focus groups. The next activity will be to distribute the surveys to utility customers to gather the date required to build the customer preference model.
TITLE       EPRI/NYSERDA/DOE TRAVEL BY ALL OTHER NON-R&D PERSONNEL

CSN           92394    POET    10064342    TASK    0279

PROGRAM AREA           Distribution

DURATION           On Going

OBJECTIVE
Facilitate application of new technologies by supporting employee attendance at industry meetings.

BENEFITS
Participation in industry research programs will help identify new technology applications which will aid in meeting corporate goals and surface new research initiatives.

TECHNICAL STATUS
N/A
TITLE    EPRI/NYSERDA/DOE TRAVEL BY CUSTOMER SERVICE PERSONNEL

CSN       92387    POET    10064342    TASK    0274

PROGRAM AREA    Distribution

DURATION    On Going

OBJECTIVE
Facilitate application of new technologies by supporting employee attendance at industry meetings.

BENEFITS
Participation in industry research programs will help identify new technology applications which will aid in meeting corporate goals and surface new research initiatives.

TECHNICAL STATUS
N/A
TITLE  EPRI/NYSERDA/DOE TRAVEL BY ENVIRONMENTAL AFFAIRS PERSONNEL

CSN    92374    POET   10064342    TASK    0263

PROGRAM AREA  Distribution
DURATION  On Going

OBJECTIVE
Facilitate application of new technologies by supporting employee attendance at industry meetings.

BENEFITS
Participation in industry research programs will help identify new technology applications which will aid in meeting corporate goals and surface new research initiatives.

TECHNICAL STATUS
N/A
OBJECTIVE

We will test a text analytics software produced by Odin Text and licensed through KL Communications, the company that runs our Customer Advisory Community activities such as surveys and chat rooms. The software has the capability to pull out various verbal trends and phrases in the software as requested by the user. Additionally, the software provides an emotional index from 1 to 10 along eight emotional axes such as Joy, Anger, Surprise, and Anxiety. For at least six of the weekly Customer Advisory Community surveys and each of the four quarterly customer satisfaction surveys we will benchmark the performance of the text analytics software applied to open ended responses against the current manual methods of KL and Con Edison reading responses. The five following methods of processing the open ended responses will be compared: KL and Con Edison manual analysis of open ends, KL basic granular coding of open ends completed manually, KL and Con Edison each using the text analytics software to glean insights.

BENEFITS

If the text analytics software is able to discover the insights that were found by human review, the software can be used to offset some of the time required to process open ended survey responses, resulting in a cost savings. If the text analytics software also pulls out new insights from the open ended responses that were not generated by manual human review, we will gain a better understanding of our customer needs, preferences, frustrations and interests as well as our customers' likelihood of adopting certain current and potential future utility programs. This will allow for more effective program design, better anticipation of the future needs of our customers, and better customer satisfaction.

Although we will not evaluate the performance of the software across additional applications in this pilot, the three seat annual license Con Edison receives will allow for use of the software to analyze a very wide array of textual data currently collected by the company providing additional potential benefits. Examples include Employee Advisory Committee responses, Twitter, Facebook and other social media responses, and web analytics and new company website survey engine results.

TECHNICAL STATUS

The company is currently seeking new channels to engage with customers about their energy usage and improve their experience with the company. These efforts are in tight alignment with the Reforming the Energy Vision proceedings underway. The Customer Operations department has assembled a Customer
Advisory Community comprised of roughly 10,000 customers with a demographic makeup similar to our customer base as one key initiative for obtaining feedback from customers and understanding how they may engage in some of our programs. The department also administers a quarterly customer satisfaction survey, and it has formed an employee advisory community. The activities of the customer and employee communities and the customer satisfaction survey typically contain some number of open ended responses. Currently a Customer Operations department member reads and parses the open ends for content manually. This process can be time consuming, includes subjectivity of the person reading the responses, and some insights from the customer responses may be missed.

The text analytics software is currently being used by both KL Communications and company employees in order to analyze the survey open ended responses. So far the software shows promise for providing new insights beyond those elucidated by human review of the surveys, however the final evaluation will occur once a larger number of surveys have been analyzed.
TITLE: Customer Experience Survey Findings

CSN: 99846  POET: 21788017  TASK: 0001

PROGRAM AREA: Electrical Customers

CONTRACTOR: KL Communications

DURATION: 12/8/2015 to 12/2016

ENGINEER: Reichborn-Kjennerud

PROJECT LEAD: Hollis Krieger

AUTHORIZED: $ 25,000  EXP. THROUGH 2015: $ 16,300

OBJECTIVE

In this project a general customer experience survey will be issued to customers who have had a recent experience with Con Edison, and the survey will focus on the experience within a given commodity. The numerical and open ended responses (as analyzed in part using a text analytics engine) for this new survey will be compared to the customer experience surveys that were issued to general Advisory Community members, many of which may not have had a recent interaction with the company, to determine if new findings are elucidated from a commodity targeted customer experience survey.

BENEFITS

The company is currently seeking to improve the way in which it serves its customers. New insights into how to improve customer experience are key to achieving this goal. Some findings may be missed in the current survey methodology resulting in missed opportunities for the company to improve its service.

TECHNICAL STATUS

The company is currently seeking new channels to engage with customers about their energy usage and improve their experience with the company. These efforts are in tight alignment with the Reforming the Energy Vision proceedings underway. The Customer Operations department surveys customers in a number of different ways. A subset of the customers from the general Con Edison customer base is chosen to complete quarterly Customer Satisfaction surveys in which customers are probed, in part, on the operational performance of the company. Additionally, there is an increasing focus on the overall customer experience. Quarterly customer experience surveys are issued to some customers in the Advisory Community. However, we do not administer these surveys to target customers who have had recent interactions with the company, nor do we target the customer experience in a particular commodity.

The first round of customer experience surveys by commodity have been conducted and they are being analyzed to determine the insights elucidated.
The proposed project is intended to build on the success of Con Edison's use of Detectent's data analytics solution. This new project will implement Detectent's Customer Intelligence Platform (CustomerIP) in order to enhance Con Edison's revenue protection process and create one electronic point of interface for all RPU cases. This will allow Con Edison to define and manage a streamlined process that encompasses the lifecycle of a case from initial flagging to field investigation and on through the billing process. This proposed project will also establish offline investigation forms that will provide field investigators with access to all pertinent account and meter information through an offline copy of their current electronic investigation forms. The offline forms will allow field investigators to view relevant information, record measurements, observations and notes as well as attach pictures while on location regardless of the wireless connectivity.

**BENEFITS**

Con Edison is expected to realize the following benefits from enhancing and implementing the Customer Intelligence Platform:

1. Efficiency gains in the field investigation process
2. Enhanced reporting tools
3. Offline field Investigation tools
4. Paperless workflow for the billing and revenue protection departments
5. Single interface for all revenue protection case creation and management

**TECHNICAL STATUS**

This enhanced software platform went live in September 2014. The new software is accessed via tablets used by field personnel. The software builds on the existing theft detection algorithms, and includes enhanced algorithms for tracking customer account data for both gas and electric services. The algorithms in part work by comparing the relative gas and electric usage for a given customer type. The upgraded software has been successful and we exceeded our goal for detection of three million dollars of fraudulent service.
OBJECTIVE

The purpose of this project is to research and develop techniques that follow forensic best practices that can be used as part of a cyber investigation involving proprietary critical assets. The research would involve the O&R Energy Control Center and CECONY Substation identifying the BES Cyber Assets within their respective facilities. Given this list of BES Cyber Assets, the Cyber Action Team will procure these sample test devices and then develop best practices to address at a minimum the following:

- Determine the compatible tools needed to perform a data collection
- If it is possible to perform a collection without restarting or shutting down the asset.
- If a live collection is possible, then determine what is the impact of the acquisition on the asset
- If it is possible to perform a logical data collection without physically tampering with the asset
- If it is possible to perform a collection of volatile data
- What tools can be used to analyze the collected information

Of the various BES Cyber Assets to be identified by both groups, the Cyber Action Team proposes to use a phased approach and concentrate on a subset of the BES Cyber Assets. The first phase will concentrate on a subset of BES Cyber Assets that are available in both O&R and CECONY substation environments. Additionally, this first phase will be limited to a few select BES Cyber Assets in order limit costs and to have a manageable asset count.

BENEFITS

The result of this project will be a guideline for incident handling and response to specific critical BES Cyber Assets within the O&R ECC and CECONY substations. If there is a cyber-investigation involving cyber assets that are in scope of phase 1 of this project, the result of this project will provide a direct guide with tested and repeatable procedures on how to perform a data collection of the device.

TECHNICAL STATUS

As part of the Critical Infrastructure Protection (CIP), NERC developed a set of standards used to secure and protect critical assets within the bulk electrical system (BES). NERC CIP-008 is a standard that requires electrical companies to identify, classify, and respond to cyber security incidents involving critical cyber assets (V3) and BES Cyber Assets (V5). Cyber assets are defined by NERC as programmable...
electronic devices, including hardware and software. The data contained in the devices is also considered a cyber asset. Critical cyber assets are those that, if damaged or destroyed, will affect the reliability or operability of the bulk electric system. These assets can be a part of the Supervisory Control and Data Acquisition (SCADA) system or the Distributed Control System (DCS). Both systems are a part of the Industrial Control System (ICS). Therefore, these cyber assets are also generically ICS devices. Various departments within Con Edison, including Energy Control Centers, substations, central engineering, distribution, and compliance, have developed incident response plans to address these new standards for the critical and regular cyber assets. Note that these assets are not connected to the Con Edison corporate network. The incident response plans reference the Corporate Security Cyber Action Team to assist as part of the forensic collection and preservation process, as well as to evaluation process to determine if asset was compromised. Additionally, the incident response plans reference the Cyber Action Team to assist with handling malware, vulnerability assessments, and any suspicious activity on these cyber assets. Most cyber assets are non-traditional computer devices and therefore do not contain an embedded commercial operating system, such as Windows or Linux. Most devices contain proprietary configurations, firmware, or system that most commercial forensic hardware and software do not support.
OBJECTIVE

The rate engineering department will make use of two EPRI customer preference tools to aid in the design of TVP based rates for REV Demonstration Projects and future rate cases. The EPRI tools are developed through surveying utility customers using a discrete choice methodology where the survey participants answer preference questions comparing a small number of options such as their preference of one time of use (TOU) rate, versus another TOU rate, versus a flat rate. The first EPRI tool (ESP1) has been developed with non-Con Edison survey inputs about rate plans. Phase 1 of this project will focus on customizing the ESP1 tool to reflect the Con Edison customer demographic, however this tool will lack any adjustment that reflects the unique nature of the customers in our service territory. This phase is being undertaken in order to obtain near term estimates of customer preferences of various TOU rate plan options for use in developing REV demonstration projects. In phase 2 of the project, an ESP2 tool will be developed throughout 2016 which will contain Con Edison specific survey results as well as an adjustment factor to reflect the unique Con Edison customer base as needed. The ESP2 survey will cover rate plans as well as enabling technologies.

BENEFITS

The EPRI tools, while not fully validated, will provide key insights into customer preferences of various TVP rates that are currently lacking. This is expected to increase the chances that early TVP rates are reasonably well adopted by our customers, either through opt-in or opt-out strategies. Ultimately, well adopted rates can provide projected cost savings to the company due to the reductions of load during peak periods, as reported in the Nexant study. Additionally, better informed TVP rate design during the early stages of introducing these rate structures may also reduce the potential for wasted funds due to a poorly adopted rate resulting from the high cost of implementation of a new TVP rate.

TECHNICAL STATUS

As part of the New York state Reforming the Energy Vision (REV) initiative CECONY is being pressed to propose rates with time variable pricing (TVP) for residential customers. These TVP based rates can provide benefits to the company, primarily in lowering capital and operational costs by alleviating demand on our infrastructure during peak periods, as reported in a June 2015 study completed for Con Edison by Nexant (titled “Cost Effectiveness of Time-Varying Pricing with Advanced Metering
Infrastructure in CECONY Territory"). The new rate structures may be widely applicable if advanced meter infrastructure (AMI) is deployed system-wide in the coming years. However, designing TVP based rates that are beneficial to the CECONY system but also attractive to our customers is challenging. The cost of designing, implementing, and maintaining a new rate structure (due to, for example, program design and administration, marketing, operations, and customer acquisition costs) can be very large. The Nexant report estimated a systemwide deployment of an example residential TVP rate would cost between $44 and $193 million, depending on the enrollment level and opt-in vs opt-out strategy. Although the benefit-cost ratios in the range of example scenarios studied ranged from 1.26 to 3.24, customers must adopt the rate at the estimated level to achieve this performance.

This project is currently underway. The ESP1 tool has been modified for the Con Edison territory and the results are being reviewed to inform internal discussions around TVP rate design.
TITLE   Evaluate Smart Thermostats' Impact on Energy Efficiency and Demand Response

CSN     99878   POET    21696978   TASK     0001

PROGRAM AREA   Electrical Customers

CONTRACTOR   EPRI

DURATION   10/1/2015 to 12/2017

ENGINEER   Doherty

PROJECT LEAD   David R. Logsdon

AUTHORIZED   $ 85,000

EXP. THROUGH 2015 $ 35,000

OBJECTIVE
This project seeks to join with other utilities to engage EPRI to evaluate the effectiveness of several smart thermostats:

1. Do smart thermostats result in energy savings with residential customers?
2. Do smart thermostats result in load reduction during demand reduction events with residential customers?
3. What are specifications of smart thermostats on the market, the different architectures for providing utility demand response?
4. How can data from these devices used to provide continuous Verification of EE and DR performance?
5. How can data from devices be leveraged for other utility energy efficiency programs?
6. What are the various mechanisms a utility can leverage in delivering an EE/DR program?
7. At what rate do residential customers opt to participate in smart thermostat pilots/programs?
8. How do customers use and interact with the thermostats?
9. How are customer participation and energy and demand impacts affected by demographics, season, technolog.

BENEFITS
This project will inform both utilities and the public of energy-saving and cost-saving potential of smart thermostats. It will provide guidance whether and how smart thermostats can fit into utility programs, and how customers use them. Smart thermostats may help overcome the utility cost effectiveness hurdle as well as broaden and improve customer acceptance of demand response. This collaboration will also leverage our investment by expanding the sample and by pooling and sharing results from evaluations across different customer, utility and technology contexts.

TECHNICAL STATUS
In Progress – Literature review of market-ready smart thermostat technologies is under way and guidelines are being developed for smart thermostat trials and analyses.
TITLE   Self-Commissioning LED-Lighting Pilot

CSN   90417    POET  21085057    TASK  0001

PROGRAM AREA   Electrical Customers

CONTRACTOR   Philips, Energy & Resource Solutions

DURATION   9/5/2014 to 12/2015    ENGINEER   Reichborn-Kjennerud

PROJECT LEAD   David Logsdon

AUTHORIZED   $ 40,000    EXP. THROUGH 2015   $ 26,692

OBJECTIVE

This project will have four phases: 1.) M&V base lining, 2.) Installation, 3.) Data Collection, 4.) Evaluation

1. M&V base lining will consist of the installation of current transformers on the 22nd floor lighting circuits to evaluate usage/consumption of the current lighting installation; expected duration for this phase is one month.

2. The installation process will require work by the Con Edison Facilities team and will be overseen by Mike Whelan.

3. Data collection will run for the course of the year, with concurrent user-experience collection and logging of any comfort/inconvenience issue.

4. Evaluation will follow data collection and will compare baseline data to data collected during the data collection phase to attribute benefits to wattage and controls and user experience will be summarized.

BENEFITS

There are numerous quantitative benefits resulting from a significant decrease in energy used and a lower cost of maintenance in changed bulbs. Additional qualitative benefits include the Measurement and Verification that will be provided by the pilot test. If the test is successful we will consider implementation of this technology in existing and future Energy Efficiency and Demand Management programs. On the other hand, completing this test prevents the possibility of implementation of technology in our programs that may not be successful.

TECHNICAL STATUS

The light fixtures and control boards were installed in early 2015 and the measurement and verification (M&V) data was collected throughout the year. The M&V vendor is currently analyzing the data to determine the energy savings provided by the lights in various operational modes.
OBJECTIVE
The Randall's Island Auto-Loop uses sectionalizing switches on distribution network feeders to isolate faults allowing the operator to expedite the restoration of the unfaulted feeder sections. Various studies performed by Distribution Engineering have suggested that the use of such switches during network contingencies greatly improves the reliability of the network system and reduces the likelihood of network shutdown. By implementing a computer program to operate switches based on field data and operating spec EO-4599, the switch automation will decrease the time it takes to locate a fault and manually operate the switch. Reducing the time to locate a fault and restore unfaulted portions of distribution feeders will reduce the likelihood of a cascading event that will lead to a possible network shutdown. The objective of the proposed automation project is to address the goals of performing a demonstration of an auto-loop type design in an underground system via automation software. Software that will dictate the operation of the auto-loop will be integrated in the existing XA21 system allowing for the automatic operation of the Randall's Island underground auto-loop. This system will provide the means to explore the state of the network feeders of the underground auto-loop in real-time and providing information about outages. We expect to operate the system via Human Machine Interface (HMI) from a local control center which is secured by Con Edison's firewall system. Programming of the automation software is required for the system to operate according to Con Edison's developed logic.

BENEFITS
Automation of the Randall's Island underground auto-loop design will improve network design resiliency and enhance restoration efficiency, helping to reduce feeder processing time and bottom-line costs.

TECHNICAL STATUS
The software automation algorithm development was complete in 2014. The team worked with the vendor GE, who developed the Sequential Control module in XA/21, to implement the algorithm into the system for test purposes and be trained on programming future algorithms into the system. In order to integrate all of the data points from the algorithm, a dedicated server space is required. The team has submitted the forms in late 2015 to request the virtual servers and will be bringing an application developer on board by the 2nd Quarter of 2016 to program the server.
TITLE  SMART GRID DEMONSTRATION IN LONG ISLAND CITY

CSN  92621       POET  10064342       TASK  0355

PROGRAM AREA  3G System of the Future

CONTRACTOR  Silver Springs, Gridpoint

DURATION  1/9/2009  to  4/2015

ENGINEER  Lee

PROJECT LEAD  GHAFURIAN R.

AUTHORIZED  $5,750,000       EXP. THROUGH 2015  $1,612,478

OBJECTIVE

The objective of the demonstration is to concentrate several new and ongoing projects relating to Smart Grid 3G SoF in one location, the Long Island City network, and incorporate a comprehensive communication and data management system that covers all of these initiatives. The demonstration includes several functionalities of Smart Grid including smart meter technology and their placement in a horizontal or vertical arrangement, demand response verification, home area network equipment integration, distributed resource integration, secondary network monitoring and modeling, multi switch control and coordination, and remote transformer monitoring. These functionalities will be coordinated as much as possible, allowing for synergy among the technologies to achieve the objectives of each and contributing to an overall data management system and analysis. Integrating dispersed smart meters along with secondary monitoring devices has the potential to verify system models and predict system conditions and automating and controlling sectionalizing switches and network protectors can increase system flexibility and reliability. A communication system to support each functionality and a method to manage and analyze the large amount of data must also be explored to make smart grid possible. The scope will be modified and expanded, if needed, to more fully examine the overall Smart Grid benefits and develop a comprehensive evaluation and recommendation.

BENEFITS

Experience gained in the proposed demonstration will help to further refine the direction of smart grid by determining the best technology and most cost beneficial approach toward implementing system wide smart grid applications. The demonstration will help to evaluate the key functions of smart grid applications to our system.

TECHNICAL STATUS

The 3G System of the Future group has implemented the Smart Grid in Long Island City. In Long Island City, meters, home area networks, transformer and network protector control, electric vehicle charging, feeder reconfiguration, and a common communication system were installed, along with supporting data management for the control center and engineering applications. Testing and performance of the system have been evaluated. A final report has been completed and includes recommendations for future investigations and widespread deployment.
In this project, we seek to maintain the reliability and safety for our electric distribution system while demonstrating alternative technologies to defer infrastructure upgrades. We seek to develop a transportable grid support energy storage system that is easy to connect and disconnect on our secondary grid system with the goal of streamlining the connection process in using these systems. The energy storage system we seek to demonstrate is expected to have zero environmental impact and minimal running and maintenance cost. This has the added benefit of improving the Company’s carbon footprint.

BENEFITS

Once proven to be technically and economically viable, it is expected that TESS can be used to defer infrastructure upgrades while improving customer’s reliability and power quality. It will further Con Edison’s commitment to green our way of doing business shrink our carbon footprint in our operations and going above and beyond in our compliance with environmental laws and regulations, ultimately leading the way to more sustainable future. We also expect the technology will provide us with operational efficiencies that cannot be realized using current technologies. Upon project completion, we will provide us with operational efficiencies that cannot be realized using current technologies. Upon project completion, we will provide recommendation whether to pursue further deployments.

TECHNICAL STATUS

The energy storage manufacturer has made changes to a number of design elements which is expected to improve safety on their system in the future. Con Edison is currently finalizing the technical specification with the manufacturer.
OBJECTIVE

This project will focus on the development, testing and field demonstration of various technologies for improving the safety of Con Edison’s distribution facilities. We will engage vendors to develop the prototypes and install in limited company locations for trials and feasibility study.

BENEFITS

We intend to share any development with both corporate and regional personnel in order to benchmark our efforts against possibly related activities in the industry. The expected benefit is improved safety for our company personnel and public.

TECHNICAL STATUS

Con Edison’s Underground Network Distribution System consists of thousands of miles of conduit duct, the majority being steel or precast concrete. Most of our cable failures leading to manhole events occur between structures in the duct, if we can improve the protection of our cables in this environment, we will make our system safer for our crews and customers. Flame Shield phenolic conduit is a strong, lightweight, low smoke and toxicity material that has very high heat resistance properties.

We have conducted our own tests of the Flame Shield Phenolic. We have conducted heat testing at Van Nest Shop and the conduit maintains its shape with minimal damage in temperatures up to 2000 degrees F. The conduit also performed well on strength tests using a Tinius Olsen materials testing machine at our Tech Services lab in Astoria. We have met with one of our subsurface contractors in Staten Island who is willing to use the material in a pilot program to collect information about ease of use and practicality. We are meeting with EH&S to discuss conduit cutting tests with air monitoring so that we may collect data to be used for determining what PPE would be required when the contractor cuts the material.
Funds appropriated for this project will go towards the development of a workplace charging policy by piloting workplace charging methods and gathering feedback from participants and internal stakeholders. The team will identify existing 110V electrical outlets or location where 110V electrical outlets can easily be installed at pilot locations for use by employees to charge their personal electric vehicles. These locations will require electrical work to install outlets and to isolate the EV load for existing outlets within the facility as well as signage and pavement markings. Participants in the program will use their manufacturer supplied level 1 cord sets to charge their EVs at these designated 110V electrical outlets. Employees will register each EV with the project to obtain permission to charge at company facilities. The project team will look to work with employees in and outside the program to draft a workplace charging policy.

**BENEFITS**

The development of electric vehicle workplace charging policy has been a relatively unexplored area within Con Edison as well as the process for extending this benefit to employees. Internally, a few have been able to policy ideas and methods to deploy these processes but they have not been demonstrated in practice. This project will look to accomplish this and move the needle on the technical readiness.

**TECHNICAL STATUS**

Recognizing that the broad adoption of PEVs is an unpatrolled opportunity for our business and that leading by example with our employees is an important step to realizing this vision, Con Edison has committed to the Edison Electric Institute Employee PEV Engagement Initiative. The initiative tasks member companies to develop and execute a program to access the demand for EV charging amongst its employees, educate employees by providing educational tools to raise familiarity with the technology and encourage adoption. Lastly, it tasks each company to provide workplace charging program at a scale to achieve its workplace charging goals.

Con Edison has also committed to spend 5% of annual fleet acquisition dollars to develop a market for plug-in electric technologies. To meet this objective CECONY has a proposed a charging infrastructure plan for these fleet vehicles that consists of Level 1, Level 2 and DC Fast Charging capabilities across
multiple sites. The level 2 and DC Fast Charging stations will be available for workplace charging as well. Prior to the implementation of this plan, workplace charging programs should be developed and piloted.

**Update**

600 employees participated in the Workplace Charging survey and the vast majority expressed interest in purchase an EV in the next few years. 400 employees participated in the EV ride and drive discovered the joy of driving an EV and learned about the numerous benefits of owning one. None of the employees who attended the event indicated that they currently drive an EV, but the majority of attendees were interested in purchasing one in the near future. To date, there are 10 Con Ed employees working out of 6 locations who are commuting to work in a plug-in EV and have registered or are in the process of registering for the Workplace Charging Program. As of the start of 2016, 20 level 1 charging stations were installed at 10 Con Ed facilities. Lastly, an electric vehicle charging reservation system for Con Edison’s Learning Center was built to provide our employees an opportunity to reserve electric vehicle charging facilities while visiting the location.

**Next Steps**

The team is in the process of procuring low cost and simple vehicle telematics hardware to monitor level 1 charging infrastructure utilization.