2025

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

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CONTENTS

1. INTRODUCTION

In a rapidly changing energy landscape, Consolidated Edison Company of New York, Inc. ("CECONY") and Orange and Rockland Utilities ("O&R") (together, "the Companies") continue to focus on research and development (R&D) to maintain reliability, manage risk, control costs, and prepare for a smarter, safer, and cleaner future. The characteristics of our system (large population, high load density, tremendous infrastructure density, high marginal costs for new infrastructure, and the demand for continued reliability levels) and increasing customer expectations present CECONY and O&R with technical issues that are unique in New York State and in the industry. These factors, and a focus on clean energy, climate resilience and customer-sited technologies, and with our service territories' unique demographic, require us to be at the forefront of developing cutting edge power delivery improvements, innovative solutions, and new engagements with clean tech incubators and universities.

The Companies' R&D portfolio supports our commitment to a clean energy future by targeting research and development that facilitates the transition to a net-zero carbon economy by 2050. The R&D portfolio also focuses on obtaining the greatest results for challenges unique to the Companies over various product delivery times, addressing risks as well as longer term strategic value. The Companies' portfolio balances a mix of projects that are short-term and strategic, as well as small and large ones.

2. GOALS AND OBJECTIVES

The electric utility industry delivers electricity in a safe, reliable, economic, environmentally sound, and transparent manner considering sustainability and conserving natural resources. To fulfill this obligation, continuous improvement in every phase of the Companies' operations is required. Success is dependent primarily on a sound research, development, and demonstration program, with support, advice, and cooperation from our customers, government, industry, academia, and other electric utilities.

The R&D Department ("the Department") works collaboratively with the Companies' operational groups and other internal customers to implement innovative or state-of-the-art technologies that support the long-term sustainability of our businesses. The Department does this by identifying, developing, demonstrating, and providing advanced equipment, hardware, software methodologies, analytics, etc. for the Companies' operations. The Department's overall role and responsibilities involve formulating and implementing an R&D portfolio which addresses the strategic and near-term needs of the Companies' electric transmission and distribution (T&D) systems, including building on the Department's work on distributed energy resource (DER) technologies and innovations into our operations, planning, and forecasting capabilities.

A relentless focus on safety, operational excellence, customer experience, and clean energy sets the groundwork for our R&D portfolio. The following are guidelines used in establishing the Companies' R&D portfolio:

- Develop and demonstrate advanced technologies and techniques to:
  - Facilitate the transition to a clean energy future.
  - Improve the safety, efficiency, cost-effectiveness, reliability, resiliency, use, and

maintainability of the energy delivery system.
- Extend the useful life of existing company equipment.
- Increase worker and public safety and improve productivity.
- Improve cyber and physical security.
- Improve load and weather forecasting.
- Enable our customers and our own facilities to better manage and reduce energy costs, while also reducing adverse environmental impact.

- Support clean energy and environmental research to operate and plan the electric systems in a cost-effective and environmentally excellent manner.
- 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.
- Research and evaluate technologies that promote a healthy and safe workplace in response to current or future pandemic.

3. ORGANIZATION

Since its formation in 1970, the Department has kept pace with the changing electric utility industry so that continued progress is made in identifying research projects that will improve service, reducing cost to the consumer and minimizing the environmental impact of supplying adequate amounts of electric power. The Department has aggressively pursued new emerging technologies that improve the Companies' operations, serve our customers, and help facilitate the transition to a clean energy future.

The Department 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, and inclusive:
    - Relying on and encouraging the talents of others within the Companies
    - Conducting open discussions to address specific issues
    - Conducting timely and frequent outreach activities with internal customers and external stakeholders and technologists
- Recognizing the substantial interest that customers and other external stakeholders have in our business, we engage with customers and external stakeholders in every aspect of our business:
    - Continually learning about technological innovations
    - Benchmarking against utility and non-utility industry leaders
    - Seeking out new ideas across a broad spectrum of different industries, academia, policymakers, governmental agencies, national laboratories, research consortia, and incubators
- With a cost-conscious mindset, employees act like business owners:
    - Identifying the Companies' short- and long-term needs that may have R&D solutions
    - Developing and deploying advanced technologies and analytical techniques to meet those needs

- Developing and deploying advanced technologies to improve:
  - worker and public safety
  - operational efficiency
- Working to increase value and leveraging expenditures

3.1. STAFFING AND DEPARTMENTAL ORGANIZATION

The Department is comprised of two major sections: "Electric" and "Gas & Steam" R&D. Personnel in the department typically come from the Companies' operating areas with external technology experience, and with many years of experience in the utility or in other industries or academia, providing the department with a R&D staff with broad experiences. Each of our staff seeks to develop extensive internal contacts and a detailed understanding of our business needs and R&D best practices. Working collaboratively within the Companies, R&D staff establish and implement R&D projects. The support of our internal customers, with their professional staff and labor forces, helps keep the R&D projects address their needs and ensures that solutions get implemented. Also, many of the Companies' staffing and labor hours on R&D projects are provided by company organizations outside the Department. This collaborative approach ensures customer focus and program success.

Electric R&D projects implement new technologies to improve safety, efficiency, reliability, and operating performance, extend the useful life of electrical equipment, mitigate environmental impacts, and facilitate the clean energy transition. These projects also support the Companies' Customer Energy Solutions organization by advising, developing, and helping to introduce better end-use technologies and by providing the planning tools required to understand and influence electricity usage to benefit the Companies and its customers. Included are R&D activities in the areas of electrical distribution, transmission, substations, power systems planning, operations, energy management and use, computing applications, and cybersecurity.

The Technology Transfer program stresses the importance of maximizing return on our investment in R&D. Monthly highlights, ideation sessions, Technically Speaking seminars, expanded staff meetings, workshops, status reports, technical publications, research databases, and company intranet notices keep employees informed of and engaged with new and emerging technologies.

3.2. PROGRAM DEVELOPMENT AND MANAGEMENT

The Department, guided by corporate goals and objectives and in collaboration with other company organizations, determines technological R&D needs, develops the R&D portfolio, and establishes programs that implement the plan. Individual projects are funded either solely by the Companies 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 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 Department monitors initial implementation of new technology to confirm that expected benefits are achieved and

potential implementation problems are addressed. It also monitors for developments of new technologies that might be of future benefit to the Companies and customers.

The Department leverages the use of its financial resources through participation in industry-wide research that is also funded by others in the industry. Technical advisors and subject matter experts (SMEs) in the Department and other company organizations advise and direct industry-wide research through the Electric Power Research Institute (EPRI) and other industry consortia.

3.3. 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 planning 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 milestones for payments, 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, to the extent possible. 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 Energy Solutions, 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.

3.4. TECHNOLOGY TRANSFER

Seminars, workshops, status reports, technical publications and research databases keep employees informed and engaged with new and emerging technologies. Employees participate as advisors to EPRI and have access to internet-based technology libraries, enabling on-line searches of databases that include ongoing research projects, publications, products, experts, and patents. As the R&D program has

matured, more individuals throughout the Companies have become aware of R&D information and products that are of value to them in achieving corporate goals and objectives.

4. RESEARCH AND DEVELOPMENT PROGRAM

The purpose of the Companies' electric 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. The Department is driven by the goal to provide new technology options to fill near term operational needs and longer-term strategic needs of the corporation. The R&D program strives to provide proactive problem-solving opportunities that have the potential for making incremental or even transformational changes 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 are needed but 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 advance the more pertinent innovative products
- Anticipate changing technology needs driven by our internal business, by external regulation and by our customer needs, and based on these needs, develop and implement plans to bring new technology options to the Companies
- 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 R&D projects

The Department pursues these goals and initiatives through a wide variety of external and internal programs and activities.

4.1. COLLABORATIVE R&D

The Companies continue the commitment to industry-group R&D programs and actively participate in the decision-making process of national organizations such as EPRI; the National Electric Energy Testing, Research & Applications Center (NEETRAC); and the Centre for Energy Advancement through Technological Innovation (CEATI), which are effective venues for collaboration on research, development, prototyping and testing the widening range of technologies and equipment that are becoming possible or being developed by vendors. Using industry-group R&D programs sustains technology transfer, participates in important standards development activities, and leverages R&D funds via federal and other funding and collaboration with utilities. Participation also enables the Companies to exclusively define the scope and initiate expedited projects tailored to its needs.

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 utilities, industry, government, and private organizations located throughout

New York State and the nation for further development. The Companies' flexible R&D program allows for reducing the risk associated with initial development of technologies of specific importance to the Companies. Other entities may then be willing to help 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 the Companies unless there is support in the forms of funding the basic research and feasibility of proof of concept and providing a reasonable market for the product. This requires the Companies to fully fund product development 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 multimillion-dollar demonstrations.

The Companies have budgeted $4.7 million in 2025 in support of electric industry group research. Form E-1 identify the estimated expenditures for industry group R&D programs, as well as the Companies' total expenditures for internal and contractor programs.

4.2. 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 Companies 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 $3.3 million in 2025 for general and administrative support of the electric R&D program.

4.3. 2024 R&D SUCCESSES

In 2024, R&D's notable successes include:

- Evaluated and validated the innovative concept of a multi-terminal battery energy storage system (BESS), which utilizes a common direct current (DC) bus to connect multiple distribution feeders through multiple inverters to one or more DC resources such as batteries, photovoltaic (PV) systems, and electric vehicle (EV) charging systems, resulting in potentially higher generation hosting capacity as the resources are connected to multiple feeders.
- Tested and evaluated sulfur hexafluoride (SF6) gas alternatives in EPRI laboratory facilities to provide a safe yet realistic substation environment in which the industry can learn together on issues such as handling, operation, maintenance and disposal of the SF6 gas alternatives.
- Successfully demonstrated a Con Edison patented distribution cable LED test lamp with audible signals and LCD indicating voltage, leading to the production of multiple units for piloting.
- Completed and deployed the inaugural Battery Energy Storage Playbook, a "living" document which aims to ensure the development of safe, reliable, and affordable energy systems while considering the entire life cycle, and to also serve as a guide to project managers and others supporting substation and distribution feeder-sited energy storage projects in the Companies.
- Successfully demonstrated an innovative Voltage Regulating Distribution Transformer (VRDT) which has its voltage tap operation performed in a vacuum attached to a Completely Self-Protected Transformer (CSP), offering a complete and safe solution against lightning, switch surges and severe overloads.

- Successfully developed and tested a device to remotely operate the Companies' 480V Pringle Switches (3-phase gang-operated manual load break switches), from a safer distance away.
- Developed and implemented a Virtual Reality (VR) training module which uses an immersive VR environment to show the potential impacts of not wearing the proper Personal Protective Equipment (PPE) when there is an equipment failure while racking in a circuit breaker.

4.4. 2025 PROGRAM

The 2025 R&D program is segregated into four (4) sub programs: transmission, distribution, substations, and customer engagement. Program areas of focus, goals and objectives and some of the program elements underway are summarized for each area.

Transmission Program

Goals and Objectives

- Develop replacement options
- Minimize environmental impact of dielectric fluid
- Improve safety
- Maximize use of existing facilities

The Transmission R&D 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 transmission area include developing and testing technologies for:

- Replacing current underground transmission cable technologies
- Expediting detection and location of dielectric leaks in underground transmission pipes and structures
- Locating disbonded coatings on underground transmission pipes
- Expediting detection and location of faults in transmission feeders
- Reducing the impacts of geo- and electromagnetic and intentional electromagnetic events

Distribution Program

Goals and Objectives

- Improve worker health and safety
- Improve public safety
- Improve operational efficiency
- Improve asset management
- Enhance system reliability and resiliency
- Enhance the customer experience
- 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, extend equipment life, and reduce costs of construction, maintenance and operation of the distribution systems. R&D activities in the distribution area include developing and testing technologies for:

- 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
- Exploration of partial discharge detection as a diagnostic for incipient failures and other anomalies in distribution cables, joints and transformers

Substations Program

Goals and Objectives

- Improve operational efficiency
- Maximize use of existing facilities
- Improve safety and security
- Develop lower-cost, smaller-size, and more efficient, reliable, and environmentally acceptable equipment

The Substation R&D program focuses on improving the operational efficiency and security of substation equipment and extending the useful life of installed equipment. R&D activities in the substations area include developing and testing technologies for:

- Monitoring and assessing, both on-line and in real time, the condition (including the operating status) of power transformers, load tap changers and circuit breakers
- Fault current mitigation, as utilities in dense urban environment are experiencing increased fault current levels due to additional distributed energy resources as well as systems being operated at higher power levels than in the past
- Arc flash protection
- SF6 management and alternatives
- Advanced inspection tools and systems

Customer Engagement Program

Goals and Objectives

- Improve the customer experience
- Maintain competitiveness
- Integration of data collection

Customer Engagement projects focus on efforts to enhance the customer experience and lower costs, which include assessments and demonstrations of new technologies that offer:

- Improved demand management and energy efficiency
- Non-intrusive analysis of customer end uses
- Improved interconnection practices

- Distributed Energy Resource (“DER”) and Electric Vehicle (“EV”) facilitation
- Electrification of heating

ADDITIONAL INFORMATION

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

King Look
Director
R&D Department
(212) 460-4801
lookk@coned.com

FORM E-1
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
RESEARCH AND DEVELOPMENT PROGRAM PLAN EXPENDITURES 2024 - 2028 ($'000)

CSN	Project	Task	TITLE	2024 Actual	2025 Estimate	2026 Estimate	2027 Estimate	2028 Estimate
			Administration (Common Distribution 77.60% to Electric)					
92032	10064342	0024	SALARIES AND WAGES	$2,557	$2,737	$2,819	$2,904	$2,991
92034	10064342	0025	OTHER EXPENSES	$252	$310	$310	$310	$310
92649	10064342	0372	PATENT SEARCHES IN CONNECTION WITH COMPANY R&D TECHNOLOGY APPLICATIONS	$60	$155	$155	$155	$155
			Subtotal Administration	**$2,869**	$3,203	$3,285	$3,369	$3,457
			Industry					
N/A	27360819	0001	EPRI 2024-2028 Electric Distribution 5-Year Base Portfolio	$2,207	$2,115	$2,178	$2,243	$2,310
N/A	27360821	0001	EPRI 2024-2028 Electric Transmision 5-Year Base Portfolio	$2,403	$2,334	$2,404	$2,476	$2,550
92394	10064342	0279	EPRI/NYSERDA/DOE TRAVEL BY ALL OTHER NON-R&D PERSONNEL	$36	$60	$60	$60	$60
92374	10064342	0263	EPRI/NYSERDA/DOE TRAVEL BY ENVIRONMENTAL AFFAIRS PERSONNEL	$4	$20	$20	$20	$20
92388	10064342	0275	EPRI/NYSERDA/DOE TRAVEL BY SYSTEM & TRANSMISSION OPERATIONS PERSONNEL	$6	$20	$20	$20	$20
			Subtotal Industry Groups	**$4,655**	**$4,549**	**$4,682**	**$4,819**	**$4,961**
			In-House Projects					
			General Common Projects (Common Distribution 77.60% to Electric)					
	26550050	0001	DOE Tracking Real-time Anomalies in Power Systems (TRAPS) - 287	$0				
N/A	27636628	0001	Insider Threat Research - Phase 2 - CMU (Carnegie Mellon University) - 426	$9				
N/A	27396002	0001	Enersion EPRI Incubate Challenge Demonstration - 401	$18				
N/A	27757396	0001	Zero Emission Heat Pump Demonstration 398	$16				
91619	26196029	0001	Radiator Labs Hybrid Electrification Demonstration - 255	($13)				
91510/91516	25258817	0001	Eyes in the Field - Wearables with AR	$3				
91495	25126727	0001	Preventing Surface Sediment Contribution to TSS and PCBs Concentrations at Astoria's Outfall B via PM-10 Certified Sweeper Evaluation Pilot - 152	$21				
N/A	27457226	0001	Evaluation of RFID Technologies for Traceability and Quality Control of Laboratory Supplies - 406	$22				
91622	26203341	0001	EPRI Climate READi (REsilience and ADaptation initiative): Power	$116				
N/A	27001737	0001	AI Automation for Contracts Analysis Proof of Concept via NYU - 286	$150				
N/A	27494943	0001	Evaluation of Knives / Cutting Tools with Inherent Safety Designs - 410	$6				
N/A	27540601	0001	OT (Operational Technology) Cyber Security Technology Transfer Workshop - 416	$27				
N/A	27219263	0001	Evaluation of Portable Cooling Stations - 365	$6				
N/A	27209073	0001	VR Substation Experience to recreate High Hazard Injuries - 328	$18				
			Subtotal Common	**$400**	$458	$472	$486	$501

FORM E-1

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

RESEARCH AND DEVELOPMENT PROGRAM PLAN EXPENDITURES 2024 - 2028 ($'000)

			Transmission					
91626	26248431	0001	Demonstrate Pulsed Eddy Current (PEC) Robot for High Voltage Feeder Pipe Assessment	($127)				
90994	23581395	0001	138 kV XLPE Feeders Sharing Manhole Study	($0)				
N/A	27409209	0001	Reliable Protection for an Inverter-Based Resources Dominant Grid: Technology Development and Field Demonstration - 395	$4				
91576	25914705	0001	Ambient Adjusted Rating (AAR) for Overhead Transmission Network - 228	$2				
N/A	27919483	0001	NYSERDA - Developing DLR (Dynamic Line Rating) Implementation Best Practices - 458	$5				
N/A	27473597	0001	Qualification of Alternate Supplier for 345 kV HPFF/XLPE Transition Joint - 409	$52				
N/A	26688587	0001	Development of a Disbonded Coating Corrosion Index for HPFF - 280	$80				
N/A	27372811	0001	Enhancing Situational Awareness in A Carbon-Neutral Grid with An Automatic-Calibrated System Model - NYSERDA Study via Quanta - 392	$25				
			Subtotal Transmission	**$41**	$618	$637	$656	$676
			Substation					
92736	20707502	0001	Demonstration of remote breaker racking systems	($2)				
90604	22270906	0001	Next Generation Substation Battery Demonstration	($24)				
N/A	27548837	0001	Lab Assessments of Handling Practices and Chemical Analysis of SF6 Alternatives (EPRI) - 403	$120				
N/A	26565083	0001	Duresca Busbar Thermal Testing 294	$79				
N/A	26584592	0001	Robotic Inspection and Patrol for Substations - 293	$78				
N/A	27881686	0001	Testing of SF6 Free Circuit Breakers - 457	$154				
N/A	26559746	0001	Evaluation of Substation Robotic Analytical Tools-288	($57)				
91515	25258659	0001	Substation Inspection Robot Development - 181	$63				
			Subtotal Substation	**$411**	$516	$531	$547	$563
			Transmission & Substation	**$451**	$1,134	$1,168	$1,203	$1,239
			Distribution					
91628	26272210	0001	Weather Innovation and Smart Energy and Resilience Industry-University Cooperative Research (WISER) - 262	$50				
N/A	27777038	0001	Applications Research Program - CEATI – 2024 - 402	$394				
N/A	27919315	0001	Applications Research Program - CEATI – 2025 - 461	$99				
91340	24482265	0001	Alternate 480V PTO Data Gathering Demonstration - 77	$57				
N/A	27284200	0001	Multi-Terminal AC-DC-AC Interconnection for Distributed Storage Phase-1 Study via EPRI - 377	$108				
N/A	26987256	0001	International Utility Working Group Participation - 323	$23				
N/A	26455697	0001	EPRI Emerging Energy Storage Technologies Supplemental - 270	$27				
N/A	26581105	0001	Sharc Piranha Wastewater Heat Pump NYC Building Retrofit Feasilbility Study - 295	($14)				
N/A	26703913	0001	Aging and Evaluating Underground Structure Covers and Frames - 303	$0				
91439	24932760	0001	Adaptive Protection Enhancement Development for Low Voltage Distributed Networks - 140	($5)				
N/A	27045196	0001	Identification of Failure Signatures for Select Medium Voltage Distribution Assets - 330	$249				
N/A	27105609	0001	Battery Energy Storage Digital Twin Model Development -343	$40				
N/A	27219261	0001	Enhanced Prototype Development of Electric Operations Cable Persuader Tool - 366	$21				
91602	26185016	0001	Testlamp Development - 248	$40				
N/A	27257720	0001	Renewable Meter Adapter Solutions - 370	$25				
N/A	27514430	0001	2 0 2 4 NEETRAC Applications Research - 413	$146				
N/A	27917814	0001	NEETRAC 2025 Applications Research - 460	$146				
N/A	26584707	0001	PRECISE Smart Inverter Modeling Analysis Software Tool Evaluation Pilot via NREL	$201				
N/A	27039852	0001	Evaluation of Field Lead Testing Kits or Devices - 332	$2				
90880	23102147	0001	Remote Closing Device for Feeder Reactor Switch	($3)				
N/A	27284243	0001	Prototype Development of Enhanced Duct Iron for Cable Installation - 379	$18				
92456	20652549	0001	Demonstration of safety tools and equipment for electric operations	$13				
N/A	27540600	0001	Prototype Development of Pringle Switch Handle Remote Operator - 408	$31				
N/A	27360010	0001	Underground Low Voltage Cable Detection and Tracing - 391	$13				
N/A	26683658	0001	Instrument Development with FOD - 297	$8				
N/A	27209710	0001	Evaluation of Utility Locating Devices for Locating Electrical Faults - 364	$2				
N/A	27789956	0001	Splicing Machine for Underground Power Cables-ARPA-E collaboration -443	$4				
N/A	27036773	0001	Voice to Text Trouble Ticket Documentation Proof of Concept	$60				
N/A	27381817	0001	Restrained Manhole Cover and Frame Performance Tests - 399	$272				
91347	24509152	0001	Manhole Monitoring System Phase 2 Analytics - 102	($38)				
99821	21852771	0001	Structure Monitoring System	$1				
N/A	27050631	0001	Voltage Regulating Distribution Transformer (VRDT) Pilot - 326	$59				
N/A	27036772	0001	Streetlight with Neutral to Earth Voltage (NEV) Monitoring and Verification - 327	$4				
N/A	27104289	0001	Stray Voltage Mobile Scanning Development - Quasar - 337	$46				
N/A	27104288	0001	Stray Voltage Mobile Scanning Development - EPRI - 334	$1				
			Subtotal Distribution	**$2,097**	$1,151	$1,186	$1,222	$1,259

FORM E-1
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
RESEARCH AND DEVELOPMENT PROGRAM PLAN EXPENDITURES 2024 - 2028 ($'000)

			Customer					
99876	21702861	0001	ICS Data Acquisition using Forensic Techniques	($48)				
91548	25583813	0001	ICS Data Acquisition using Forensic Techniques - Phase II - 204	$48				
N/A	27611656	0001	Building Energy Smart Technologies (BEST) Center 3-Year Membership - 430	$100				
				$100	$0	$0	$0	$0
			EH&S					
				$0				
				$0				
			Electric Transportation					
				$0				
				$0				
			TOTAL ELECTRIC PROGRAMS	**$2,649**	**$2,285**	**$2,354**	**$2,425**	**$2,498**
			Total CECONY Research & Development Before O&R Proportion for NY Electric/Gas & NJ RECO	**$10,572**	**$10,495**	**$10,792**	**$11,099**	**$11,416**
			Total CECONY Research & Development For O&R Proportion for NY Electric/Gas & NJ RECO	**($430)**	**($531)**	**($546)**	**($561)**	**($577)**
			Total CECONY Research & Development After O&R Proportion for NY Electric/Gas & NJ RECO	**$10,142**	**$9,964**	**$10,247**	**$10,538**	**$10,839**

FORM E-1
ORANGE & ROCKLAND UTILITIES (ORU)
RESEARCH AND DEVELOPMENT PROGRAM PLAN EXPENDITURES 2024 - 2028 ($'000)

L3 Project	TASK	TITLE	2024 Actual	2025 Estimate	2026 Estimate	2027 Estimate	2028 Estimate
		Industry Groups					
10104042	0001	Travel	$47	**75**	$75	75	75
		Projects Under $5K	**$0.011**				
		Sub-total	**$47**	**$75**	**$75**	**$75**	**$75**
		In-House Projects					
27001738	0001	L3_ORU PowerClerk Configuration for FERC 2222 Program	$5				
27921084	0001	L3_EPRI Concrete Inspection Technologies Evaluation	$55				
27921085	0001	L3_EPRI Direct Embedment Foundation Backfill Performance	$65				
		Electric Project Total	**$125**				
		Subtotal In-House Projects	**$172**	**$250**	**$250**	**$250**	**$250**
		Total ORU Research & Development Before CECONY Affiliated Billing (IN) & New Jersey RECO (OUT)	**$220**	**$325**	**325**	**325**	**325**
		Total ORU Research & Development Allocated to New York Jersey	**($54)**	**($80)**	**($80)**	**($80)**	**($80)**
		CECONY Affiliated Billing (6.85% of Administration & Industry - Electric Power Research Institute - EPRI)	**$515**	**$531**	**$546**	**$561**	**$577**
		Total ORU Research & Development Allocated to New York	**$681**	**$776**	**$791**	**$806**	**$822**

TITLE Demonstrate Pulsed Eddy Current (PEC) Robot for High Voltage Feeder Pipe Assessment

POET 26248431 **TASK** 0001

OBJECTIVE

Gas Tunnel Maintenance maintains the dielectric fluid-filled 138 and 345 kV electric feeder infrastructure within the Company's tunnels. The steel feeder pipes are coated with paint and wax tape to protect them against corrosion and are inspected for corrosion triennially. Because these pipes traverse through the shafts which can range in depths at about two-hundred feet, Tunnel crews must utilize safety harnesses, bosun chairs and scaffolding to address potential safety hazards during inspections. The inspection process also requires removal of the coating to manually measure pipe wall thickness and to visually inspect the surface condition for any physical anomalies such as gouging and pitting that could potentially affect that thickness. In prior R&D phases, a prototype robot with a pulsed eddy current (PEC) sensor system was fabricated and demonstrated, showing a volumetric metal loss inspection without damaging the wax tape coating.

In this next phase, the approach will be to further develop additional compensation algorithms during inspection of energized feeder lines. These include contributing factors, such as three-phased conductor mass and orientation within the feeder lines, distance between feeder cables, circumferential location of pipe, variations in material property during the pipe manufacturing process that might have a potential impact in the accuracy of wall thickness readings, as well as the effects of paint coating versus wax tape coating.

Also, the robot's design will explore reducing its size and weight to optimize its ability to traverse within the allowed spatial clearance between pipes during an inspection scan.

BENEFITS

The project's qualitative benefits include enhanced safety of the field inspection crews by minimizing work-at-height, and a much larger quantitative data collection to assist in making upgrade and repair decisions. The project also provides quantitative benefit because the testing is non-destructive without need for removal of coatings. Non-destructive assessment of corrosion under coating enables the programmatic upgrades and repairs of the system, mitigating the risk of dielectric fluid leak to the environment.

By reducing its weight from an estimated 75 pounds to 10 pounds, the robot may also exhibit improved mobility around pipes with tighter clearances and subsequently capture more accurate pipe wall thickness data. In turn, this provides a greater area of piping inspected.

Lastly, if the robot can detect wall thinning early on, the Company may be able to avoid potential oil leaks.

TECHNICAL STATUS

The design and development of the robot with improved wall loss detection and the final technical report are complete and delivered. This project was also capitalized by Gas Tunnel Operations..

Tasks (checked boxes are completed):

☒ The robot traverses on horizontal pipes.

☒ The robot traverses sweeps with a radius of curvature of at least 10 feet.

☒ The robot operates on both bare and coated pipes.

☒ The robot operates on pipes coated with a two-layer coating consisting of polyethylene and butyl adhesive (known commercially as PRITEC™) and wax tape.

☒ The robot operates at a distance of at least 100 feet from the battery pack and the PEC instrument.

☒ The robot operates at a speed of 3 inches per second along the pipe, not including limitations imposed by the PEC tool.

☒ The robot collects circumferential PEC data 360 degrees around the pipe that it drove on barring any obstructions around the pipe's surface.

☒ The weight of the robot is reduced from 75 pounds to less than 30 pounds.

TITLE International Utility Working Group Participation (IUWG)

POET 26987256 **TASK** 0001

OBJECTIVE

The IUWG uses annual surveys and in-person meetings / presentations to share cutting-edge electric utility engineering and operations practices for the betterment of all involved and the industry as a whole. Meetings include an annual one-week conference, which includes a technical forum and an executive forum. The technical forum is an opportunity for utilities to discuss relevant topics, share information through technical surveys and discussions and share best practices. New and emerging issues, such as Smart Grid, energy efficiency, renewable energy resources and safety, increase the need for this type of collaboration.

BENEFITS

The International Utility Working Group (IUWG) was created by Con Edison in 2004 to facilitate knowledge sharing between 10 global electric utilities. The information shared in this group and during an annual IUWG conference helps improve safety, operations, and customer experience at Con Edison. Benchmarking of best practices with engineers and managers from utilities worldwide helps to improve existing processes and develop new ones.

TECHNICAL STATUS

Themes covered in recent meetings included:

- Focusing on the customer
- Implementing resiliency focused systems and practices to prepare for extreme weather events
- Changing landscape due to the increased integration of distributed energy resources
- Reviewing Electric Vehicle progress, including current levels of vehicles and future planning

This working group continues to be a place where the company can openly discuss challenges and source new ideas. Con Edison's shared themes were:

- Safety
- Innovations in machines to remove workers from high hazard environments
- Long-range plans for a safe, reliable, sustainable future
- Climate resiliency plans
- Our Clean Energy Commitment
- System upgrades to address reliability, resilience, renewables integration, and load growth
- Electrification
- Utilization of Smart Meter Data

The next IUWG meeting is scheduled for May 2025.

TITLE Alternate 480V PTO Data Gathering Demonstration

POET 24482265 **TASK** 0001

OBJECTIVE

Develop, manufacture and install 15 prototype auxiliary RMS transmitters that will communicate wirelessly and assimilate into existing RMS comms protocols. Each new transmitter will be housed in its own enclosure and will report the data back periodically to NetRMS.

Many 460V network locations have the network protector located in a different compartment than the transformer, and the gap between the transformer and protector is otherwise occupied by building structure, making it physically prohibitive to securely wire the PTO sensors on the transformer, to the RMS transmitter at the network protector. Not only do these locations represent the largest service installations, but also represent a major gap in compliance to PSC requirements to remotely monitor all network installations and an operating risk in that we are unable to use PTO data to better assess network transformer health.

BENEFITS

This project will provide an additional means to provide data through the Network Remote Monitoring System (NetRMS). At a minimum, developing the project will allow us to bring back pressure, temperature, and oil (PTO) information for roughly 1000 locations where the data is currently unavailable due to physical constraints. Future expansion of the project will give the ability to add new sensors and sources of information to locations where it otherwise would be limited.

TECHNICAL STATUS

Prototype auxiliary RMS transmitters were developed and installed in network vaults, effectivly communicated during the trial period, and satisfactorily met physical and environmental challenges. R&D project complete. Field deployment in progress

Tasks (checked boxes are completed):

☒ Outline basic technical challenge and need, and develop and issue RFQ

☒ Evaluate RFQ responses, and develop and issue purchase order

☒ Develop enhanced NWP Relay

☒ Modify XA21 Distribution SCADA system software to accept new comms

TITLE Adaptive Protection Enhancement Development for Low Voltage Distributed Networks

POET 24932760 **TASK** 0001

OBJECTIVE

One foundational design basis for low voltage underground network distribution systems is that the network protector automatically disconnects its associated transformer from the secondary grid when the power starts flowing in reverse direction. But building a carbon-free grid requires distributed renewable energy sources and empowering customers to locally generate power at their premises. Power will increasingly come from multiple sources and flow in multiple directions, violating uni-directional design basis of existing standards. We seek to develop and demonstrate bi-directional power flow through network protectors while maintaining network reliability.

BENEFITS

Create opportunities for additional renewable resources and network resiliency during normal and contingency conditions by modeling and demonstrating novel network protector relay protocols and settings that permit 'friendly' reverse power flow while still protecting against fault-induced backfeed.

TECHNICAL STATUS

Tasks (checked boxes are completed): all complete

☒ Assess and evaluate adaptive protection needs

☐ Simulate and test adaptive protection that enables increased PV penetration

☐ Develop method for assessment, design, and placement of adaptive protection

☐ Issue final Report

TITLE Weather Innovation and Smart Energy and Resilience Industry-University Cooperative Research (WISER)

POET 26272210 **TASK** 0001

OBJECTIVE

Weather Innovation, Smart Energy and Resilience Center (WISER), is a new NSF-supported Industry-University Cooperative Research Center (IUCRC), that partners UAlbany and the University of Connecticut (UConn) to leverage the research and expertise at both institutions to create advanced weather- and climate-based solutions for the energy industry, now and in the future.

Join WISER Center in its charter year to collaborate with university academics and researchers, utilities and others to enhance Con Edison weather innovation, smart energy and resilience.

BENEFITS

Participation in the WISER Center increases technology transfer and funding leverage, and complements ongoing work with EPRI, NEETRAC and elsewhere. We expect to gain enhanced knowledge of interdependency of power delivery, weather, and climate domains vital to sustain reliability and resiliency of supply to Con Edison customers. The NSF ICUC model for member-driven university-industry collaboration also helps drive innovation and commercialization by meeting needs of a broader base.

TECHNICAL STATUS

WISER was launched, Con Edison joined, and the first cohort of deliverables are being finalized

Tasks (checked boxes are completed):

☒ Engage NSF and obtain concept approval for new IUCRC

☒ Engage electric utilities and other interested parties

☒ Launch WISER

TITLE Aging and Evaluating Underground Structure Latched Covers and Frames

POET 26703913 **TASK** 0001

OBJECTIVE

Engage the Electric Power Research Institute (EPRI) to conduct research to better understand the degradation process for components of restrained underground structure cover systems, and evaluate how exposure to weather, traffic vibration, road salts and various roadway chemicals could affect performance of different system designs.

BENEFITS

This research project seeks to identify restrained structure cover degradation modes, inform cover restraint specifications and evaluate cover components that can be modified to mitigate deterioration and impairment from service and aging in urban roadway and traffic environments.

TECHNICAL STATUS

After this project was scoped and before chamber building began, EPRI experienced a failure of a similar chamber at Charlotte. As a result, the project was delayed and an enhanced factory-built aging chamber and monitoring system was ordered. During the pause, we re-evaluated and enhanced the planned test protocol, adding additional covers and lenghtening the aging protocol.

Tasks (checked boxes are completed):

☒ Identification and prioritization of cover and frame systems to be evaluated

☐ Acquire chamber to age frame and cover assemblies components

☐ Accelerated aging test

☐ Post-aging dismantling and comprehensive inspection

☐ Analysis

☐ Report on testing, conclusions and recommendations

TITLE Stray Voltage Mobile Scanning Development - EPRI

POET 27104288 **TASK** 0001

OBJECTIVE

An infrequent, but recurrent problem in Con Edison service area is the presence of stray voltages on manhole covers and gratings, as well as light poles, sidewalks, and other city street furniture. The objective of this project is to identify alternate technologies, diversify program options to reduce vendor lock-in risks, and potentially reduce program costs. We plan to further develop proytotype EPRI technologies into a function system capable of mobile detection, diagnosis and location.

BENEFITS

This work, systems developed and final report will expand our knowledge base and articulate new technology and its suitability for the intended application; as well as provide for follow-on commercial product development. This will enable improved discovery and repair of contact voltage related anomalies thereby improving public safety and increasing the quality of life in the neighborhoods we serve.

TECHNICAL STATUS

Tasks (checked boxes are completed)

☒ Prototype Board Design and Testing

☒ Field Validation and Go/No Go decision

☐ Circuit Board and Hardware Fabrication

☐ Bills of Materials development

☐ Hardware Systems Development and fabrication

☐ Installation of mobile system, Field Demonstration, Qualification and Training

TITLE Stray Voltage Mobile Scanning Development - Quasar

POET 27104289 **TASK** 0001

OBJECTIVE

An infrequent, but recurrent problem in Con Edison service area is the presence of stray voltages on manhole covers and gratings, as well as light poles, sidewalks, and other city street furniture. The objective of this project is to identify alternate technologies, diversify program options to reduce vendor lock-in risks, and potentially reduce program costs. . The project team has identified potential sensor technology concepts from Quasar Federal Systems that seem capable of being brought to commercialization. The purpose of this appropriation is to prove feasibility of using Quasar's sensors through progressive steps:.

BENEFITS

This work, system(s) developed and final report will expand our knowledge base and articulate new technology and its suitability for the intended application; as well as provide for follow-on prototyping and commercial product development. If successful, this will enable improved discovery and repair of contact voltage related anomalies thereby improving public safety and increasing the quality of life in the neighborhoods we serve. This new technology will also help break through the sole-source intellectual property lock possessed by the present vendor.

TECHNICAL STATUS

Tasks (checked boxes are completed):

☒ create analytical proof of concept model

☒ design and build mobile test cart and demonstrate in testbed environment

☐ mount and test on a pickup truck

☐ design, build and test a vehicle-mounted prototype

☐ design, build and test a pre-commercial system

TITLE NEETRAC Applications Research

POET 27514430 **TASK** 0001
POET 27917814 **TASK** 0001

OBJECTIVE

Continue collaboration in the National Electric Energy Testing, Research & Applications Center (NEETRAC), located within the School of Electrical and Computer Engineering at Georgia Tech, and thus help drive innovation, sustain technology transfer, participate in important standards development activities, and leverage R&D intellectual and financial resources via other utility and governmental contributions and collaboration.

BENEFITS

Research, Development and Demonstration to better drive innovation, improve safety, transition to Clean Energy, enhance customer experience, advance operational excellence, reduce risk, allocate resources more effectively, appropriately deploy new technologies, and increase operational capability and performance of our workers.

TECHNICAL STATUS

Research, Development and Demonstration to better drive innovation, improve safety, transition to Clean Energy, enhance customer experience, advance operational excellence, reduce risk, allocate resources more effectively, appropriately deploy new technologies, and increase operational capability and performance of our workers. Specific deliverables are yet to be determined, but in 2023 we received results of three completed baseline projectsOrganization of BL Projects completed

☒ Impact of Die Choice on Connectors – Phase 2 completed

☒ Field Diagnostics for Distribution Transformers – Scoping Study completed

Receiving interim findings of work in progress on nineteen projects under way, including:

- Among the Projects In Progress: [All In Progress]
- Benchmarking Utility Construction Quality Assurance Practices – In progress
- Evolution of Diagnostic Technologies Deployed for Power Cable Systems
- Scoping Study of Cable Minimum Bending Radius - Performance and Flexibility
- Evolution of Utility Microgrid Experience
- Impact of Neutral Corrosion on Service Reliability of Jacketed Cable Systems - Phase II
- Performance of MV Joints by Wet Accelerated Aging
- Correlation Between Distribution Transformer Aging Models and Condition Assessment Techniques
- Challenges Surrounding Energy Storage Systems (ESS) Inside Substations
- Flooding Impact on Single Phase Pad-Mount Transformers - Initial Study
- Corrosive Environments Best Practices Study
- Scoping Study on AI Usage in Electric Energy Delivery
- Continuing Evolution of Power Cable System Design

TITLE Prototype Development of Enhanced Duct Iron for Cable Installation

POET 27284243 **TASK** 0001

OBJECTIVE

The Current Duct Iron used has employees working close to moving parts of the cable truck. To reduce injuries, a team is evaluating the cable process looking to find a safer way for our employees to work. Whether there are new processes or tools, they are trying to explore different and improved avenues.

The objective is to improve the current cable pulling iron/sleeve. By increasing the size of the duct iron allows our employees to install the iron in the duct and exit the structure and be away from danger as well as any pinch points. Van Nest Shops will fabricate 100 prototype duct irons initially. We will field test four different size irons; for 4" ducts and 5" ducts as well as two different lengths for each duct.

BENEFITS

The benefit is creating a safer work place for our employees

TECHNICAL STATUS

☒ Project team meetings at Van Nest machine shop.

☒ Van Nest to fabricate four different size irons; for 4" ducts and 5" ducts as well as two different lengths for each duct; 100 new units.

☒ X Trial the fabricated duct iron daily and use the feedback to gauge how well this will work.

☒ X Upon getting the feedback from the users we can determine if this new style duct iron will work as intended. Project is complete.

TITLE Instrument development with FOD

POET 26683658 **TASK** 0001

OBJECTIVE

The Field Operating Department (FOD) is a highly specialized department within Electric Operations that locates distribution feeder faults. Another task they are responsible for is cable phase identification. The operation is done by injecting a tracing current onto the phases and positive identification is done by detecting the current at the cable. At present, the instrumentation of choice is a high-quality galvanometer made by Yokogawa. The galvanometer is extremely versatile and sensitive to very small signals. Unfortunately, high quality galvanometers are no longer manufactured or soon to be phased out as industry continues to digitize. In the interim, we are looking for a solution to help supply immediate needs, but a longer-term solution is to identify novel ways to replace its functionality and add additional capabilities to help operators optimize fault finding.

The objective of this project is to:

1. Replace the currently obsolete galvanometer and
2. Develop or evaluate alternative technologies that replace its function and add capability to the instrument.

BENEFITS

The project's benefits will result in immediate impact by addressing the current challenges associated with sourcing the obsolete instrument. Additionally, in the longer term, we anticipate substantial benefits from creating a new instrument that can more effectively adapt to technological changes.

TECHNICAL STATUS

Solutions will be lab tested as well as in the field to ensure full function replacement is obtained. Two main deliverables include (1) A functional replacement of the galvanometer; and (2) Identify new methods and instruments

Tasks (checked boxes are completed):

☒ Identify requirements of galvanometer

☐ Identify evaluation strategies

☐ Design and build functional replacement galvanometer

☒ Identify and design novel solutions and instrumentation for galvanometer

☐ Evaluation of novel solutions

☐ Final report out and next steps

TITLE Voice to Text Trouble Ticket Documentation Proof of Concept

POET 27036773 **TASK** 0001

OBJECTIVE

In STAR, the trouble ticket commonly called B-ticket contains valuable information from the field that is entered using free form text. Much of that information is communicated directly from the field using phone calls. In rare instances, miscommunications from either party can result in incorrect information documented as user remarks, delay in troubleshooting, inefficiencies in the control center, and increased difficulty in processing the information due to unstructured data.

The objective of this proof-of-concept project is to demonstrate the feasibility of emergency crews or first responder crews using a voice enabled interface to update trouble ticket remarks potentially augmenting the current state of the emergency crew calling the Operating General Supervisor (OGS) in their respective Control Center (CC) to update the trouble tickets with remarks manually.

In this PoC, we plan on training a voice enabled system that would be capable of:

- Learning the vernacular of Electric Operations (trained voice model),
- Setup to capture all necessary data fields associated with the respective use cases,
- Update or add user remarks and populate structured data in a database

In addition, the project will investigate the efforts required to integrate with B-ticket in the STAR system

BENEFITS

The qualitative benefits would be to improve the quantity and quality of the data collected by the emergency crew, reduce the number of calls needed to the Operating General Supervisor in the Control Center, freeing them to focus on higher priority tasks, and allows for structured data to be captured to enable efficiencies in reporting and engineering data analysis.

TECHNICAL STATUS

Accuracy and success rate of voice to text are key metrics indicating performance. The concept and technology was tested in the field alongside the companies normal operations.

We also intend to conduct ticket calls with a number of callers testing the system's accuracy.

Tasks (checked boxes are completed):

☒ Document fields and information captured on B-ticket with end-to-end process map
☒ Dictionary of relevant Con Ed terms and nomenclature
☒ Process deployment and Software platform access
☒ Training and user testing
☒ System Integration requirement discovery

TITLE Identification of Failure Signatures for Select Medium Voltage Distribution Assets

POET 27045196 **TASK** 0001

OBJECTIVE

Con Edison operates the largest underground network system in the country. By design, these networks provide highly reliable service to customers, as they generally continue to reliably deliver electricity to customers after the failure of one or more distribution network assets. However, when network assets do fail, the Company must identify the point of failure and rapidly make the necessary repairs, which increases in importance with electrification The Company's goal is to return a failed feeder to service within 14.5 hours, with the "clock" starting from the moment an asset fails and a feeder circuit locks out. The immediate challenge is to determine which asset failed and, once that is established, what steps need to be taken to safely isolate the asset, make the necessary repairs, and return the impacted feeder to service. All of this work is governed by very detailed operating procedures established by the company.

The project will build failure signatures of three of the following asset types: ESNA terminators, mechanical joints and 3 way-1 way splices. This project seeks to use existing power quality meter data (sampling rates of 128 data bits per cycle or greater), i.e., waveforms from the time just before, during, and immediately following the asset failure, to provide system operators with a high degree of certainty as to the type of asset that has failed. Because this data is available in near real time, system operators could use high-confidence asset failure signature analysis to determine the type of asset that failed and use that information to guide the troubleshooting and repair efforts from the event's outset. This failure signature analysis offers the potential to enable the Company to update its work procedures such that locating and repairing to specific types of failures could be performed quicker.

BENEFITS

Defining and developing the ability to identify the failure signatures of specific assets will improve the reliability and resiliency of Con Edison's medium voltage distribution network. The objective is to define a high probability asset failure signature for each of these three asset types (ESNA terminators, mechanical joints and 3 way-1 way splices), so that this information can be used in real time by the company's system operators to shorten the repair process for future failures.

TECHNICAL STATUS

The report has been issued, summarizing findings of the asset failure signature analysis for ESNA terminators, mechanical joints and 3 way- 1 way splices including precision and recall for the algorithm as well as confidence level under various operating scenarios (e.g loading, road salt present, etc).

Tasks (checked boxes are completed):

- ☒ Label failure waveforms and associated assets
- ☒ Delivery and ingestion of waveforms onto learning model
- ☒ In-person SME discussion of asset failure waveforms and potential noise
- ☒ Preliminary findings and model calibration
- ☒ Final report issued and subsequent discussions taken place

TITLE Renewable Meter Adapter Solutions

POET 27257720 **TASK** 0001

OBJECTIVE

Meter Collar adapters provide homes with a universal, discrete interface for power from PV systems, battery and EV at a lower cost than conventional methods. As our customers seek to embrace and engage in a clean energy future, there is a need for a cost effective and technically efficient device to support our customers' clean energy solutions. These solutions may include electric vehicles, solar, and/or energy storage systems, like batteries. The customer's distribution panel, where these solutions would connect, can be located away from the equipment, not have sufficient circuit space, and/or require wall and ceiling demolition and construction. One solution, a meter adapter, may avoid these limitations by creating a load side tap from the incoming service at the meter pan. Significantly, the meter adapter is not a concept, but a commercially available solution. The main limitation of the current adapters is that they only accommodate one distributed energy resource (DER) such as photovotaic or gas powered electric generators.

The objective of this project is to test a number of market options available to assess feasibility of supporting customer interconnection solutions. The proposed modification would not be of the meter adapter, but rather the downstream panel or disconnect. The single circuit panel or disconnect would be changed to a multi-circuit panel or disconnect which could accommodate all the customers solutions. At this time, it is unknown if there are any electrical Power Quality (PQ) issues, operational challenges, and/or safety issues associated with using the multi-circuit panel or disconnect. A pilot will replicate the customers clean energy solutions in a controlled environment.

BENEFITS

The Company will benefit by providing a cost effective interconnection solution for customers to avoid expensive electrical upgrades.

TECHNICAL STATUS

A thorough search has been conducted to identify solutions in the market place. Options that fit the project's need were not available. As a result a custom solution is being designed and built. The project will use the combination of cost, effectiveness and ease of installation as metrics to gauge success. Plans to implement will be dependent on the results.

The expected deliverables of the project are 1) Evaluation setup and technical review, 2) identify code and PQ compatible configurations for combination of customer DER solutions downstream of disconnect, and 3) Technical review of meter adapter(s) options

Tasks (checked boxes are completed):

☒ Identify demonstration site and requirements

☒ Identify solution providers and secure test hardware

- ☒ Identify solution(s) and options
- ☐ Procure demonstration hardware
- ☒ Evaluation plan development with SMEs
- ☐ Co-development with solution providers of custom solutions
- ☐ Installation and evaluation

TITLE Splicing Machine for Underground Power Cables-ARPA-E collaboration

POET 27789956 **TASK** 0001

OBJECTIVE

For the past century, power cables have been spliced manually. The leading cause of medium voltage cable failures are the splices due to operator workmanship when performing the splice. These cables are often stored in cable vaults underground in major cities. These cable vaults can be dangerous and present many challenges to the operators when splicing the cable. The challenges can include space, lighting, hazardous gases, and other energized power cables.

This project is to create an error-free splicing machine for medium voltage (5-46kV) power cables. This machine will splice the cable using an automated, hands-free, error-free approach for a faster and more reliable cable splice. The splice machine will also limit the time a worker has to be in the manhole increasing worker safety. The technical approach will be to combine technologies to complete every aspect of the cable splice. This machine will also be required to document every step of the splice process making it possible for human or machine learning enabled artificial intelligence (AI) to review.

BENEFITS

Benefits will include improved safety resulting from reduced worker time in underground electrical enclosed spaces and enhanced reliability resulting from consistent quality of machine-made splices.

TECHNICAL STATUS

During development the machine will be broken up into several subsystems. The subsystems will include the unit operations, safety, vision, power, control, environmental, and a mounting structure. These sub-systems will first be individually tested and then brought together to form one machine. There are six core processes in the splicing operation. Identified as cutting and layer preparation, abrading cable layers, neutral wire handling, taping layers for protection, cleaning cable surfaces, and completing the splice. For each core process, different technologies will be evaluated. The chosen technologies will then be combined into one automated machine that can fit in a manhole to perform the work. This machine would improve the reliability of the underground MV network power grid by improving the process from a manual one to an automated process which will enhance human safety.

Tasks (checked boxes are completed):

☒ Requirements document

☒ Subsystem concept plan

☐ Lab prototype

☐ Field prototype

☐ Manufacture ready design and protype

TITLE Substation Inspection Robot Development

POET 25258659 **TASK** 0001

OBJECTIVE

This research project will investigate the suitability of Unmanned Ground Vehicles (UGVs) to perform some inspection and monitoring tasks of indoor electric distribution substations. UGV present the potential to perform a variety of critical inspection tasks on demand, allowing for more frequent inspections, more comprehensive and persistent searching for anomalies, and a telepresence solution that allows engineers and technicians to view and process valuable data remotely without the need to be on site at a specific substation. The plan is to develop and test a prototype indoor substation inspection robot that is equipped with the appropriate technology and sensors to operate autonomously in the substation and automatically transmit inspection data to a server.

BENEFITS

This research project will investigate the suitability of Unmanned Ground Vehicles (UGVs) to perform some inspection and monitoring tasks of indoor electric distribution substations. UGV present the potential to perform a variety of critical inspection tasks on demand, allowing for more frequent inspections, more comprehensive and persistent searching for anomalies, and a telepresence solution that allows engineers and technicians to view and process valuable data remotely without the need to be on site at a specific substation. The plan is to develop and test a prototype indoor substation inspection robot that is equipped with the appropriate technology and sensors to operate autonomously in the substation and automatically transmit inspection data to a server.

TECHNICAL STATUS

Project was kicked off in August of 2021, in collaboration with Stevens Institute of Technology. Stevens team conducted a review of existing technology in the field and commenced design of robot's hardware and software. Next steps – completion of design and development of algorithms for robot functionality as an inspection robot and demonstration of its capabilities in substation. Next steps are to develop analytics for collected inspection data.

Tasks (checked boxes are completed):

☒ Design and develop robot hardware & software for indoor inspection.
☐ Develop analytics software and dashboard or integrate with other software.

TITLE Evaluation of Substation Robotic Analytical Tools

POET 26559746 **TASK** 0001

OBJECTIVE

This project's objective is to research and evaluate commercially available analytical platforms that could be deployed on any mobile autonomous robotic solutions. The analytical software packages will be evaluated by integrating them onto mobile robotic solution deployed 24/7 in the EPRI 138 kV research substation in Lenox MA to collect data and then evaluating the data collected. The evaluation will be performed by introducing different asset degradation modes in the 138 kV research substation.

BENEFITS

This project's objective is to research and evaluate commercially available analytical platforms that could be deployed on any mobile autonomous robotic solutions. The analytical software packages will be evaluated by integrating them onto mobile robotic solution deployed 24/7 in the EPRI 138 kV research substation in Lenox MA to collect data and then evaluating the data collected. The evaluation will be performed by introducing different asset degradation modes in the 138 kV research substation.

TECHNICAL STATUS

Tasks (checked boxes are completed):

☒ Development of specification guideline for software solutions

☒ Contract signed Q3/2022

☒ Kick-off meeting February 2023

☒ Testing commenced December 2023

☒ Testing will be completed December 2024

TITLE Duresca Busbar Thermal Testing

POET 26565083 **TASK** 0001

OBJECTIVE

The objective of this project is to test the Duresca busbar by an independent certified lab to confirm its ability to withstand 63 kA for 1 sec as required by CENG specs and IEEE Standards. Con Edison engineers may witness the test.

The Duresca insulated busbar for 138 kV applications can benefit the Company by its use in substation upgrade projects because its smaller than traditional busbars. Installing a smaller size busbar will emiminate the need for additional structures normally required to provide adequate isolation. However, the busbars' thermal rating under short circuit current has not been tested to Con Edison specifications and IEEE Standards.

BENEFITS

Results of this research will allow the use of DURESCA busbar for future substation projects, with potential savings by reducing amount of civil work though no specific project plans are completed to estimate savings.

TECHNICAL STATUS

Tasks (checked boxes are completed):

☒ Test report provided by certified independent lab.

TITLE Robotic Inspection and Patrol for Substations

POET 26584592 **TASK** 0001

OBJECTIVE

Quality and frequency of technical inspections of substation equipment and security surveys can be improved by using robots. They may be used for routine inspections, as well as on as-needed basis, while substation operators are performing other tasks, requiring their full attention, such as switching, testing, processing feeders etc. Use of robots in substations is in its nascent stage and requires experimental work to adapt robot features for performance of tasks at hand, as well as development of substation personnel skills in operating robots.

The project objective is a demonstration of robotic device use for substation technical inspection, and security patrol tasks. A robotic platform was chosed based on the results of the testing conducted by EPRI in 2021-22. EPRI performed testing on four robotic platforms in their research substation facility. The project will include training for substation personnell along with 1 year of technical support by the robot manifacturer.

BENEFITS

Use of robotics will allow for more frequent routine and on-demand inspections and patrolling of substations, while substation operators and mechanics are performing other tasks. Automating the inspection process will improve systematic documentation and analysis of equipment condition.

TECHNICAL STATUS

The robotic device with visual and infrared inspection capabilities, will autonomously navigation the outdoor substation facility, and perform pre-programmed inspection tasks selected by substation operations personnel.

On-time and on-budget completion of pilot project with continuous use of robot for technical and security inspections will constitute success.

Tasks (checked boxes are completed):

☒ Pilot project started in December 2023

☒ Testing will be completed 4Q24

TITLE Lab Assessments of Handling Practices and Chemical Analysis of SF6 Alternatives (EPRI)

POET 27548837 **TASK** 0001

OBJECTIVE

This research project has the objective of evaluating the handling, operation, maintenance, and disposal of alternatives to SF6 gas by conducting tests and analysis on products such as g3 and EconiQ. This project utilizes the EPRI laboratory facilities to provide a safe yet realistic substation environment ito test these gases.

Emerging SF6 replacement gases are more complex to handle, maintain, analyze and dispose. As utilities consider adopting these new gases it is helpful to be able to research, learn and demonstrate these new procedures in a safe research environment. While Sulfur hexafluoride (SF6) has been used for decades in circuit breakers, gas insulated substations and lines, and other equipment, a drawback for SF6 is it has a very high global warming potential (GWP). New York State have implemented regulations to control the use of SF6 above certain thresholds. Manufactured gas alternatives such as g3 and EconiQ are available, but the Company has no experience on how to effectively perform operation and maintenance tasks with these new gases.

BENEFITS

The projects benefit is qualitative in nature. Safety and reliability are critical during any implementation of new technologies and this research provides a means of continual improvement. The use of alternatives to SF6 gas reduces greenhouse gas emissions.

TECHNICAL STATUS

The research is in progress.

Tasks (checked boxes are completed):

☒ Final report summarizing the research results 4Q24.

TITLE Applications Research Program - CEATI – 2024

POET 27777038 **TASK** 0001

OBJECTIVE

Objective of this program is to improve current practices, knowledge and technology used in power transmission and distribution. Con Edison engineers participate in 15 interest groups and task forces in CEATI that cover many aspects of distribution, transmission and substations equipment design, asset management, health and safety, as well as system operation and planning. On each project there are assigned 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.

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 Smart Grid, Reforming the Energy Vision (REV) and Low-Carbon Resources Initiative (LCRI). 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.

BENEFITS

Engaging with these CEATI projects will allow Con Edison organizations to increase leverage of expenditures and improve technology transfer; it 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

The portfolio for 2024 includes participation in 16 programs selected by Con Edison project advisors, and while deliverables will vary, projects will provide final report, webcasts, presentations and industry events such as conferences and meetings, with complimentary registrations for participants, as well as other project-specific deliverables.

TITLE Testing of SF6 Free Circuit Breakers

POET 27881686 **TASK** 0001

OBJECTIVE

The objective of this project is to purchase, install, and test the performance and reliability of three 138vK SF6 free substation breakers. The testing of each breaker includes gas degradation, lightning impulses, hot and cold temperatures, and full life of mechanism operation.

BENEFITS

Results of this research will help in understanding equipment maintenance, operation, and gas handling of SF6 free alternate equipment.

Completion of project deliverables and a final technical report that documents all the findings will serve as project success metrics. If testing demonstrates the SF6 free equipment meets Central Engineering performance standards, the project will be deemed successful, and the project results will be used by Central Engineering to specify the use of SF6 free circuit breakers.

TECHNICAL STATUS

Tasks (checked boxes are completed):

☒ Final report summarizing the research results 4Q24.

TITLE Applications Research Program - CEATI – 2025

POET 27919315 **TASK** 0001

OBJECTIVE

The CEATI program seeks opportunities to improve current practices, knowledge and technology used in power transmission and distribution. CEATI's efforts are driven by over 100 participating organizations, including electric & gas utilities, governmental agencies and research bodies, with 8 focused interest groups and specialized taskforces funded in 2025. CEATI participants have diversity that contributes to the strength of its programs and brings value to all participants via financial leverage and intellectual synergies. CEATI works to continue development of tools and technologies to better deliver electricity, as well as to more intelligently use information to diagnose the health of components, and predict and prevent failures. The CEATI model for member-driven collaboration facilitates quick mobilization of new projects and also helps to enhance commercialization by meeting needs of a broader utility base.

In the program, Con Edison engineers will participate in the 8 interest groups and task forces 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 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.

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 also challenged to operate cost-effectively by seeking and deploying new technologies while we also seek opportunities to enhance the capability of our workforce as these changes are taking place.

BENEFITS

Engaging with 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 proposed projects 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

The program planned for 2025 comprises 8 projects selected by Con Edison project advisors, and while deliverables will vary, projects will deliver final reports, webcasts, presentations and industry events. The list of programs are Overhead Transmission Equipment, Station Equipment, Grounding and Lightning, Power System Planning and Operations, Health and Safety, Advanced Distribution Operations, Protection and Control, and Infrastructure Protection and Security.

TITLE Sharc Piranha Wastewater Heat Pump NYC Building Retrofit Feasibility Study

POET 26581105 **TASK** 0001

OBJECTIVE

The objective of this project is to perform a Proof-of-Concept Study to install the PIRANHA heat pump made by SHARC Energy (SHARC), as a Wastewater Energy Recovery System at a Con Edison customer location. PIRANHA, the first of its kind in the HVAC heat pump market, extracts thermal energy from a building's wastewater stream before it exits the building to pre-heat domestic hot water that can provide for both heating and cooling needs. The selected demonstration site, to be installed by a third-party installation contractor, Bound Construction, is: The Kimberly Hotel, Manhattan, New York. This project will demonstrate Proof of Concept for PIRANHA heat pump to support full-scale market adoption in New York and its effectiveness to scale up as a customer end-use efficiency measure.

BENEFITS

Piranha heat pumps can offset up to 100% energy usage and associated carbon emissions, otherwise used for domestic hot water. The technology has a high expected useful life estimated at 25 years, lower expected maintenance due to fewer rotating parts, and societal and climate benefits of thermal ocean pollution reduction. PIRANHA offers significant energy savings because of the high Coefficient of Performance (COP) of 3.5 and above, independent from the outdoor air temperature, resulting in high performance during the cold winter months, compared to traditional air source heat pump. The unit also can offer grid flexibility benefits by performing peak load shifting using hot water storage.

TECHNICAL STATUS

The selected contractor acted as a liaison between the customer, Con Edison, and the equipment provider (SHARC) to facilitate necessary site assessments in planning for the retrofit of the wastewater heat pump system; heat pump PIRANHA unit, wastewater holding tank, domestic hot water storage tank(s), piping and auxiliary pump system. Unit was too large in size for the installation to proceed with economically feasible logistical installation options.

Tasks (checked boxes are completed):

☒ Drawing for each viable unit size and space layout configuration were issued

☒ Conceptual architectural, electrical and plumbing plans issued

☒ 30% design drawing for selected option issued

☒ Final report with recommended scope of work and turnkey project cost is issued

TITLE Building Energy Smart Technologies (BEST) Center 3-Year Membership (years 2023 to 2025)

POET 27611656 **TASK** 0001

OBJECTIVE

The objective is to fund a membership of Building Energy Smart Technologies (BEST) Center, that will position the Company to potentially advance state-of-art technologies and tools for environmentally sustainable buildings and cities. BEST Center develops tools and technologies to improve the building's energy efficiency and supports intelligent integration of buildings with the distribution grid by leveraging advances in storage, sensors and machine learning technologies.

BEST was formed in 2021 and started operation in 2022 under a model that's member-driven academia-industry-government collaboration. The program's administration and operation expenses are covered by the National Science Foundation (NSF), an independent federal agency that supports fundamental research and education in science and engineering. BEST partners with City College of New York (CCNY) and University of Colorado at Boulder (CUB) and focuses on four key research areas: 1) Smart Building Materials and Systems, 2) Smart Building Energy Systems, 3) Integrated Energy Generation Systems and 4) Smart Cities Building Energy Smart Technologies Center.

BENEFITS

Con Edison has a two-seat (previoulsy vice-chair and currently chair) representation on the Industry Advisory Board (IAB) of the BEST Center. IAB members collectively determine research topics in annual funding cycle, funded with the membership fee, and have an option to become project advisors. The Company has the ability to steer the Center's research to align with Company goals.

TECHNICAL STATUS

Each annual cycle BEST Center funds between 6 to 8 projects that provide value to the Company. While individual projects may have project-specific deliverables, at a minimum each project will provide a final report, webcasts and presentation. Furthermore, industry events such as conferences and meetings, with complimentary registrations for participants, will be offered.

TITLE Evaluation of Field Lead Testing Kits or Devices

POET 27039852 **TASK** 0001

OBJECTIVE

The underground electric distribution system used lead soldering to join conductors. Lead is deemed a hazardous material and, as such, the dirt and debris in the structures is treated as lead contaminated waste when the structure is cleaned to facilitate work in the structure. The assumed contaminated waste is either treated with a solidifier or taken away as hazardous waste whereas no in situ testing is performed.

The objective of the project is to evaluate commercially available lead test kits or devices to detect for lead down to a level of 5 parts per million (ppm) (hazardous waste classification). The plan is to perform bench and field tests of the lead test kits or devices and compare results against a lab analysis or a known reference standard.

BENEFITS

The qualitative benefit is having a field test available to assess in-situ for lead level in structures. In-situ testing may reduce O&M lead waste disposal costs.

TECHNICAL STATUS

The evaluation will be deemed successful if a product can meet the 5 ppm specification detection threshold, is reproducible, and accurate. The research may also be considered successful, in the absence of meeting specifications, if a practicable technology adaption is identified. If the technology provides reliable measurements, the implementation plan is to obtain EH&S approval to allow field testing of utility structure waste streams to evaluate the need to dispose of all waste streams as hazardous material. Project work is ongoing.

Tasks (checked boxes are completed):

☒ Initiate field evaluation

☒ Evaluation of testing kits or devices

☐ Review of statistical analysis results

☐ Recommendations

TITLE Evaluation of Utility Locating Devices for Locating Electrical Faults

POET 27209710 **TASK** 0001

OBJECTIVE

When an underground direct buried electric distribution asset faults, repair necessitates the need to locate the fault in order to excavate to facilitate a repair. The need to excavate also requires the mark out of the buried energy infrastructure. Before a survey crew performs the mark out, an approximate location of the damage has to be found. Locating the exact point of an electrical fault so as to minimize the area to be marked out as well as minimize excavations to repair the fault is a technical challenge.

The project's objective is to evaluate devices for use as locating technology for precise location of electrical faults. The plan is to identify locating device(s) that focus on underground electrical assets and field evaluate them for performance of locating faults and assets.

BENEFITS

Locating technology that can precisely locate electrical faults will improve the process by reducing the time it takes to repair a fault.

TECHNICAL STATUS

The deliverables from this pilot will be to identify what device(s) may provide the Company with a solution that most accurately locates underground electrical faults. The data obtained from the pilot program will be summarized in a project report.

Success will be determined by reviewing the accuracy of the fault location mark outs by the locating device(s) and comparing to the actual fault location. The implementation plan would be to then recommend the device(s) to Electric Operations for consideration as a replacement option.

Tasks (checked boxes are completed):

- ☒ Select devices
- ☒ Deploy for field evaluation
- ☒ Gather feedback from participating field crews/users
- ☒ Review feedback
- ☒ Make recommendation
- ☒ Project complete

TITLE ICS Data Acquisition using Forensic Techniques – Phase 1

POET 21702861 **TASK** 0001

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 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

BENEFITS

The result of this project will be a guideline for incident handling and response to specific critical BES Cyber Assets within the CECONY substations. If there is a cyber-investigation involving cyber assets that are in scope 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

Tasks (checked boxes are completed):

☒ Build tools sets for data extractions.

☒ Create Chip-off solutions for ICS devices

☒ Develop knowledge on ICS device operations

☒ Project Closeout

TITLE Manhole Monitoring System Phase 2 Analytics

POET 24509152 **TASK** 0001

OBJECTIVE

The Pilot was designed to evaluate a new business innovative process, where a vendor can provide a turnkey project to manage a risk associated with our underground structures. The main objectives of the pilot were:

- Determine the all-in cost to install and operate a sensor unit
- Develop an algorithm for early warning notification of structure risk profile
- Test and evaluate Con Edison response to integrate workflow with third-party vendor
- Establish benchmarks for program roll-out
- Evaluate the performance of the new structure observation system sensors

BENEFITS

The vendor will develop a high-level architecture for data analytics of the Structure Observation System sensors data and other relevant data sets available at Con Edison, such as AMI data sets, asset data, weather data and maintenance and other relevant data. This architecture will serve as the blueprint for larger operational engagement that will move Con Edison from Alarm based dispatch to predictive dispatches and move away from scheduled monitoring and inspection of manholes to a condition-based Inspection. This turnkey exploratory project can also provide a model for transferring risk associated with the deployment of new and emerging technologies to a third party.

TECHNICAL STATUS

Tasks (checked boxes are completed):

☒ Algorithm developed for early warning notification

☒ More than 4,000 units monitored during the pilot

☒ During the pilot, approximately 13,000 alarms were received, 110 field inspections were dispatched, 9 were escalated to Con Edison for remediation with 1 confirmation of true positive

☒ Algorithm developed did not produce early warning accuracy desired

☒ Final report delivered in 2022

TITLE ICS Data Acquisition using Forensic Techniques - Phase II

POET 25583813 **TASK** 0001

OBJECTIVE

This project is Phase II of the "ICS Data Acquisition using Forensic Techniques" project to continue 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 involves the O&R and the CECONY Substation departments identifying the Bulk Electric System (BES) Cyber Assets within their respective facilities.

Given this list of BES Cyber Assets, the Cyber Action Team will procure 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 data collection without restarting or shutting down the asset.
- If a live collection is possible, then determine 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

BENEFITS

This project will develop 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 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

Tasks (checked boxes are completed):

☒ Build tools sets for data extractions.

☒ Create Chip-off solutions for ICS devices

☒ Develop knowledge on ICS device operations

TITLE Streetlight with Neutral to Earth Voltage (NEV) Monitoring and Verification

POET 27036772 **TASK** 0001

OBJECTIVE

The purpose of this project is to evaluate whether streetlights with NEVs under 5V and not mitigated would evolve over time and become a safety concern. DE-SPEAR group is seeking to monitor voltages on streetlights with NEVs over time to determine whether the voltages will stay below 5V and not considered a safety risk. The data collection will involve sending contractors to select locations to measure the voltage, as well as installation of continuous voltage monitoring at select locations. Once the data is analyzed, a determination can be made whether streetlights with a neutral to earth voltage can be left in place without mitigation.

Streetlights in New York City account for 5% of all existing electric shocks and 19% of detected energized objects (ENE) in 2020 and 2021. Of the detected energized objects approximately 50% were below 5V and not considered a safety risk. However, currently the regulatory requirement is mitigation below 1V. We currently troubleshoot for stray and contact voltage on streetlights and make repairs per EO-10322 and EO-10360. Most often, a 5V or below contact voltage on a street light is due to the presence of neutral to earth voltages (NEVs) and the neutral bonded to the streetlight body. The current method to mitigate to below 1V resulting from NEVs is by unbonding the neutral from the K2-Stud on the streetlight body. Experiments performed at EPRI have demonstrated that this action inadvertently results in preventing the current limiting fuse in the streetlight circuit from blowing in case of a direct 120V phase to streetlight body short circuit. Fuse operation will depend on the ground impedance during the fault. This potential voltage that is presented on the streetlight body in such a fault could be a shock hazard. Therefore, the current practice of mitigating a NEV may potentially create a more dangerous situation for the public.

BENEFITS

The evaluations and demonstrations in this project will allow more informed quantification of operational impacts, practical feasibility and operational advantages which then can be used as inputs to planning operational deployment.

TECHNICAL STATUS

A summary report of findings from the monitoring and testing and recommended practice with regard to neutral bonding on the streetlights will be delivered.

Tasks (checked boxes are completed):

☒ Update specification EO-10322 to Rev 5 to include streetlight bonding

☒ Perform site monitoring on select site to check for voltage fluctuations and issue report

☒ Perform some random site verification that procedure EO-10322 Rev 5is being followed

TITLE Underground Low Voltage Cable Detection and Tracing

POET 27360010 **TASK** 0001

OBJECTIVE

In this project, we will be developing and evaluating a new THD (Total Hormonic Distortion) PQ tester for troubleshooters working on energized equipment/objects (ENE) detection and mitigation. The current specification for Contact and Stray Voltage testing of Distribution Structures and Street Lights requires recording harmonic content data of an ENE. However, the current meter has been discontinued and was previously a costly tool. Its replacement is even costlier and primarily designed for lab environments, with a wide, fragile LED screen and a low IP rating, making it unsuitable for harsh field conditions and use inside our structures.

Currently, there is no alternative product on the market that can detect harmonic content as low as 1V, is rugged, and can function as a multimeter tool capable of detecting AC voltage up to 600V and current up to 2000A simultaneously. Additionally, we require a harmonic tester that can detect THD with respect to the fundamental frequency and harmonic orders up to the 25th harmonic.

We aim to evaluate new technology solutions that can assist our ENE troubleshooting field crews in accurately detecting THD and the 3rd harmonic using a rugged handheld device that also functions as a multimeter with a clamp-on amp probe for detecting AC current.

BENEFITS

This new tester is a compact and rugged PQ tester with an IP54 rating, ensuring protection against water and dust in field conditions. It can detect harmonic content ranging from 1V to 600V, as well as AC/DC voltage, frequency (Hz), and current up to 2000A using a clamp-on current probe. This eliminates the need for an additional multimeter in the field. Moreover, it is available at a very competitive price as compare to current and replacement product recommended to us by manufactures.

TECHNICAL STATUS

In this project, we will be procuring new devices for the purpose of detecting harmonic contents as low as 1V and up to 600V. Meanwhile it can also be used as a multimeter equipment, eliminating the need for another voltage, frequency, and current detector. These devices will be provided to our field crews for trials. An assessment of the devices will be completed at the end of the project.

Tasks (checked boxes are completed):

☒ Develop a new hormonic tester

☒ Procure Prototype devices

☐ Test at our Lab

☐ Field Trials Prototypes

☐ Devices Assessment

TITLE EPRI Supplemental Project - Restrained Manhole Cover and Frame Performance Tests

POET 27381817 **TASK** 0001

OBJECTIVE

In this project, we will work with EPRI to test new restrained frame and cover designs at multiple energy levels. The data would then be used to develop a series of heat maps to predict the potential heat and pressures at set distances during different energy level events. This would improve our understanding of the impact of event magnitude on the risks that could occur in the vicinity of a structure experiencing a high energy event.

In addition, this project intends to explore the impact of high-energy events on the ground level infrastructure to provide information on the potential for flying debris and displacement during an event. Such information would aid in understanding the potential for collateral damage to nearby personnel and property.

BENEFITS

Since 2014, 281 manhole explosions have taken place resulting in airborne manhole covers. Having latched type ventilated covers could potentially prevent covers from being airborne while releasing explosive gas buildups, thus safeguarding persons and properties. The testing that will be performed on this project will assist with verifying whether the latched covers and frame we are installing will perform as expected. (i.e. survive a simulated manhole event with the forces we have observed in the field).

TECHNICAL STATUS

A final report of the test will be provided. It includes detailed discussions of:

☒ Test area description / setup

☒ Test protocol

☒ Gas mixture development and associated tests

☒ Test sample descriptions

☒ Summary of simulated event tests

☒ Relevant inspection data from the testing (photos and descriptions)

☐ Heat map

☐ Wind speed map

☐ Critical learnings from the project

TITLE PRECISE Smart Inverter Modeling Analysis Software Tool Evaluation Pilot via NREL

POET 26584707 **TASK** 0001

OBJECTIVE

The key outcome expected from this collaboration is to introduce the PRE-configuring and Controlling Inverter SEt- points (PRECISE) software grid modeling tool to a selected team at Con Edison for evaluation purposes and future integration into grid planning process. PRECISE enables evaluation and settings production for advanced inverters to streamline interconnection assessment Con Edison already has a home-grown tool Poly-Voltage-Load Flow (PVL) used for distribution planning and analyses, and this project will evaluate its capabilities and future integration with PRECISE. Additionally, this effort will look into challenges and opportunities from enabling advanced inverters at scale.

Advanced smart inverters for photovoltaic (PV) systems have the potential to increase the amount of renewable generation that can be safely and reliably hosted on the grid, which can help reduce emissions and improve the flexibility of the distribution system. Various functions available to smart inverters can help accomplish these goals, but the increased complexity caused by settings choice poses a considerable barrier. Modeling the time-varying nature of ideal settings and the potential for generation curtailment pose additional obstacles to utilities trying to implement smart inverters.

BENEFITS

Modeling of smart inverters and determining their optimal setting parameters within an electric distribution systems is an emergent need due to increased adoption of customer-owned DERs. There are several circuits where adding new DERs would be cost prohibitive, specifically in areas where DER penetration has progressed more quickly (i.e., Staten Island and Westchester), because circuits are at calculated hosting capacity limits. Identifying better tools/software for both planning/setting and operating smart inverters could unlock some of this capacity, allowing more customers to interconnect in these areas. With the increase in DER resources, the distribution grid needs to effectively model an increasingly variable power supply profile, which adds complexity to safety, grid stability, asset condition, reliability, and resilience.

TECHNICAL STATUS

- ☒ Task 1: Con Edison to provide NREL demonstration of PVL and the use-cases currently used
- ☒ Task 2: NREL to provide demonstration/workshops on PRECISE
- ☒ Task 3: NREL and Con Edison to identify how PRECISE contributes into roadmap for advanced inverters integration for the next 3 years, also will investigate integration of PRECISE and PVL
- ☒ Task 4: Develop data ingestion module based upon PVLs input format
- ☒ Task 5: Develop Con Edison use-cases for PRECISE
- ☐ Task 6: Demonstrate PRECISE on Con Edison’s data for identified use-cases

TITLE Voltage Regulating Distribution Transformer (VRDT) Pilot

POET 27050631 **TASK** 0001

OBJECTIVE

Distribution feeders are at times affected by low-voltage or high-voltage conditions causing the service voltage to exceed the acceptable tolerance limits of +/-5% of the nominal service voltage as specified in ANSI C84.1 American National Standard for Electric Power Systems and Equipment — Voltage Ratings (60 Hertz) and Con Edison's specification EO-2065 (Low Tension A.C. Service Voltage Limits). The VRDT has the ability to resolve this problem by autonomous regulation of the secondary voltage to the preset bandwidth using an integrated On Load Tap changer (OLTC). Additionally, using VRDTs will reduce the need for dedicated voltage regulators reducing costs related to voltage regulator procurement and installation.

In this project, VRDTs are installed on feeders affected by high or low-voltage conditions. The VRDTs have SCADA and distribution transformer monitoring systems installed. Monitor VRDTs performance and collect data including output voltage, loading (current), phase angle, frequency, power factor, and temperature.

BENEFITS

The project benefits span several key areas of distribution operations. Through Conservative Voltage Optimization (CVO), area substation transformer voltage can be reduced by up to 3%, though some customers may experience low service voltage. Substation voltage control is managed with seasonal fixed taps. With the rise of electrification and increased EV charging, voltage drops are more frequent due to dynamic, larger, and sensitive loads. Cost savings are achieved by reducing the need for pole-mounted voltage regulators and capacitor banks, implementing automatic and SCADA-controlled tap changing, and decreasing the number of low-voltage customer complaints.

TECHNICAL STATUS

VRDTs are installed on feeders affected by high or low-voltage conditions. The VRDTs have SCADA and distribution transformer monitoring systems installed. Monitor VRDTs performance and collect data including output voltage, loading (current), phase angle, frequency, power factor, and temperature.

Tasks (checked boxes are completed):

- ☒ Procure 3 VRDTs equipped with On Load Tap Changer ECO-TAP VPD from vendor Reinhausen Manufacturing Inc.
- ☒ Collaborate with AMI Group and Regional Engineering to determine which feeders are most impacted by low or high-voltage conditions to trial the VRDTs.
- ☒ Install SCADA and distribution transformer monitoring system on the VRDTs.
- ☒ Install the VRDTs and monitor their performance over the course of several months.

TITLE Battery Energy Storage Digital Twin Model Development

POET 27105609 **TASK** 0001

OBJECTIVE

In this project, we proposed an alternative approach based on Digital Twin given the practical data constraints of the Ozone Park's Battery Energy Storage System (BESS). Digital twins are virtual models designed to accurately reflect a physical object—BESS in this case. The proposed digital twin is learning based; therefore, features of the systems (ac side measurements in this case) will be related to the output (estimated lifetime) via an adaptive training process of ANN. In addition, we hypothesize that information about BESS lifetime will be hidden in ac side measurements. We will explore uncovering this information through data manipulation. For instance, as the battery degrades, it's internal resistance will increase leading to a reduction of its dc voltage for the same current flow. This reduction in dc side voltage will cause the inverter to operate at a different (higher) modulation index, which will reflect on the ac side voltage and current measurements. This change in inverter operation cannot practically be captured by physics-based models, except perhaps by the manufacturer who has all details (beyond typical spec sheet data) to build such a detailed model.

The Ozone Park BESS has been successfully used for peak shaving since 2019 as part of the Brooklyn Queens Demand Management (BQDM) program. It has been operated via the Brooklyn Queens Control Center and as a result assisted with several heat related events. With the urge to scale up BESS projects to meet Con Edison and state's goals, stacking benefits by allowing multiple concurrent use cases is essential. Therefore, Ozone Park's BESS will be used as an asset for market participation while performing its initially-intended functionality of peak shaving. Stacking benefits, however, leads to increased charge/discharge cycles, which consequently affects lifetime, warranty, etc. It is therefore crucial to be able to estimate the expected remaining lifetime of the BESS in real time and determine optimal battery charge/discharge cycling that will maximize value while preserving BESS lifetime. Degradation of a BESS is exacerbated when cycling increases. Capacity and power fade results from a complex interplay between physical and chemical mechanisms, for example, degradation mechanisms include solid electrolyte growth and decomposition, binder decomposition, graphite exfoliation, or grain isolation. These mechanisms heavily depend on factors including duty cycles, depth of discharges, cut-off voltages, temperatures, load currents, etc.

The literature is rich with research papers that looked into estimating the lifetime of BESS. Various papers suggested development of high-fidelity physics-based models of battery cells to estimate their lifetime degradation. In addition, some testing methodologies were proposed to characterize degradation, including direct capacity testing characterization, high precision coulomb counting, electrochemical impedance spectroscopy pulse power tests, EVs, and incremental capacity (IC) technique. Despite demonstrating promising results, those proposed models and testing methods often have limited practical use in real grid-scale applications. Physics based models typically require clean high-resolution data, which may not be available (which is the case for Ozone Park's BESS).

BENEFITS

The Ozone Park BESS has some constraints that result in inefficiencies in operations. In addition, the BESS OEM is unwilling to manufacture the required modules for operation. Because of this, and the expected increase in degradation of the BESS due to increased cycling for grid and market operations, there are concerns that the BESS will not be able to survive the stipulated 10 years of operations. This study will enable us to predict and operate the system in a manner that can preserve system capacity and state of health.

TECHNICAL STATUS

Tasks (checked boxes are completed):

☒ Task 1: Data Curation and Literature survey: Complete literature review with references.

Note: This project has been cancelled due to shift in Energy Storage Order direction, as per guidance by the internal working group. Only Task 1 was completed. The project was subsequently terminated.

TITLE Enhanced Prototype Development of Electric Operations Cable Persuader Tool

POET 27219261 **TASK** 0001

OBJECTIVE

Across Electric Operations, the persuader is a critical tool used by multiple departments. This tool is used to “persuade” secondary cable back into its original shape if it has been mis-shaped to easily place into a connector. It is also used to combine two smaller cable sizes into a larger conductor. For instance, 2-4/0s can be combined to make one 500MCM piece. This is helpful in correcting neutral cables which may otherwise be frayed. However, the manufacturer discontinued production of this tool. The objective of this project is to create an improved version of the tool that will be versatile for different cable sizes in tight spaces. In addition, the new version should be manufactured and made available as a "Class & Stock" tool. This version tool will be developed and produced at Van Nest Shops and evaluated by different departments within Electric Operations. The plan is to test three set of varying sizes for different cable sizes and to gain feedback on the final design.

BENEFITS

By developing this tool, field splicers should reduce the risk of injury when properly using the tool for its intended task. In addition, the tool will peform the task in a much more efficient manner.

TECHNICAL STATUS

☒ Con Edison Van Nest shops to manufacture 24 sets (72 total units).

☒ Field evaluation period to review the tool’s performance and determine its success in field use.

TITLE Multi-Terminal AC-DC-AC Interconnection for Distributed Storage Phase-1 Study via EPRI

POET 27284200 **TASK** 0001

OBJECTIVE

There are issues in addressing dynamic power flow challenges that arise from rapid Distributed Energy Resources (DER) growth and the electrification of buildings and transportation. Traditional methods of handling load growth, such as reconductoring or adding additional lines, may not suffice. The unique challenge is to design and implement an AC-DC-AC intertie system with energy storage at the boundary of existing networks or area stations within Con Edison's distribution system. This novel system architecture and control design are not currently available.

The objective of this project, entitled "Multi-Terminal Interconnection for Distributed Storage," is to develop a concept for an AC-DC-AC interfaced energy storage system. The project is divided into three phases: Phase I (Concept), Phase II (Laboratory), and Phase III (Demo).

In Phase I, the focus is on defining the system's use cases, controller requirements, and system architecture. These design decisions will be verified through electromagnetic transient (EMT) analysis, and a control strategy will be finalized. Additionally, a request for proposals (RFP) for vendor support will be prepared and issued.

BENEFITS

Qualitative Benefits:

1. Increased DER Integration: The project can allow for greater integration of Distributed Energy Resources (DERs) like renewable energy sources and electric vehicle chargers. The quantification of DER integration benefits can be based on increased DER capacity and utilization.
2. Enhanced Grid Resiliency: Implementing the AC-DC-AC intertie system with energy storage can significantly enhance our grid resiliency. By improving the ability to share load between different area stations, the distribution system can better withstand disruptions and outages, providing a reliable power supply to customers during adverse conditions.
3. Efficiency Improvement: The innovative system architecture can lead to improved energy distribution efficiency with higher service quality.
4. Advanced Control Capabilities: The control strategy development can provide advanced control capabilities, enabling precise management of power flow, voltage regulation, and frequency response. This enhances the overall stability and performance of the grid.
5. Emission Reduction: More efficient energy distribution and grid management can lead to reduced emissions. By maximizing the use of available grid infrastructure, the project can help achieve environmental sustainability goals.

Quantitative Benefits:

1. Increased DER Integration: The project can allow for greater integration of Distributed Energy Resources (DERs) like renewable energy sources and electric vehicle chargers. The quantification of DER integration benefits can be based on increased DER capacity and utilization.

2. Load Management: Quantifying the reduction in substation/area station reverse power flow and peak shaving capabilities can lead to a precise estimation of load management benefits in terms of reduced stress on critical grid components.
3. Economic Analysis: The techno-economic analysis will provide quantitative insights into the economic benefits of the AC-DC-AC intertie system. It can assess the return on investment (ROI) and the potential for reduced energy distribution costs.
4. Reduced Downtime Costs: By enhancing grid resiliency and reducing downtime during disruptions, Con Edison can minimize the financial impact of outages incurred by customers.
5. Customer Satisfaction: Improving grid reliability and resilience can result in increased customer satisfaction.

TECHNICAL STATUS

☒ Ongoing PM Updates: Periodic updates on project progress for stakeholders.

☒ Summary of prioritized use cases: This deliverable will provide a clear understanding of the identified use cases for the AC-DC-AC system, helping to determine its practical applications.

☒ System architecture and control requirements analysis: This deliverable will outline the system requirements necessary to fulfill various use cases, including power parameters, voltage levels, and control response times.

☒ EMT simulation results and component models: EMT simulation results will validate the system's basic operation, allowing for stability and performance in different scenarios.

☒ Guidance on control implementation: Recommendations for structuring both primary and secondary controls will be provided, offering a framework for future development and interface requirements.

☒ Final (technical) report and webcast: A comprehensive report summarizing the project's efforts, findings, and outcomes will be produced. Additionally, a technology transfer workshop will be conducted to disseminate project insights.

TITLE Enhancing Situational Awareness in A Carbon-Neutral Grid with An Automatic-Calibrated System Model - NYSERDA Study via Quanta

POET 27372811 **TASK** 0001

OBJECTIVE

The objective of this project is to investigate the feasibility of developing an inverter-based resources (IBR) plant model representative of an utility-scale IBR plant that can be validated and calibrated online using the synchronized measurement by Phasor Measurement Units (PMUs) at the point-of-interconnection (POI). This solution will enable the IBR plant model to follow the changes occurred inside the plant by calibrating and validating the model after such changes are detected.

With increased penetration of IBRs, such as utility-scale solar PV and onshore/offshore wind plants, it has become difficult for system operators to have a reliable situational awareness regarding the adequate system operation security margins. Properly modeling utility-scale IBR plants has been and remains to be a major challenge. As such, plants are complex dynamic systems. Improperly modeled IBR plants lead to an inaccurate power system model, which in turn lead to errors in determining adequate margins. All power system operation security assessment tools, such as real-time contingency analysis (RTCA), transient stability assessment (TSA), and voltage security assessment (VSA), are dependent on an accurate system model to produce correct margin assessment results. Incorrect margins could cause a power system to be operated either too conservatively and that prevents the full capacity of the grid being utilized to transport IBRs generated power; or, it could result in cascade tripping and system collapse under certain system conditions.

BENEFITS

Operating a power system without being aware of inadequate operation security margins can lead to costly reliability problems. A scheduled system switching operation or an unplanned outage or disturbance may suddenly trigger cascading tripping events causing major power disruptions affecting a wide area. Impacts can include inconvenience to customers and financial losses. The development of this system will help to prevent/mitigate these effects.

TECHNICAL STATUS

Tasks (checked boxes are completed):

☒ Task 1 – Select An IBR Plant and Collect Relevant Information. Deliverable: A Summary Report for Task 1 that documents the IBR plant selection process and the collected IBR plant information.

☒ Task 2 – Develop A Real-Time Simulation Setup. Deliverable: A summary report documenting the developed real-time simulation setup that includes the developed IBR plant model, the small power system, and the PMUs and a PDC.

☒ Task 3 – Develop IBR Plant Model Online Calibration/Validation Method. Deliverable: A Summary Report for Task 3 that documents the developed online IBR plant model calibration and validation methods.

☒ Task 4 – Evaluate Online Calibration/Validation Method for IBR Plant Model. Deliverables: (1) A Summary Report for Task 4 that documents the evaluation results of the developed IBR plant model online calibration and validation method; (2) A webinar at the end of the task organized by the Contractor and ConEd for NYS stakeholders; (3) An accepted conference paper at an industry conference

☐ Task 5 - Final Written Documentation. Deliverables: (1) A draft version of the Final Written Document; (2) A final version of the Final Written Document.

TITLE Reliable Protection for an Inverter-Based Resources Dominant Grid: Technology Development and Field Demonstration

POET 27409209 **TASK** 0001

OBJECTIVE

Future bulk power systems are expected to operate with a high penetration of inverter-based resources (IBR). Some areas of today's bulk power system are at or have already gone past a tipping point where IBR accounts for more than half of the power generation. Such high IBR penetration fundamentally changes the system's short-circuit behaviors and challenges existing transmission line protection principles. This project team is tasked to assess the impact of IBR and develop mitigation solutions.

Project Goals:

1. Assess gaps in commonly used short circuit simulation software and outline a future development roadmap to communicate to software vendors.
2. Develop a time domain electrical-mechanical transient co-simulation framework to analyze system fault signatures in high inverter-based resource (IBR) scenarios and interactions between system protection and IBR protection.
3. Develop a stability analysis software tool that can assess stability throughout a fault considering both power system protection and IBR control logic and calculate critical fault clearing time and stability margin under various IBR penetration levels.
4. Assess the impact of high IBR penetration on transmission protection systems and communicate effective IBR study tools and operational impacts to utilities' engineering support and operations groups.
5. Develop and demonstrate new and practical protection schemes that enable safe and reliable grid operation with up to 100% IBR generation.
6. Develop a commercialization and implementation roadmap for developed protection technologies.

BENEFITS

The project will advance protection study modeling and simulation capabilities and develop strategies and new technologies to maintain reliable system protection for all levels of IBR penetration. The developed technologies will be field-tested by Con Edison, and lessons learned will help guide future company decisions when integrating more IBR.

TECHNICAL STATUS

Tasks (checked boxes are completed):

☒ Task 1.1 – Model and simulation requirements

☒ Task 1.2 – Develop a large-scale bulk power system model

☒ Task 1.3 – Assess gaps in existing SC programs

- ☒ Task 1.4 – Build time domain Co-Sim framework
- ☒ Task 2.1 – Define realistic high IBR penetration cases
- ☒ Task 2.2 – Procure vendor inverter simulation models
- ☒ Task 2.3 – Procure commonly used protective relays
- ☐ Task 3.1 – Design a Wide-Area System Protection (WASP) scheme
- ☐ Task 3.2 – Design adaptive protection schemes
- ☐ Tasks 4 & 5 – Utility lab HIL demo and field demo year-1 planning
- ☐ Task 6 – Year-1 outreach and involvement
- ☐ Task 7 – Cybersecurity plan review
- ☐ Task 8 – Community benefit plan review

TITLE Distribution-Sited Energy Storage Deployment for Transmission and Sub-Transmission Applications NYSERDA Study via EPRI

POET 25989329 **TASK** 0001

OBJECTIVE

This project is funded by the New York State Energy Research and Development Authority (NYSERDA), and EPRI plans to develop a comprehensive and systematic analysis framework to identify, select, prioritize, and evaluate points of interconnection for deploying energy storage across Con Edison's 63 area stations for transmission and sub-transmission services. The analysis intends to optimize operations for load relief, congestion at the stations to support changes associated with future offshore wind integration and existing electric generation fleet retirements. This study aims to identify the primary grid services across the area stations and prioritize these points of interconnection based on hosting capacity availability, topology in the network, physical space constraints in an urban environment, availability of primary feeder for ease of integration. The study intends to evaluate how aggregated energy storage dispatch across area stations can provide services and reliability to the system. The project intends to construct reliability scenarios by determining power flow conditions based on constrained hours to evaluate the reliability impacts of energy storage on the Con Edison system. EPRI intends to develop transmission and sub-transmission planning methods, screening analytics, and locational net benefit analysis techniques to evaluate targeted energy storage deployments.

BENEFITS

The project intends to develop and further refine a framework for planning and evaluating transmission energy storage deployments across territory. EPRI also anticipates that the framework will be demonstrated with accessible, non-proprietary models by conducting hosting capacity and product cost modeling analysis that includes multiple deployments of energy storage.

The framework in the project evaluates both short-term benefits (curtailment reduction, market services) and long-term benefits (resource adequacy, and supporting transmission buildout). The project's framework enables comparison of energy storage benefits at the transmission level against real-world implementation challenges in an urban environment. This comprehensive analysis framework can enable a better understanding the economic feasibility through stacked-benefit analyses and the operational feasibility, which are key to supporting wider energy storage deployment. The framework and methodologies developed in the project intends to be transferred to utilities and other stakeholders in New York and beyond for their use for grid analysis. Expected benefits and new learnings of this project include:

- A comprehensive and systematic analysis framework to plan and evaluate points of interconnection for deploying energy storage for transmission and sub-transmission services across a territory
- Deeper understanding of the technical approach, model validation and data alignment techniques to enable more robust planning analyses involving energy storage
- Improving evaluation of transmission network reliability benefits of energy storage, and this project will also facilitate evaluating the reliability benefits that energy storage can provide.

- Where available, using accessible, non-proprietary models and data, or open-source tools such as Distributed Energy Resource Value Estimate Tool (DER-VET) to enhance transparency of the analysis process.

In addition, this research could benefit the general public by developing and sharing insights about modeling, data and analysis considerations that inform similar types of analysis to optimally place energy storage and understand its value to the grid.

TECHNICAL STATUS

EPRI Produced NYSERDA Public Deliverables include:

☒ Technology Transfer Plan

☒ Framework Technical Approach, Model Validation and Data Alignment

☒ Production Cost Modeling Analysis Results

☒ Site Selections, Prioritization and Reliability Benefits

☒ Summary of Technology Transfer Activities

☒ Final Written Report

TITLE Remote Closing Device for Feeder Reactor Switch

POET 23102147 **TASK** 0001

OBJECTIVE

Objective is to develop, design, test and deploy prototype device that will be operated through SCADA. The following tasks will be performed during the project:

1 - investigate existing actuators and feasibility of their use in vault environment.

2 - design means of fixation of the device onto the handle and to the tank body;

3 - provide connectivity to SCADA system.

Timeframe for development and fabrication - 6 months.

BENEFITS

Remote Closing Device will allow electric operations to return feeders to service immediately after repair and testing, thus improving system reliability and equipment availability.

TECHNICAL STATUS

The remote closing device prototype was designed and tested in Con Edison's Transformer shop in Astoria May 23, 2019. In 2020, work continued to improve ergonomics (reduce weight and provide handles for control box), while maintaining existing functionality. New version of device delivered in July 2020. The new device was updated and ruggerdized for all weather conditions. In 2024, Distribution Engineering and Electric Operations will proceed with final field testing.

TITLE EPRI 2024-2028 5-Year Base Portfolio

POET 27360819 **TASK** 0001 - Electric Distribution
POET 27360821 **TASK** 0001 - Electric Transmission

OBJECTIVE

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

Various operational and environmental challenges and constraints related to the distribution of electric power and the efficient use of electric energy.

BENEFITS

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

TECHNICAL STATUS

Company Membership is ongoing through 2028.

TITLE EPRI Emerging Energy Storage Technologies Supplemental

POET 26455697 **TASK** 0001

OBJECTIVE

This supplemental study will focus on investigating emerging energy storage technology vendors to study their performance and determine their viability for connection to the operating grid. Each system demonstration will be fully characterized and studied by the EPRI team, and the results of each demonstration will be assembled in annual reports.

BENEFITS

Benefits will include:

1. Demonstration systems are successfully installed with minimal to no external delays.
2. Technology received go-ahead from Fire Departments and other AHJs.
3. Performance is fully characterized and deemed adequate for Con Edison applications (determined through regular reviews and the summary findings reports)

TECHNICAL STATUS

This project is ongoing and is scheduled for completion in 2025. Deliverables will include:

☒ Technology-specific Procurement Specification Recommendations: Suggested solicitation requirements for an energy storage RFP that enable its design/implementation to meet the desired performance characteristics

☒ Technology Performance Summary Report: Detailed testing methodology descriptions, key performance data and analysis, and documented lessons learned collected from energy storage system evaluation

TITLE Ambient Adjusted Rating (AAR) for Overhead Transmission Network

POET 25914705 **TASK** 0001

OBJECTIVE

FERC has published multiple ruling proposals that indicate regulation requiring utilities to implement advanced ratinxgs instead of static rating. There are several technical challenges that would need to be addressed to reduce compliance issues when adopting advanced ratings, such as ambient adjusted ratings (AAR). Incorrect implementation of ambient adjusted ratings could result in violations of NESC clearance requirements or lead to premature failure of transmission assets. The R&D project plan is to calculate AAR for a pair of EHV feeders; and prepare a technical report that identifies appropriate sources of ratings data, ratings assumptions that balance risk with system capacity, and guidance on methods to expand the results to other lines.

This project will demonstrate how ambient adjusted ratings would work on a congested feeder. This will include, understanding historical performance, qualifying, and selecting data sources, and simulating the adoption of AAR on the line. The plan is to:

1. Select a pair of overhead EHV feeders and demonstrate how AAR would increase transmission capacity, and the amount of capacity gained
2. Deploy field Instrumentation to collect data required to validate AAR data sources (air temperature, wind speed, wind direction, solar intensity, etc.)
3. Identify sources of data that can be used to apply AAR in near real time
    3.1. Identify accuracy of available sources, this could include sources such as weather models or public weather stations depending on data quality and availability
    3.2. Demonstrate if AAR would significantly vary over distance, this information would guide how many sources of data are needed to fully implement AAR
4. Examine accuracy of 10-day AAR forecasts and develop risk mitigation approaches as needed to compensate model errors. Data from different forecast models can be compared to data collected within the transmission corridor to evaluate comparative performance.

BENEFITS

The project's benefit is qualitative in nature and a successful demonstration will provide methodologies which can help define and reduce risks of overloading transmission assets beyond their capacity. In some conditions Ambient Adjusted Ratings can increase system capacity and relieve congestion. This can be leveraged with an improved understanding of the quantity and frequency with which extra power flow would be available beyond the existing ratings.

TECHNICAL STATUS

An AAR for a pair of EHV feeders; a technical report that identifies appropriate sources of ratings data, ratings assumptions that balance risk with system capacity, and guidance on methods to expand the results to other lines.

Tasks (checked boxes are completed):

☒ Completed the AAR installation for one pair of selected EHV feeder

☒ Validated and qualify the weather data provider for Con Edison services area

☒ Determine the Corporate safety margin for AAR which includes the DeFacto wind consumption

☒ Install an alternate weather station to validate the performance of the EPRI AAR model

☒ Develop the statement of work for assessing substation equipment AAR.

Additional delivery

- Setup weather stations selections model for CECONY and O&R services territories.

TITLE Development of a Disbonded Coating Corrosion Index for HPFF

POET 26688587 **TASK** 0001

OBJECTIVE

Various High-Pressure Fluid-Filled (HPFF) feeders on the 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 underneath 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 has occurred on pipes that were coated with coal tar enamel or somatic (asphalt) coating. Since the 1980's, Con Edison has used tape coat (extruded polyolefin) coating, which is not yet showing similar.

Based on the success of prior reflectometry disbonded coating testing Project will perform further disbonded coating analysis of suspect pipe areas and use the data to develop a corrosion index that indicates the severity of coating loss and pipe corrosion for HPFF pipes to serve as a prioritization tool for future pipe enhancement/refurbishment projects. The corrosion index will consist of factors relating to pipe coating damage locations along the feeder pipes, the severity of the coating damage, and the confidence level in the location and severity of the damage.

The plan is as follows:

Task 1: Setup the coal tar coating pipe model in laboratory environment to validate the reflectometry model for disbonded coating test.
Task 2: Select footages on feeders for disbonded coating test. Perform the reflectometry disbonded coating test to determine severity of corrosion on selected bulk power feeders.
Task 3: The reflectometry test results will be used to create a pipe coating corrosion index.
Task 4: Train Company field crews to perform the future field measurement of the reflectometry disbonded testing.

BENEFITS

If a coating corrosion index is developed based on the disbonded coating analysis from Heuristech, Transmission Operations may initiate a new program directly targeting suspect portions of HPFF pipes. This would allow the Department to assess the extent of corrosion and take proactive steps (such as pipe/coating enhancement or refurbishment) to address the issue prior to actual dielectric fluid leaks occurring.

TECHNICAL STATUS

Project is complete. Performed reflectometry disbonded coating test to determine severity of corrosion on Feeders 71 and 72. Index identified a high risk for corrosion area in September 2023, with an actual leak occurring in May 2024.

Tasks (checked boxes are completed):

- ☒ Completed field assessment for feeder Y50
- ☒ Completed field assessment for feeder 71 and 72
- ☒ Completed field assessment for feeder M29
- ☒ Completed the field procedure for corrosion index assessment for buried pipes
- ☒ Completed training for Trans Ops crews to perform collection of field data for corrosion index assessment

TITLE Qualification of Alternate Supplier for 345 kV HPFF/XLPE Transition Joint

POET 27473597 **TASK** 0001

OBJECTIVE

Taihan Cable has been identified as the only other supplier worldwide in a position to manufacture and effectively test 345 kV HPFF/XLPE transition joints. The objective of this project is to qualify Taihan as an alternate supplier. To qualify the 345 kV Transition Joint, the supplier will perform qualification tests in accordance with industry standards and will perform physical dissection analysis of the joint. Con Edison representatives from Engineering and R&D will be in attendance to observe conformance of critical stages of the qualification tests and ensure accuracy of the tests and to observe dissection results.

Testing will be performed simultaneously on two (2) Transition Joints with 345 kV 2500 kcmil HPFF cable on one side of each joint and 345 kV 5000 kcmil Solid Dielectric cable on the opposite end of the joints.

Evaluation will include a review of the electrical and mechanical tests protocols prior to start of the test, followed by a detailed review and evaluation of electrical and mechanical stress test results and dissection of the joint which will be performed as part of a visual examination to further confirm test results.

Specific critical tests will include:

- Subjecting of the joint to Elevated Temperatures prior to electrical testing, High Voltage AC Testing, Partial Discharge and Ionization Inception Level Testing, Lightning Impulse and Switching Surge Testing, High Dielectric Fluid Pressure withstand testing.
- Con Edison has approx. 700 circuit miles of underground High-Pressure Fluid Filled (HPFF) transmission feeders ranging in voltage class from 69 to 345 kV. Con Edison has qualified to date only one supplier of 345 kV HPFF/XLPE transition joints, Sumitomo, leaving the Company at risk for a supply interruption if there were to be a manufacturing issue.

BENEFITS

Con Edison has qualified to date only one supplier of 345 kV HPFF/XLPE transition joints, Sumitomo. To develop a second supply source as a means to ensure material availability and to enhance market competition through competitive bidding, it is necessary to qualify an additional supplier.

TECHNICAL STATUS

Qualification of a second supplier of 345 kV transition joint from HPFF to XLPE insulated cables.

Tasks (checked boxes are completed):

☒ Accepted on electrical tests according to IEEE 404, AEIC CS-9, and IEC 60840x

☒ Accepted on mechanical tests for the transition joints High Dielectric Fluid Pressure withstand testing.

☒ Accepted after the dissection of the transition joint when both electrical and mechanical tests had been completed and passed; it showed no damages inside the transition joint's side wall.

This project is complete.

TITLE NYSERDA - Developing DLR (Dynamic Line Rating) Implementation Best Practices

POET 27919483 **TASK** 0001

OBJECTIVE

To address this challenge utilities we are looking to leverage new ratings methods such as AAR (ambient adjusted ratings) and DLR (dynamic line ratings). Dynamic line ratings, or DLRs, are transmission line ratings that reflect up-to-date forecasts of weather conditions, such as ambient air temperature, wind, cloud cover, solar heating, and precipitation, in addition to transmission line conditions such as tension or sag There are different technologies that aid in deployment of AAR and DLR, each with unique sets of strengths and weakness. Some technologies are more accurate under a given set of conditions, but those conditions may not be present on all lines. DLR are much more operationally complex than AAR and may not provide value to utilities in all cases. Because they are hard to predict (forecast) it may be more beneficial for some lines to apply AAR instead of DLR or vice versa. It is possible that to get the most benefit for utility customers a blend of technologies may be required.

The objective of this research is to demonstrate unique methods for determining AAR and DLR on select feeders at Con Ed. The primary goals are to:

- Demonstrate when AAR or DLR offer the most benefit.
- Better understand the complexity differences between AAR and DLR
- Investigate the forecasting uncertainty in 3-day and 10-day forecasts of AAR and DLR
- Better understand the conditions when re differing AAR and DLR technologies provide the best benefit (balance between accuracy, ampacity, complexity, etc.)
- Understand how different technologies may affect ratings of feeders under similar conditions
- Demonstrate how AAR and DLR differ from static ratings
- Understand if there are supplementary benefits from the technologies aside from DLR

In Dec 2021 Federal Energy Regulatory Commission (FERC) implemented order 881 requiring transmission operators to implement Adjust Ambient Rating (AAR) on their lines by July 2025 to ease congestion on the transmission feeders. On June 2024, FERC issued an advance notice of proposed rulemaking (“ANOPR”) regarding potential reforms to require transmission providers to use DLRs to further encourage more accurate and transparent line ratings.

AAR uses existing environmental data and high-quality weather forecasts to adjust and rate the performance of overhead lines. DLR is more accurate by combine AAR data, and solar heating and wind speed to even more accurately reflect transfer capability.

BENEFITS

The projects’ objective is to meet FERC compliance and as such are qualitative in nature and not quantitative. The project is also to provide specifics as how to install and operate three different types of DLR systems and each utilizes different technology to obtain dynamic line ratings..

TECHNICAL STATUS

Project began in 2024 with filed activity to commence in 2025.

Tasks (checked boxes are completed):

- ☒ Establishing contract with EPRI on as project manager for the entire NYSERDA project
- ☐ Establishing contract and installing the DLR model with Windsim 2Q25.
- ☐ Establishing contract and installing the DLR model with Ampacimon 4Q25
- ☐ Evaluate project results

TITLE Kelvin (Formally known as Radiator Labs) Hybrid Electrification of Building Heating System Demonstration

POET 26196029 **TASK** 0001

OBJECTIVE

The objective of this project is to demonstrate hybrid electrification of the building heating system as an integration of thermostatic radiator enclosures (TREs) provided by Radiator Labs with commercially available non-cold-climate Package Terminal Heat Pumps (PTHPs) . Successful demonstration will optimize the operation of the existing building gas boiler in coordination with PTHPs during the heating season with seamless transfer between the two systems and without compromising customer comfort. The proposed pilot location currently is, but can change, at 2 Charlton Street, a 17-story high-rise multifamily building in Manhattan where a natural gas boiler provides space heating.

BENEFITS

Energy savings from this site are estimated to be 57%: 30% from the energy efficiency improvement due to TREs installation (already completed in past phase) and 27% due to gas avoidance from optimized operation between TREs and PTHPs (scope of this project). Additionally, customer comfort is expected to increase through local temperature adjustment in the room and customers will gain resilience by having flexibility of fuel switching and the option to participate in the Company's Demand Response programs.

TECHNICAL STATUS

After the heat pumps (PTHP's) were ordered and delivered on site for the installation, co-op board rejected the product design due to the aesthetic and project is put on hold untill new design is acceptable to existing owners or new demonstration site is selected.

Tasks (checked boxes are completed):

☒ Report on the development, configuration and operations of integrated controls

☒ PTHP's ordered and delivered on site

☐ Install PTHP in every through wall sleeve location in the building

☐ Develop and integrate controls between PTHP, TRE and gas heating boiler

☐ Demonstrate integrated system operation for duration up to 18 months

☐ Monitoring performance by third party measurement and verification services

☐ Optimize controls during and post demonstration

☐ Analyze and Report on performance results

TITLE Enersion Zero Emission EPRI Incubate Challenge Demonstration

POET 27396002 **TASK** 0001

OBJECTIVE

Enersion was selected by Con Edison and other utilities as part of EPRI's Incubatenergy Labs 2022 program to demonstrate its innovative adsorption chiller technology, that uses water as a working fluid, avoiding toxic refrigerants, for commercial heating and cooling applications.

The objective of this project is to pilot Enersion's Energy Cubed system to supply zero-emission cooling, heating, and electricity to the trailer size office space. The trailer system will be designed for fully off-grid operation powered by solar renewable energy, using hybrid photovoltaic thermal (PVT) panels with heat (thermal energy) recovery and convert it to useful cooling through their adsorption chiller. The system uses nonporous material, as part of the vapor compression heating and cooling cycle, designed to be regenerated with harvested heat. The system will provide up to 1 ton of cooling, 4 kW of heating and 1.75 kW of electricity.

BENEFITS

This demonstration will inform the project participants about the potential for adsorption chillers to harness solar heat as a supplement or replacement to traditional electricity consuming chillers. The Mobile Solar Energy Cubed product could also be a viable model for an off-grid command center for utility emergency response operations or deployed as a building decarbonizaiton project.

TECHNICAL STATUS

Enersion successfully demonstrated a mobile solar powered trailer system, operating off-grid providing cooling, hot water, and electricity using Enersion’s zero emission heat pump and PVT panels with battery and thermal energy storage. Project was successfully completed and technology is proposed for a future demonstration in a building as a decarbonizaiton project to reduce greenhouse gases (GHG) from fossil fuels.

Tasks (checked boxes are completed):

☒ Enersion built a mobile solar powered trailer system

☒ The system first delivered to EPRI’s Knoxville laboratory for testing

☒ The system transferred to Con Edison Spring Valley O&R site for the demonstration

☒ EPRI issued a final report. Project is completed.

☒ Final report issued

TITLE Enersion Zero Emission Heat Pump Building Demonstration

POET 27757396 **TASK** 0001

OBJECTIVE

The objective of the project is to perform building decarbonization feasibility study for Enersion System at Con Edison's headquarter at 4 Irving Place, New York, a 1.2 million square feet commercial building operating using grid electric power and district steam. The plan is to engage with third party contractor, PAR Group, to provide a pre-construction service, required to accurately evaluate the project's feasibility, scope of work, cost and schedule. Enersion submitted proposal to demonstrate Enersion at Con Edison, and it was accepted by NYSERDA NextGen Buildings Innovation Challenges (PON 3519).

The Enersion system is an advanced heat pump technology operating on a concept of adsorption chiller supplying heating and cooling. It uses a nonporous material, that requires heat to regenerate, providing an opportunity for waste heat recovery from almost any available air/hydronic waste heat sources from the building. The thermal energy (heat) can be also supplied by hybrid photovoltaic thermal (PVT) panels recovering heat generated by solar panels to provide building energy needs (space heating, cooling and hot water) with electricity also provided by the PVT panels.

BENEFITS

This feasibility study is done with intention to follow up with project demonstration. The qualitative benefit of the study will inform the project participants about practical cost and timeline of the building decarbonization project utilizing Enersion adsorption chillers (heat pump). Study will also provide an insight to how various thermal waste energy sources can be harnessed providing further building energy operating cost savings.

TECHNICAL STATUS

A feasibility study of Enersion heat pump integration to 4IP building's HVAC were completed. A project is recommended to move to the demonstration phase.

Tasks (checked boxes are completed):

☒ A review of the configuration, installation requirements and operating parameters

☒ Optimization of feasible options of size, logistics, GHG reduction impact and cost

☒ Final report exploring feasible options for the building HVAC retrofit was issued

TITLE Evaluation of Portable Cooling Stations

POET 27219263 **TASK** 0001

OBJECTIVE

Con Edison crews work in hot weather and are required to wear Personal Protective Equipment (PPE), including Fire Retardant (FR) clothing, while performing electrical, gas or steam related work. Wearing FR clothing/PPE while working in a hot environment increases the risk of heat-related illnesses. Mitigating efforts, such taking a break in a vehicle with air conditioning, can reduce the chances of heat related illnesses but running a parked vehicle violates NYC vehicle idling laws eliminating it as a means of cooling down.

The objective of this project is to evaluate portable cooling stations. These can be standalone cooling units (Vehicle approved/misting/ice type) or cooling units with enclosures (tent, head coverings, etc.). The project plan will be to select at least two cooling station types/manufacturers and pilot with participants in various operating groups. A feedback form will be provided to participants to gather field data for each model tested.

BENEFITS

The assumed benefits are qualitative. The qualitative benefits are enhancement to safety through the use of cooling stations that mitigate heat related illnesses.

TECHNICAL STATUS

Tasks (checked boxes are completed):

☒ Identify devices for field testing

☒ Identify groups for field evaluation

☒ Field evaluation in progress with initial feedback

☐ Gather feedback

☐ Make recommendations

TITLE Evaluation of RFID Technologies for Traceability and Quality Control of Laboratory Supplies

POET 27457226 **TASK** 0001

OBJECTIVE

The objective of this project is to evaluate the application of RFID technology for the use, tracking and traceability of chemicals and supplies. The plan is to tag common reagents (chemicals/supplies) used and track them in the lab and determine the amounts used, lot numbers, date and what testing was performed using a given supply.

BENEFITS

The benefits of utilizing RFID technology for chemical and supplies tracking will provide an improved proicess to maintain ISO certification though efficiency and accuracy improvements to inventory control by digitizing the current manual process of and collecting data and updating inventory datasheets and laboratory work sheets manually.

Other qualitative benefits include:

- Waste minimization by enhancing visibility of expiration dates and by ensuring First-In, First-Out inventory consumption.
- Improved Lab compliance with ISO 17025 and ELAP (Environmental Laboratory Approval Program) requirements from improved lot number and expiration date tracking.
- Efficiency gains for annual Right-to-Know reporting requirements.

TECHNICAL STATUS

Tasks (checked boxes are completed):

☒ Identify devices for field testing

☒ Identify groups for field evaluation

☒ Field evaluation (In progress)

☐ Gather feedback

☐ Make recommendations

TITLE Evaluation of Knives / Cutting Tools with Inherent Safety Designs

POET 27494943 **TASK** 0001

OBJECTIVE

The objective of this project is to identify manufacturer(s) and model(s) of "safe" knives/cutting tools that mitigate the risk of injuries. The plan will be to survey what commercially available devices with non-metallic and/or guarded edges are available for opening boxes, cutting cardboard, removing straps, etc. and selecting several that will be piloted with participants in select operating groups/locations.

BENEFITS

The benefits are enhancement to safety through the use of safer cutting tools that mitigate injuries.

TECHNICAL STATUS

Tasks (checked boxes are completed):

☒ Identify devices for field testing

☒ Identify groups for field evaluation

☒ Field evaluation (In progress)

☐ Gather feedback

☐ Make recommendations

TITLE EPRI Climate READi (REsilience and ADaptation initiative): Power

POET 26203780 **TASK** 0001

OBJECTIVE

As 1-in-50 or 1-in-100-year extreme climate events increase in frequency, and society increasingly depends on electricity, there is a need to strengthen the power sector's collective approach to managing climate risk to the power system. And, as the economy electrifies and decarbonizes, energy grid reliability and resilience will be paramount. We understand the threats posed by climate change and want to build on and affirm the work that we have done to review climate risks in our vulnerability study and resilience plans. Con Edison and ORU require science-based insights about the future power system and the environment in which it will operate to identify adaptation and resilience investments. We seek collaborative research to build an informed and consistent approach. There are many risk management tools, processes, standards, and guidelines used by power sector organizations today. However, to meet society's electricity decarbonization and climate resilience needs, the power sector should coalesce around a standardized and consensus-based framework to inform infrastructure investment and deployment. There is a need to think about greater resiliency for our energy systems.

In this project, we collaborated with EPRI and other organizations planning for climate adaptation to develop a framework that will facilitate analysis and application of appropriate climate data among stakeholders to enhance the planning, design and operation of a resilient power system. The framework incorporated a common approach with published guidance and educational resources for using climate data for specific power system assets and system vulnerability assessments, including how to treat the inherent uncertainty in climate variables. It includes a common approach to risk mitigation thresholds on the impacts to energy grid assets and the integrated power system. A set of adaptation strategies for specific climate impacts while maintaining a reliable, resilient, and affordable power system for consumers will also be developed.

There are three workstreams:

1. **Physical climate data and guidance**: A shared view on climate risk assessment data needs;
2. **Energy system & asset vulnerability assessment**: A common approach to risk mitigation thresholds on the impacts to energy grid assets and the integrated power system; and
3. **Resilience/Adaptation planning and prioritization**: A set of adaptation strategies for various climate impacts while maintaining a safe, reliable, and resilient power system for consumers. Measures should consider equity.

BENEFITS

READi Engagement includes:

- Access to EPRI SMEs to answer questions and discuss your companies' assessment activities
- Access to a community of individuals working on resilience and adaptation efforts at their companies
- Support scoping and planning of company-specific assessment activities

- Influence the development of a Common Framework for climate assessments
- Understand another informed approach to climate risk assessment and align with our strategic resilience planning
- Drive stakeholder alignment on adaptation strategies for efficient and effective investment
- Additional insights into climate justice/equity and how to think about the evolution of climate disclosures in various areas (e.g., SEC)

TECHNICAL STATUS

2024 deliverables included:

☒ Climate Data Inventory v1.0.0 and Climate Data Users Guide v1.0.0

☒ READi Insights: Downscaling

☒ Compound Hazards and the Power Sector in a Changing Climate

☒ Climate Data Gap Analysis

☒ READi Insights: An Approach to Defining Temperature Extreme Events: A Threshold-based Probabilistic Approach to Defining Extreme Temperature Events

☒ Asset Vulnerability Assessments: Considerations and Resources

☒ Climate Vulnerability Considerations for the Power Sector: End Use Assets and DER

☒ Extreme Cold Weather Temperature Calculation for EOP-012 Compliance

☒ Practices for Representing Climate Impacts in Bulk Electric System Models

☒ Climate Risk Screening Tool v0.1

☒ READi Insights: The Importance of Grid Asset Data in Support of Distribution Resilience Planning

TITLE DOE Tracking Real-time Anomalies in Power Systems (TRAPS)

POET 26550050 **TASK** 0001

OBJECTIVE

The current state-of-the-art tools detect anomalies in different layers separately. For example, EMS-based anomaly detectors focus on the physical layer while SIEM-based detectors focus on cyber events. The recently completed DARPA RADICS (Rapid Attack Detection, Isolation and Characterization Systems) project exposed shortcomings of state-of-art anomaly detectors, and showed that attacks and anomalies can go undetected in absence of robust multi-domain methods.

In this project sponsored by the DOE, we proposed a Tracking Real-time Anomalies in Power Systems (TRAPS) system that will support cross-domain integrity monitoring, anomaly detection and localization in power grid Cyber Physical Systems. TRAPS is a novel cross-domain hierarchical combination of device and system level anomaly monitors to detect and localize anomalies and their precursors. TRAPS will correlate time series measurements from electrical signals, embedded computing devices, and network communications to detect anomalies using semantic mismatches between measurements.

BENEFITS

In this project, we proposed to develop a system to enable cross-domain integrity monitoring, anomaly detection and localization in power grid Cyber-Physical Systems through a combination of controller-focused, system-focused, network-focused, and cross-domain anomaly monitors. Through the cross domain correlations across the cyber and physical layers, the tool being developed will seek to enable low-latency detection of anomalies and subtle precursors prior to observable impacts in the physical power grid. Such a system currently do not exist and can potentially provide an added level of reliability and security.

TECHNICAL STATUS

Con Edison has been working with NYU and NYPA on building out this system. Tasks (checked boxes are completed):

- ☒ Prototype implementations developed of TRAPS (Tracking Real-time Anomalies in Power Systems)
- ☒ TRAPS prototype optimized and streamlined to further increase scalability and ease of use.
- ☒ Testing on several attack/anomaly scenarios in NYU's simulator testbed
- ☒ TRAPS prototypes tested in DOE Liberty Eclipse exercises on Plum Island, NY, in collaboration with Con Edison Operations and cybersecurity teams.
- ☒ Testing on scenarios implemented in NYPA AGILe testbed
- ☐ Optimizations/refinements: Further optimizations of TRAPS for scalability to larger and more complex scenarios
- ☐ Development of more complex attack/anomaly scenarios using multiple attack/anomaly injection mechanisms

TITLE OT (Operational Technology) Cyber Security Technology Transfer Workshop

POET 27540601 **TASK** 0001

OBJECTIVE

The primary objective of this workshop is to increase cyber security awareness and reduce risk by providing vendor technology transfer tailored to our organization and cyber security requirements. This would be done by first discussing with business units their needs with a short assessment, build a customized set of objectives, provide technology transfer via an in-person workshop, and then evaluate and get feedback. In this project, we will focus on technology transfer involving specific OT equipment.

As Con Edison relies increasingly on operational technology (OT), the risk of cyber threats targeting these systems and our company continues to grow and has become a significant concern. Without adequate collaboration and awareness, our teams may not be equipped to identify and mitigate potential cyber risks, leading to vulnerabilities that could compromise our operations. Training classes that are available are often geared towards generic OT devices or open source solutions and does not contain actual hardware we utilize in the field. We need collaboration with different departments here at Con Edison and the vendors who manufacture the equipment we utilize. A workshop where we can bring all the stakeholders together would potentially allow us to build a stronger connection to our vendor, get input from business units, and tailor cyber security requirements to our own organization.

BENEFITS

The benefits of this project include cross-team employee engagement and collaboration to improve incident response capabilities. We also seek to increase strategic partnership with vendors and align with industry on cyber security architecture design and response capabilities.

TECHNICAL STATUS

Tasks (checked boxes are completed):

☒ Workshop conducted and complete.

TITLE Insider Threat Research - Phase 2 - CMU (Carnegie Mellon University)

POET 27636628 **TASK** 0001

OBJECTIVE

The primary objective of this project is to collaborate with a leader in the Insider Threat space, to help guide our team in building a program of our own. This project aims to help us identify concerning behaviors and activities of potential insiders, establish technical requirements for data, define insider threat indicators, understand how to apply analytics, measure effectiveness, navigate the tool landscape, and properly define policies, best practices, and procedures for our future incident response process.

An insider threat program is a proactive approach to mitigate risks posed by employees, contractors, and other insiders who may intentionally or unintentionally cause harm to our company. These risks could affect our reputation, service delivery, and have a financial impact. This project aims to continue where our previous research with EPRI - Insider Threat Guidebook left off. Currently, most of our research is theoretical and has not been applied. CMU's Insider Threat Research Center has been researching this problem since 2001 in partnership with the U.S. Department of Defense (DoD), the Department of Homeland Security, the U.S. Secret Service, other federal agencies, the intelligence community, private industry, academia, and the vendor community. We need additional guidance to apply previous research and also understand what other corporations like ours are using to mitigate these risks, and then bring these lessons learned back to our organization to incorporate them.

BENEFITS

We expect the benefits will include improved incident response capabilities and risk reduction relating to insider threat. We also expect to benefit from employee engagments, strategic partnership, alignment with industry and cross-team collaboration as the insider threat program is being developed.

TECHNICAL STATUS

Tasks (checked boxes are completed):

☒ Conducted training on CMU Overview of Insider Threat Concepts and Activities

TITLE Preventing Surface Sediment Contribution to TSS and PCBs Concentrations at Astoria's Outfall B via PM-10 Certified Sweeper Evaluation Pilot

POET 25126727 **TASK** 0001

OBJECTIVE

The Astoria Outfall B South West Stormwater System (SWSS), which was reconstructed in 2015, is located in the southwestern portion of the Astoria Site along 18th Avenue and discharges to the East River (via outfall B). Regular sampling of stormwater at the associated SPDES sample point (MH1A) has identified continued intermittent exceedances of the New York State Department of Environmental Conservation (NYSDEC) regulatory action limit of 200 parts per trillion (ppt) for PCBs. In 2016/2017, a third-party environmental consultant (Kleinfelder) conducted investigations to identify and evaluate the likely contributors of PCBs and TSS into the SWSS. The results of the investigation identified several contributors including sediment on the surface of the Astoria site.

This project aims to facilitate a 3-year field evaluation pilot of a PM-10 certified regenerative sweeper vacuum truck as it operates on premises in targeted areas where yard debris may be contaminating the SWSS. This project will entail removal of surface sediment from asphalt paved surfaces in the areas adjacent to, and upgrade from, entry points to the SWSS. Sediment will be removed by way of a specialized vacuum sweeper vehicle that is equipped with high efficiency filtration in the exhausted air stream.

BENEFITS

Benefits to the company include improved regulatory compliance, enhanced relationship with NYSDEC, risk avoidance associated with future SPDES permit and further enforcement actions.

TECHNICAL STATUS

☒ Ongoing EH&S and Facilities planning of vacuum sweeper operating schedule.

☐ Field pilot performance and final evaluation

TITLE AI Automation for Contracts Analysis Proof of Concept via NYU

POET 27001737 **TASK** 0001

OBJECTIVE

The objective is to develop an optimization tool to guide the formation of successful contracts in connection with transitioning some of the more routine commercial contracting work to Law's new Center of Excellence and develop data points around the Company's contracting terms and processes. The machine learning model for this pilot would be built using a data set of revised/negotiated contracts yielding acceptable and successful outcomes as identified by the appropriate SMEs in Law.

Law reviews thousands of commercial contracts each year and currently has no tool for: (a) uniformly assessing either (i) requests for revisions to Company terms received from counterparties, or (ii) counterparty forms of contract; and/or (b) compiling useful data on these issues. Without automation and assistive technologies, achieving consistency in contract review and negotiation work product and developing/tracking various metrics for this type of work are extremely difficult.

BENEFITS

Third party risk is currently managed in a decentralized way. A great deal of how we manage that risk is by putting the appropriate terms and conditions into contracts with vendors, non-disclosure agreements with partners and other written agreements. Depending on the third party and the reviewer of an agreement, we can have differing language that leads to various levels of risk. This project will help to determine ways to reduce that risk using automation that will allow us to obtain information to create more consistent processes for managing the review and mitigation of such risk to the company which can lead to fewer lawsuits or unfavorable outcomes.

TECHNICAL STATUS

The project deliverables are the development of a knowledge base of the revisions that occur in contracts and AI/machine learning-based success estimators, and ultimately, an integrated contract optimization tool.

Tasks (checked boxes are completed):

- ☒ Developing similarity estimator for revisions to enable matching revisions between different contracts and between contracts and revisions knowledge base.
- ☒ Developing knowledge base of revisions that occur in the contracts. The knowledge base will expand as new revisions occur. Furthermore, the knowledge base will track how often each revision occur in various contracts.
- ☒ Provision characterization via revisions matching with knowledge base.
- ☒ Estimating contract success rate based on tags assigned to provisions.
- ☒ Evaluation of model integration.
- ☐ Developing similarity estimator for provisions to enable matching revisions between ConEd template and vendor contracts.
- ☐ Developing contract optimization tool.

TITLE VR Substation Experience to recreate High Hazard Injuries

POET 27209073 **TASK** 0001

OBJECTIVE

Certain work scenarios create hazardous environments for employees. Potential trainings using Virtual Reality (VR) technology, can remind workers of the need for safety precautions, including understaning the potential repercussions of non-compliance with safety procedures. This reminder can potentially mitigate the occurrence of accidents.

The objectives for this project are to use VR technology to enhance safety culture and reduce the number of accidents. The Project Plan is to identify and partner with a VR vendor with expertise in developing VR scenarios for the utility industry and to develop a detailed project plan that outlines the scope of the VR scenario, timelines, resources required, and budget.

We will also assess the VR scenario's effectiveness by comparing before and after training implementation.

BENEFITS

The project deliverable is to conduct a pilot VR scenario and test it with a small group to assess its effectiveness and gather feedback. We will use the feedback to make any necessary modifications to the VR scenario. This training emphasizes the importance of wearing PPE to avoid or minimize hazard impacts resulting in reduced injuries and potentially other qualitative and quantitative metrics. Overtime, we will start assessing the VR scenario's effectiveness by comparing before and after training implementation.

TECHNICAL STATUS

The scenario begins with a generic reference to an incident that may happen in high-hazard environments. Further, an operator is shown racking a switchgear circuit breaker without proper Personal Protective Equipment (PPE) that results in an accident. As a recommended safety practice, the same scenario is repeated where this time the operator is shown donning the correct PPE and consequently, avoiding potential personal injuries.

Tasks (checked boxes are completed):

☒ Identify and contract with VR vendor

☒ Receive draft VR experience

☒ Finalize VR scenario experience and setup

☒ Evaluate VR scenario training effectiveness with user group