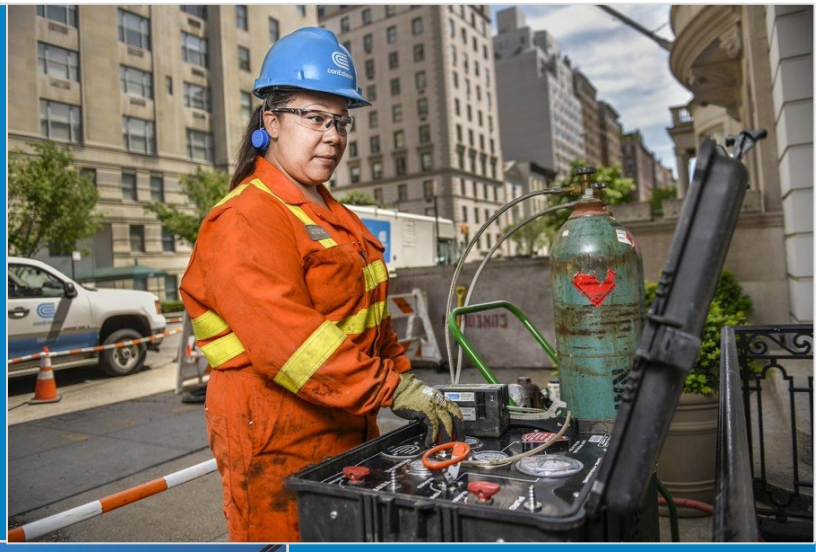
Con Edison Climate Change Resilience Plan

Case 22-E-0222

November 2023



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Abbreviations

AMI	Advanced Metering Infrastructure
ATS	Automatic Transfer Switch
CCRP	Climate Change Resilience Plan
CCVS	Climate Change Vulnerability Study
CJWG	Climate Justice Working Group
Con Edison or the Company	Consolidated Edison Company of New York, Inc.
CRRG	Climate Change Risk and Resilience Group
CRWG	Climate Resilience Working Group
DAC	Disadvantaged Communities
DPS	Department of Public Service
EAP	Energy Affordability Program
ERM	Enterprise Risk Management
FEMA	Federal Emergency Management Agency
HVAC	Heating, Ventilation, and Air Conditioning
LMI	Low to Moderate Income
MIT	Massachusetts Institute of Technology
NRI	Network Resiliency Index
NYSERDA	New York State Energy Research and Development Authority
OHPOT	Overhead Program Optimization Tool
OMS	Outage Management System
PPE	Personal Protective Equipment
PSL	Public Service Law
R&D	Research and Development

RCP	Representative Concentration Pathway
SSO	Substation Operations
SSP	Shared Socio-economic Pathway
TV	Temperature Variable
UAV	Unmanned Aerial Vehicle
UHI	Urban Heat Island
USACE	United States Army Corps of Engineers
USS	Unit Substation

Executive Summary

New York State is leading the nation in addressing climate change, both through efforts that will mitigate future climate change by reducing carbon emissions and also by taking bold actions to help adapt the state to prepare for impacts of climate change that cannot be mitigated. Leadership in this space is essential and Consolidated Edison Company of New York, Inc. ("Con Edison" or "the Company") agrees with the state's leaders and our customers: addressing climate change and advancing the clean energy transition is critical for New York's future.

One way New York State is leading is by demonstrating the need for a bold reimagining of energy systems, moving away from processes that address only immediate needs and towards processes that look farther into the future – this is true not only for resilience investments related to climate change, but in other areas like system planning for transportation and building electrification.

Con Edison's resilience plan is an example of this proactive approach applied to adaptation to climate change, preparing our infrastructure for conditions we may not experience for decades but which, when those conditions occur, may have devastating impacts if we do not plan for them now.

Indeed, for 200 years Con Edison has provided safe, reliable, resilient energy to its customers. But climate change presents new threats to the grid at a time when customers and our economy rely on electricity more than ever. The unprecedented destruction that Superstorm Sandy inflicted in 2012 transformed the trajectory and pace of the Company's resilience journey. Developing climate science has provided a pathway forward.

The Company has already taken bold action to keep its energy system reliable and resilient for its 3.6 million customers. Con Edison has invested more than $1 billion in resilience initiatives since Sandy. These upgrades have prevented more than 1 million customer outages, avoiding inconvenience for residential and commercial customers, and improving safety for all.

In 2020, the Company developed a Climate Change Implementation Plan as a guide for incorporating climate change in its planning, design, operations, emergency response, and investment practices. This

has made resilience a larger part of our company's culture. That same year, Con Edison established a climate change governance structure to oversee the incorporation of climate change into the Company's processes and practices.

The Company's aggressive efforts to fortify its equipment reflect the reality that severe weather events are becoming more common and devastating. The six worst storms in the Company's long history have all occurred since 2010.[i]

The Company also recognizes there is more to be done on behalf of our customers. This Climate Change Resilience Plan (CCRP) builds on our efforts and addresses new information on emerging and growing climate change risks that Con Edison identified in our September 2023 Climate Change Vulnerability Study (CCVS) and is consistent with the requirements of Public Service Law (PSL) §66.[1] The investments this Plan proposes are based on the latest climate change science and the analysis of internal and external experts. The investments will support Con Edison's customers as they live, work, and play in the nation's largest economic and cultural center.

The Company recognizes that the cost of our service to customers is an important consideration and the projects included in this CRRP will provide significant benefit to customers. Moreover, the Company strongly supports providing assistance to our most vulnerable customers and residents. We provide bill discounts to our most vulnerable customers enrolled in the statewide Energy Affordability Program, we have expanded our outreach to customers to increase awareness of the availability of this program, and have begun allowing customers to self-certify that they qualify to be enrolled. We also offer a variety of other payment assistance tools and programs, like flexible payment plans, as well as programs focusing on customers living in disadvantaged communities and energy efficiency programs for low- and moderate-income multi-family housing.

Con Edison is committed to continuous improvement and will update this Plan at least once every five years as science evolves and enables us to better understand the risks and take the right steps to protect our equipment and customers.

Stakeholder Engagement

Con Edison has been engaging stakeholders and collaborating with peer utilities and other infrastructure owners throughout the resilience planning process. This report represents broad stakeholder understanding that additional resilience investments are necessary for the Company to provide safe, reliable, and resilient service to its customers in a changing climate. The robust stakeholder engagement effort was designed to identify stakeholders' concerns, challenges, and goals; collect and consider best/effective practices and expertise; integrate feedback as appropriate; and provide transparency and insight on the climate study process and outcomes.

Con Edison convened stakeholders to serve on the CCRP Climate Resilience Working Group (CRWG), which provided input and feedback for both the CCVS and the CCRP throughout the project. Much of the

[i] Measured by the number of customer outages

feedback from the CRWG informed the development of the CCRP, and Con Edison considered that feedback in its approach and investment plan.

Multi-Pronged Resilience Strategy

This plan builds on Con Edison's existing resilience management framework. This innovative framework employs a multi-pronged strategy that emphasizes the use of adaptable, resilient infrastructure and operational practices that anticipate and adjust for a changing climate. This approach extends beyond individual assets and isolated events to consider the full spectrum of potential climate impacts across Company operations. Consistent with the new statutory requirements for Resilience Plans,[ii] Con Edison's investments will increase resilience to extreme events, decrease customer outages, and reduce restoration costs.

This strategy allows the Company to address various climate factors that threaten grid integrity by leveraging the tools that drive system resilience. This approach also allows the Company to capitalize on synergies between resilience measures, improve efficiency by streamlining operations, and maximize the impact of their investments. The main strategies of Con Edison's resilience management framework are to **prevent**, **mitigate**, and **respond** to the climate change vulnerabilities the Company identified in the CCVS. Con Edison classifies its resilience investments into three strategic areas: **resilience-driven investments; incorporating resilience into planning, design and operations;** and **application of new technologies**.

Con Edison's approach is adaptable, so that the Company can adjust as climate science and other external conditions evolve. Future iterations of this Plan will reflect the latest climate data and lessons learned from previous efforts just as this plan builds on our previous study and adaptation efforts. Con Edison's commitment to learning and adaptation places the Company at the forefront of resilience planning and positions the Company to meet the challenges of a changing climate.

Con Edison considers the co-benefits its resilience measures may have. These include reduced costs, sustained environmental excellence, and improved service for customers. This increases the value our investments deliver for our customers.

In addition to targeted investments in resilience projects and programs, Con Edison is taking action to make climate-informed investment decisions. Recognizing the need for a comprehensive approach to resilience, the Company embeds resilience considerations into its planning, design and operational activities, including adopting internal design guidelines that reflect the most recent climate change projections. For example, the design guidelines provide projected changes in median and peak summer average temperatures in the service area to inform equipment ratings.

Con Edison has a long tradition of innovating and using state-of-the-art technologies to enhance the resilience of its systems and operations. Con Edison is exploring and implementing new technologies and striving to promote new resilience projects within the state. For example, through the Storm Response

[ii] Public Service Law §66(29).

Technology Advancements program, the Company plans to use unmanned aerial devices, to assess storm damage and improve response times. By integrating modern technological solutions and keeping the flexibility to adopt future advancements, Con Edison is enhancing its preparedness for the increasing intensity and frequency of severe weather events.

Consideration of Equity

Con Edison recognizes that the impacts of climate change and extreme weather events can disproportionately fall upon disadvantaged communities. These communities are the least able to prepare for severe weather events and recover from them. These populations are less likely to have access to alternative heating or cooling services. They are more likely to experience food spoilage and shortages and delayed or disrupted access to healthcare.

The Company believes equity must be a crucial consideration in its resilience investments and therefore, includes equity in the planning process. The Company also tracks the number of outages in disadvantaged communities relative to other communities. Our Plan includes investments to support selected critical facilities and we would also like to support New York City's development of resilience centers by allowing these locations to maintain essential services during extreme events.

Con Edison has also formed an Environmental Justice Working Group and plans to release a finalized Environmental Justice Policy Statement later in 2023. The Company will use that document as a guide for considering equity in all of the Company's operations and investments. With disadvantaged communities comprising 45% of the Con Edison service territory, it is important that the Company considers equity where possible.

Investment Plan

The projects and programs in the investment plan address some of the most pressing climate change risks the Company identified in the CCVS. The thought process included consideration of:

- Previous and ongoing resilience work
- Factors like technical feasibility and co-benefits
- How the solutions will complement each other to protect the electric system
- The ability to prevent, mitigate, and respond to extreme weather

To make the appropriate upgrades to our electric system, Con Edison expects to invest approximately $903 million during the first five years (2025–2029) of our resilience plan. Based on the expected in-service dates for the projects, we estimate those investments will result in a rate impact to our customers of $173 million during the first five-years of the Plan. This level of expenditures over the five years (2025-2029) would have varying delivery and total bill impacts from 0.1% to 0.8% and 0.0% to 0.6%, respectively. As a result, the five-year cumulative electric delivery and total bill impacts would be 2.1% and 1.4%, respectively. Over the next 10 years (2025 through 2034), the Company will continue implementing resilience programs and projects at an order of magnitude cost of approximately $2.4 billion, and the total capital expenditures for all resilience investments for the next 20 years (2025 through 2044) are

approximately $5.6 billion. These programs will minimize outages from heat waves, snowstorms, sea level rise, and other extreme weather events and restore service faster when outages do occur.

Governance

In 2020, Con Edison established a corporate governance structure for managing climate risk and resilience and incorporating climate change considerations into the Company's core functions. This structure enables the Company to maintain progress by incorporating climate change into the Company's design, operations, and planning. Con Edison has made considerable progress in incorporating this governance structure into its operations and will continue its momentum on this effort.

The governance structure includes a corporate instruction, internal design guidelines, executive oversight, a Climate Risk and Resilience Executive Committee, and a Climate Risk and Resilience Group. It also includes public reporting on the Company's risk management activities and financial risks related to climate change impacts. These governance components work together to help Con Edison sustain climate change adaptation efforts while providing guidance, support, and oversight.

Performance Measures

Con Edison uses resilience performance measures to track the implementation and effectiveness of resilience investments (i.e., outcome-based measures). Resilience performance measures are an area of research and there is no industry standard; however, Con Edison has developed potential measures to evaluate each resilience program. Details are in the Performance Measures section.

Conclusions and Next Steps

The Company's approach and investments in this Plan will help the Company continue to provide safe, reliable, resilient energy to its customers. This Plan identifies short, intermediate, and long-term investments that will address climate change. The Company relies on the latest climate projections and literature relevant to its service territory, as well as input from stakeholders and considerations of equity in planning its investments. Con Edison will meet with stakeholders at least twice per year and report every other year on the performance measures and status of investments. This monitoring and reporting will yield lessons learned about the effectiveness of resilience investments. Con Edison will use those lessons in developing future plans. The Company requests that the Commission fully authorize the funding levels and the programs in the CCRP.

Introduction

Con Edison has long prioritized providing safe, reliable, and resilient energy to its customers, and given the impacts of climate change, new and different investments are also required. The Company recognizes the necessity of maintaining a resilient energy system that is capable of withstanding extreme weather events, especially given our customers' increasing reliance on the electric system. Con Edison's resilience journey, including a forward-looking approach to system resilience, can be traced back to the 19th century, when Con Edison built the world's first underground network. The Company continues to enhance the resilience of its electric grid, in service of its customers, as depicted in Figure 1.

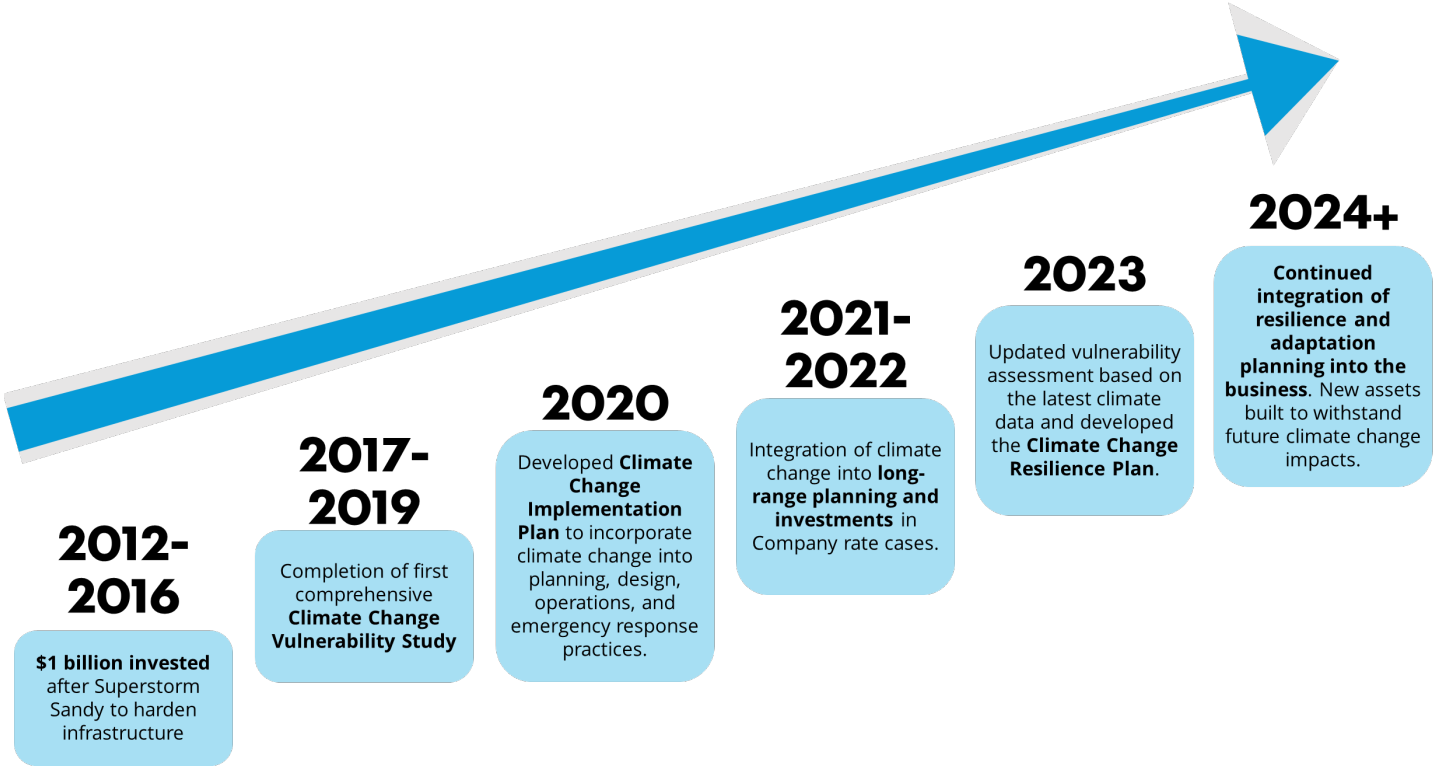


Figure 1. Con Edison's Resilience Journey.

In 2012, the unprecedented destruction of Superstorm Sandy ("Sandy") transformed the trajectory and pace of the Company's resilience journey and left a clear impact on New York State utilities' approach to climate resilience. In the last decade, Con Edison has invested more than $1 billion in resilience initiatives to strengthen its energy systems. Some examples include installing flood barriers and submersible equipment, raising or relocating critical equipment, and expanding the use of smart grid technologies.[2]

Over 1.2 million weather-related customer outages have been avoided as a result of the resilience investments Con Edison continues to make post-Sandy.

In 2019, the Company published a Climate Change Vulnerability Study ("2019 CCVS"), a comprehensive summary review of the risks climate change posed to the electric, gas, and steam systems. This 2019 CCVS established a foundational understanding of the climate risks facing Con Edison's systems.

In 2020, the Company developed a Climate Change Implementation Plan to incorporate climate change into its planning, design, operations, emergency response, and investment planning. The same year, Con Edison established a climate change governance structure to support the incorporation of climate change into processes and practices.

Con Edison's service territory has already experienced impacts from climate-driven events, such as storms and intense precipitation. For more detail on recent events, see Appendix 1: Climate Change Challenges.

Con Edison continues to:

- Study local climate change projections and science
- Identify potential system vulnerabilities
- Act to prepare its infrastructure for a changing climate and extreme weather events

This Climate Change Resilience Plan ("CCRP" or "Plan") builds upon and addresses findings in the Company's recently published Climate Change Vulnerability Study (CCVS) in September 2023, which updated the 2019 study with the latest climate science projections. Based on the CCVS findings, the Company continues to take action to address climate change risks while maintaining safe, reliable service. Above all, this Plan identifies actionable adaptation strategies that address identified vulnerabilities and will sustain service to Con Edison's customers as they live, work, and play in one of the world's largest economic and cultural centers.

The CCRP considers Con Edison's overarching **resilience framework** which was first developed as part of the Company's 2019 CCVS. The framework promotes comprehensive thinking about the types of measures that may help build a more resilient system and aims to support investments that:

• **Prevents** climate change impacts through infrastructure hardening,

• **Mitigates** the impacts from outage-inducing events by minimizing disruptions, and

• **Responds** rapidly to disruptions to reduce recovery times for customers.

Building resilience into complex energy systems as climate science evolves is a dynamic process. Our understanding of climate change will continue to grow. It is essential to learn from our investments and identify opportunities for improvement. Con Edison is committed to continuous improvement and will update this Plan every five years.

Legislative Context

In March 2022, New York State enacted a new section to the Public Service Law (PSL) §66(29)[3] which requires major electric utilities to conduct a Climate Change Vulnerability Study and develop a Climate Change Resilience Plan. The goals of the CCVS and CCRP are to better prepare utilities for climate change and severe weather events. The new law requires Con Edison, along with the other electric utility companies to submit a CCVS within 18 months (Con Edison's submittal was on September 22, 2023), and this CCRP within 60 days after the CCVS filing.

Con Edison's CCRP provides a comprehensive long-term roadmap and investment strategy to address climate risks identified in the CCVS for the next 5-, 10-, and 20-years. Informed by findings from the CCVS, the CCRP establishes Con Edison's plan to address priority vulnerabilities and aims to achieve the following as required by PSL §66:

- Mitigate the impacts of climate change to Con Edison infrastructure, reducing restoration costs and outage times associated with extreme weather events, and enhancing reliability,
- Incorporate climate change into Con Edison's planning, design, operations, and emergency response,
- Incorporate climate change into processes and practices, manage climate change risks and build resilience; and
- Propose adjustments, as necessary, to how the Company plans and designs infrastructure for the increasing impacts of climate change.[4]

Con Edison's CCRP is comprehensive, and also meets the law's requirements to establish a systematic approach and multi-pronged strategy to address the impacts of climate change, reduce restoration and outage times, and enhance electric infrastructure resilience. Because the Plan is a complete package of needed resilience investments, it includes funding for both new and expanded programs and, as detailed in the Investment Plan section, the Company is seeking authorization for all new resilience spending [iii] during the first five years of the Plan. [iv]

Con Edison has expanded or developed new programs that are feasible, reasonable, practical, and designed to meet the needs of our customers and the service territory. In preparation for this filing and based on the climate change data, the Company evaluated its electrical system for almost two years. The

[iii] Con Edison's current electric Rate Plan runs through 2025 (Rate Year 3). The Company's request for resilience spending of approximately $92.5 million in 2025 is in addition to amounts already authorized in the current electric Rate Plan. Because 2025 is the last year of the approved Rate Plan, the Company has included the full amount for needed resilience investments in 2026 through 2029.

[iv] The Company is not bifurcating needed resilience investments between resilience plans and rate cases because such a process would not meet the requirement to present a "systematic approach" and a "multi-pronged strategy." Bifurcation does not consider the requirement that the Commission incorporate approved resilience funding directly into base rates without further review as well as the requirement that the review of the resilience plan be separate from a corporation's rate proceeding.

Company reviewed design parameters of equipment and procedures, and then developed or expanded these programs to address the impacts of the climate change variables detailed in the CCVS.

In the CCRP, the Company is required to provide the Commission with the estimated costs and benefits to the Company and its customers. For each program or project included in the Plan, the Company provides the detailed cost estimates for the first five years (2025-2029) as well as projections through 2044. In addition, the Company provides a description of the customer benefits in terms of overall resilience, outage prevention, or quicker outage restoration times as applicable. The Company also provides the five-year estimated annual rate impact for its Plan.

As the Joint Utilities explained in their comments filed on August 22, 2022 in this proceeding, "there currently is no widely recognized and accepted methodology for comparing resilience investments to customer and regional avoided costs."[5] The same is true today. The Company will work with the Commission and Staff to consider and discuss appropriate methodologies for evaluating resilience investments in the future.

In addition to the cost information, each program description contains a schedule of planned expenditures and implementation for the first five years of the plan and projected expenditures with increases based on similar scope and inflation through 2044. Because the new law requires the Company to file a new CCRP every five years, the Company will provide similar detail in its next resilience plan filing.

The Company has also included opportunities to coordinate with municipalities through its proposed Storm Resilience Center and improve communications with customers through its Emergency Outage Communications Program and included processes to evaluate the effectiveness of each investment in the CCRP through performance measures. See the Performance Measures section for more detail. All of this work was done with the input of the Company's climate resilience working group which provided advice and feedback to the Company in the development of the CCRP. See the Engagement of the Climate Resilience Working Group & Other Stakeholders section for more detail.

Con Edison's CCRP is a comprehensive and cohesive long-term plan for mitigating climate change impacts, reducing restoration times and related costs, and enhancing reliability as required by the law. Because the CCRP is the Company's full plan, reductions or changes to individual components of the CCRP can impact the overall effectiveness of the Company's resilience efforts. Therefore, the Company requests that the Commission fully authorize the funding levels and the projects/programs in the CCRP.

Climate Change Vulnerability Study Summary

The purpose of the Climate Change Vulnerability Study (CCVS) was to update our understanding of climate change risks to Con Edison's electric system to inform the development of this Plan. In the CCVS, Con Edison built upon its 2019 CCVS and understanding of physical and operational vulnerability by:

- Understanding the basis of the latest science and the changes in projections from the 2019 CCVS.
- Applying these insights and revisiting previously identified impacts to determine if and how they may differ (in timing or magnitude) based on the latest climate change projections.
- Advancing prior work by completing a comprehensive rating of risks to the various components of the Company's electric system between now and 2050. This development is useful as it helps to highlight the near-term risks.

Advanced Climate Science

Con Edison is committed to basing its planning decisions on the latest climate science and has therefore:

1) Invested in comprehensive modeling with highly customized climate data specific for use within our service territory.

2) Maintained a partnership with Columbia University for over 6 years.

3) Contributed to and invested in the Mesonet system (e.g., New York City Micronet). The NYC Micronet is a network of 22 (17 owned by Con Edison) weather stations designed to report both real-time and long-term data for measuring high-impact events and monitoring climate change.

The CCVS used the latest climate projections to understand how climate change may manifest in the coming years. Updated climate projections were provided by the New York State Energy Research and Development Authority ("NYSERDA") in partnership with Columbia University and supplemented with literature reviews and an additional data set developed by the Massachusetts Institute of Technology (MIT). Primary findings from the climate change projections developed for this Study are summarized in Table 1.

Temperatures will increase faster. The 2023 CCVS found that **by 2030**, there could be **17 days per year** when the temperature in Central Park **exceeds 95°F**, compared to a previous projection of 11 days per year. This will also lead to increasingly frequent, **intense heatwaves**.

Precipitation projections show an increase relative to historical norms. This could **increase deluge precipitation events** – short-duration, high-intensity rainfall—that may impact municipal stormwater systems, resulting in localized flooding.

 	**Sea level rise** projections have not changed since the 2019 CCVS. Con Edison's service area is still expected to experience **16 inches of sea level rise by 2050**. While the Company's efforts and process updates have begun to address the risk, continued investments are needed.
 	**Wind and ice** projections remain the most uncertain. A review of external scientific studies indicates that the Con Edison service area is likely to experience **stronger wind gusts** in the future due to **intensifying storms**, particularly during tropical cyclones. In addition, there remains the potential for **more higher-intensity radial icing events** (ice forming on overhead distribution and transmission lines) in the winter.
 	Directional changes in **extreme events** have not changed since the 2019 CCVS, but new scientific research has strengthened and refined current understanding of these risks. • **Hurricanes** are expected to increase in intensity with a higher probability of northeast tracks due to a projected northward migration of strong hurricanes. • **Extreme heat waves** will increase in both frequency and intensity. • **Nor'easters and cold snaps** may increase in intensity but are expected to decrease in frequency. • **Deluge precipitation** is expected to increase in both frequency and intensity. • **Concurrent and consecutive** extreme events are expected to increase in frequency and intensity.

Table 1. Summary of climate updates and changes since Con Edison's 2019 CCVS.

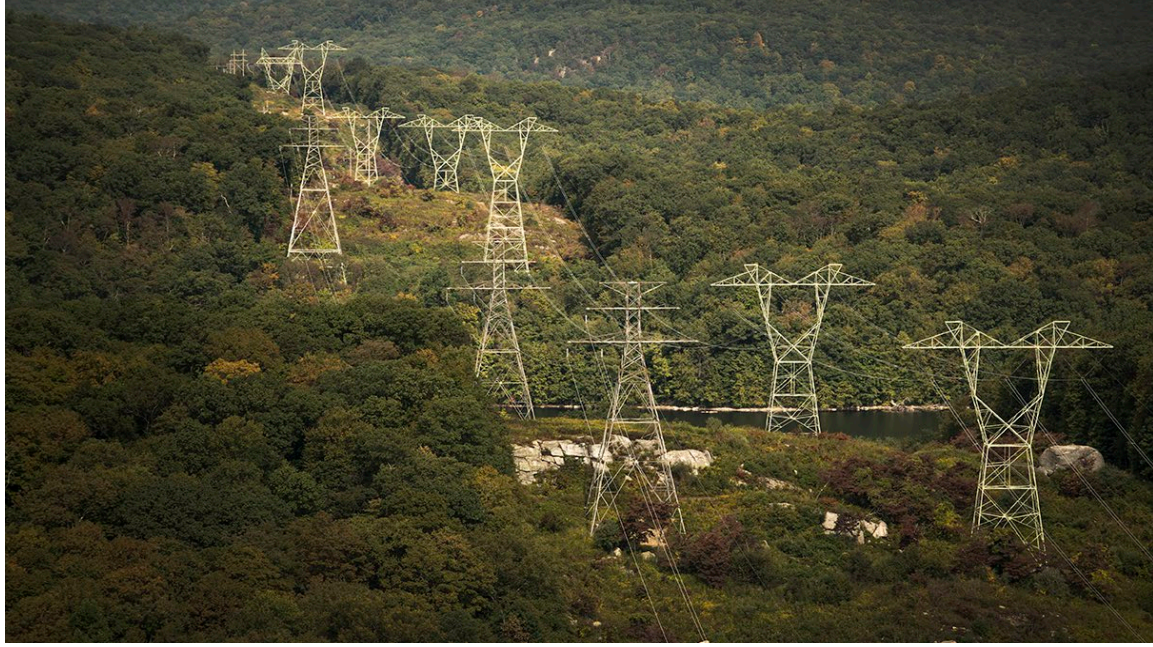
Vulnerability is defined as the potential for assets or operations (and, by extension, customers) to be affected by climate change. Vulnerability incorporates the degree to which assets may be exposed to climate hazards, as well as the potential impacts of exposure, defined by infrastructure sensitivity. Exposure and asset sensitivity were considered together to generate vulnerability rankings of primary (dark blue), secondary (medium blue), and low (pale blue); the results of this analysis, along with summaries of the impacts of each hazard, and detailed summaries of the physical and operational impacts of each hazard are summarized in Appendix 2: Physical and Operational Hazard Impact Summaries.

The highest vulnerability asset-hazard combinations from the CCVS included substations, overhead transmission, overhead distribution, and underground distribution. These, along with selected secondary vulnerability combinations, were prioritized for adaptation measures in this Plan.

	Trans.	Subs.	Dist.	2050 Projected Change and Impact to Con Edison's Electric System
Temperature and Temperature Variable (TV)	OH		OH	Con Edison's electric system will see impacts due to rising temperatures, and those impacts will increase during intense heat waves. Increasing temperature variable ("TV")[v] indicates load will increase and high load levels will continue for longer periods, potentially straining the capacity of the system. Overhead transmission and distribution, substation, and underground distribution assets are particularly vulnerable to the impacts of heat and subject to accelerated deterioration, decreased reliability, and decreased capacity.
	UG		UG	
Flooding	OH		OH	Con Edison has already experienced flooding that has impacted its assets. That risk is likely to increase. Substations are especially vulnerable to flooding since they contain a large quantity of equipment that is sensitive to water. The exposure assessment found that a 16-inch rise in sea level by 2050 (relative to 1995-2014 sea levels) would impact 23 substations in 2050 during a 1% annual chance flood. Seven of these locations do not currently have flood protection, while 16 have flood protection that would need to be modified to provide adequate protection against future flood levels
	UG		UG	
Wind and Ice	OH		OH	Wind and ice present a threat to the overhead distribution system, which is susceptible to tree contact during intense wind and icing events.
	UG		UG	
	OH = Overhead assets UG = Underground assets Primary (dark blue); Secondary (pale blue); Low (light blue)			

Table 2. Summary of vulnerability ratings for all hazards and asset groups (transmission, substations, distribution) under the 75th percentile of the SSP5-8.5 emissions scenario for 2050.

[v] TV is an index that Con Edison uses to evaluate system load. It is similar to a heat index but considers the persistence of heat and humidity over three days. Electric summer TV is calculated using a weighted calculation of the rolling three-hour average of wet and dry bulb temperature for the current day (70%; D), prior day (20%; D-1), and next prior day (10%; D-2).



Engagement of the Climate Resilience Working Group and Other Stakeholders

For climate resilience planning to be effective, it must include a broad range of stakeholders, and leverage external expertise. Con Edison collaborates and coordinates with other utilities in New York State and around the country regarding climate resilience efforts. Con Edison also benefits from being located in an area with leadership on climate resilience – the Company can share resources (e.g., climate science data) and best practices with a variety of stakeholders including New York State Department of Public Service staff, the NYC Mayor's Office of Climate and Environmental Justice and other municipality representatives, labor groups, and advocacy groups for consumers, the environment, and equity.

Con Edison has engaged stakeholders throughout the resilience planning process. This report represents a shared stakeholder understanding of the identified resilience investments for Con Edison to serve its customers safely and reliably in a changing climate.

This effort was designed to build upon previous engagement efforts, with many members participating consistently since 2012. The intent is to capture feedback, input, and experience and fulfill the Company's goal of serving communities' and customers' energy needs. The robust stakeholder engagement effort was designed to:

- Identify stakeholders' key concerns, challenges, and priorities
- Collect and consider best practices and expertise
- Integrate stakeholder feedback in Con Edison's resilience planning
- Provide transparency and insight on the climate study process, investments, and outcomes

Con Edison convened a group of external stakeholders to serve on the Climate Resilience Working Group ("CRWG"). The purpose of CRWG was to provide input and feedback to the CCVS and the CCRP throughout the project. A list of the organizations represented on the CRWG is provided in Table 3.

Organization Type	CRWG Member Organization
Federal Agencies	U.S. General Services Administration
State Agencies	Department of Public Service (DPS)
	New York State Energy Research and Development Authority (NYSERDA)
	Office of the New York State Attorney General
	New York State Office of General Services
Universities	Columbia Sabin Center for Climate Change Law
Local Government	NYC Mayor's Office of Climate and Environmental Justice
	Westchester County Government
Unions	Utility Workers Union of America, AFL-CIO, Local 1-2
Customer Advocate Groups	AARP New York Brooklyn Navy Yard Cogeneration Partners Centsiblehouse NRG Energy, Inc. Individual/Consultant New York Energy Consumers Council, Inc. The Ad Hoc Group, Inc. WE ACT for Environmental Justice
Other Infrastructure Owners	MTA
	Port Authority of New York and New Jersey
	PSEG-LI/LIPA

Table 3. Climate Resilience Working Group Member Organizations.

Con Edison engaged CRWG members through numerous meetings, which focused on the following:

	CRWG Meeting Date	Meeting Focus
1	**August 9, 2022**	Introduction to the climate legislation and the role of the working group.
2	**December 14, 2022**	Climate science updates and objectives and timelines for the project.
3	**March 28, 2023**	Climate change pathways and associated risk tolerance; understanding how risk tolerance impacts planning and design.
4	**June 23, 2023**	CCVS updates and the approach to the CCRP.
5	**August 28, 2023**	CCVS updates and the projects/programs in the Investment Plan section of the CCRP.
6	**September 25, 2023**	CCRP project and program overview part 1.
7	**September 26, 2023**	CCRP project and program overview part 2.
8	**October 30, 2023**	Stakeholder feedback on draft CCRP and proposed investments.

Figure 2. Climate Resilience Working Group Meeting Dates and Focus.

Stakeholder Input

Con Edison actively reviewed its approach and investment plan in response to CRWG feedback. Table 4 summarizes the CRWG feedback and how it was incorporated into the CCVS and CCRP.

CRWG Feedback	Actions Taken
Engagement Process CRWG members want to be engaged early and often with the opportunity to review and provide feedback at key stages.	Con Edison added additional CRWG meetings to the schedule. Con Edison provided proposed schedules of milestones and dates for feedback opportunities.
Updated Pathway Selection CRWG members were actively engaged in discussions surrounding the updated climate change pathways used projections.	Using the updated climate data from SSP5-8.5 this pathway aligns with the risk tolerances of the previous pathways in the 2019 CCVS, which used the corresponding RCP 8.5 data.

CRWG members recommended feedback and alignment on the chosen pathways and their associated risk tolerances, especially to align with New York City's pathway selection.	Con Edison performed external benchmarking to align with regional resilience guidelines, including New York City.
Updates and Changes from the previous published reports CRWG members were also concerned about steam and gas system vulnerabilities, in addition to the electric system.	Per the legislation, only the electric system was required to be assessed and incorporated into this Plan. The Company also reviews climate change risks associated with the gas and steam systems.
Scope of Vulnerability Assessment CRWG members recommended additional climate hazards for consideration, including wildfire, wind, and icing. CRWG members also raised concerns about the use of Federal Emergency Management Agency (FEMA) maps for locations outside the FEMA floodplain that were inundated during Hurricane Sandy.	Difficult-to-model climate hazards were qualitatively analyzed based on literature, including wildfires, hurricanes, wind, extreme heat, nor'easters, and cold snaps. Wind and radial icing projections were included in the CCVS, along with information on the limitations of the dataset. Con Edison benchmarks with New York City's Climate Resilience Design Guidelines which uses FEMA floodplain maps as the basis for construction and engineering/design purposes. The Company supplements designs with other resources, such as NYC Stormwater Maps and Flood Hazard Mapping tools. Con Edison adheres to the latest building codes and undertakes a complete environmental review when it comes to building and planning new infrastructure. For areas inundated by Sandy's storm surge, Con Edison fortified its system to FEMA +3' and is now moving to FEMA +5' based on sea level rise projections.
Exploring new resilience strategies and coordinating with others CRWG members recommended exploring new projects and programs throughout the study. CRWG members also inquired about the recent US Army Corp of Engineers	Con Edison has included a series of resilience solutions in this plan, including a green infrastructure pilot, additional underground interrupters, erosion protection and drainage upgrades, and other projects and programs.

(USACE) plan [vi] and how that affects Con Edison's planning process.	Con Edison engaged its research and development group in the development of the Plan and will continue to work with them on new ideas. The US Army Corps of Engineers coastal resilience proposal has not been integrated into this plan since it is not yet fully developed. However, when more details are provided and approved, it may be used in future iterations of this Plan.
Equity CRWG members are concerned about environmental justice. They recommend that the CCRP should consider prioritizing circuits beyond critical facilities and consider equity.	The Company has formed an Environmental Justice Working Group and established draft corporate Environmental Justice principles that will inform its planning processes, including the CCRP. The Consideration of Equity section in this Plan includes the state's disadvantaged communities (DAC) maps which will be used for tracking the Company's investments within these areas.
Climate Justification CRWG members and DPS Staff requested additional detail from Con Edison on the climate science justifications for increasing the size of existing resilience programs.	The Company has revised program descriptions to connect the climate science with the need and value for stakeholders.

Table 4. Summary of CRWG feedback and actions taken

[vi] The USACE Climate Action Plan can be found on the USACE website.

Multi-Pronged Resilience Strategy

Con Edison developed a holistic resilience management framework to think strategically and innovatively about the portfolio of investments to reduce both near and long-term climate change risks. This framework emphasizes the importance of adaptable, resilient infrastructure and operational practices that anticipate changing climate conditions. This approach extends beyond individual assets and isolated events to comprehensively address the spectrum of climate impacts across operations. The objectives of Con Edison's investments are to increase resilience from extreme events, decrease customer outages and disruptions, and reduce restoration costs.

More information on the multi-pronged resilience strategy is provided in the following subsections.

Past Investments

Con Edison's prior investments demonstrate the Company's firm commitment to resilience across infrastructure and operations. These investments were informed by past events, such as Hurricane Andrew, Hurricane Irene, and Superstorm Sandy, as well as changes to Company policies that incorporated resilience into design guidelines.

Past initiatives to improve the Company's resilience have included:

Strategy	Hazard Addressed
Installed higher and stronger flood barriers	Flooding
Installed submersible equipment	Flooding
Raised flood prone infrastructure	Flooding
Pilot project that selectively undergrounded overhead power lines	Wind and Ice, Extreme Events

Strengthened flood design standards to exceed city code, by requiring an additional foot of elevation for 100-year flood protection measures	Flooding
Updated planning and operations processes to account for future changes in climate	Multiple
Installed advanced smart-grid technologies	Multiple
Made improvements to storm readiness and restoration processes	Extreme Events
Established a dedicated Climate Risk and Resilience Group to work on resilience efforts	Multiple

Table 5. Summary of Past Resilience Investments.

As the Company navigates the evolving landscape of climate risks, it continues to refine its strategies, adapt its practices, and draw insights from past climate events. Con Edison's commitment to continual learning and adaptation underpins the Company's place at the forefront of resilient infrastructure and operations and makes the Company well-prepared to meet the challenges of a rapidly evolving climate. Figure 3 illustrates the Con Edison's approach to increasing system resilience, via asset replacements, new construction, resilience projects, and operational measures.

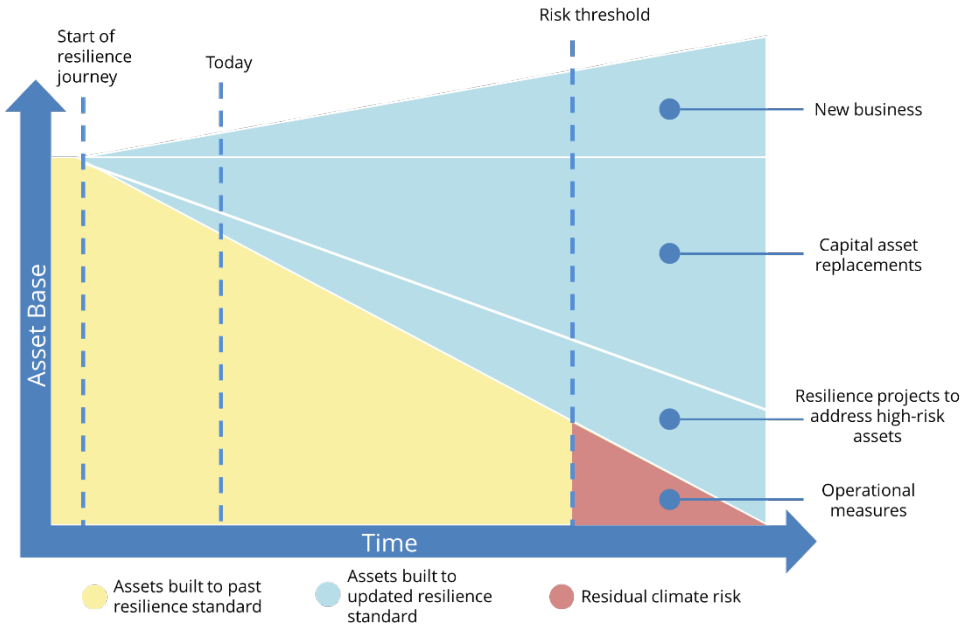


Figure 3. Con Edison's climate resilience approach

Adapting to Coastal Flooding and Sea Level Rise

In the aftermath of Hurricane Sandy in 2012, Con Edison recognized the mounting challenges posed by climate change induced coastal flooding and sea level rise. Con Edison is consistently evaluating how to adapt to the evolving threats of sea level rise and coastal flooding. The Company adopted an internal climate change design guideline that requires all infrastructure in coastal areas to incorporate the risk of sea level rise. For example, the guideline requires substations within the area of the 1% annual chance floodplain plus 5 feet of simulated sea level rise to be evaluated and hardened, as appropriate. Such long-range planning may result in design changes such as requiring the use of floodwalls, waterproof cabinets, or other flood risk mitigation measures. By utilizing forward-looking climate science, Con Edison demonstrates its commitment to being proactive and adaptable.

Resilience Management Framework

Con Edison's resilience framework addresses various climate factors that threaten grid integrity by leveraging tools such as system hardening, data analytics, and load management. Given the multifaceted nature of climate-related risks, no individual measure or solution can provide comprehensive resilience. This holistic approach allows the Company to capitalize on synergies between resilience measures, improves efficiency by streamlining operations and maximizes the impact of investments. Overall, the framework emphasizes:

- Reducing the impact of climate-driven hazards.
- Considering solutions across planning, operations, engineering, and emerging technologies.
- Maintaining adaptability.

The following sections describe how Con Edison will use this framework to develop and implement resilience work.

Reducing the impact of climate-driven hazards.

This principle focuses on reducing impacts by hardening the electric system, mitigating impacts of events by modifying system design to reduce customer impacts of damages, and increasing the Company's ability to respond to events and restore service expeditiously.

The main strategies of Con Edison's resilience framework are to **prevent**, **mitigate**, and **respond** to the climate change vulnerabilities identified in the CCVS. Each of these strategies consistently play a role in the Company's approach, fortifying infrastructure and services against climate events and maintaining dependable service.

Figure 4. Con Edison's three strategies to address climate risks

"**Prevent**" encompasses proactive measures to both reduce climate change risks and enhance the reliability and resilience of Con Edison's electric system. "Prevention" investments are not necessarily a one-time event. Rather, the ability to prevent climate change impacts must be integrated and revisited throughout the life cycle of Con Edison's assets. Doing so requires changes in the planning, design, and construction of new infrastructure, ongoing data collection and monitoring, and investment in the upgrade of existing infrastructure using forward-looking climate information.

Example **Prevent** strategy: Elevation of sensitive equipment to avoid flood damage.

"**Mitigate**" includes strategies to reduce the impacts of climate events, since Con Edison cannot feasibly harden its energy systems to tolerate every possible low-probability, high-impact extreme weather event. These actions serve to reduce damage and protect exposed systems from further damage. Examples include auto-loop sectionalization, bifurcating feeders, and increasing feeder diversity.

Example **Mitigate** strategy: Grid automation using devices such as switches, auto-loop circuits, and reclosers.

"**Respond**" refers to improvements to reduce recovery times. Activities in this category involve the continuous improvement of Con Edison's emergency response efforts and outage management system to support swift response to power outages.

Example **Respond** strategy: Utilization of AMI and new storm response technologies to allow for faster restoration times using data and machine learning.

Investing in prevention, mitigation, and response will lessen the impact of climate hazards and allow Con Edison to recover more quickly. Figure 5 visualizes the possible impact of a climate change-driven extreme weather event on Con Edison's service without resilience investment (left) and with resilience investment (right).

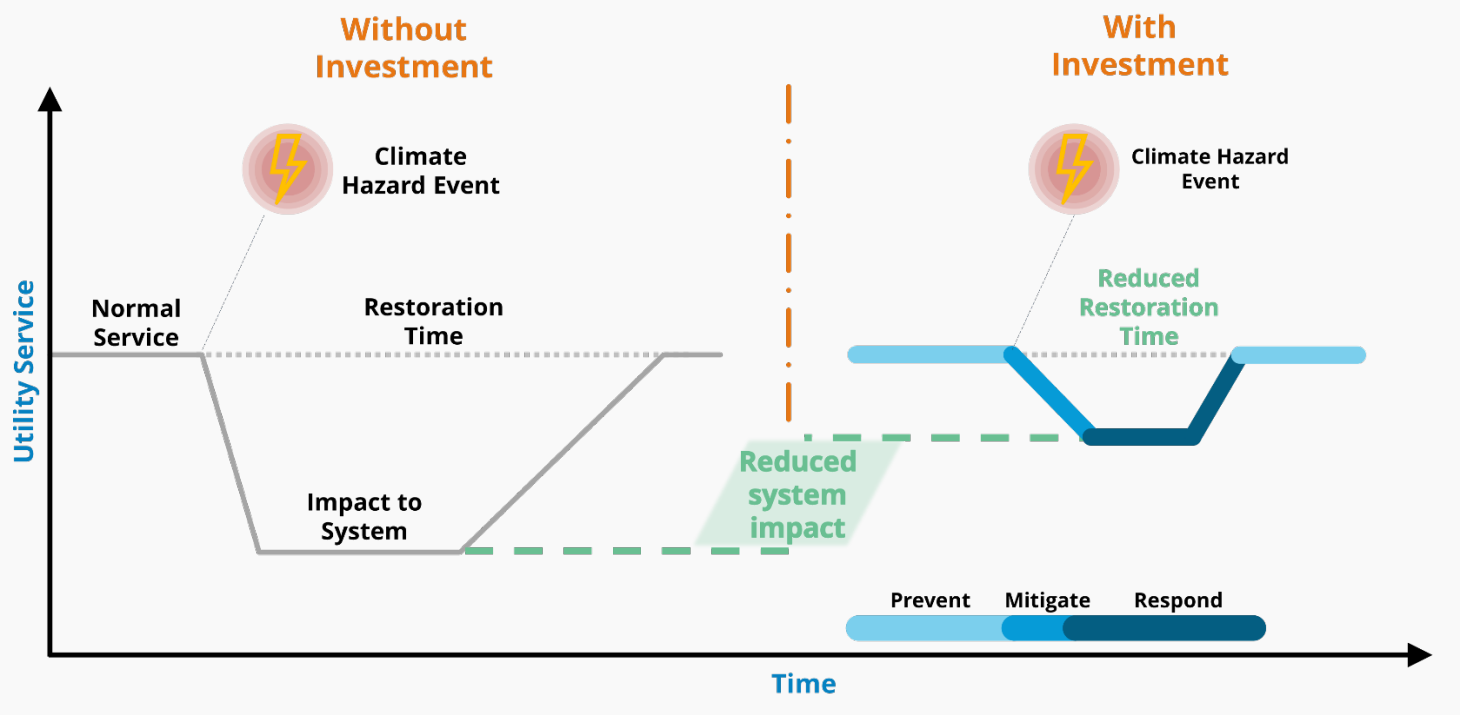


Figure 5. Visualization of how resilience measures can reduce the impact of a climate hazard event on service

The Investment Plan section of this CCRP provides more information on the full portfolio of proposed investments across these strategies.

Considering solutions across planning, operations, and emerging technologies.

Updating planning and design approaches will help all Company strategies and investments to be more resilient. This is paired with strategic investments in existing infrastructure to enhance its resilience, and consideration of new or emerging approaches to resilience that could be piloted.

Resilience investments are categorized in three areas: resilience-driven asset investments, incorporation of resilience into planning, design and operations, and application of new technologies. Con Edison plans to use this framework to help define future projects to enhance resilience. These investments may also provide co-benefits (advantages or positive effects that are secondary to the primary goal of increasing resilience) that improve system performance in other areas. Outcomes include increased system reliability, long-term value and cost savings, and enhanced preparedness for the integration of new technologies and grid capabilities for the future.

Maintaining adaptability.

The Company's resilience framework is flexible and supports continued adaptability over time. This approach allows Con Edison to develop near term strategies, while formulating future projects and programs based on projected climate conditions over 10- and 20-year planning horizons. This long-term

outlook reduces the cost of managing uncertainty as resilience measures can be sequenced to respond to changing conditions. It also allows future iterations of this Plan to consider new climate science and lessons learned from previous efforts. For example, Con Edison may identify solutions to implement now that protect against near-term climate changes that are lower cost and foundational, while leaving options open to protect against plausible changes emerging later in the century.

Figure 6 depicts how flexible adaptation pathways are used to maintain tolerable levels of risk. As seen by the blue line, the key to flexible adaptation is to continually monitor and adjust to keep the total risk level below a tolerable threshold.

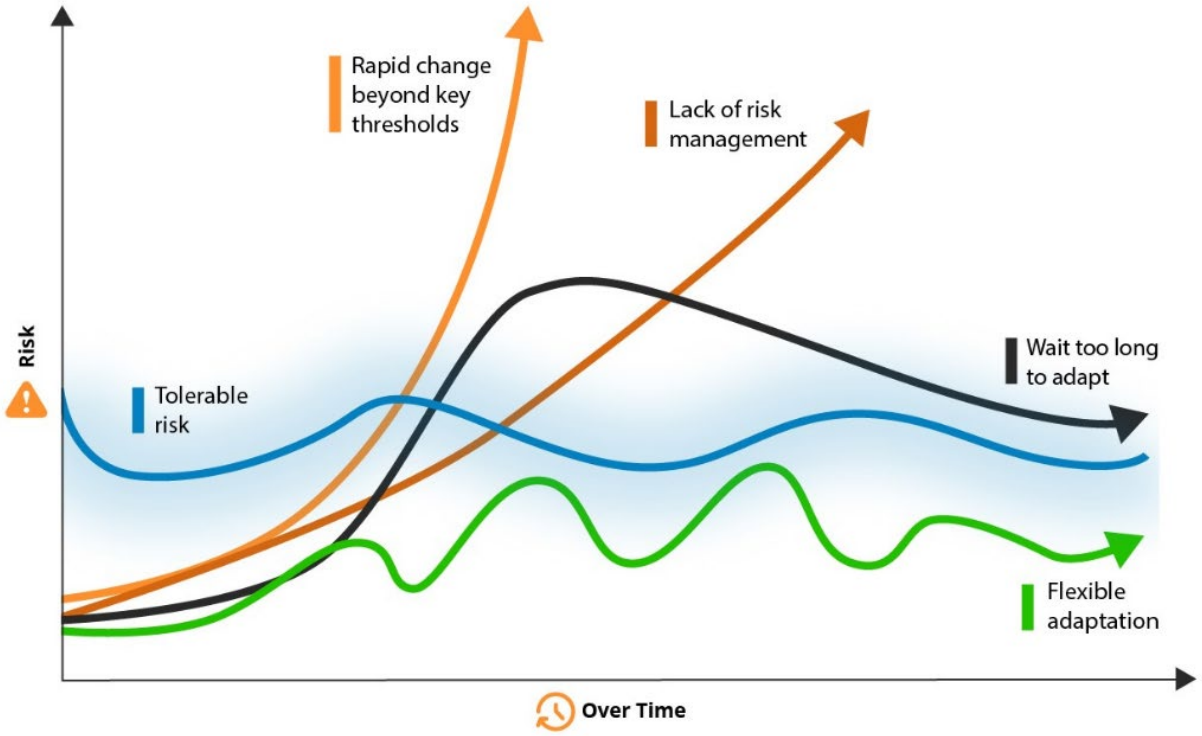


Figure 6. Flexible adaptation pathways in the context of tolerable risk and risk management challenges to non-flexible adaptation. Adapted from Rosenzweig & Solecki, 2014.

Furthermore, Con Edison considers impacts beyond the immediate scope of its resilience investments with co-benefits such as reduced costs to customers, sustained environmental excellence, and improved customer service. This perspective amplifies the overall value and effectiveness of Con Edison's resilience efforts.

Investment Categories

Con Edison recognizes that its past investments have reduced outages, but additional investments will be needed to address future climate change impacts. The forward-looking resilience projects and programs included in this CCRP were developed using the resilience management framework and encompass work that will address changing climate hazards as their primary objective.

Resilience-Driven Investments

Con Edison recognizes that its past investments addressed the known risks at that time, however more is required to prepare the grid for the impacts of climate change. The resilience projects and programs included in this Plan are specifically designed to cope with changing climate hazards. Some investments may provide co-benefits, though the primary driver of the investments is increasing resilience.

Building, reinforcing, and adapting infrastructure to enhance resilience is an ongoing necessity. The lessons learned from previous efforts will inform the planning and implementation of these projects.

The investments proposed in this Plan are shown in Figure 7 below, categorized by which strategy they primarily support. Programs with an asterisk (*) are shared between Con Edison and O&R. More detail on each item is given in the Investment Plan section of this CCRP.

Prevent

- Selective Undergrounding
- Non-Network Resiliency
- Substation Operations Storm Hardening
- Submersible Equipment
- Critical Facilities
- Green Infrastructure and Rewilding
- Living Shorelines and Nature-Based Solutions
- Substation Enclosure Upgrade

Mitigate

- Primary Feeder Resiliency
- Erosion Protection and Drainage Upgrade
- Non-Network Resiliency Cutout Upgrade
- Heat Mitigation for Worker Safety

Respond

- Substation Loss Contingency
- Storm Resilience Center*
- Storm Technology Advancements
- Emergency Outage Communications
- Micronet Weather Station Expansion

Figure 7. Resilience-driven investments

Incorporating Resilience into Planning, Design, and Operations

Recognizing the need for a comprehensive approach to resilience, the Company embeds resilience considerations into its planning and operational activities, including adopting internal design guidelines that reflect the most recent climate change data. For example, when planning capacity projects for substations to address increasing customer demand, projected increases in temperatures (which can also drive increased demand) are incorporated into the design process. This includes higher temperature and temperature variable (TV) projections used in power equipment ratings and load relief planning, sea level rise projections used in updated flood risk standards, and heavy rainfall and wind considerations. [vii] These considerations can lead to design modifications, such as situating a new substation farther from a floodplain or elevating it, thereby reducing the risk of future flood impacts.

Tools are provided to engineers and planners to assist with these updates and modifications, including information on how to apply the FEMA Preliminary Flood Insurance Rate Maps [viii] to account for sea level rise, and forward-looking rainfall intensity-duration-frequency curves. [ix] Con Edison incorporates resilience to bolster its entire system to withstand the challenges presented by climate change and is committed to refining these practices for better outcomes.

In its 2020 Climate Change Implementation Plan, Con Edison identified strategies to update operational processes to better address the multifaceted risks posed by climate change. These updates span across several key areas of the Company's operations, each playing a role in enhancing the overall resilience of the system. Table 6 provides an overview of these updates and their implications for Con Edison's climate resilience strategy.

Procedure or Practice	Climate Dependencies and Planned Adaptations
Load Forecasting	Con Edison recognizes that climate change will increase customer demand for electricity and has (since 2020) refined its load forecasting process to incorporate future temperature projections. Con Edison has integrated an increase in peak TV of 1 degree in 2030 (87 TV) and 2 degrees in 2040 (88 TV) into its electric system peak load forecast. [6] This integration enhances the Company's ability to anticipate and prepare for future electricity demand under hotter conditions.
Load Relief Planning	Since 2021, the load relief planning process has been updated to account for hotter conditions that will lead to increased loads (driven by increased air conditioning use and electrification) and reduced electrical equipment

[vii] Note that temperature projections show a 1% decrease in transformer ratings by 2035 and a 2% decrease by 2045. These minimal impacts will be incorporated into load relief planning.
[viii] The most up-to-date FEMA FIRM map is the 2015 National Flood Hazard Layer (NFHL) for the State of New York, which reflects the FIRMs done by each county. https://www.fema.gov/flood-maps/national-flood-hazard-layer
[ix] This information is publicly available through Cornell University. http://ny-idf-projections.nrcc.cornell.edu/index.html

	capacity. This update helps identify areas where growth in electricity peak demand could exceed system capacity, which allows Con Edison to implement load relief measures as required. By adapting to forward-looking temperature projections, Con Edison is able to maintain reliable service and keep equipment ratings within design parameters.
Reliability Planning for the Sub-Transmission and Distribution Systems	Con Edison's reliability planning process for the electric sub-transmission and distribution systems considers how weather conditions, including heat, rain, wind, snow and ice, affect equipment failures and customer outages. To maintain reliability standards, the Company has integrated climate change-adjusted load forecasts and projected increases in heat into its modeling processes.
Asset Management	The Company is making key asset management updates to cope with projected sea level rise, increases in temperature, and changes in intense rain events. The Company has also updated its flood design standard for new sites, adding the sea level rise projections and freeboard to FEMA's 1% annual chance base flood elevation. As climate science evolves, Con Edison will review existing assets and make changes as needed.
Facility Energy System Planning	Con Edison has incorporated climate change projections into its process for periodic replacement and installation of heating, ventilation, and air conditioning (HVAC) systems in its buildings. The Company is also using more efficient lighting and other green design elements to reduce building thermal loads, allowing Con Edison to be better prepare for increased demand on HVAC systems.
Emergency Response Activations	Con Edison is considering projected climate data in its emergency response planning. For example, the Company conducts emergency response drills and exercises based on projected future climate conditions. By including climate data related to heat, precipitation, and flooding in periodic emergency response plan reviews, the Company can adjust to account for new conditions.
Worker Safety Protocols	Con Edison plans to include new climate projections for heat in future reviews of worker safety protocols. Con Edison continues to leverage the latest research and plans to invest in several heat stress pilot projects that will be the foundation for future worker safety protocols. Con Edison is proposing to invest in a new worker safety program for cooling personal protective equipment (PPE) and to explore other new technologies.

Enterprise Risk Management (ERM)	Con Edison has integrated climate change into its ERM risk identification process. This incorporates climate change in the overall risk management strategy, allowing the Company to better understand and manage climate risks.

Table 6. Incorporating climate change into planning, design and operations.

Application of New Technologies

Con Edison actively explores and implements new technologies, striving to set higher standards for resilience projects. By employing modern technological solutions and maintaining the flexibility to adopt future advancements, Con Edison is enhancing its preparedness for the increasing intensity and frequency of climate-driven events.

Moving forward, Con Edison will pursue three avenues of engagement to continue to understand and evaluate the latest developments in resilience technologies:

- **Identifying system needs and existing capabilities**: Evaluating areas of system performance that need new resilience solutions will help Con Edison focus its search for technologies that will have the greatest impact. An integral part of this assessment involves optimizing the value of recent advancements, such as advanced metering infrastructure so that the Company fully leverages its existing capabilities while identifying areas for further enhancement.
- **Partnering to develop new technologies**: Working with government and industry to collaborate on new energy technologies, which may involve sharing system data, providing opportunities for testing equipment, or access to the Company's subject matter experts.
- **Monitoring industry developments**: Tracking new technologies and approaches coming out of national laboratories and the private sector, while also engaging other electric utilities to understand how they are deploying new technologies.

Con Edison's research and development (R&D) teams play a crucial role in allowing the Company to stay at the forefront of new technology. Through its proactive research and piloting of new technologies, Con Edison is contributing to an industry-wide approach of resilience strategies and solidifying its reputation as a forward-thinking leader in the field.

Areas of innovative investment that Con Edison is including in this Plan include use of automation equipment to mitigate disruptions due to outages, construction of a new Storm Resilience Center, investment in advanced storm response technologies (such as unmanned aerial vehicles for rapid response), and new worker safety technology, which include investigating the use of reflective hard hats and mobile cooling centers. More detail on the proposed resilience measures is shown in the Investment Plan section.

Consideration of Equity

Con Edison recognizes that the impacts of climate change are disproportionately falling upon overburdened communities who are the least able to prepare for and recover from them. [7] These communities tend to be the most exposed to and the most sensitive to climate hazards, like inland flooding or extreme heat, both of which are projected to increase across Con Edison's service territory. [8]

Analyses by the U.S. EPA show that minorities are more likely to live in areas with the highest projected levels of climate change impacts. [9] In addition, vulnerable populations are more likely to lack access to heating or cooling services, more likely to experience food spoilage and shortages, and can experience delayed or disrupted healthcare services during a power outage. [10] Elderly and health-compromised groups also have a lower tolerance for extreme temperatures. These communities have also been shown to correlate with increased health risks, lower levels of power outage preparedness, and willingness and means to evacuate if necessary. [11]

Con Edison's Role

Con Edison recognizes the importance of equity and its crucial role in energy resilience planning. The Company has been deliberate about reviewing how it incorporates equity into the planning process and tracking the implementation of clean energy and climate resilience-driven programs. In the Company's most recent rate case, the Company reaffirmed its continued focus on investments and programs that provide disadvantaged communities with safe and reliable service. For details on how Con Edison defines "disadvantaged communities," see Appendix 3: Defining Disadvantaged Communities.

Recently, Con Edison has received funding for several clean energy investments that will benefit disadvantaged communities, including:

The **Reliable Clean City Projects** invests approximately $800 million to upgrade electrical substations and build new, local transmission lines that will deliver clean and reliable energy to customers in Queens, Staten Island, and Brooklyn.

The **Brooklyn Clean Energy Hub** is a transmission substation that will strengthen New York's power grid and meet the region's growing demand for electricity. It will accommodate additional load from expected electrification and provide important resilience benefits to communities in Brooklyn and Queens.

Con Edison has formed an Environmental Justice Working Group and plans to release a corporate policy statement to apply an equity lens to its operations and programs. Con Edison will consider these principles going forward as the Company learns from the effects investments may have on DACs through reporting. Key components of the policy statement include:

- Con Edison will work to actively reduce or address any disproportionate burdens of operations on DACs;
- Con Edison will work to understand DAC concerns;
- Clean energy and resilience investments will benefit DACs;
- Con Edison will provide opportunities for employment in their clean energy future. [x, 12]

The EJWG's principles are embodied within subcommittees that are responsible for setting and achieving these objectives. One objective is to focus on working with operational groups to develop review processes to advance work that will benefit DACs. Another objective is to educate Company employees on environmental justice, which will allow for more consideration of DACs across the corporation. In addition, the Company will work to expand efforts to recruit and train residents of DACs as well as seek federal funding for projects within these areas. Lastly, the EJWG will be responsible for supporting and advising the development of the Company's reporting efforts as the Company makes investments in these communities.

Con Edison has committed to two ways to report on investments in DACs to learn how they affect these communities. The first is to report the value (dollar amount) of strategic electric capital investments in DACs (and determining the baseline), through biennial retroactive reporting using the New York State DAC map (see Figure 8). The second is to track the number of outages in DACs relative to non-DACs to understand the level of impact on these communities. Furthermore, for the selective undergrounding program, Con Edison will align with its latest rate case and follow screening criteria that consider DACs in the site selection process. See the Project Prioritization Selection Project Prioritization Selection Criteria section for more detail.

[x] Con Edison has issued a Request for Proposal (RFP) to community-based organizations and educational institutions to train the next generation of professionals. These proposals may be related to jobs in clean energy, technology, climate change adaptation, and environmental restoration.

These actions help to balance broader infrastructure needs with focused DAC resilience enhancements and to align with the New York State (NYS) Climate Leadership and Community Protection Act. The Company also plans to work with external stakeholders to assist in project site selection and prioritization for investments that specifically benefits DAC communities, such as the Critical Facilities program.

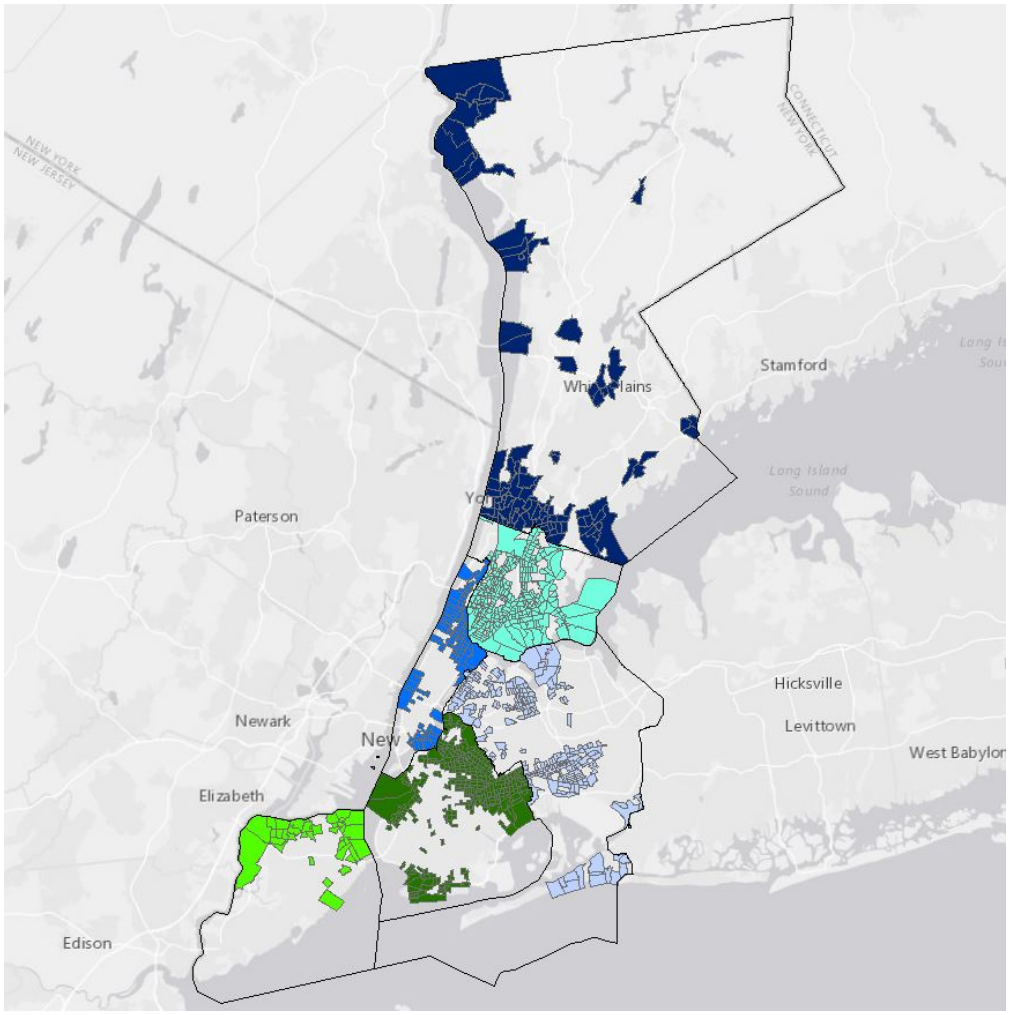


Figure 8. Disadvantaged communities in Con Edison's service territory, colored by county.

Project Prioritization Selection Criteria

Many of the investments in this plan are of a programmatic nature and therefore the phasing of implementation based on location has yet to be defined. To consider equity in the implementation of the Plan, Con Edison has developed general project prioritization selection criteria that may be used to develop the phasing of specific infrastructure investments and guide investments that benefit disadvantaged communities. The criteria draws inspiration from the Undergrounding Pilot Program Screening Criteria included in the Company's 2022 Rate Case, which has received stakeholder support. The Company recognizes the criteria is general at this point and that it should be modified as needed for different programs, as specific programs may have different or additional screening criteria.

This screening criteria could be used in a step-by-step manner, starting with the first objective.

1. Identify where investments will avoid the largest number of outages. Con Edison will prioritize assets that have been identified by our engineers and planners as being vulnerable by 2050, as well as assets that have a history of recurring outage events. Investing in these vulnerable assets first will reduce the overall number of outages for the system by replacing older or damaged equipment and those projected to be exposed in the near term with more resilient equipment. This is an important first step of system planning to increase system resilience.

2. Identify where investments would have the greatest impact for critical customers (hospitals, fire stations, emergency facilities, etc.). Prioritizing these investments will enable customers to keep receiving service during an extreme weather event, either at home or at a community facility.

3. Identify disadvantaged communities using the NYS DAC Map. Once criteria 1 and 2 have been considered and specific assets have been identified that also serve disadvantaged communities, as identified in the NYS DAC Map, the assets may then be prioritized for investment.

Using the Screening Criteria

The following provides an example of how the screening criteria may be used to select which transformers to replace in a program due to increased temperature risks.

1. 25 transformers are identified as having a history of failure and are located in areas that are projected to have high risk of extreme heat by 2050.

2. Of those 25 transformers, 10 serve critical customers.

3. Of the remaining 15 customers, seven of them serve areas identified as disadvantaged communities.

The seven identified transformers could be prioritized for investments first. The remaining transformers would then eventually be upgraded as part of regularly phased work.

Investment Plan

This section summarizes the resilience investments that Con Edison plans to make to prevent, mitigate, and respond to the risks of projected climate changes. The investments follow the resilience management framework and were developed through a comprehensive process, as described below.

First, Company subject matter experts reviewed and agreed upon the primary and secondary climate risks identified in the CCVS to address in the next 5-20 years. This included considering how those risks might be mitigated through investments already committed and through the commitments to integrate changing future climate conditions. The resulting set of high priority risks (based on potential impacts to the electric system and to customers) includes:

- Temperature impacts on electric substations and across the transmission and distribution systems.
- Temperature impacts on the Company's workforce.
- Sea level rise, flooding, and erosion impacts across the transmission and distribution systems, and on other Company facilities.
- Wind and ice impacts on the Company's overhead transmission and distribution systems.
- Emergency response and preparedness for extreme weather events.

These areas encompass many of the primary risks identified in the CCVS. The specific justifications for inclusion of each investment are included in the subsections below.

The Company developed the set of preferred adaptation strategies for each hazard by:

- Working through the resilience management framework to consider solutions that prevent, mitigate, and respond to climate change impacts through a mix of traditional solutions and innovative strategies.
- Mapping the toolbox of potential adaptation measures included in the CCVS to the priority risks and hosting additional discussions in order to think holistically about the set of potential solutions.

- Narrowing the set of potential solutions by considering factors such as technical feasibility and co-benefits.

The resulting package of proposed investments was reviewed by company leadership and the CRWG. To implement these programs, Con Edison expects to invest approximately $903 million over the first five years (2025–2029) of the resilience plan. This amount includes approximately $884 million in capital expenditures and $19 million for operations and maintenance. Based on estimated in-service dates for the projects, the Company estimates those investments would result in a revenue requirement of $173 million over that same period. This level of capital expenditure over the five years (2025-2029) would have a varying delivery and total bill impact from 0.1% to 0.8%, and 0.0% to 0.6% for customers, respectively. As a result, the five-year cumulative electric delivery impact would be 2.1% and total bill impact would be 1.4%.

Year	Capital Requested ($ Millions)	Rate Base ($ Millions)	Revenue Requirement[xi] ($ Millions)	Associated O&M ($ Millions)	Delivery (% Change)	Total Bill (% Change)
2025	$91	$16	$6	$2	0.1%	0.0%
2026	$139	$66	$16	$3	0.2%	0.1%
2027	$193	$153	$31	$4	0.4%	0.3%
2028	$222	$261	$50	$4	0.6%	0.4%
2029	$239	$371	$70	$6	0.8%	0.6%

Table 7. Estimated revenue requirement and total bill impact by year[xii].

Over the first 10 years (2025 through 2034), the Company will continue implementing resilience programs and projects at a cumulative order of magnitude cost of $2.4 billion, and the total capital expenditures for all resilience investments for 20 years (2025 through 2044) will be approximately $5.6 billion.

The Company recognizes that the investments needed to prepare and protect customers from climate change have an impact on customer rates. The Company is committed to providing assistance to vulnerable customers who can be the most impacted by extreme weather, due to their location or lack of resources to mitigate the impacts of an extreme weather event. In addition to the equity considerations focused on disadvantaged communities, Con Edison has current programs that prioritize affordability for low- to moderate- income (LMI) customers. The Company provides discounts to those who are eligible as part of the Energy Affordability Program (EAP). EAP discounts are reset each year to account for changes in the Company's rates as part of base rate cases, so participating customers are, in effect, mitigated

[xi] The Revenue Requirement is the sum of all costs incurred to the customers during a period of time; for the purposes of bill impacts – this is on an annual basis. This expenditure is for the resilience investments introduced in this CCRP.
[xii] Con Edison will recover the amounts requested in 2025 through a surcharge. 2025 is the final year of the Company's current electric rate plan.

against some of the impacts of increased rates. In the Company's most recent base rate cases, the Company more than doubled the target level for its low-income Energy Affordability Programs to over $202 million per rate year and continued its reconnection fee waiver program, which provides low-income customers with a waiver of the normal charge to reconnect service after termination for non-payment.

In addition to these cost savings, the Company continues its efforts with customers and stakeholders to assist LMI customers. The Company has implemented outreach and education regarding bill assistance and payment plan opportunities for all customers and coordinates with social service agencies to apply public assistance funding directly to customer accounts. The Company also participates in an EAP Working Group led by DPS Staff to discuss statewide efforts to improve and expand the EAP program. Finally, the Company is a partner to NYSERDA in providing information related to the most vulnerable customers for participation in NYSERDA's Empower Program, and offers energy efficiency and building electrification programs to LMI customers in multi-family homes. The Company will continue to work with stakeholders on these and other customer affordability programs.

A year-by-year schedule of expenditures is shown in Figure 9. The proposed resilience investments, along with timing and implementation, are shown below.

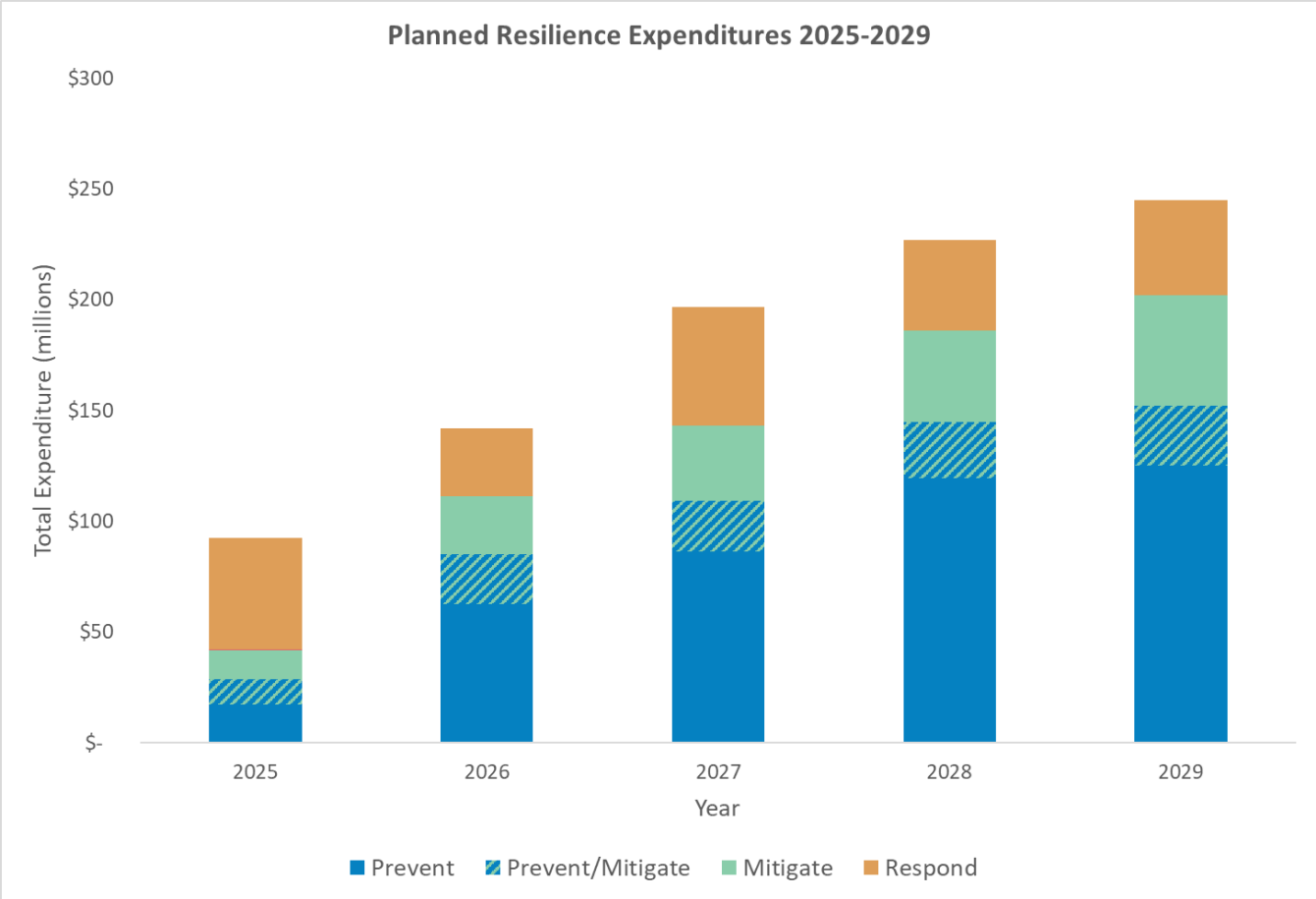


Figure 9. Expenditures by Resilience Strategy and Year.

The proposed investments are shown below in Table 8. Investments are listed with the climate hazard(s) they address and resilience management framework strategy(s) they support. Please note that while many programs will reduce risk from multiple hazards, in this report they are organized by the **primary** climate hazard addressed (in bold below).

Investment	Climate Hazards	Strategy
Primary Feeder Resiliency	**Heat**, Extreme Events	Mitigate
Heat Mitigation for Worker Safety	**Heat**	Mitigate
Micronet Weather Station Expansion	**Heat,** Extreme Events	Mitigate, Respond
Substation Operations Storm Hardening	**Flooding**	Prevent
Submersible Equipment	**Flooding**	Prevent
Erosion Protection and Drainage Upgrade	**Flooding**, Extreme Events	Mitigate
Green Infrastructure and Rewilding	**Flooding**	Prevent, Mitigate
Living Shorelines and Nature-Based Solutions	**Flooding**	Prevent, Mitigate
Selective Undergrounding	**Wind and Ice**, Extreme Events	Prevent
Non-Network Resiliency	**Wind and Ice**, Heat, Extreme Events	Prevent, Mitigate
Non-Network Resiliency Cutout Upgrade	**Wind and Ice**, Extreme Events	Mitigate
Critical Facilities	**Extreme Events**, Wind and Ice	Prevent, Mitigate
Substation Loss Contingency	**Extreme Events**, Heat, Flooding, Wind and Ice	Respond
Substation Enclosure Upgrade	**Extreme Events**	Prevent
Storm Resilience Center	**Extreme Events**	Respond

Storm Response Technology Advancements	**Extreme Events**	Respond
Emergency Outage Communications	**Extreme Events**	Respond

Table 8. Summary of Planned Resilience Investments.

The investments are proposed to mitigate the effects of heat, flooding, wind and ice, and extreme events, with the specific connection to the most recent climate data summarized below.[xiii] For individual program details, see Appendix 4: Project and Program Details.

Heat

Increasing temperature and humidity are a risk to Con Edison's electric system and hotter conditions will lead to a harsher operating environment for the entire electric system. As noted in the CCVS, updated climate projections indicate that electric assets will be exposed to higher temperatures sooner than previously projected, making this an urgent risk to begin addressing over the next 5 years and beyond. For example, 17 days with maximum temperatures exceeding 95°F are projected to occur in 2030 which were previously projected to occur in 2040 (up to a decade earlier). The potential impacts of heat include:

- Accelerated asset degradation: Increasing temperatures can result in premature asset failure that, if unexpected, could result in customer outages.
- Physical impacts: Line sagging due to heat can reduce the clearance between overhead assets and surrounding vegetation, which can increase the potential for contact with vegetation, leading to asset failure and safety risks.
- Decreased asset capacity: Increasing temperatures can increase system load, which could exceed system capacity and force the Company to implement load shedding to avoid further damage to equipment.
- Worker high heat stress: Increasing temperatures can increase worker high heat stress and potential health impacts.

To address these risks, Con Edison has developed the following key programs:

- **Primary Feeder Resiliency**: Installs switches and bifurcates existing feeders that are prone to failure during high heat events to prevent failures and reduce the number of customers who would be affected during an outage.
- **Heat Mitigation for Worker Safety**: Pilot tests cooling/reflective hardhat alternatives, heat wicking base-layer garment, and emerging portable cooling equipment to reduce employee heat stress.
- **Micronet Weather Station Expansion**: Collected weather data will be used to validate climate models, help predict outages, and inform system planning such as identifying heat islands.

[xiii] The Company has provided both financial and non-financial benefits for the investments in the CCRP. Because there currently is no widely recognized and accepted methodology for comparing resilience investments to customer and regional avoided costs, the specific cost savings to customers cannot currently be provided. As a result, financial and non-financial benefits can overlap. As noted earlier, the Company will continue to work with the Commission and DPS Staff to further review an appropriate customer benefit methodology.

Primary Feeder Resiliency

Mitigate

Investment Description

Climate Hazard(s)
Heat (Temperature Variable, Heat Waves)

Scope
The Primary Feeder Resiliency program enhances the core resiliency work performed under the Primary Feeder Reliability program and further mitigates potential network system vulnerabilities resulting from future climate-driven increases in heat, temperature variable (TV, heat plus humidity), and extreme heat events (heat waves and heat domes).

The Primary Feeder Resiliency program enhances feeders by installing modern interrupter switches and by bifurcating primary feeders to withstand the impacts of climate change. Sectionalizing overhead feeders has been a primary strategy for mitigating the risks of extensive feeder outages across the industry for many years. This program emphasizes additional network sectionalizing and bifurcation of priority feeders achieved through installation of interrupters in new underground structure locations and feeder extensions when required. These new interrupters are next-generation, vacuum-based sectionalizing switches that allow for partial circuit isolation rather than a full feeder outage resulting from a fault. Now, it's possible to implement this best practice for underground feeders, providing both resiliency benefits that will strengthen network operations and protect customers under a wide variety of extreme circumstances and blue sky benefits, including support for the Company's clean energy and electrification goals

Justification
The CCVS found that temperature increases are expected to occur a decade earlier than previously understood. Current projections estimate that by 2050, there will be 32 days per year in which the daily average temperatures exceed 86°F, compared to 3 days in the historical baseline and 26 days estimated in the 2019 CCVS (a 23% increase). The CCVS also found that heatwaves are likely to increase in frequency and duration, with approximately nine heatwaves per year by 2050 compared to a baseline of two heatwaves per year. Currently, system peak loads are driven by customer cooling needs. When feeders operate at loads above their assumed design threshold, they can experience accelerated degradation, which could lead to premature failure and customer outages. Operating at loads above the design threshold can also force Con Edison to reduce the output of power to customers, as a protective measure.

Program Benefits

Upgrading to the latest technology and extending interrupter technology throughout the network distribution system helps the Con Edison system absorb failures on primary feeders by limiting the number of feeders and associated network transformers out of service through automatic actions – i.e., dropping the faulted sections automatically to keep un-faulted sections in service. The program also increases the resiliency of the network system by bifurcating and, in some cases, extending key primary feeders. These feeders are reconfigured into double legged feeders with an interrupter installed on each leg. Bifurcating a feeder not only provides the benefit of being able to isolate half of the feeder if faults occur rather than having the entire feeder out but it also protects available feeder capacity on the remainder of the feeder. Previous feeder bifurcations have resulted in increased normal and emergency feeder ratings by 40-50%.

Funding Request

2025 – 2029	2030 – 2034	2035 – 2044
$113,000,000	$262,100,000	$786,400,000

Long-term Roadmap

This is an on-going program with no currently planned ending date. The specific plan for work under this program will be evaluated each year, but, currently, the annual scope of work for the program in future years is expected to be similar to the scope of work included for 2025-2029 (*i.e.*, to include similar volumes of the same types of work). The annual per unit cost is assumed to escalate by inflation, with an assumed inflation rate of 3%.

Heat Mitigation for Worker Safety

Mitigate

Investment Description

Climate Hazard(s)
Heat

Scope
The primary objective of this program is to bolster and maintain safe working conditions for employees through piloting and field testing various emerging technologies to mitigate heat illnesses associated with sustained higher temperatures. The focus would include garnering feedback of the use and effectiveness of innovative equipment and emerging technology in the next few years, including but not limited to:

- Cooling/Reflective hardhat alternatives
- Heat wicking base layer garments
- Emerging portable cooling equipment

To execute this work, Con Edison will procure the above equipment and deploy it in select departments initially. Based on feedback from the program, as well as analysis of temperature data, Con Edison may decide to roll out the protective equipment to a larger swath of the Companies' workforce.

Justification
Over the coming decades, the Con Edison service territory is expected to experience higher average temperatures, as well as more frequent and extreme heat waves. By 2030, the number of days per year with a 2PM Heat Index [xiv] over 90°F are projected to increase from a baseline of 13 days to 39 days per, approximately a 300% increase. Average summer temperatures are projected to increase to 80°F compared to baseline of 75°F by 2030. These projections are importantly intensified by the urban heat island effect (UHI), which causes urbanized areas to experience higher temperatures than outlying areas due to high concentrations of infrastructure that absorb and re-emit the sun's heat more than natural, un-urbanized landscapes. It is estimated that 78% of New York experiences at least 8°F more heat due to the UHI effect. [13]

Increased exposure to extreme heat has the potential to threaten the safety of staff who work outdoors and are exposed to the weather conditions on a regular basis. As both average and extreme temperatures increase, the risk of workers being exposed to potentially dangerous heat conditions will increase proportionately. Protecting workers will require changes to pace of work, which could make outage duration and restoration times longer If an outage event should occur at the same time as an extreme heat event, it becomes essential to the provide workers with safe conditions to allow them to perform restoration work needs and minimize the outage duration for customers.

Program Benefits

This program will assist in the comprehensive approach to mitigate heat illness and heat stress of employees due to the exposure of forecasted prolonged heat waves and overall higher temperatures in our area. This program will also increase the overall health and wellness of employees as well as support response times for restoration and maintenance of system.

Funding Request

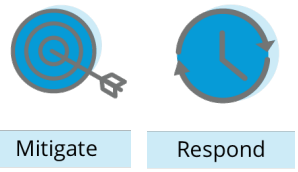
2025 – 2029	2030 – 2034	2035 – 2044
$1,000,000	$1,000,000	$2,000,000

Long-term Roadmap

Since this program is to pilot and purchase new technologies as they are developed and accepted, the future funding is only an approximate and subject to change.

[xiv] The Heat Index quantifies the combined effect of air temperature and relative humidity and reflects the human-perceived, rather than the actual, temperature. It's used to assess health risks for employees working in the heat.

Micronet Weather Station Expansion



Investment Description

Climate Hazard(s)
Heat, all climate hazards and extreme events

Scope
Two weather stations are proposed in Westchester County within CECONY service territory. They will help fill weather observation and existing data gaps in Westchester County while providing crucial information on weather and climate. The two proposed weather stations are expected to be sited on company property in Elmsford, NY and Rye, NY.

Justification
Data gaps in local weather observations in Westchester County can affect the ability to 1) understand Urban Heat Island (UHI) effects, 2) respond to and accurately stage crews during extreme weather events (e.g., heatwaves). The proposed weather stations will be used to better understand the impacts of climate change across the service territory, primarily for tracking temperatures and temperature differentials and potential impacts due to factors such as the Urban Heat Island (UHI) effect. The UHI effect causes urban areas to run warmer than surrounding areas because urban land surface characteristics retain more heat, and it limits overnight cooling. Recent studies have shown New York City to have the highest average UHI index per capita, with people feeling at least 9.5°F more heat in the city due to the local built environment. Having more weather stations throughout the service territory, rather than only using the Central Park station, will better represent the temperatures experienced across different parts of New York City and the surrounding areas. The service territory has also already been impacted by several extreme events, such as Tropical Storm Isaias in August 2020 and the deluge rainfall that hit the Hudson Valley in July of 2023. Projections indicate that extreme events like hurricanes, extreme heat waves, nor'easters, and deluge rainfall, will increase in intensity in the future.

It is crucial for Con Edison to make science-based decisions on investments and resilience initiatives, and having more granular data on weather experience across the service territory is critical to this process. The Company must work to develop the tools and data that will allow that to happen smoothly and consistently. Without this program, there will be a less illustrative understanding of potential weather impacts across different areas of the service territory and existing processes will have to rely on weather data from non-representative weather stations in New York City and southern Westchester. These stations do not adequately correlate to observed or forecasted weather across the Lower Hudson Valley.

Program Benefits

This project will provide the benefits of improved relationships with external stakeholders, providing regulatory compliance, and improved data for future climate change adaption decisions.

The project also continues a strategic partnership with the State University of New York (SUNY) at Albany. The Company will be supporting a state university through this partnership, as well as contributing to the NYS Mesonet by integrating the new weather monitoring stations under this project into the state-wide network that currently lacks a strong presence in the CECONY service territory. In return, the Company will benefit from their already-established expertise in this field and vast array of resources in future research and analytics to properly digest the data that will be gathered.

Funding Request

2025 – 2029	2030 – 2034	2035 – 2044
$224,000	$0	$0

Long-term Roadmap

This project will expand upon Con Edison's existing Micronet weather stations and, in conjunction with Orange and Rockland's installation of an additional 7 stations, will continue to provide important weather-related data. At this time, there is no expected plan for future expansion of additional Micronet weather stations.

Flooding

Rising sea levels, coastal storms, and increasingly intense precipitation presents flooding risks to Con Edison's electric system. Updated heavy rain projections have increased with the newest climate data, as noted in the CCVS. Specifically, projections show that annual days with precipitation exceeding two inches, relative to a baseline of three days, could reach five days in 2050. This increase in heavy precipitation events, along with rising sea levels and more frequent coastal storms, necessitates action. The potential impacts of flooding and water intrusion include:

- Equipment damage: Floodwaters, saltwater spray, and water intrusion damage electric components, leading to increased repair costs and longer outages.
- Equipment corrosion: Saltwater from rising sea levels and coastal storms corrode electronic components, introducing longer-term risks for asset failures and outages.
- Soil weakening: Water exposure weakens equipment foundations, increasing risk due to erosion near riverbanks and coasts.
- Limited accessibility: Flooding and high tides make it difficult for maintenance and repair crews to access key assets, delaying timely service restoration during or after storms.

To address these risks, Con Edison has developed several programs:

- **Substation Operations Storm Hardening**: Mitigates flood risks at 23 substations through infrastructure improvements such as raising assets, installing flood barriers, and relocating control rooms, aiming to enhance reliability and minimize service interruptions from flooding and storms.
- **Submersible Equipment**: Aims to protect underground distribution assets vulnerable to flooding so that equipment can continue functioning if exposed to flood waters. Customers will benefit from a more reliable and continuous supply of energy, and restoration costs for the Company will be reduced.
- **Erosion Protection and Drainage Upgrade**: Upgrades weather enclosures for switchgear cubicles and relay cabinets across selected substations, enhancing the system's resilience to inclement weather and reducing the potential risk of equipment failure from flood events.
- **Green Infrastructure and Rewilding**: Con Edison plans to install more green infrastructure and rewild with native vegetation on various types of company property. Rewilding is a conservation approach that allows the land and its ecosystems to return to a more natural state. This will reduce operational costs of vegetation management and improve contributions to natural habitats, allowing for more ground infiltration.
- **Living Shorelines and Nature-Based Solutions:** Pilot project to enhance the resilience of shoreline properties to rising sea levels and storm surge, while at the same time providing surrounding communities with an aesthetically pleasing shoreline composed of native species. Living shorelines are more cost effective than hardened structures and are better at dissipating wave energy during major storms.

Substation Operations Storm Hardening

Prevent

Investment Description

Climate Hazard(s)
Flooding, Extreme Events

Scope
The scope of the Substation Operations Storm Hardening program includes work needed to mitigate increased risks of flooding identified by Con Edison's CCVS at 23 area and transmission substations. Storm hardening physically improves infrastructure to make it less susceptible to damage from flooding and other extreme weather events. The loss of a single area substation could result in an interruption of electric service to a large number of Con Edison's customers, which makes protection from storm events important to prevent customer outages and avoid costly repairs.

- The types of flood protections that are likely to be considered as protective measures include:
- Installation of moats and walls around critical station equipment
- Sealing of troughs, conduits, panels and cabinets, as well as any other critical station penetrations
- Installation of removable flood doors and barriers
- Installation of sump pumps in protected areas
- Migration of a substation control room to a higher elevation
- Elevation of critical relays and control panels
- Installation of nitrogen powered pumps for pressurization plants
- Installation of fiber optic communication lines
- Raising and sealing of moat walls, curbs, louvers and flood barriers

Justification
Adoption of the FEMA+5' standard results in 23 area and transmission substations that are projected to be vulnerable to flooding with projected rise in sea levels

The CCVS concluded that Con Edison's electric system is vulnerable to risk of damage from extreme flooding and weather events like those that have been experienced in recent history. The Study also confirmed through a growing body of scientific evidence that projected climate change estimates extreme storm events will likely increase in frequency and intensity in the future. In fact, by some estimates, severe weather events (thunderstorms, strong winds, etc.) are projected to increase in frequency by 5%-20% per 1˚C warming (under the SSP5-8.5 scenario).

Numerous evaluations following actual events have also revealed that the increased frequency of these types of events tends to erode the ability of communities and their residents to cope with and recover from the impacts of extreme events, with members of disadvantaged communities the least able to recover.

Program Benefits

Severe flooding can result in customer outages, present issues of inaccessibility, and lead to equipment damage. The proposed resiliency investments included in the Substation Storm Hardening program will improve Con Edison's ability to withstand the impacts of climate changes without experiencing substation equipment failures from projected future flood levels accompanying rising sea levels, heavy precipitation, and storm surge from severe storms.

Funding Request

2025 – 2029	2030 – 2034	2035 – 2044
$25,300,000	$470,600,000	$570,200,000

Long-term Roadmap	The first five years of this program are currently projected to focus on engineering, planning, design, and procurement for the flood protection enhancements needed at each of the substations identified as at-risk under the higher standard (FEMA+5'). Costs are projected to escalate with the beginning of construction in 2030, and all flooding protections are projected to be completed by the end of 2040.

Submersible Equipment

Prevent

Investment Description

Climate Hazard(s)
Flooding (Sea Level Rise)

Scope
After Superstorm Sandy, Con Edison undertook an extensive storm hardening program to install flood protections, including submersible equipment, for all existing facilities that were in the floodplain for 100-year storms to make the underground system more resilient to such storm events. Con Edison also changed design standards to require the installation of submersible equipment for all new underground distribution equipment installed in a flood zone.

Design standards in Con Edison's Climate Change Planning and Design Guideline Document establish the sea-level rise adjusted Design Flood Elevation (DFE) criteria of a 100-year storm with 3 feet of sea level rise and 2 feet of freeboard (FEMA + 5'). The Company evaluated all vault locations when plotted on a survey map and identified all locations within the FEMA +5' floodplain. At the FEMA + 5' level , non-submersible underground distribution equipment (120V/208V transformers and 460V transformers with network protectors) located in the projected floodplains – at nearly 400 locations – will be replaced with submersible equipment under this program.

Justification
The CCVS indicated that sea level rise may exceed Con Edison's current design standards for coastal flood protection (e.g., a 100-year storm with 1 foot of sea level rise and 2 feet of freeboard; FEMA +3') between 2030 and 2080. Underground distribution assets that are located within the current 1% annual chance floodplain are projected to face more frequent and severe flooding, and assets that are not currently in the 1% annual chance floodplain could still face future flooding risks as sea level rise expands the extent of the 1% annual chance floodplain. In addition, underground equipment that is in the expanded future floodplain is not submersible and could be damaged if deluge rainfall events overwhelm the stormwater systems and result in flooding outside of the FEMA floodplains. If exposed to flooding, underground distribution assets could experience severe damage, corrosion, and accessibility issues during necessary repairs and restoration. Damage to these assets would result in frequent customer outage events and reduced reliability across the system.

Program Benefits	This program will benefit Con Edison's customers in providing a more reliable and continuous supply of electricity. In addition, the program will reduce restoration costs for Con Edison by avoiding premature equipment replacement or failure and ultimately reduce repair and replacement costs.

Funding Request	**2025 – 2029**	**2030 – 2034**	**2035 – 2044**
	$45,900,000	$24,400,000	$0

Long-term Roadmap	The current plan for this program is for all equipment identified as vulnerable to flooding at the new standard to be replaced by the end of 2033. The current timeline anticipates over 60% of the 120V/208V transformers and all of the 460V transformers and network protectors being replaced in the initial five years, with the remaining 127 120V/208V transformers replaced over the next four years.

Erosion Protection and Drainage Upgrade

Investment Description

Mitigate

Climate Hazard(s)
Flooding, Extreme Events

Scope
This program will install reinforcements and upgrade drainage systems in select substations to protect from erosion that may occur from extreme, deluge rain events or large storms (e.g., hurricanes and nor'easters). Similar to the Substation Enclosure Upgrade program (above), the Erosion Protection and Drainage Upgrade program is designed to mitigate the risk of potential substation equipment damage and failures at area and transmission substations caused by climate-driven increases in heavy precipitation during extreme storm events.

The program will begin in 2024 with six substations initially identified as in-scope for upgrades: Dunwoodie, Sprain Brook, Rainey, Ramapo, Gowanus, and Granite Hill. Erosion and drainage issues were discovered at these stations from hurricane Ida in late 2021. Erosion and drainage issues have also been noted at four additional stations – East 63rd Street, Ossining, West 65th Street, and Pleasantville – and upgrades at these stations will be included in this program. Erosion protection and drainage upgrades will begin with Dunwoodie and Sprain Brook and will target concurrent work on two substations per year. Typical upgrades at each station include replacement of below grade cable trays and installation of new retaining basins; however detailed engineering and evaluations will be performed at each station to determine the appropriate upgrades at each facility.

Justification
The CCVS projects an average annual increase in precipitation up to 15% by 2050, with the heaviest 5-day precipitation amount at Central Park of 11.8 inches. The number of days per year with more than 2 inches of precipitation is also projected to increase 33% by 2030 and 88% by 2080 from the historical baseline.

Prolonged and intense rain events which lead to flooding can cause erosion and undermine substation equipment. In extreme events, the impacts of flooding and erosion could cause critical substation equipment to lose control power, resulting in customer outages and costly restoration costs depending on the extent of sub-asset damage. Erosion caused by extreme rain events could also create unsafe conditions and safety hazards for substation personnel. Proactive investment in erosion protection and drainage upgrades helps to mitigate these risks.

Program Benefits

Proactive investment in erosion protection and drainage upgrades helps to mitigate the risk of damage to substation equipment caused when equipment shifts and becomes unstable after periods of heavy precipitation causes the ground to erode. Shifts in equipment position are likely not only to damage the equipment but also, possibly, to result in loss of service for large numbers of customers served from the substation. Erosion conditions also represent safety hazards to crews working in the substation.

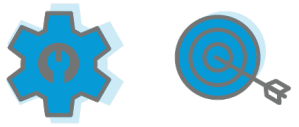
Funding Request

2025 – 2029	2030 – 2034	2035 – 2044
$21,800,000	$31,000,000	$77,600,000

Long-term Roadmap

This program is an on-going program with no currently planned ending date. The specific plan for work under this program will be evaluated each year, but, currently, the annual scope of work for the program in future years is expected to be similar to the scope of work included for 2025-2029 (i.e., to include similar volumes of the same types of work). The annual per unit cost is assumed to escalate with an assumed inflation rate of 3%.

Green Infrastructure and Rewilding



Investment Description

Climate Hazard(s)
Flooding

Scope
Green infrastructure will be constructed to mitigate the impacts of increased precipitation from deluge rain events using rain gardens, bioswales, permeable pavement, and natural retention ponds that can absorb rainwater and reduce stormwater runoff.

Rewilding efforts can help reduce runoff and erosion by restoring native vegetation, which naturally absorbs and retains water and contribute to temperature regulation.

Installing green roofs can help mitigate the extended growing season and warmer temperatures by providing insulation against heat absorption and loss, reducing energy use, and creating a more biodiverse environment.

Justification
Increased precipitation and risks of flooding can negatively impact company equipment, especially in substations and service centers.

Flooding can damage electrical equipment, transformers and other critical infrastructure.

Extended growing seasons can affect vegetation growth, potentially obstructing access to equipment for maintenance and repair. Increased growth may also interfere with crucial transmission lines and can decrease reliability of services to customers.

Protection against extreme weather events such as hurricanes and severe storms will potentially cause damage to equipment and disrupt power distribution with strong winds and/or heavy rain.

Less biodiverse habitats do not channel rain and storm water back to the earth as effectively as more biodiverse natural areas. The need to improve the approach to stormwater management and flood mitigation is only expected to grow in importance. The number of days per year with more than 2 inches of precipitation is projected to increase 33% by 2030 and 88% by 2080 from the historical baseline.

Furthermore, continuing with standard vegetation management practices for overhead structure corridors would fail to achieve the same benefits as investing in native, growth-limited vegetation. Standard practices include mechanical cutting of existing brushes, tree trimming, and approved use of pesticides and herbicides. While this process effectively safeguards the overhead structures, it incurs maintenance costs and limited contribution to natural habitats.

Program Benefits

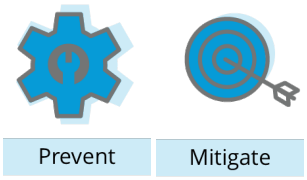
This process will enhance biological diversity, or biodiversity, which refers to all life on earth, and recognizes the value of maintaining a variety of living species. Biodiversity not only emphasizes mutually beneficial plantings, but also includes insects and animals that taken together contribute to the ecosystem, reduced operational maintenance and increased resiliency. Biodiverse habitats, even with greater vegetation growth seasons in New York, due to climate change, can naturally limit their height – thus maintaining better equipment clearances while requiring minimal upkeep after establishment. In terms of climate change, rain inundation from extreme weather events may result in storm water runoff and flooding that affects nearby water bodies and combined sewer systems. With rewilding and strategically planted vegetation at Company facilities, transmission line right of ways, and substations, these facilities will increase their storm water retention and become more resilient to climate change.

Funding Request

2025 – 2029	2030 – 2034	2035 – 2044
$6,000,000	$6,000,000	$12,000,000

Long-term Roadmap	This program will be reevaluated every five years during each Resilience Plan update and based on the latest science. The goal of this program is to prioritize and invest in various types of green infrastructure and rewilding projects at different facilities across Con Edison's service territory. The operational needs and locations will vary over time and be coordinated in conjunction with the Company's experts to maintain operational resiliency.

Living Shorelines and Nature-Based Solutions



Investment Description

Climate Hazard(s)
Flooding (Coastal Storm Surge, Sea Level Rise, Heavy Rainfall)

Scope
Create a pilot program to construct a 1,000' of living shoreline that utilizes natural materials such as vegetation, rocks, and shells to stabilize shorelines, reduce erosion, and protect against rising sea levels.

Justification
The increased frequency and severity of climate events, including severe coastal storm surge and rising sea levels, has elevated the importance of protecting shoreline properties. Currently, assets are typically protected by conventional bulkheads or a riprap wall. These structures are not expected to exist in perpetuity due to chemical and physical degradation. This type of degradation combined with sea level rise and storm surge could compromise shoreline-adjacent facilities and equipment, potentially resulting in financial burdens and outages for the communities served. Salt water, either from storm surge or sea level rise, can also lead to corrosion and infrastructure damage over time.

By 2030, sea level rise at the Battery is projected to be 16 inches. It is anticipated that Con Edison's service area will be increasingly exposed to flooding due to projected sea level rise and increased intensity of extreme storms, such as hurricanes and tropical cyclones, which are likely to bring with them the possibility of higher storm surge. North Atlantic hurricanes are projected to become more intense and have higher rainfall amounts (~10-15% increase) relative to historical hurricanes.

Program Benefits

Living shorelines are a type of nature-based solution that uses natural materials such as plants, rocks, and shells to stabilize a shoreline, reduce erosion, and protect against rising sea levels, while providing habitat to increase biodiversity. Tidal salt marshes, a type of living shoreline, are known to be among the most productive ecosystem types on Earth, sequestering tens of thousands of tons of carbon annually. They can help purify water, reduce erosion, and store carbon. During major storms, living shorelines have been shown to perform better than hardened shorelines by dissipating wave energy and therefore reducing wave action, rather than just deflecting it downstream like hardened shorelines. Living shorelines can also be cost-effective compared to hardened structures, in aspects of both installation and maintenance costs.

A living shoreline would benefit the communities we serve by greening the landscape and capturing harmful greenhouse gases, while also increasing the resiliency for Company and community facilities. Active shorelines can enhance ecological biodiversity attracting aquatic life, plants, and birds/bats. An active shoreline creates an ecotone between the land and aquatic habitat which leads to species diversity and growth of unique ecosystems.

Funding Request

2025 – 2029	2030 – 2034	2035 – 2044 (O&M only)
$3,300,000	$6,300,000	$600,000

Long-term Roadmap

The first phase of this pilot project is to construct 1,000 linear feet of living shoreline after conducting an internal feasibility study to determine the best approximate location. Upon review of successful implementation and construction, the next phase would be to install an additional 1,000 linear feet of living shorelines at either the same or different location, depending on the site location. The O&M

costs are based on USACE estimates but are expected to decline over time as the shoreline fully develops and grows.

Wind and Ice

Con Edison's service area is expected to experience higher wind gusts in the future, and there remains the potential for severe icing events. As noted in the CCVS, maximum wind gusts in New York City could increase from 80 mph to 110 mph by midcentury and hurricane winds speeds are projected to increase as well. Additionally, there is potential for increased freezing rain frequency and ice accumulation. The potential impacts of wind and ice include:

- Line impacts: Con Edison's electric system is built to withstand defined design tolerances for combined ice and wind loading, consistent with the National Electric Safety Code (NESC) Rule 250B. Wind or ice loading that exceeds these standards can result in asset failure, resulting in outages.
- Vegetation impacts**:** Strong winds and ice accumulation can cause trees and tree limbs to fall on overhead lines and other equipment, causing customers to lose service.

To address these risks, Con Edison has developed the following programs:

- **Selective Undergrounding**: Converts high-risk overhead electrical lines to underground systems to enhance resilience against extreme weather events like storms, wind, and ice, based on a data-driven approach. Aims to reduce customer outages and long-term repair costs by focusing on the most at-risk circuits.
- **Non-network Resiliency**: Uses advanced analytics tools to inform the installation of aerial cables and upgrades to overhead feeders thereby strengthening the distribution system against wind and ice hazards.
- **Non-network Resiliency Cutout Upgrade**: This program will continue to install automatic and fuse-less reclosers throughout the non-network system, shortening the length of time that a circuit is out of service, which is especially beneficial during storms with high winds.

Selective Undergrounding

Investment Description

Climate Hazard(s)
Wind Gusts and Ice, Extreme Events

Prevent

Scope
The goal of the Selective Undergrounding program is to prevent outages during heat waves, high winds, and storm events by placing the most vulnerable segments of the non-network system underground.

The program prioritizes segments of the overhead system that are most vulnerable to damage in these weather conditions, such as main runs in heavily wooded areas and radial spur installations where damage is more likely to result in customer outages. Con Edison uses the Overhead Program Optimization Tool (OHPOT) model to review data at the 4, 13 or 27kV primary "segment" or "protective device" level (e.g., Spur, Sub-Spur or main Run segment). The statistics provided by OHPOT are primarily based on the Outage History (PSC Outage Database) and consist of the number of outage events for that segment, and customers impacted. This, and other information, such as available fault current and the length of the segment, helps determine the appropriate mitigating measures. In late

2021, Environmental Justice (EJ) metrics were added as another input. These inputs can then be used by the system to prioritize jobs.

OHPOT selects overhead circuits to be considered for undergrounding based on the best available data and current circuit configuration. For example, the tool may be configured to mark circuits as warranting "U – underground review" based on meeting **any** of these four criteria:

1. An EJ area containing 10% of population in the LMI category AND a line segment experiencing four (4) or more outage events in last 6 years.
2. The segment experienced four (4) or more outage events in last 6 years AND the segment outages resulted in a total of 1,500 or more customer outages in last 6 years.
3. The segment experienced eight (8) or more outage events in last 6 years.
4. The segment experienced three (3) or more outage events in last 3 years.

Circuits meeting the selected criteria are then forwarded for engineering review and analysis. This review includes detailed engineering and constructability analyses to determine the solution that best mitigates the circuit vulnerabilities, including:

- Selectively undergrounding a problematic portion of the circuit
- Selectively undergrounding a portion of the circuit and creating a tie to a neighboring circuit
- Selectively undergrounding the entire circuit
- Pursue other appropriate design enhancements under other programs

Justification

Over the past two decades, New York has experienced multiple major storm events – both hurricanes and nor'easters – bringing high winds that downed trees and overhead facilities, resulting in widespread power outages. The CCVS found that Con Edison's service territory is projected to experience an increase in the frequency and intensity of storms, including wind and ice. Hurricanes are projected to cause wind speeds increases far beyond typical average speeds, and wind speeds of the most intense hurricanes are projected to increase. Freezing rain frequency and radial icing are also projected to increase, although the magnitude of the trend remains highly uncertain.

Exposure to these climate hazards can present an increased risk to the distribution system. Increased temperatures can lead to line sag, presenting safety concerns in areas with vegetation clearance limitations. High winds can cause downed trees or wind-blown debris to make contact with overhead lines, especially if there is limited vegetation clearance. Contact with vegetation can cause asset failure, result in system outages and require restoration. If overhead distribution lines make contact with vegetation, fallen poles can lead to system outages and require restoration. In the event of an extreme storm, difficulty accessing the damaged asset may prolong the restoration time and cause customers to remain without power.

Program Benefits

By continuing the Selective Undergrounding program, Con Edison will increase the resiliency of the system but eliminating exposure to extreme events such as heat waves and extreme wind and ice storms. Underground assets will be protected and allow reliable service to customers. This initiative is also expected to result in fewer instances of high fault current, reduced stress on cable connections and splice joints, and less operational wear on breakers, switches, and reclosers—potentially extending the lifespan of these equipment. Public safety is another key focus of the undergrounding program, as it minimizes the risk of downed conductors and associated hazards. This, in turn, reduces the need for wire-guards, thereby cutting down on storm restoration costs and freeing up Con Edison personnel for other critical restoration tasks.

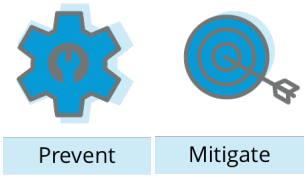
Funding Request

2025 – 2029	2030 – 2034	2035 – 2044
$333,000,000	$563,500,000	$1,410,200

Long-term Roadmap	This program is an on-going program with no currently planned ending date. The specific plan for work under this program will be evaluated each year, but, currently, the annual scope of work for the program in future years is expected to be similar to the scope of work included for 2025-2029 (i.e., to include similar volumes of the same types of work). The annual per unit cost is assumed to escalate by inflation, with an assumed inflation rate of 3%.

Non-Network Resiliency

Investment Description



Climate Hazard(s)
Wind Gusts and Ice, Heat, Extreme Events, Heavy Rainfall

Scope
The Non-Network Resiliency Program is the second of four programs, like the Selective Undergrounding program (above), included in Con Edison's resilience plan to address potential climate change impacts on the overhead non-network distribution system, including the risk of system failures resulting from increases in wind, extreme storms, and heat.

The Non-Network Resiliency Program will both prevent potential outages on the overhead distribution system and mitigate the extent of system outages that do occur.

Justification
Outages are prevented by replacing vulnerable open wire conductor with aerial cable, which has been shown through prior pre- and post-storm evaluations to be as much as 20 times more reliable per foot than open wire conductors. The extent of actual outages is mitigated by installing Automatic Transfer Switches (ATSs) and diversifying primary sources to the 4kV system, limiting the number of customers experiencing outages from a single fault.

The non-network overhead distribution system is primarily at risk from increases in the frequency and intensity of storms and the accompanying high winds and ice accumulation. Current scientific literature indicates that winds are projected to become more intense and have faster wind speeds in the future largely due to more intense storms. There is also the potential for higher-intensity radial icing events in the winter months. Furthermore, there is high confidence that the probability of coincident extreme events will likely continue to increase in both frequency and intensity in the future. Strong winds and ice accumulation from intense storms can cause trees and tree limbs to fall and make contact with the non-network system, potentially resulting in widespread outages. Furthermore, Con Edison's electric system is vulnerable to increasing temperatures and sea level rise. Projections indicate that the number of days per year with maximum temperatures exceeding 95°F will be 32 days per year in 2050, compared to a historical baseline of 4 days per year. Projections also show that sea level rise could reach 16 inches by the 2050s and 36 inches by 2100 within the service area.

Program Benefits	This program will reduce the number of customers outages and the time to restore power, when outages occur, as well as mitigate risks for non-network equipment that are vulnerable to extreme events through the system hardening approaches. Limiting the extent of customer outages on this system during an event has the supplemental benefit of reducing the overall duration of system outages by focusing available restoration crews on other issues.

Funding Request	**2025 – 2029**	**2030 – 2034**	**2035 – 2044**
	$60,600,000	$78,300,000	$128,200,000

Long-term Roadmap	The current high-level plan for this program projects completion of the known scope of work (based on current conditions) to be completed by the end of the twenty-year period (2025-2044). The volumes of work performed annually are projected to ramp up over the first few years of this period, remain approximately level for the next ten years, and then ramp down over the last seven years. The per unit costs are projected to escalate annually by an estimated 3% inflation rate.

Non-Network Resiliency Cutout Upgrade

Mitigate

Investment Description

Climate Hazard(s)
Wind Gusts and Ice, Extreme Events, Heavy Rainfall

Scope
The Non-Network Resiliency Cutout Upgrade program integrating devices with reclosing capabilities into the non-network system, increasing Con Edison's capacity to mitigate outages and limiting the impact of climate change on customers by reducing outages caused by temporary faults, such as tree contact and live phase conductor interactions. This program installs automatic, Trip Saver reclosures at locations with less than 6 kA of available fault current and Single Triple Single (STS) reclosers (also automatic and fuse-less) at locations with between 6 kA and 15 kA of available fault current.

Justification
Typically, if there is a fault on a non-network feeder, reclosers re-configure the circuit so that the closest reclosing device to the fault opens while all others are closed, protecting the majority of a non-network circuit (circuits that can run for several miles) from outages caused by a single fault. Without reclosers that can automatically re-configure the system to isolate a fault, all customers fed through the circuit would lose service from a single event, such as a downed tree during a storm.

This project mitigates risks for the overhead distribution system that is highly vulnerable to wind and ice and other extreme events such as heat waves and flooding. Wind and ice events that exceed the design tolerances for combined ice and wind loading can cause asset failure, along with downed trees and falling vegetation. Projections indicate that the service area is likely to experience higher wind speeds and gusts due to intensifying hurricanes, nor'easters, and thunderstorms in the future. North Atlantic hurricanes are projected to become more intense (~5% increase) and have higher rainfall amounts (~10%-15% increase) in the future relative to historical hurricanes. There is also the potential for higher intensity radial icing events in the winter months in the future, though the magnitude is uncertain.

High temperatures can also cause overhead distribution lines to sag and lose material strength, increasing the potential for contact with vegetation and resulting asset failure and safety risks. Projections indicate higher than average temperatures and periods of extreme high heat through the end of the century. In particular, projections indicate that the number of three-day heat waves with temperatures averaging above 90°F for each day could increase to 4 heat waves per year by the 2080s, compared to 0 heat waves in the historical baseline. Decreased capacity and higher than usual demand from higher temperatures could necessitate load shedding to prevent severe damage to substation equipment.

To address these risks, the upgrades and installations from this program will automate shut offs and restore power automatically when the equipment is damaged, therefore making outages shorter than previous designs.

Program Benefits

Initial assessments of non-network circuits, primarily using OHPOT, based on current system conditions, identified over 250 priority circuits where installation of reclosing devices would mitigate the risk of outages to customers, and high-level planning efforts suggest that this initial scope of work can be completed in less than ten years.

Installing reclosers on spurs on the non-network system increases the resiliency and reliability of this system by providing capabilities that enable Con Edison to avoid some outages, and restoring the system to normal operations more quickly than would be possible without these investments.

Funding Request

2025 – 2029	2030 – 2034	2035 – 2044
$10,000,000	$4,900,000	$0

Long-term Roadmap	The Non-Network Resiliency Cutout Upgrade Program targets the installation of approximately 267 cutout devices on the non-network system. The current high-level plan projects that over 70% of these devices will be installed in the initial five-year timeframe, and the remaining devices will be installed by the end of 2033. The annual volumes and types of work for 2030-2033 are anticipated to be ramping down slowly from 2029 levels with per unit costs escalating annually by an estimated 3% inflation rate.

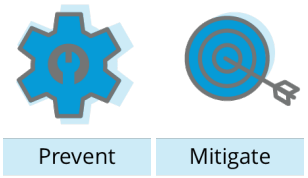
Extreme Events

Extreme weather events, including concurrent or consecutive extreme events, present additional challenges to operations, planning, and infrastructure across the electric system. These events may take the form of intense storms, hurricanes, extreme heat waves, Nor'easters and cold snaps, deluge rainfall, or multiple extreme weather events (e.g., ice storm followed by a cold snap). There is high confidence that the probability of coincident extreme events will continue to increase in both frequency and intensity in the future. [14] Due to the wide variety of hazard types that may take the form of extreme events, impacts to Con Edison's infrastructure and operations could be widespread, including infrastructure damage and failure, operational disruptions, and increased risk of prolonged customer outages.

To address these risks, Con Edison has developed several programs:

- **Critical Facilities**: Focuses on fortifying over 2,000 critical facilities on Con Edison's non-network distribution system against extreme weather like wind and ice. Strategies include upgrading to stronger aerial cables, implementing advanced Supervisory Control and Data Acquisition (SCADA) switching schemes, and streamlining emergency backup generation.
- **Substation Loss Contingency**: This existing program will be enhanced and will allow Con Edison to continue acquiring mobile substation equipment that can be utilized in the event of substation failure or partial power loss as a result of extreme weather and climate events.
- **Substation Enclosure Upgrade**: This existing program will install weatherproof enclosures for switchgear cubicles and relay cabinets to reduce the impacts of flooding and extreme precipitation on substations.
- **Storm Resilience Center**: This state-of-the-art facility aims to reduce outage and recovery times during extreme weather events. The Center will serve as a central hub for crews, equipment, and emergency response coordination. It is specially designed to host up to 500 mutual aid crew members and space for storm vehicles and equipment. Key areas of focus include rapid deployment of remote mutual aid resources and centralized training for all stakeholders.
- **Storm Response Technology Advancements**: Leveraging cutting-edge technology, this program aims to enhance storm response and reduce outage times. The first focus area employs technologies like unmanned aerial vehicles and GPS vehicle tracking to speed up damage assessment and resource allocation. The second area uses advanced weather modeling and data analytics to anticipate storm impacts, allowing for smarter, more efficient responses.
- **Emergency Outage Communications**: Enhances the Company's emergency communications program to be prepared to message its entire customer base faster than current technology allows. This will make communication more efficient and reduce traffic to call centers.

Critical Facilities



Investment Description

Climate Hazard(s)
Extreme Events, Wind Gusts and Ice

Scope
Critical Facilities (as defined in Con Edison's Customer Service Procedure, CPS 4-5-4) include facilities important to our communities' emergency response (e.g., hospitals, police, fire, EMS operations, etc.), facilities housing critical infrastructure (e.g., transportation facilities, water pollution control plants, etc.), facilities providing critical public services (e.g., prisons and correction facilities, shelters/care facilities, etc.), and residential facilities considered more vulnerable (e.g., developments with large elderly populations, nursing homes, high-rises, etc.). Over 2,000 locations currently designated as Critical Facilities are served by the non-network distribution system.

The Critical Facilities program enhances service to the locations on or fed via non-network distribution circuits to withstand climate impacts by implementing one or more of the following strategies:

- Undergrounding of overhead cables and equipment
- Replacement of open-wire conductors with Aerial
- Redundancy of supply through the use of SCADA, loop and bypass design
- Configuration for rapid deployment of emergency backup generation

Justification
Heavy precipitation and wind-related stress and debris from extreme storms were determined to be primary vulnerabilities for Con Edison's overhead distribution system in the 2023 Climate Change Vulnerability Study. Recent studies and science project a 20% to 40% increase in nor'easter strengthening (i.e., producing the types of storms with destructive winds) immediately inland of the Atlantic coast by late-century, suggesting stronger storms may more frequently impact the New York Metropolitan Region with heavy precipitation, wind, and storm surge, giving clear importance to the scope of work under this program. Con Edison's Climate Change Vulnerability study also confirmed through a growing body of scientific evidence and climate projections that these extreme storm events to be likely to increase in frequency and intensity in the future as a result of climate change.

This project will mitigate risk for critical facilities and the feeders that serve them by upgrading ones that are vulnerable to extreme events, like wind storms and rain events. To address this risk, the Critical Facilities Program will prioritize and upgrade non-networks feeders. Addressing at risk feeders that serve critical facilities will help reduce the number of outages experienced during storm events, including wind and rain events. Mitigating outages for critical facilities, including hospitals, emergency centers, and disadvantaged communities will ultimately support efforts to improve community resilience. By prioritizing critical facilities, this project will provide reliable service and improve public safety.

Program Benefits

Given the projected climate changes with the potential to impact not only the Company's electric delivery systems but many other critical infrastructures supporting the communities in the service territory, the Company realizes that availability of the infrastructure and public services provided by the facilities identified as critical will be more important than ever and would look to support strengthening the circuits serving Critical Facilities. The Company proposes to leverage existing Emergency Preparedness coordination processes to prioritize circuits serving Critical Facilities.

These investments strengthen the distribution system serving community facilities which are vital for residents to prepare for and recover from the impact of increasingly frequent and more severe weather events. These "hardened" facilities have higher probabilities of maintaining electric service and of being restored more quickly than they would have without these investments.

Funding Request	2025 – 2029	2030 – 2034	2035 – 2044
	$39,000,000	$57,000,000	$146,800,000

Long-term Roadmap

This is an on-going program with no currently planned ending date. The specific plan for work under this program will be evaluated each year, but, currently, the annual scope of work for the program in future years is expected to be similar to the scope of work included for 2025-2029 (i.e., to include similar volumes of similar types of work). The annual per unit cost is assumed to escalate by inflation, with an assumed inflation rate of 3%.

Substation Loss Contingency

Investment Description

Respond

Climate Hazard(s)
Extreme events, all climate hazards

Scope
The Substation Loss Contingency program invests in the purchase of additional equipment that can be deployed to facilitate recovery from either the loss of an area substation or to partially recover from the loss of a bulk power substation. The purchase of this equipment was begun in 2021 and is forecast to be completed in 2026. Only a portion of the required equipment has been received. The remainder is pending procurement, design, construction, and delivery, with associated milestones and milestone payments scheduled throughout 2023 to 2026.

The Company is also proposing the inclusion of a mobile control center in this program. The proposed mobile control center is a Mobile Control Center (MCC) designed with core operational systems such as an Energy Management System (EMS), Feeder Management System (FMS), Pi-Historian, Local Area Networks and Communications systems. In cases of emergencies, the MCC will be capable of performing the functions of Con Edison's Energy Control Center or the Alternate Energy Control Center (the ECC and AECC) to support both the system in case of a loss of either an Area Substation or a Transmission Substation.

Together, the three components of the Substation Loss Contingency program – the Rapid Deployment Area Substation, the Transmission Resiliency Transformers, and the Mobile Control Center – will provide multi-pronged solutions that will enable the Company to recover from near-catastrophic failures on the transmission system and extensive, prolonged outages to customers.

Justification
Con Edison's transmission system is designed to be robust: in all areas of its service territory, no single failure should result in the loss of load; and in much of its service territory (that system serving network distribution system load), no two failures should suffice to cause a loss of load. Consequently, while it is unlikely, though by no means impossible, that random failures of equipment will force load to be dropped, this may not hold true of a system confronted by the anticipated increases in load or undercut by vulnerabilities that allow the common cause failure of equipment. The rare loss of load events – involuntary load shedding – resulting from transmission system failures – have major impacts. The Substation Loss Contingency program is designed to mitigate the risk of customer impacts in the event of the loss of area or transmission substations.

Acute heat events and flooding hazards present risks to substations' ability to function properly and are expected to increase in frequency and intensity over the coming decades. For flooding, the number of days per year with more than 2 inches of precipitation is projected to increase 33% by 2030 and 88% by 2080 from the historical baseline. As for heat, the highest maximum annual temperature by 2030 is projected to be 103˚F compared to baseline of 97˚F.

While other resilience measures become implemented, it is important to have solutions available to address hazards today. Having deployable transformers and mobile switchgears available can help minimize customer outages by having the resources available to restore power and the substation's

ability to operate at an increased rate. With the equipment purchased under this program, Con Edison will have the capability to quickly deploy the necessary equipment to failed substation and restore service to large numbers of customers much more quickly than without this capability.

Program Benefits

With the equipment to be purchased under this program, Con Edison will have the capability to construct a Rapid Deployment Area Substation near the location of a failed substation within approximately seven days and restore service to large numbers of customers much more quickly than without this capability. Rapid Deployment Area Substations can also be used to provide load relief to area substations when the capacity at a substation must be reduced, such as in instances when equipment may be vulnerable to damage or failure from excessive, sustained heat or when forecast load is predicted to exceed substation capacity. Additionally, in the rare case of loss of service to a bulk power station, the bulk power transformers (Transmission Resiliency Transformers) and mobile relay panels purchased under this program, will allow the Company to restore partial functionality to the bulk power station. Coordination and integration of these supplemental resources with the transmission system will be enabled by a mobile control center, and all equipment is currently planned to be implemented in less than five years.

The construction of a rapid deployment area station reduces the likelihood of loss of electric service to customers and the availability of Transmission Resiliency Transformers reduces the likelihood of the loss of a transmission substation and promotes controllability to mitigate the loss of a substation increasing reliability, resilience (including climate adaptation) improving our response to changing climate and enhancing customers' coping abilities.

The resiliency transformers are for use at any of the 33 transmission substations. The loss of any of these transmission substations would result in severe issues with system power flows and stability and/or a loss of supply to several area substations that serve critical load in our service territory potentially impacting many customers.

The project addresses the current inability to quickly restore power to customers following the loss of an area substation for 24 hours or longer in instances where it is either impractical or not viable to restore electric service via typical distribution solutions (generators, shunts, switching). In such cases, a new rapid deployment area substation will be installed adjacent to the failed substation to restore power to those customers not able to be restored via other means. This also assists in addressing the current inability to quickly restore reliable power flows through one or more area substations during certain catastrophic events. In such cases, these new transformers would be dispatched to the transmission stations to restore reliable power flows, or to feed area substations to restore power to those substations, hence to the customers supplied by those area substations.

Funding Request

2025 – 2029	2030 – 2034 (O&M only)	2035 – 2044 (O&M only)
$25,743,000	$166,000	$415,000

Long-term Roadmap

The scope of this program is currently projected to be completed by the end of 2027.

Substation Enclosure Upgrades

Prevent

Investment Description

Climate Hazard(s)
Extreme Events

Scope
The Substation Enclosure Upgrades program addresses risks of potential equipment damage and failure at area and transmission substations from water intrusion resulting from extreme precipitation during extreme storm events.

Under this program, robust, weatherproof outdoor enclosures will be installed to protect switchgear and relay cabinets from potential water intrusion during more frequent and intense extreme storms, preventing water-related equipment damage and potential equipment failures. These equipment failures do not typically result in outages to customers because of the overall robust designs of the transmission system, but they do decrease the system's resiliency by limiting the ability for the system to withstand additional challenges during extreme weather events.

Plans for installation of substation enclosure upgrades are developed for each region annually, with work prioritized based on the current conditions of switchgear cubicles and relay cabinets and risks of exposure to weather conditions, with work planned to optimize availability during planned transmission system outages.

Justification
As the atmosphere warms due to climate change, precipitation events (including rainfall, downpours, snowfall, and ice) are expected to become more intense due to how a warmer atmosphere holds more water vapor and thus provides increased energy for strong storms. This program aims to address risks associated with substations from flooding and extreme precipitation.

Climate projections indicate that the Con Edison service territory could experience more frequent and intense rain events in future decades, increasing the likelihood of a substation being exposed to flooding from rain. Average annual precipitation is projected to increase from 0% to 15% relative to the historical baseline in Central Park through 2050. The heaviest 5-day precipitation amount could be 11.8 inches at Central Park by 2050, which represents a 17% increase over the historical reference period. The number of days per year with more than 2 inches of precipitation is projected to increase 33% by 2030 and 88% by 2080 from the historical baseline.

Program Benefits

The main benefit of installing upgraded enclosures is the potential avoided cost of having to replace damaged switchgear or relay panels.

Accelerating the work included under the Substation Enclosure Upgrades program increases the overall resiliency of the transmission system to withstand the impacts of future climate-driven weather events by maintaining the robust, three-contingency design of the system – i.e., by reducing the risk of failure of switchgear and relays due to water intrusion as one of the three "contingencies" that the system is designed for. These equipment failures do not typically result in customer outages, but the probability of outages is increased with each system failure experienced.

Funding Request

2025 – 2029	2030 – 2034	2035 – 2044
$5,700,000	$8,100,000	$20,200,000

Long-term Roadmap

This program is an on-going program with no currently planned ending date. The specific plan for work under this program will be evaluated each year, but, currently, the annual scope of work for the program in future years is expected to be similar to the scope of work included for 2025-2029 (i.e., to include similar volumes of the same types of work). The annual per unit cost is assumed to escalate by inflation, with an assumed inflation rate of 3%.

Storm Resilience Center

Respond

Investment Description

Climate Hazard(s)
Extreme Events – Increasing Storms

Scope
Con Edison and O&R will enhance our storm readiness and response programs through the development of a state-of-the-art storm response facility, the Con Edison and O&R Storm Resilience Center (the Center). The Storm Resilience Center will serve as a centralized staging area for crews, including mutual aid, during recovery from extreme weather events. It will also serve as a bed-down location for mutual aid crews. Finally, the Center will serve as the year-round home for what will eventually be 250+ bucket trucks that the Companies will maintain for use by up to 500 mutual aid crews that, without the need to supply their own vehicles, can be flown in to support system restoration. The Center will replace the existing Pomona facility with a new facility that has expanded storm response capabilities. This new central facility will be used as a mutual aid operations management center, stage and maintain storm response vehicles and materials as well as providing sleeping space and support for mutual aid resources. The current location is a lease with uncertainty in renewal and cost; in addition, it will be inadequate for the additional trucks we will have by 2025.

Justification
From an operational perspective, the increasing frequency and intensity of extreme weather events could exceed and challenge Con Edison's current emergency preparedness capabilities. For example, frequent activations of emergency response teams could impact the Company's available personnel and spare equipment resources, if not addressed. Thus, the implementation of the Storm Resilience Center is critical to keeping a larger contingent of support trained and prepared with resources in place to accelerate deployment for response to events.

The CCVS concluded that Con Edison's distribution system is vulnerable to extreme weather events like those that have been experienced in recent history, including hurricanes and tropical cyclones. Projections indicate that hurricanes in the service territory will likely become more intense in the future, with higher rainfall amounts relative to historical hurricanes, stronger winds, and coastal storm surge. Numerous evaluations following actual events have also revealed that the increased frequency of these types of events tends to erode people's ability to cope with and recover from the impacts and that disadvantaged communities are the least able to recover. Furthermore, there is high confidence that the probability of coincident extreme events will likely continue to increase in both frequency and intensity in the future. When extreme events occur concurrently or sequentially to other events, efforts to respond become more difficult, and the impacts can become intensified or cascading.

Program Benefits

The primary benefits of the Center are reductions in customer outage times and costs for any storm event that requires the support of mutual aid crews outside of the Company's local area. The proposed Storm Resilience Center will provide advanced support capabilities for Con Edison's communities and customers that are not currently available (see the initiatives in the project description above). Furthermore, with the increase in extreme weather events it may become more difficult to rely on local mutual aid during storm events in the future. Thus, this investment is important for more efficient and faster recovery times after storms.

Funding Request

2025 – 2029	2030 – 2034 (O&M only)	2035 – 2044 (O&M only)
$169,868,000	$14,478,000	$36,242,000

Long-term Roadmap

The Storm Resilience Center is projected to be in service in 2030, with no long-term capital funding projected at this time.

Storm Response Technology Advancements

Respond

Investment Description

Climate Hazard(s)
Extreme Events – Increasing Storms

Scope
Similar to the Storm Resilience Center (above), the scope of the Storm Response Technology Advancements program is focused on addressing vulnerabilities of the electric distribution system to extreme weather events like those that have been experienced in recent history, including hurricanes and tropical cyclones. As part of a multi-pronged strategy to reduce outage duration times and costs for customers following storm events, Con Edison will improve responses to extreme weather events through the development and use of various technologies to increase the safety, effectiveness, and efficiency of system restoration. Initial storm response technologies have been identified for development and implementation under this program, and the Company will continue to evaluate other opportunities to enable improvements in system restoration capabilities.

Initial storm response technologies proposed for development and implementation under this program include:

- Use of unmanned aerial vehicles (UAVs), such as satellites, drones, and high-altitude robot technology, to conduct storm damage assessments
- Use of distribution transformer monitoring technology and pole-top sensors to digitally communicate system status information including transformer voltages, loading, and temperature and information indicating potential system damage to other system components, such as leaning poles and downed conductors
- Development of a dynamic distribution system event simulator designed to increase distribution system operator proficiency and effectiveness in their response roles
- Use of self-service kiosks to onboard and support storm response resources, including employees and mutual aid resources
- Installation and use of global positioning system (GPS) devices in mutual aid storm response vehicles to integrate crew locations with the Outage Management System
- Development of an innovative electronic mobile material application that can be used to direct crew requests for materials to the nearest “material truck” (already in the field)

Justification
Extreme weather events cause extensive OH infrastructure damage resulting in customer outages and additional resource requirements to rebuild/repair the system.

The CCVS concluded that Con Edison’s distribution system is vulnerable to extreme weather events like those that have been experienced in recent history, including hurricanes and tropical cyclones. Projections indicate that hurricanes in the service territory will likely become more intense in the future, with higher rainfall amounts relative to historical hurricanes, stronger winds, and coastal storm surge. Numerous evaluations following actual events have also revealed that the increased frequency of these types of events tends to erode people’s ability to cope with and recover from the impacts and that disadvantaged communities are the least able to recover. Furthermore, there is high confidence that the probability of coincident extreme events will likely continue to increase in both frequency and intensity in the future. When extreme events occur concurrently or sequentially to other events, efforts to respond become more difficult, and the impacts can become intensified or cascading.

The technology improvements as part of this program will provide advanced support capabilities for Con Edison’s communities and customers that are not currently available (see the initiatives in the project description above). Furthermore, with the increase in extreme weather events occurring throughout the country, it is essential to be able to quickly understand the full breadth of impacts to adequately supply support crews throughout the service area in the case of a storm or other extreme event. Without the adoption of technology, Con Edison and the communities they support could

	experience extended outage periods in cases of severe storms with extensive damage. Thus, this investment is important for more efficient and faster recovery times after storms.		
Program Benefits	Development and implementation of these and other storm response technologies will result in improvements in storm response safety, effectiveness, and efficiency for all storm restoration activities, not just extreme storm events.		
Funding Request	**2025 – 2029** $21,904,000	**2030 – 2034** $8,203,000	**2035 – 2044** $20,533,000
Long-term Roadmap	The current scope of the Storm Response Technology Advancements Program is projected to be completed by 2028 and incorporated with the Storm Resilience Center in 2030.		

Emergency Outage Communications

Investment Description

Respond

Climate Hazard(s)
Extreme Events

Scope
To support the Company's resiliency measures and the reinforced Emergency Response Plan, the Company's goal is to enhance its emergency communications program to be prepared to message its entire customer base (3.5 million account holders) in a faster manner than the current technology allows. For that, the Company proposes capital and expense initiatives for 2025 – 2029 that will enable the acquisition of the telecom bandwidth necessary to reach large numbers of customers quickly and reduce latency.

The Company will work with its messaging provider to build a new infrastructure that will include, among other items:

- The acquisition and maintenance of Dedicated Ports for contracted throughput/bandwidth through Tier 1 telecom providers. This will allow high message deliverability. (To clarify, Tier 1 telecom providers own or control their own portion of data transmission networks, while Tier 2 and 3 providers lease bandwidth from them.)
- The use of load balancers to evenly distribute incoming and outgoing data traffic across hundreds of servers.
- Auto-Scaling, allowing the infrastructure to scale up automatically when the traffic surges and scales down when it recedes.
- High Throughput APIs, which are designed to handle large batches of messages.
- Real-time Monitoring & Alerts for any anomalies such as failures, delays, or bottlenecks on messaging traffic.
- AI-Powered Text to Speech (TTS) Technology: For voice messages that are pre-recorded, the new TTS technology will allow the AI generation of raw audio waveforms, resulting in more natural-sounding voices than traditional TTS systems, and eliminating the time-consuming voice recording process for emergency messages.

Justification
The increased frequency and severity of climate events and related outages can affect the speed and efficiency of communicating with large groups of customers to relay vital information before and during large impact emergencies. The end result of this program will be a highly efficient outage and emergency communications program that will allow the Company to reach out to its customers in massive scale with urgent and import messages via text, voice calls and e-mails at the fastest speed modern available technology allows.

The increased frequency and severity of extreme weather events and related outages has elevated the importance of improving the speed and efficiency of communicating with very large groups of customers to relay vital information before and during large impact emergencies. The current state of the science suggests that extreme and coincident events, including hurricanes, extreme heat waves, nor'easters and cold snaps, and deluge rainfall, could increase in intensity in the service territory in the future, necessitating effective communication methods to improve customer resiliency during these events. According to the CCVS, the number of days per year with Heat Index over 90˚F is projected to be 39 in 2030, a staggering 300% jump compared to a baseline of 13 days. The Study also forecasts an increase in the number of heatwaves lasting 3 or more days and projects that Con Edison's territory will experience high heat of 103°F by 2030. The rising temperatures will cause load to increase, potentially challenging the capacity of the system, and customers could face an increased risk of potential rolling outages.

Investment in communications platform upgrades and dedicated telecom services will improve the delivery of messages during weather-related events, while also reducing costs to the Company. More efficient communications may also help the Company prevent potential rolling outages and blackouts. When energy loads are reaching their peaks, an efficient massive messaging campaign requesting customers to reduce usage could help balance the load and prevent scenarios that would require emergency power shutoffs or cause blackouts.

Program Benefits

- Quick and reliable updates during extreme weather events enhance customer preparedness, safety and response.
- Increase in more timely communication.
- Improved message delivery rates and reduction of message latency.
- Increase in equity of services, with all regions of the Company receiving the same messaging in a short window of time (today, messages are staggered by region, going from the region with the smallest customer count to the largest, in a process that could take several hours to complete.)
- Expanded ability to comply with regulatory mandates for customer communications during emergencies.
- Improved customer engagement by reaching more customers through data-driven campaign optimization
- Position the Company as an innovative communications leader, increasing brand reputation

Funding Request

2025 – 2029	2030 – 2034	2035 – 2044
$20,610,000	$27,000,000	$72,000,000

Long-term Roadmap

This program is expected to continue into the future and will be reevaluated based on the latest operational needs and the latest technology. If new technology becomes available that no longer warrants this program, Con Edison will weigh the costs and benefits of any new or better technology.

Long-Term Funding Plan

Figure 10 below represents our best estimate of what is necessary to support Con Edison's comprehensive resilience goals, continue delivering our core services, and adapt our system to a changing climate. Where known, the long-term roadmap for each investment is described in the sections above.

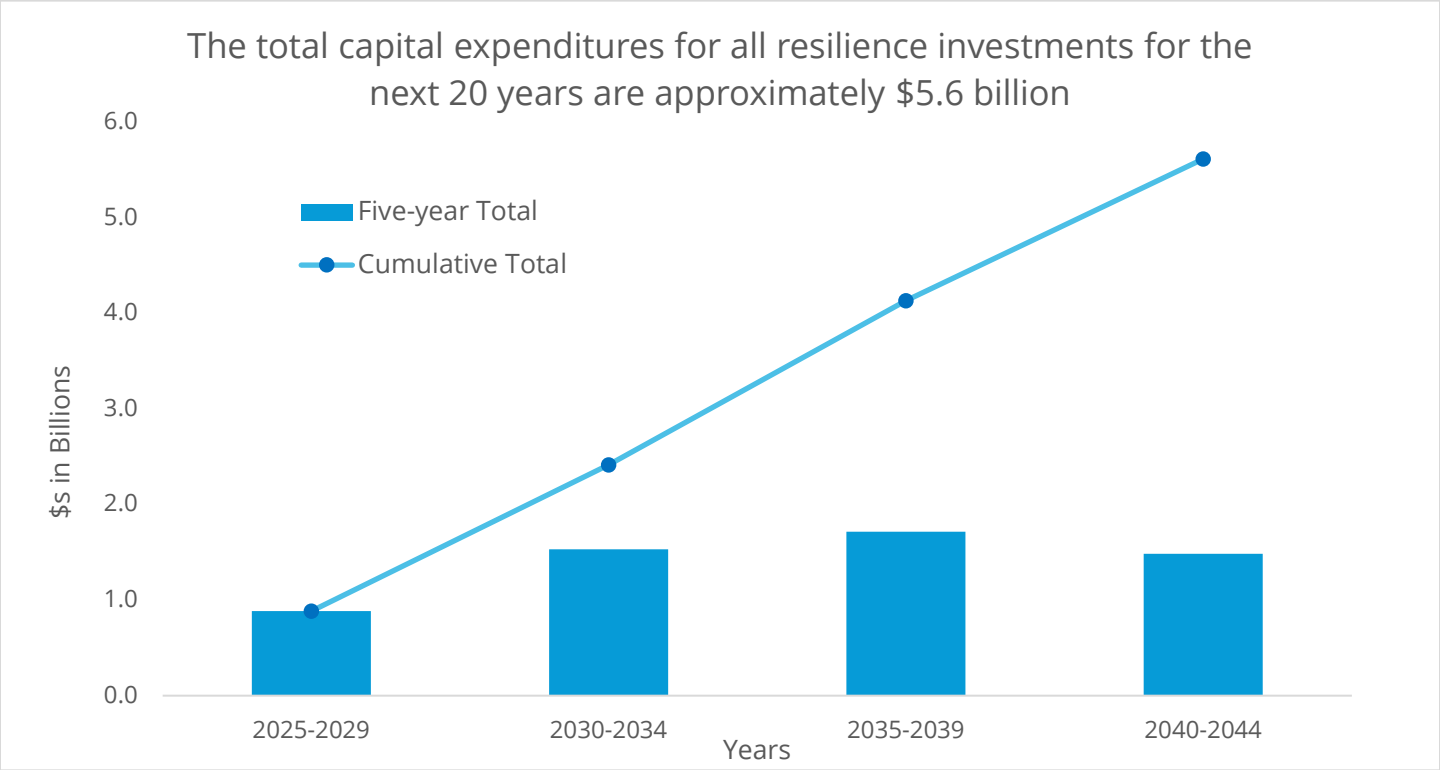


Figure 10. Long-Term Expenditure Projection

Governance

As part of the development of its 2020 Climate Change Implementation Plan, Con Edison established a corporate governance structure for managing climate risk and resilience efforts. This structure enables the Company to track and maintain progress for incorporating climate change into the Company's assets, operations, and planning. The governance approach includes:

- A **Corporate Instruction** that governs how the Company integrates climate change information into its processes for designing, building, and investing in resilient infrastructure, as well as planning for emergency weather events.
- Internal design guidelines that provide climate change projections and guidance on its use in planning, design, operations, and other Company processes.
- The **Climate Risk and Resilience Executive Committee**, which is responsible for providing oversight and organizational support for the development, coordination, communication, and implementation of strategies to prepare and adapt to climate change and incorporate climate change projections into Company organizations, policies, and practices.
- A **Climate Risk and Resilience Group** that assists operating and planning groups with their adaptation and resilience efforts, continues to monitor climate change science, and continues the Company's engagement with stakeholders. It reports to the executive committee.
- A procedure to provide **public reporting** on its progress, continued risk management activities, and financial risks related to climate change through the Company's annual Sustainability Report and other industry-standard risk reporting frameworks. [xv]

[xv] CEI reports using the ESG/Sustainability disclosure guidelines and templates developed by the Task Force on Climate-related Financial Disclosures (TCFD), the Sustainability Accounting Standards Board (SASB), and the Edison Electric Institute (EEI) and the American Gas Association (AGA). These disclosures are accessible at https://lite.conedison.com/ehs/2022-sustainability-report/sustainability-reports/.

This governance structure continues to provide a comprehensive and coordinated climate change adaptation effort. It also provides the appropriate responsibility, oversight, and guidance. Figure 11 shows the governance structure as incorporated at Con Edison.

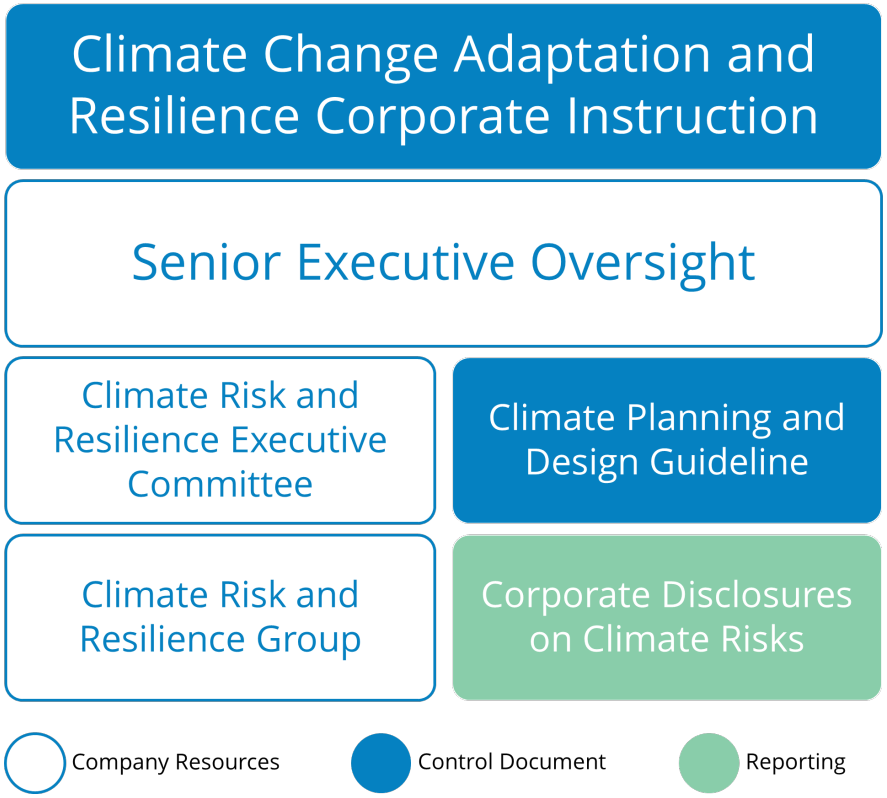


Figure 11. Climate Adaptation Governance Structure.

Performance Measures

Performance measures will be used to track the effectiveness of resilience investments (i.e., outcome-based measures) and the implementation of programs and projects. There is no standardized set of performance measures for the resilience of electric distribution systems. [15] Performance measures to track the resilience of the electric system are difficult to define and formalize because they are centralized around "individual, low-frequency events [so] it is often not possible to base measurements on historical data". [16] However, Con Edison recognizes the importance of performance measures to track progress, incorporate lessons learned, and improve future iterations of this CCRP. More information on available performance measures literature is available in Appendix 5: State of the Literature on Resilience Performance Measures.

Con Edison will track both outcome-based and implementation-based resilience measures on a biennial basis. Outcome-based measures will attempt to assess the overall effectiveness of the Company's Resilience Plan, and implementation-based measures will assess the progress over time using a more traditional project management approach. Measures are subject to change over time as more peer reviewed and benchmarked measures become widely accepted in the utility industry. Additional details relating to the specifics may be found in the expanded program descriptions in Appendix 4: Project and Program Details.

Con Edison's proposed approach to performance measures is summarized below.

Outcome-Based Resilience Measures

Impact of Major Storms: Following a major storm or extreme weather event that results in outages, Con Edison will continue to track the number of outages and restoration times (broken down into lower-level measures, as appropriate). Con Edison will also review the type of weather event that occurred as compared to system performance. This review will be used to understand the effectiveness of the various investments Con Edison made, to obtain an understanding of the overall resilience of the electric system, and to identify opportunities to improve the effectiveness of the Resilience Plan.

Network Distribution System Resiliency: Con Edison will measure the overall resilience of the network distribution system using the Network Resiliency Index (NRI). NRI identifies portions of the network more likely to experience area-level outages than others and can be used to evaluate the potential resiliency impacts of network changes under projected future conditions. Changes in the NRI will be evaluated to assess the effectiveness of network resiliency programs and to evaluate potential changes to the Resilience Plan.

Non-Network Distribution System Resiliency: Con Edison will measure customer outage frequency for the circuits on the non-network distribution system enhanced under resilience programs. The Company will take the three-year average customer outage frequencies pre- and post-enhancements and track this measurement over time for incorporation into its biennial reporting.

Outage Communications: The goal of this program is to rapidly increase the pace of emergency communications to Con Edison's millions of customers. To gauge the effectiveness of this program, Con Edison will measure the number of customers reached and the time it takes to reach them during major emergency events. [xvi]

Emergency Preparedness: The goal of this program is to expand the existing Micronet weather monitoring program by installing two additional weather stations. Con Edison will continue to track the number of storms or extreme events by comparing with the measured rain totals, wind speeds, and temperatures experienced.

Implementation-Based Resilience Measures

Resilience Program	Implementation-Based Resilience Measure
Primary Feeder Resiliency	Number of planned network feeder bifurcations completed Number of planned interrupters installed in new network locations
Selective Undergrounding	Number of planned miles of overhead non-network distribution system converted to underground
Non-Network Resiliency	Miles of planned aerial cable installations completed Number of planned automatic transfer switch installations completed
Non-Network Resiliency Cutout Upgrades	Number of planned sectionalizing switches installed

[xvi] Life Support Equipment (LSE) customers that have registered with the Company will also receive these notices. However, this does not change or modify the Company's existing LSE notification process where Customer Service Representatives reach out via telephone calls to check on the status of these customers.

Critical Facilities	Number of Critical Facilities identified and prioritized for enhancement where enhancements have been completed
Submersible Equipment	Number of network system equipment identified and planned for replacement that have been replaced with submersible equipment
Storm Response Center	Percentage of implementation plan milestones met
Storm Response Technology Advancements	Percentage of technology implementation plan milestones met
Erosion Protection and Drainage Upgrade	Number of substations with identified issues enhanced as planned
Substation Loss Contingency	Percentage of implementation plan milestones met
Substation Operations (SSO) Storm Hardening	Number of substations identified for hardening completed as planned
Substation Enclosure Upgrades	Number of substations identified and prioritized for enclosure upgrades completed as planned
Heat Mitigation Program for Worker Safety	This program is composed of pilot technologies to be implemented over the course of the five years. Specific performance measures can be determined at a later date
Living Shoreline and Nature Based Solutions	Percentage of implementation plan milestones met.
Rewilding and Green Infrastructure	Acres rewilded with established native habitat and/or amount of danger trees/invasive habitat removed Gallons of water projected to be captured during a major rain event from the installed measures

Table 9. Proposed performance measures for Con Edison's Investment Programs and Projects.

Conclusion and Next Steps

As evidenced by recent examples of extreme weather, the effects of climate change threaten the operational capacity and resilience of Con Edison's electric system, and therefore, potentially impacts safety, reliability, and resilient service to our customers. This Plan identifies short-, intermediate-, and long-term resilience investments and operational changes to address the projected risks of climate change. Con Edison will continue to gather input from stakeholders and consider equity in our resilience investments. The Company's climate resilience governance structure will guide the strategy and oversight for the implementation of this Plan.

While implementing this Plan will be the primary focus for resilience work moving forward, these will not be the only actions the Company undertakes. Con Edison understands that the Company can continue to advance its resilience capabilities and lead the conversation about what's next for future resilience work. The Company is currently considering the following as next steps:

- This Plan outlines an initial set of performance measures, but there are currently no industry-accepted performance measures for electric system resilience. Going forward, the Company would like to participate in **future collaborative efforts with peer utilities**, other infrastructure owners, and regulators on this topic.
- Continue to partner and collaborate with the **Electric Power Research Institute** for benchmarking and knowledge sharing on the latest climate change insights.
- Review the potential development of a **risk visualization tool** to support decision-making, such as a geospatial tool to visualize both climate exposure and key attributes of assets that may make them more sensitive to the changes in climate (e.g., flagging non-submersible equipment). Developing such a tool can help internally improve alignment around understanding of climate risks.
- Examine methods for capturing the **community benefits and effectiveness** of Con Edison's resilience investments, with a focus on vulnerable populations. While this Plan's main goal is to reduce customer outages and restoration costs, it is difficult to estimate the magnitude of those benefits for customers. This is particularly challenging but working with stakeholders

such as the NYC Mayor's Office of Climate and Environmental Justice could help frame future planning efforts.

- Continue to **align resilience and decarbonization** in long-range planning efforts by reviewing strategies to understand gaps and opportunities. Integration of the Company's electrification efforts with its resilience efforts will enhance the Company's ability to holistically manage climate change impacts. One potential approach is to partner with stakeholders, such as the NYC Housing Authority, to combine electrification efforts of buildings with climate resilience efforts so that vulnerable populations will have continued service during extreme weather events.
- Conduct further research and modeling of the **Urban Heat Island (UHI) effect** and integrate these considerations into load forecasting and asset management/ratings. The collection of additional Micronet data will help the Company's understanding of this topic. The Company may also look to partner with New York City on reducing the UHI effect by assisting with the expansion and implementation of the upcoming Urban Forest Master Plan to increase tree canopy and reduce UHI impacts to disadvantaged communities. [17]
- Continue to explore alternative funding sources for resilience projects such as federal programs like the Infrastructure Investment and Jobs Act. By exploring **alternative funding** resources, it will allow for the implementation of additional resilience programs.

While this Plan's focus is on the electric system based on the legislation, Con Edison will continue to utilize the latest climate science and address potential vulnerabilities for the gas and steam systems that serve our customers.

Con Edison's CRRG will continue leading implementation of the resilience programs and will meet at least twice a year with the Working Group to share relevant updates. The Company will work with Community Boards, neighborhood groups, and nonprofits within DACs to review the effects of these investments. Con Edison's monitoring and reporting on performance measures will lead to lessons learned about the effectiveness of resilience investments. Combined with new climate science, these lessons learned will inform future updates of this resilience plan (on a 5-year cycle). Con Edison's proactive commitment to action will help minimize customer outages, reduce restoration costs, enhance reliability, and improve resilience.

Appendix 1: Climate Change Challenges

Investing in climate resilience has become a priority for Con Edison. Minimizing the impacts of climate change on the Company's equipment requires immediate action. [18] Given the geography of the Company's service territory, Con Edison faces an array of weather trends and climate conditions, including heat, sea level rise, ice and windstorms, and inland flooding, among other extreme events. We have already experienced damage from these types of events today.

One key finding from the CCVS is that temperatures will increase faster than previously thought, meaning that extreme heat events will become more frequent and intense. In New York City, the Urban Heat Island ("UHI") effects exacerbates the impacts of higher temperatures. UHI causes urban areas to run warmer than surrounding areas due to urban land surface characteristics. [19] According to an independent group of scientists, 78% of New York experiences at least 8°F higher temperatures due to the UHI effect. [20] To better understand these challenges, Con Edison has invested in the New York City Micronet, a network of 17 weather monitoring stations that helps the Company make informed decisions regarding resilience. Micronet data from 2021-2022 illustrate this effect across the City, showing the coolest daily minimum summer temperatures at the Staten Island site (68°F), and the highest daily minimum summer temperatures at the Murray Hill site in Midtown Manhattan (72°F). Micronet data also highlights the importance of monitoring weather at each site. Average temperatures at Central Park tend to be lower due to the cooling effects of tree cover and vegetation and may not apply to the other weather stations. [xvii] An expansion of weather monitoring is critical to tracking temperature differentials and potential asset impacts across our service territory.

Examples of how changes in heavy precipitation events and increasing temperatures are already impacting and projected to impact Con Edison's service area include:

Precipitation:

- In September 2023, Tropical Storm Ophelia brought 7.88 inches of rain in 15 hours, recorded at John F. Kennedy International Airport in NYC. [21]
- In September 2021, the remnants of Hurricane Ida more than 7 inches of rainfall to Central Park, with more than 3 inches falling in just one hour, putting the city under its first flash flood emergency. [22]
- The Climate Change Vulnerability Study projects an average annual increase in precipitation of as much as 15% by 2050, with the heaviest five-day precipitation at Central Park of 11.8 inches.
- In August 2011, Hurricane Irene brought upwards of 6 inches of rainfall to Central Park, causing major inland flooding.
- North Atlantic hurricanes are projected to become more intense (~5% increase) and have higher rainfall amounts (~10%-15% increase) relative to historical hurricanes.
- In September 1999, Hurricane Floyd brought upwards of 5 inches of rainfall to Central Park, causing major inland flooding in areas to the west of the service territory.

[xvii] The average daily minimum summer temperature between 1991-2020 at Central Park is 67°F.

Extreme Heat Events:

- In July 2022, there were six days with a maximum daily temperature at or above 90°F, followed by flash flood warnings. [23]
- July 2023 saw the hottest three-week period of global mean surface air temperatures ever recorded, along with several temperature records broken across the globe. [24]
- While heat waves with daily average temperatures above 90°F provide sustained heat during the daytime and nighttime, heat waves with daily maximum temperatures above 95°F are periods of prolonged daytime heat. The number of consecutive days with peak temperatures above 95°F at Central Park was up to two days on average between 1981 and 2010. By 2050, this could be seven consecutive days.

Other types of extreme weather have impacted our customers in recent years. For example, from April 18 to 20th, 2022, a Nor'easter brought 50 mph wind gusts and up to 18 inches of snow to parts of New York[25] In addition, compound extreme events, such as two Nor'easters in five days in March 2018 that resulted in numerous repair jobs and customer outages struck our region. [26]

For information on how climate change is exacerbating these challenges and posing risks to the Company's infrastructure, see Appendix 2: Physical and Operational Hazard Impact Summaries.

Appendix 2: Physical and Operational Hazard Impact Summaries

Temperature and Humidity

The latest climate projections show that increasing temperature and humidity remain high priority hazards for Con Edison. Data from Columbia suggests that temperature will increase faster than previously expected, possibly causing system impacts much sooner. Coincident high heat and humidity is also expected to intensify rapidly over the coming decades. Con Edison combines temperature and humidity together over a three-day period as a measure of heat wave intensity in a custom climate variable called Temperature Variable ("TV").

Temperature and TV represent a high priority concern for most of Con Edison's physical assets. Higher temperatures can cause reductions in capacity for certain equipment, accelerated degradation (potentially leading to failures and decreased system reliability), as well as physical impacts, such as line sag. When high temperatures coincide with high humidity, Con Edison typically experiences a spike in demand due to customer air conditioning use. In extreme situations, reduced capacity and increased demand could lead to capacity shortfalls. All these risks have the potential to result in increased frequency of customer outages and repair costs.

Temperature and TV also represent a threat to Con Edison's operational processes:

- Load forecasting and load relief planning calculations are influenced by temperature (since high temperature increases demand).
- Higher average temperatures can accelerate vegetation growth, increasing the risk of vegetation contact with lines.
- Higher temperatures can also present a risk to the health and safety of Con Edison personnel who work outside.

Many of these vulnerabilities were addressed as part of the Company's 2020 Climate Change Implementation Program, however, the accelerated rate of change in temperature will likely mean that additional investments are required to maintain capacity, reliability, and safety standards.

Flooding

Flooding remains a high priority hazard for Con Edison, especially for area and transmission substations. The Company has undertaken significant work to harden the electric system in the years since Superstorm Sandy, but the risk of flooding has not been eliminated entirely. It is anticipated that Con Edison's service area will be increasingly exposed to flooding due to sea level rise on the coast. The risk of inland flooding due to precipitation also remains high. Extreme storms such as hurricanes are likely to increase in intensity, bringing with them the possibility of storm surge.

The latest climate science is aligned with the 2019 CCVS projections. As stated in the table above, it finds that a 16-inch rise in sea level by 2050 (relative to 1995-2014 sea levels) would result in 23 substations exposed to flooding during a 1% annual chance flood. This would result in equipment damage, ongoing corrosion issues, and reduced access if surrounding roads are flooded. These impacts could result in more frequent outages with longer repair times and higher costs of recovery.

An increase in flooding due to sea level rise, precipitation, or storm surge will also likely result in more frequent activations of Con Edison's emergency response procedures. The Company has developed a robust emergency management framework, but an increase in extreme events could still impact the Company's resources and delay recovery.

Wind and Ice

Wind and ice have historically been difficult to model due to their highly localized nature. To inform this Study, Con Edison sought out the best available information by acquiring an additional data set from MIT that provides some insight into future wind speeds and radial icing potential. This data set and other studies demonstrate that wind speeds will likely increase, and the risk of radial icing will remain. Extreme storms such as hurricanes can cause wind speeds to increase far beyond typical average speeds. Wind speeds of the most intense hurricanes are projected to increase. Freezing rain frequency and radial icing are also projected to increase, although the magnitude of the trend remains highly uncertain due to the specific atmospheric conditions required for ice storms to occur.

These potential changes in wind and ice present an especially large risk to overhead distribution equipment. Overhead distribution assets, including conductors, attachments, and cross-arms, are built to withstand defined design tolerances for combined ice and wind loading, but they are frequently adjacent to neighboring vegetation that may be downed during these events. Contact with trees can cause lines to disconnect and fall, and can even lead to pole collapse, especially older poles, or those with existing damage. This can result in asset failure, leading to outages and restoration costs.

Extreme and Coincident Events

Climate models have difficulty resolving extreme weather events, including coincident or consecutive extreme events, due to the small space and time scales at which these events occur and the rarity of the events themselves. This necessitates an evaluation of extreme events using historical analogs and projections from scientific literature. Updating the 2019 CCVS, the current study incorporated findings from the most up-to-date scientific literature and included additional context for hurricanes, winds, nor'easters, cold snaps, and wildfire. Each extreme event illustrates differing projected future change in terms of frequency and intensity across the service territory:

- Hurricanes are projected to increase in maximum sustained wind speed intensity but will likely experience no change in overall frequency. However, formed hurricanes may travel further northeast

- Extreme heat waves are projected to increase in both frequency and intensity. Higher temperatures could also increase the likelihood of severe drought, which create favorable conditions for wildfire. Furthermore, increased winds can increase the risk of wildfire and exacerbate their damage by spreading their area of impact. The overall risk from wildfire remains relatively low, however, the projected increases in temperatures combined with the potential for lightning strikes and human error could lead to a higher likelihood of wildfires.
- Nor'easters and cold snaps are projected to decrease in frequency as temperatures warm, but the strongest storms and cold snaps could increase in intensity. Deluge precipitation (high intensity and short duration precipitation events) are projected to increase in both frequency and intensity. The occurrence of multiple extreme weather events either simultaneously (compounding) or sequentially (cascading) is projected to increase in both frequency and intensity.

Importantly, extreme and coincident events can amplify the damage to energy infrastructure and can hamper emergency response activities. These events potentially put Con Edison workers at risk and are the most likely to result in prolonged outages for customers. They also strain other infrastructure systems that Con Edison relies on such as municipal stormwater drainage systems, and the transportation network – these interdependencies can exacerbate the impacts to the Company's system.

Appendix 3: Defining Disadvantaged Communities

To help better understand how Con Edison's investment prioritization serves disadvantaged communities (DACs) Con Edison will utilize the DAC map developed by New York State. If measurements show that the prioritization process fails to benefit DACs fairly, Con Edison will adjust it to do so. In 2019, New York State signed into law the Climate Leadership and Community Protection Act ("Climate Act"), requiring the State to consider disadvantaged communities in regulatory actions, amongst other requirements. As defined in Climate Act Environmental Conservation Law §75-0111, DACs are identified "based on geographic, public health, environmental hazard, and socioeconomic criteria, which shall include but are not limited to:

1. Areas burdened by cumulative environmental pollution and other hazards that can lead to negative public health effects;
2. Areas with concentrations of people that are of low income, high unemployment, high rent burden, low levels of home ownership, low levels of educational attainment, or members of groups that have historically experienced discrimination on the basis of race or ethnicity; and
3. Areas vulnerable to the impacts of climate change such as flooding, storm surges, and urban heat island effects." [27]

The Climate Act charged the Climate Justice Working Group (CJWG) to lead the development of criteria to identify disadvantaged communities and confirm that underserved communities' benefit from climate change investments. The CJWG identified 35%, or 1,736 census tracts in New York State as DACs. [28] The tracts are identified based off 45 indicators, some including potential pollution exposures, potential climate change risks, income, and race and ethnicity. [xviii] Con Edison relies on the best publicly available resources to define the indicators for identifying populations that are disproportionately burdened by energy outages, to serve as a useful planning tool.

The CJWG released an accompanying interactive map that geographically plots census tracts in New York State and indicates those identified as disadvantaged communities in purple. This valuable tool is being adopted by Con Edison to help identify where investments are to be prioritized throughout the service territory based on engineering and system needs. Based on the criteria described above, disadvantaged communities comprise 45% of Con Edison's service territory by population.

[xviii] For a full list of indicators, see Technical Documentation on Disadvantaged Communities Criteria.

Appendix 4: Project and Program Details

Primary Feeder Resiliency

Electric Operations / DE

1. Project / Program Summary

Type: ☐ **Project** ☒ **Program**	**Category:** ☒ **Capital** ☐ **O&M**
Work Plan Category: ☐ **Regulatory Mandated** ☒ **Operationally Required** ☐ **Strategic**	
Project/Program Title: Primary Feeder Resiliency	
Project/Program Manager: Stephen Pupek	**Project/Program Number (Level 1):** 27207959, 27207952, 27207953, 27207955, 27207954, 27207951
Status: ☐ **Initiation/Planning** ☐ **In-Progress (Projects Only)** ☒ **On-going (Programs Only)**	
Estimated Start Date: Ongoing	**Estimated Date In Service:** Ongoing
2025-2029 Funding Request ($000) **Capital: $113,000** **O&M: –**	

Work Description:

The Primary Feeder Resiliency program enhances the core resiliency work performed under the Primary Feeder Reliability program and further mitigates potential network system vulnerabilities resulting from future climate-driven increases in heat, temperature variable (TV, heat plus humidity), heat waves and heat domes by installing additional network interrupters and bifurcating/reconfiguring existing network feeders. Sectionalizing overhead feeders has been a primary strategy for mitigating the risks of extensive feeder outages across the industry for many years. Now, it's possible to implement this best practice for underground feeders, providing both blue sky benefits – including support for the Company's clean energy and electrification goals – and resiliency benefits that will strengthen network operations and protect customers under a wide variety of extreme circumstances.

Con Edison's Climate Change Vulnerability Study (the Study or the CCVS) projects an increase in TV in Con Edison's service territory of 1°F as early as 2030. The Company assessed the potential impact of this increase in temperature on the underground network distribution system using the Network Resiliency Index (NRI) where the lower the NRI, the more reliable the network has historically been. NRI is the measure used to gauge the reliability of all 65 second contingency networks on the Con Edison distribution system. The lower the index, the less likely for that network to experience cascading feeder outages during extreme weather events. Factors that impact the NRI include the number (and age) of components in the network, component failure rates, longer and elevated predicted periods of heat stress, and feeder/network loading, and the load shifts during contingencies. The Company's network reliability goals target NRI results where all networks have an NRI of less than 1.0 and the average NRI for the top 25 networks (i.e., the 25 networks with the worst NRI) less than 0.5. The current plan is for forecasted network performance issues to be a focus of the Primary Feeder Reliability program – as projected TV values are incorporated into future NRI analyses as part of the Company's standard practice – with an emphasis on installation of interrupters in existing underground structures (replacing existing manual switches) and the replacement of known problem transition joints (e.g., PILC removal). The scope of the Primary Feeder Resiliency program goes beyond that of the Primary Feeder Reliability program to mitigate the potential, but unquantifiable, risks associated with projections of increases in extreme heat events. For the resiliency program, NRI can be used to point to the circuits where program enhancements will provide the most benefit.

The CCVS projected increases in the frequency, duration, and intensity of low frequency but potentially high impact climate-driven periods of extended, extreme heat – heat waves and heat domes in the service territory. In fact, according to research for the Study, July 2023 saw the hottest three-week period of global mean surface air temperatures ever recorded, along with multiple broken temperature records around the globe. If not prepared for these extreme weather events, the impact to customers could be significant, at a time when customers are coping with a broad range of impacts from the weather event.

To mitigate the risks of these potentially high-impact events, this program emphasizes additional network sectionalizing and bifurcation of priority feeders achieved through installation of interrupters in new underground structure locations and feeder extensions when required. These new interrupters are next-generation, vacuum-based sectionalizing switches that allow for partial circuit isolation rather than a full feeder outage resulting from a fault. Upgrading to the latest technology and extending interrupter technology throughout the network distribution system helps the Con Edison system absorb failures on primary feeders by limiting the number of feeders and associated network transformers out of service through automatic actions – i.e., dropping the faulted sections automatically to keep unfaulted sections in service.

Limiting the impact of a fault on the network both reduces the number of customers impacted and supports faster restoration of the primary network. Isolating faults, in turn, can also prevent the need to implement emergency actions necessary to prevent cascading failures in network system – such as voluntary load reduction, emergency voltage reduction and proactive load shedding – that would impact many more customers. Installation of interrupters also reduces the need for new mains and improves the reliability of individual primary sections and the associated network transformers. Improving the reliability of the transformers in a localized area reduces the probability that secondary mains will be required to carry not only their normal load but also contingency load. The same is true for Network Transformers. The Company projects the installation of approximately 100 state-of-the-art interrupters on the network system over the next 5 years under this program, beginning by installing six new interrupters in 2025 and ramping up to 35 new switches in 2029.

The Primary Feeder Resiliency program also increases the resiliency of the network system by bifurcating and, in some cases, extending key primary feeders. These feeders are reconfigured into double legged feeders with an interrupter installed on each leg. Network feeders with an NRI greater than 0.2 would be in-scope for potential bifurcation/reconfiguration, approximately 40 feeders currently, and the program will target bifurcation of one network feeder per year. Bifurcating a feeder not only provides the benefit of being able to isolate half of the feeder if faults occur rather than having the entire feeder out but it also protects available feeder capacity on the remainder of the feeder. Previous feeder bifurcations have resulted in increased normal and emergency feeder ratings from 40-50%. During extreme heat waves, loads are generally higher and system capacity can become limited. Reconfigured feeders help reduce the risk of feeder capacity shortfalls.

The program will prioritize program investments based on current projections of network and feeder reliability, increased resilience from limiting customer exposure to outages, support of clean energy, and support for the Company's clean energy and electrification goals.

Justification Summary:
Following Superstorm Sandy, Con Edison worked with a Storm Hardening and Resiliency Collaborative to recommend storm hardening investments and one of the recommendations was to conduct a Climate Change Vulnerability Study (CCVS or the Study). The initial Climate Change Vulnerability Study was conducted in 2019 and was updated in 2023. The approach followed a multi-step process that cycled through the steps for each potential climate hazard, incorporating feedback from stakeholders throughout the evaluations. The Study used the best available science to evaluate the sensitivity of Con Edison's electric system to projections of potential climate hazards including:

- **Temperature and humidity** – from heat and coincident high heat and humidity (known as temperature variable or "TV")
- **Flooding** – coastal flooding from sea level rise and/or inland flooding from precipitation
- **Wind and ice**
- **Extreme and coincident weather events** – hurricanes/wind, extreme heat waves, nor'easters/cold snaps, and multiple concurrent or consecutive extreme events

The hazards that the Study found to pose an elevated risk to Con Edison's assets and operations include heat and humidity, major storms, wind and ice, and extreme events.

	Con Edison's service territory is projected to be impacted by rising temperatures. Those impacts are expected to be amplified during intense heat waves. Increasing TV will cause load to increase, potentially challenging the capacity of the system.
	Con Edison has previously experienced flooding events that have impacted its assets from major storms. Due to future climate projections, that risk is expected to expand in Con Edison's service area, and facilities like substations will be more exposed to flooding.
	Con Edison's overhead distribution system has historically been the most sensitive to wind and ice, due to its susceptibility to tree contact during high wind and icing events.
	Extreme events are low-likelihood, high-impact scenarios that can amplify and compound the types of impacts anticipated from changes in temperature, sea level rise, and other variables. These events pose risks to all aspects of the system and are especially impactful for emergency response planning.

Specific projections of future climate conditions, referred to as pathways (Pathways) were incorporated into the Company's forecasting and planning processes – including load forecasting, load relief planning, reliability planning for the sub-transmission and distribution systems, asset management planning, facility energy system planning, planning for emergency preparation and response, and worker safety – through the development of a new Climate Change Planning and Design Guideline document (Guidelines). This document specifies the methodologies to be used to evaluate the vulnerability of electric facilities to projected climate changes and establishes specific design standards to be met for each climate hazard over the useful life of the asset.

The Con Edison Climate Change Vulnerability Studies project increases in average and maximum air temperatures throughout the century relative to historical conditions, with the 2023 Study projecting that temperatures will increase faster than projected in the 2019 Study. By all measures evaluated in the Studies – maximum daily temperature, number of days per year in which maximum temperature exceeds 95°F, and number of days per year the daily average temperature exceeds 86°F – climate-related increases in heat are projected to occur roughly a decade faster than projected in the first Study.

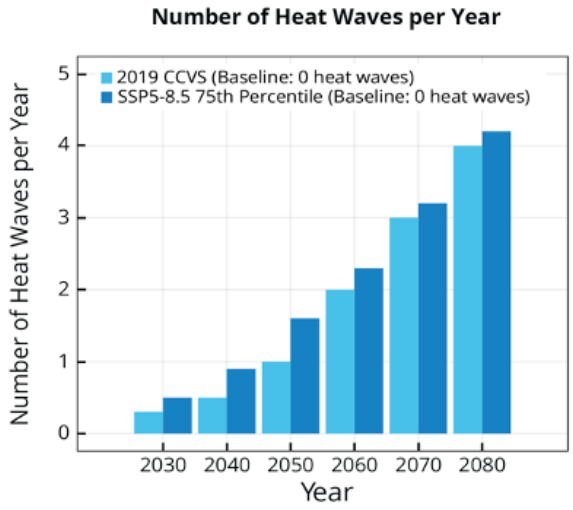
Variable	Study	Baseline	2030	2040	2050	2080
Highest annual maximum daily temperature	Current Study	97°F	103°F	104°F	106°F	112°F
	2019 CCVS	97°F	101°F	103°F	104°F	108°F
The number of days per year in which maximum temperatures exceed 95°F	Current Study	4 days	17 days	27 days	32 days	69 days
	2019 CCVS	4 days	11 days	18 days	23 days	47 days
The number of days per year in which daily average temperatures exceed 86°F	Current Study	3 days	16 days	22 days	31 days	68 days
	2019 CCVS	3 days	11 days	16 days	21 days	45 days

In addition, projections of Temperature Variable (TV) – an index that is similar to a heat index but which considers the persistence of heat and humidity over several days – that historically occur only once a year (e.g., 86°F) are forecast to become common occurrences within a generation, occurring as many as 16 times per year by 2050 and as many as 49 times per year by 2080.

Variable	Study	Baseline	2030	2040	2050	2080
Days per year with maximum summer TV exceeding 86°F	Current Study	1 day	6 days	10 days	16 days	49 days
	2019 CCVS	1 day	6 days	10 days	15 days	35 days

Multiday heat events, known as heat waves, are also impactful because they drive demand for air conditioning and can strain infrastructure. Heat waves of three or more consecutive days with maximum daily temperatures above 90°F occurred approximately twice per year in New York City between 1981 and 2010. Recent heat waves in New York City include events in July 2022, July 2019, July 1999, and July 1993, which featured 6, 4, 10, and 1 consecutive days, respectively, with maximum daily temperatures at or above 90°F, respectively.

Projections show that the number of three-day heat waves with temperatures averaging above 90°F for each day will increase (see the figure below). While heat waves with daily average temperatures above 90°F provide a measure of sustained heat during the daytime and nighttime hours, heat waves with daily maximum temperatures above 95°F represent periods of prolonged daytime heat. The number of consecutive days with peak temperatures above 95°F at Central Park was up to two days on average between 1981 and 2010. By 2050, this could be seven consecutive days.



Extreme heat can manifest as heat waves or other tail-end heat events, such as heat domes, that increase demand for air conditioning and, in turn, limit the capability of efficiency reductions. Unlike hurricanes or other extreme storms, heat wave intensity and frequency are tightly linked to long-term changes in atmospheric temperature and are thus comparatively well-simulated in climate model projections. Additionally, higher temperatures associated with urbanization, a phenomenon referred to as the Urban Heat Island (UHI), such as from lower surface reflectivity of built surfaces and waste heat from buildings, can exacerbate the impacts of extreme heat events. Heat waves are intensified by events such as heat domes, which are areas of high pressure in the atmosphere that trap hot air. The Climate Change Vulnerability Study projections increases in the frequency, duration, and intensity of extreme heat days in the service territory by the late 21st century. Across Con Edison's

service area, approximately 9 heat waves are projected to occur in 2050 compared to a baseline of 2 heat waves per year.

The key sensitivities of electric assets to the projected changes in temperature and TV are:

- Decreased asset capacity: An asset's internal temperature is the result of (1) the amount of power flowing through it and (2) the temperature of the environment in which it operates. Operating at ambient temperatures above a design reference can decrease the operational rating of an asset. In turn, derating the system (reducing the output of power as a protective measure) due to increasing temperatures decreases the resilience capability of the system by decreasing capacity.
- Accelerated asset degradation: Assets are designed to operate within a particular environment. When temperatures exceed design assumptions, components (e.g., insulation) age at an accelerated rate.
- Increased system load: During periods of coincident high temperature and humidity (as represented by high TV values), customer cooling demand increases. Con Edison's system has historically experienced a spike in load during such conditions, primarily due to air conditioner use. These projected high-load situations could exceed system capacity.

The Climate Change Vulnerability Study identified projected increases in temperature and humidity as a primary vulnerability to the underground distribution network system – i.e., finding that the assets in the network system are at high risk of failure from this hazard. This vulnerability is confirmed by the Company's internal Network Reliability Index (NRI) models., Monte Carlo simulations used to predict the performance of a network. The program uses the historical failure rates of the various components/equipment that are in the network, and, through probability analysis, determines which networks are more likely to experience a shutdown. Con Edison's targets all networks having an NRI of less than 1.0 and maintaining the average NRI for the top 25 networks at less than 0.5.

When choosing resilience strategies to address identified climate vulnerabilities, Con Edison follows a resilience framework that encompasses investments that:

- Prevent climate change impacts by hardening infrastructure
- Mitigate the impacts from outage-inducing events by minimizing disruptions
- Respond rapidly to disruptions by reducing recovery times and costs

The enhanced Primary Feeder Resiliency program does not prevent the potential climate change impacts from increasing temperatures and heat waves discussed above, but it does increase the network system's resiliency by mitigating the impacts of outage events, limiting the number of network transformers out of service and the impact of a single failure on primary network feeders. The interrupter device operates instantaneously, automatically opening to isolate primary faults detected downstream from the device. The interrupter device is coordinated to operate before the corresponding Area Station feeder breaker thereby preventing the entire feeder from going out of service. Un-faulted sections remain in service. The faulted and isolated cable sections can be processed from the interrupter device to reduce restoration time. Similarly, faults on bifurcated primary network feeders can be isolated to half of the feeder rather than the entire feeder, limiting the impact of a single fault.

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

Impact on Disadvantaged Communities

The resilience strategies included in Con Edison's Resiliency Plan have been chosen in alignment with our Resiliency Framework that provides guidance for developing a comprehensive set of adaptation strategies to mitigate future climate change risks. This comprehensive set of strategies

incudes investments that enable Con Edison's electric system to prevent climate change impacts by hardening infrastructure, mitigate the impacts from outage-inducing events by minimizing disruptions to customers, and respond rapidly to disruptions by reducing recovery times and costs.

While the programs included in the Plan are largely focused on withstanding climate changes and avoiding outages, most programs also enable Con Edison to limit outage impacts on customers (i.e., absorb outage impacts), and restore service more quickly than would otherwise have been possible (i.e., recover quickly). Many of the investments proposed to strengthen Con Edison's ability to withstand extreme climate conditions will also, naturally, reduce the risk of outages during "blue sky" conditions.

Disadvantaged communities (DACs) have fewer alternatives during energy system outages and will be more at risk from climate change. Because of this lack of alternatives, resilient and reliable energy service is an important priority for the communities and for Con Edison. Due to the size of Con Edison's electric system and the population density in the City, almost half of Con Edison's system serves at least one DAC. The Company has committed to tracking investments that benefit DACs specifically and to measuring and monitoring system performance in DACs and non-DACs. This tracking process will provide data and allow the Company to evaluate the benefits of its investments to customers in DACs and revise its investment approach if needed.

The Company has also formed an Environmental Justice Working Group under an executive committee and plans to release a finalized Environmental Justice Policy Statement in 2023 to apply an equity lens to resilience-driven investments. Key components of the upcoming policy statement include:

- Operations will not disproportionately burden DACs.
- Con Edison will work to understand DAC concerns.
- Clean energy investments will benefit DACs.
- Con Edison will provide opportunities for employment in the clean energy future.

These equity considerations will help inform resilience plan investments moving forward.

Impact on Greenhouse Gas (GHG) Emissions

The primary goals of the programs and projects included in the Climate Vulnerability and Resiliency Plan, including the Primary Feeder Resiliency program, are to withstand, absorb, or recover from the impacts of future climate changes on Con Edison's electric system. While none of the programs are focused on reducing GHG emissions, some of the programs could have small but positive impacts on Con Edison's overall GHG emissions, and none of the programs should negatively impact Con Edison's overall GHG emissions.

All of the programs that prevent or reduce the number of "truck rolls" required to assess, operate, or restore the electric system (i.e., the number of physical trips made by operators, technicians, and other field personnel to physical field locations) will reduce Con Edison's overall GHG emissions by reducing vehicle emissions associated with each field trip prevented. The Primary Feeder Resiliency program reduces the need for field visits by converting manual switching operations to automatic operations and by reducing feeder outages requiring field restoration. Actual program reductions in GHG emissions from reductions in physical trips to the field depend on the number of trips avoided, the miles driven per trip, the type of vehicle, the type of fuel burned, and the condition of the vehicle.

Impact on Clean Energy Commitment
The Primary Feeder Resiliency program supports Initiative 2 under Pillar 1 of the Clean Energy Commitment, Build the Grid of the Future.

Impact on 5-year and long-range plans (10-year)
This resilience program aligns with and supports Con Edison's integrated strategy, included in the January 2022 Long-Range Plan, focused on four strategic objectives related to Clean Energy, Climate Resilience, Core Service, and Customer Engagement. Con Edison's Climate Resilience strategic objective aims to increase the resilience of the energy infrastructure to adapt to climate change. Furthermore, Con Edison sees the role of utilities as changing from providing, "Universal access to energy that is safe and reliable" to providing, "Universal access to energy that is safe, reliable, and *resilient* (able to prevent, mitigate, and recover from events.)" (emphasis added)

The Primary Feeder Resiliency program provides resilient energy delivery by increasing the ability of the electric distribution system to withstand the impacts of climate-driven increases in heat and humidity (as measured by TV) with fewer equipment derates and failures and increased network reliability.

Impact on Company Risk Mitigation Activity
Resiliency, in simple terms, can be defined as having the capacity to withstand or to recover quickly from difficulties. While a bit more complex, Con Edison's Resilience Management Framework definition of resilience is very similar – i.e., the Framework identifies resilience strategies as investments that enable Con Edison to withstand changes in climate and avoid outages, absorb impacts from outage-inducing events by limiting the number of customers impacted or improving the customers' ability to cope with outages, recover quickly, and advance to a better state. Both equate resilience with the avoidance or limitation of difficulties or negative consequences – i.e., with the mitigation of risk.

The 2022 Electric Operations Risk Assessment and Mitigation plans include mitigation activities associated with increasing risks of major storms that could damage the Con Edison system and impact customers. Con Edison's comprehensive set of resiliency programs are designed to increase the ability of the electric system to withstand the impacts of climate change, including the increasing risk of storms, and limit potential impacts to customers. The Primary Feeder Resiliency program mitigates the risk of increased network outages from climate change, while also mitigating risks to network customers by providing additional means of limiting the number of customers impacted by network failures and enabling faster network restoration.

2. Supplemental Information

Alternatives
Alternative 1
Voltage reduction during heat events has proven to be effective in avoiding system failures. If network performance (NRIs) is not maintained to the 2021 levels, the specification (EOP-5022) governing voltage reduction could be updated to reduce voltage more preemptively on circuits to avoid failures.

Alternative 2
During high load events, we have load shedding programs that provide guidance on dropping customers from the grid to preserve the system's operational integrity. An alternative could be to institute aggressive load shedding / rolling blackout programs to preserve the system integrity and avoid equipment failure. This alternative is not desirable because it will result in poor customer experience.

Risk of No Action
Based on the Climate Change Vulnerability Study, the risk of not performing the work included in the Primary Feeder Resiliency program is significant declines in the reliability of the network system beginning in 2030. The NRI analysis performed projects that by 2030 eight networks will not meet NRI targets and the average NRI for the top 25 networks would increase to 0.87.

Non-Financial Benefits
The program began in the mid 1980's due to concerns over the reliability and potential environmental impact of PILC cable. PILC cable contains a dielectric fluid (usually a mineral oil) and a lead sheath that are potential environmental contaminants.

The first generation of underground sectionalizing switches deployed on the distribution system were motor-operated three-phase SF6 (sulfur hexafluoride) gas insulated switches. Over time these switches have become problematic to operate due to motor failure, or loss of SF6 gas. These switches are being selectively targeted for replacement with the newest variant, which is a vacuum-based switch.

Summary of Financial Benefits and Costs
1. Cost-benefit analysis
A comparative analysis between periods of extreme heat and normal conditions indicates that the underground distribution system is highly susceptible to extreme heat events. This issue is anticipated to become more pronounced with the expected increase in the frequency of heat events like heat domes in the coming decades, leading to a substantial rise in faults and component failures, particularly during the summer months.

Although predicting the recurrence of extreme weather events is a complex task, based on climate science, there is growing evidence suggesting an increased likelihood of heat events such as heat domes. Given the potentially devastating consequences of a network shutdown during these less frequent but highly impactful events, it is crucial to enhance our preparedness.

To address these challenges, NRI indicators will be utilized to identify networks that are most susceptible. Implementing strategies such as feeder sectionalization and bifurcation in these vulnerable networks will significantly enhance their resilience against extreme heat events.

2. Basis for estimate
The estimated annual cost of the enhanced Primary Feeder Resiliency program was calculated by applying average historical costs associated with interrupter installations and feeder bifurcations to the forecasted number of interrupters to be installed and feeders to be bifurcated each year. Per unit costs are escalated annually for inflationary increases of 3%.

Installation of Interrupters

	2025 Annual Units	2026 Annual Units	2027 Annual Units	2028 Annual Units	2029 Annual Units	2023 Unit Cost ($000)	2025 Unit Cost (000) (assuming 3% inflation annually)	2025 Cost ($000)	2026 Cost ($000)	2027 Cost ($000)	2028 Cost ($000)	2029 Cost ($000)
Primary Section	24	48	80	108	140	$ 41.00	$ 43.50	1,044	2,088	3,480	4,698	6,090
Interrupter Switch	6	12	20	27	35	$ 200.00	$ 212.18	1,273	2,546	4,244	5,729	7,426
Conduit Cost 250' Section	12	24	40	54	70	$ 175.00	$ 185.66	2,228	4,456	7,426	10,026	12,996
Manhole Installation	6	12	20	27	35	$ 68.00	$ 72.14	433	866	1,443	1,948	2,525
						Total Cost- Interrupters		$ 4,978	$ 9,955	$ 16,592	$ 22,400	$ 29,037

Feeder Bifurcation

	2025 Annual Units	2026 Annual Units	2027 Annual Units	2028 Annual Units	2029 Annual Units	2023 Unit Cost ($000)	2025 Unit Cost (000) (assuming 3% inflation annually)	2025 Cost ($000)	2026 Cost ($000)	2027 Cost ($000)	2028 Cost ($000)	2029 Cost ($000)
Feeder Extensions included	Feeder 1	Feeder 2	Feeder 3	Feeder 4	Feeder 5	2023	2025	2025	2026	2027	2028	2029
INSTALL REPLACE UG CONDUIT	12	12	12	12	12	$ 43.75	$ 46.41	$ 557	$ 574	$ 591	$ 609	$ 627
INSTALL REPLACE UG MANHOLE VAULT	5	5	5	5	5	$ 68.00	$ 73.57	$ 368	$ 379	$ 390	$ 402	$ 414
INSTALL REPLACE UG PRI COND CONV SECTION LEG	58	58	58	58	58	$ 41.00	$ 48.34	$ 2,804	$ 2,888	$ 2,975	$ 3,064	$ 3,156
INSTALL REPLACE UG SEC COND CONV SECTION LEG	2	2	2	2	2	$ 41.00	$ 50.94	$ 102	$ 105	$ 108	$ 111	$ 115
INSTALL REPLACE UG SVC CABLE CONV	2	2	2	2	2	$ 3.10	$ 4.16	$ 8	$ 9	$ 9	$ 9	$ 9
INSTALL VISO Switch	2	2	2	2	2	$ 230.00	$ 237.31	$ 475	$ 489	$ 504	$ 519	$ 534
						Total Cost- Feeder Bifurcation		$ 4,313	$ 4,443	$ 4,576	$ 4,713	$ 4,855
						Total Program Cost - Interrupters + Feeders		$ 9,291	$ 14,398	$ 21,169	$ 27,113	$ 33,892

Project Risks and Mitigation Plan
Risk 1 – Skilled Labor Availability

Risk 1 Mitigation Plan
Work with Work and Resource Management group to schedule resources around known busy periods in order to maximize productivity. In addition, projects are prioritized to have resources focus on higher impacted jobs first. Barring significant system emergencies, the Company should be able to progress this work as planned.

Risk 2 – Material Availability

Risk 2 Mitigation Plan
Engineering to work with Work and Resource Management and supply chain to establish a cohesive plan to align with vendor lead times and stay engaged with vendors so that lead times are maintained and if shortages are encountered, plan is adjusted as needed.

Technical Evaluation / Analysis
Primary feeder reliability is effectively managed through the Network Reliability Index (NRI) ranking that leverages current system conditions and historical data to provide a proven method for targeting problem issues throughout the electric system. The introduction of new interrupter switches will expand the utilization of interrupter technology in the distribution system. The incorporation of these switches into circuits allows for partial circuit isolation rather than a full feeder outage resulting from a fault, reducing the system impact and improving the restoration time for the faulted section. Similarly, faults on bifurcated primary network feeders can be isolated to half of the feeder rather than the entire feeder, limiting the impact of a single fault.

Project Relationships (if applicable)
N/A

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	–	–	–	–	–	–
Capital	–	–	–	–	–	–

2025-2029 Request:

Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	–	–	–	–	–
Capital (Total)	**$9,300**	**$14,700**	**$22,200**	**$29,200**	**$37,600**
Labor	$1,857	$2,935	$4,432	$5,830	$7,507
M&S	$2,921	$4,617	$6,972	$9,171	$11,809
Contract Svcs.	$1,905	$3,011	$4,548	$5,982	$7,703
Other	$179	$284	$428	$563	$725
Overheads	$2,438	$3,853	$5,819	$7,654	$9,856

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	–	–	–
Capital	**$262,100**	**$345,200**	**$441,200**
Basis for funding direction:	Assumes similar scope plus annual inflationary cost escalation (3%).	Assumes similar scope plus annual inflationary cost escalation (3%).	Assumes similar scope plus annual inflationary cost escalation (3%).

Heat Mitigation for Worker Safety

Environment, Health, & Safety

1. Project / Program Summary

Type: ☐ Project ☒ Program	**Category: ☒ Capital ☐ O&M**
Work Plan Category: ☐ Regulatory Mandated ☐ Operationally Required ☒ Strategic	
Project/Program Title: Heat Mitigation for Worker Safety	
Project/Program Manager: Wayne Murray	**Project/Program Number (Level 1): N/A**
Status: ☒ Initiation/Planning ☐ In-Progress (Projects Only) ☐ On-going (Programs Only)	
Estimated Start Date: 1/2025	**Estimated Date In Service: N/A**
2025-2029 Funding Request ($000) **Capital: $1,000** **O&M: $0**	

Work Description:
Con Edison's 2023 Climate Change Vulnerability Study recognizes a multitude of upcoming challenges such as temperature and sea level rise, stronger wind gusts, and increased frequency and magnitude of extreme events. As all of Con Edison's service territory will be subjected to rising temperatures, which in turn will produce intense heat waves with an increasing temperature variable, it is critical to develop a program to incorporate heat illness mitigation technologies for workers.

The program would purchase, pilot, and field test various emerging technologies to mitigate heat illnesses associated with sustained higher temperatures on worker health. The focus would include garnering feedback of the use and effectiveness of innovative equipment and emerging technology in the next few years to include but not limited to cooling/reflective hardhat alternatives, heat wicking base layer garments, and emerging potable cooling equipment. Additionally, the program would also seek to mitigate the impact that heat illnesses will have on our employees through the continuous implementation of a Heat Related Illness/Injury Prevention Program, specifically where technology and innovation can assist with heat alert programs.

Justification Summary:
Con Edison maintains specifications and procedures to protect worker safety, environment, and health. These range from overarching corporate environmental, health, and safety procedures to general environmental, health, and safety instructions, along with many others. With most of the Con Edison system to be impacted by rising temperatures, and those impacts will be amplified during intense heat waves with increasing temperature variable. It is critical to develop a program to incorporate heat illness mitigation technologies which includes taking the following aspects into consideration:
- Days per year with 2PM ET Heat Index over 90˚F are projected to be 39 days per year in 2030 compared to baseline of 13 days (factor of 3 or 300%)
- Potential for 1 three-day heat wave with each day's temperatures averaging above 90°F for each day by 2030.
- Highest maximum annual temperature by 2030 projected to be 103˚F compared to baseline of 97˚F
-Average summer temperature by 2030 projected to be 80˚F compared to baseline of 75˚F

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

This program is meant to protect worker health and safety in a changing environment, and as such will not have a direct impact on greenhouse gas emissions at this time. This program is to explore new technologies and having employees who are prepared to safely work in inclement weather will allow for faster restoration.

Since disadvantaged communities already have higher rates of many adverse health conditions and are potentially more exposed to environmental hazards; having employees who are prepared to safely work in inclement weather and extreme heat will maintain and restore our system to mitigate and lessen existing inequalities that can be exacerbated due to climate change.

People who live in disadvantaged communities which may be near pollution sites or in housing developments without public transportation, sufficient insulation, or air conditioning, will benefit from no disruptions to infrastructure including electrical grid, during natural disasters.

2. Supplemental Information

Alternatives

Due to the increasing temperatures, current specifications and procedures will have to be modified and worker productivity would be negatively impacted resulting in decreased restoration times. Additionally, if local, state and/or federal regulatory requirements to protect workers do not come to fruition (as heat related precautions may be included in the upcoming regulatory world), then there will be no regulatory push for heat related protections.

Risk of No Action

Risk 1 Employees will be exposed to the forecasted higher sustained temperatures, increasing exposures to heat illness, heat stress or fatality. It is essential for employees to be able to safely respond in the event of an outage in order to restore and maintain operation of the system and have technology and innovations to address the following aspects:
- Days per year with 2PM ET Heat Index over 90˚F are projected to be 39 days per year in 2030 compared to baseline of 13 days (factor of 3 or 300%)
- Potential for 1 three-day heat wave with each day's temperatures averaging above 90°F for each day by 2030.
- Highest maximum annual temperature by 2030 projected to be 103˚F compared to baseline of 97˚F
-Average summer temperature by 2030 projected to be 80˚F compared to baseline of 75˚F

Risk 2 Continued strain on the energy system if restoration is not adequately completed in a timely manner.

Non-Financial Benefits

This program will assist in the comprehensive approach to mitigate heat illness and heat stress of employees due to the exposure of forecasted prolonged heat waves and overall higher temperatures in our area. This program will increase the overall health and wellness of employees as well as support response times for restoration and maintenance of system.

Summary of Financial Benefits and Costs

1. Cost-benefit analysis (Required)

The financial benefit of creating a program that will pilot and field test various emerging technologies to mitigate temperature impacts will decrease employees sustaining heat related illnesses and effects. This program will also positively contribute to maintaining employee safety and wellbeing. We will work with industry groups and research organizations to get more information in this area.

2. Basis for estimate
Since the program is comprised of conducting pilots and field tests of various emerging technologies as this need grows and the markets expand product development to mitigate heat illnesses associated with sustained higher temperatures; specific equipment is not known at this time. The focus would include garnering feedback of the use and effectiveness of innovative equipment and emerging technology in the next few years to include but not limited to cooling/reflective hardhat alternatives, heat wicking base layer garments, and emerging potable cooling equipment.

Cooling tents is one option to be explored with costs expected to start in the $2,000 range per item. The Program would comprehensively pilot and test various equipment products over the next few years.

Project Risks and Mitigation Plan
Risk 1 Supply chain issues with delivery and timeliness of equipment due to potential bottlenecks and material constraints.
Mitigation plan- Diversity of review and pilots for various types of equipment and technology with a spectrum of vendors.

Technical Evaluation / Analysis
Con Edison Climate Change Vulnerability Study with specific considerations for addressing the following aspects:
- Days per year with 2PM ET Heat Index over 90˚F are projected to be 39 days per year in 2030 compared to baseline of 13 days (factor of 3 or 300%)
- Potential for 1 three-day heat wave with each day's temperatures averaging above 90°F for each day by 2030.
- Highest maximum annual temperature by 2030 projected to be 103˚F compared to baseline of 97˚F
-Average summer temperature by 2030 projected to be 80˚F compared to baseline of 75˚F

Project Relationships (if applicable)
This program supports Con Edison's efforts to become more resilient to climate change.

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	N/A	N/A	N/A	N/A	N/A	N/A
Capital	N/A	N/A	N/A	N/A	N/A	N/A

2025-2029 Request:
Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	N/A	N/A	N/A	N/A	N/A
Capital (Total)	$200	$200	$200	$200	$200
Labor					
M&S					
Contract Svcs.	$200	$200	$200	$200	$200
Other					
Overheads					

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M			
Capital	$1,000	$1,000	$1,000
Basis for funding direction:	Since this program is to pilot and purchase new technologies as they are developed and accepted, the future funding is only an approximate and subject to change.		

Micronet Weather Station Expansion

Emergency Preparedness

1. Project / Program Summary

Type: ☒ Project ☐ Program	**Category: ☒ Capital ☒ O&M**
Work Plan Category: ☐ Regulatory Mandated ☐ Operationally Required ☒ Strategic	
Project/Program Title: Micronet Weather Station Expansion	
Project/Program Manager: Matthew Leszak	**Project/Program Number (Level 1):**
Status: ☐ Initiation/Planning ☒ In-Progress (Projects Only) ☐ On-going (Programs Only)	
Estimated Start Date: 1 month after project approval	**Estimated Date In Service: 6 months after project approval**
2025-2029 Funding Request ($000) **Capital: $108** **O&M: $116**	**5-Year Ongoing Maintenance Expense ($000)** **O&M: $116**

Work Description:

Two weather stations are proposed in Westchester County within the Con Edison Company of New York (CECONY) service territory. They will help fill weather observation and existing data gaps in Westchester County while providing crucial information on weather and climate. The two proposed weather stations will be sited on company property in Elmsford and Rye, New York.

Installation of the weather stations and instrumentation will be completed and operational in six months or less. Total cost of the build-out for two units is $108,000.00. The proposed weather stations will complement the existing network of weather stations ordered upon in the Joint Proposal in 2019, which yielded the NYC Micronet (17 Company-owned weather stations in NYC). Associated upkeep, calibration, and troubleshooting of equipment will be carried out by the Company qualified vendor, the Research Foundation for SUNY (the same entity which currently operates and maintains the NYC Micronet).

Maintenance schedule ranges from every few months to five years and will be handled by skilled technicians from the University of Albany (NYS Mesonet). Please refer to the table below for approximate maintenance schedule:

Task	Frequency
Site cleaning and inspection	Two to three times per year
Temperature sensor rotations for calibration	Every 2 years
Relative humidity sensor rotations for calibration	Every 18 months
Pressure sensor rotation for calibration	Every 5 years
Pyranometer sensor rotation for calibration	Every 2 years
Snow depth: Replacement of transducers	Every 2 years
Wind monitor: Replacement of vertical flange	Every 5 years
Wind monitor: Replacement of horizontal flange	Every 5+ years
Test wind monitor speed and direction	Every 3 years
Precipitation gauge: Filling with antifreeze	Every fall
Precipitation gauge: Empty antifreeze/water mix	Every spring
Test precipitation weight	Every 3 years

Justification Summary:
The proposed weather stations will be used to better understand the effects of climate change. As mentioned in NYS Senate Bill 4824-A, lines 11-18, a rise in storm intensity is expected as a result of climate change. This has been seen firsthand with the recent impactful storms of Riley and Quinn, Tropical Storm Isaias, the July 9th 2023 Hudson Valley floods, and the September 29th 2023 NYC floods. The weather data received from the proposed weather stations, in conjunction with incorporation into the Company impact model, we believe will reduce restoration and outage costs by providing a more granular sense of overhead distribution impacts. These additional weather stations are necessary as existing weather observations are sparse across the Lower Hudson Valley region, especially given the fact weather patterns change significantly on a localized scale due to terrain influences.

Sustainability Assessment including Project/Program's Impact on Greenhouse Gas Emissions and Disadvantaged Communities:

This project will not impact greenhouse gas emissions, directly or indirectly. This project does offer some benefit to employee safety, as all proposed sites are located on company property. Real-time weather observations may enable employees to understand when hazardous weather or ground conditions could be present at their place of work.

Relationship to Broader Company Plans and Initiatives (e.g. Long-Range Plans, CLCPA Initiatives, Risk Mitigation)

This project will complement the NYC Micronet, a network of 17 Company-owned weather stations ordered upon in the Joint Proposal in 2019 with purpose to monitor and understand the effects of climate change.

2. Supplemental Information

Alternatives
Existing, less reputable weather stations do exist in the proposed expansion area. Purchasing the weather data from these third-party owners is an alternative, but data integrity would be highly questionable. Accurate and reliable data is required not only for our impact model, but also to accurately measure the degree of climate change.

Risk of No Action
If no action is taken to pursue this project, we will have a less granular sense of potential weather impacts across Westchester County. This means we will continue to use existing processes for our Company impact model and its respective projections, which include retrieving weather data from non-representative weather stations in NYC and southern Westchester that do not adequately correlate to observed or forecasted weather across the Lower Hudson Valley.

Non-Financial Benefits
This project will provide the benefits of improved relationships with external stakeholders, ensuring regulatory compliance, and improved data for future climate change adaption decisions.

The project also continues a strategic partnership with the State University of New York (SUNY) at Albany. The Company will be supporting a state university through this partnership, as well as contributing to the NYS Mesonet by integrating the new weather monitoring stations under this project into the state-wide network that currently lacks a strong presence in the CECONY service territory. In

return, the Company will benefit from their already-established expertise in this field and vast array of resources in future research and analytics to properly digest the data that will be gathered.

Summary of Financial Benefits and Costs
1. Cost-benefit analysis
N/A

2. Major financial benefits
N/A

3. Total cost
$ 224,000.00

4. Basis for estimate
University of Albany provided an itemized operating and maintenance schedule to Con Edison detailing the costs for the next 5 years.

5. Conclusion
Please see Project Justification section.

Project Risks and Mitigation Plan
Project risks include potential supply chain issues impacting the retrieval of unique equipment and weather sensors. This may lead to delays with installation and ultimately the time when weather stations go online and become fully operational. The mitigation plan is to order parts immediately upon acceptance of this project and/or seek out other companies who may be able to fulfill in a timelier manner.

Technical Evaluation / Analysis
N/A

Project Relationships (if applicable)
This project will directly complement the NYC Micronet, a network of 17 Company-owned weather stations ordered upon in the Joint Proposal in 2019 with purpose to monitor and understand the effects of climate change.

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	N/A	N/A	N/A	N/A	N/A	N/A
Capital	N/A	N/A	N/A	N/A	N/A	N/A

2025-2029 Request:
Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M		$28	$28	$30	$31
Capital (Total)	$108				
Labor					
M&S					
Contract Svcs.					
Other					

Overheads					

Total Ongoing Maintenance Expense by Year:

	2025	2026	2027	2028	2029
O&M	$0	$28	$28	$30	$31

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	TBD	TBD	TBD
Capital	$0	$0	$0
Basis for funding direction:	At this time, there is no expected plans for future expansion of additional Micronet weather stations. The O&M costs past this request are not known at this time, and will be included in the next submittal.		

Substation Operations Storm Hardening Program

Central Operations / SSO

1. Project / Program Summary

Type: ☐ **Project** ☒ **Program**	**Category:** ☒ **Capital** ☐ **O&M**
Work Plan Category: ☐ **Regulatory Mandated** ☒ **Operationally Required** ☐ **Strategic**	
Project/Program Title: Substation Operations (SSO) Storm Hardening Program	
Project/Program Manager: John Mazzani	**Project/Program Number (Level 1):** 27204331
Status: ☒ **Initiation/Planning** ☐ **In-Progress (Projects Only)** ☐ **On-going (Programs Only)**	
Estimated Start Date: 2026	**Estimated Date In Service: 2041**
2025-2029 Funding Request ($000) **Capital: $25,300** **O&M: –**	

Work Description:

The scope of the SSO Storm Hardening program includes all work needed to mitigate increased risks of flooding identified by Con Edison's Climate Change Vulnerability Study at 23 Area and Transmission substations. This program is not a new program at Con Edison but, rather, a revival of similar programs that were implemented twice previously to address similar risks. The first SSO Storm Hardening program was undertaken immediately after Superstorm Sandy to install immediate flooding protection measures at substations impacted during Sandy, and the second SSO Storm Hardening program hardened all substations located in a floodplain for a 1% annual chance Baseline Flood Elevation (BFE) of FEMA + 3'. (See "Justification" section, below, for additional discussion.)

The SSO Storm Hardening program is part of the comprehensive set of investment strategies included in Con Edison's Climate Vulnerability and Resiliency Plan (the Plan) to address the vulnerabilities of the electric system to the impacts of climate change – from heat/temperature variable, flooding (caused by sea-level rise, storm surges or heavy precipitation), or extreme events (such as hurricanes, nor'easters, or heat waves) – identified in the 2019 and 2023 Climate Change Vulnerabilities Studies (CCVS, the Study, or the Studies). These strategies were developed by following Con Edison's Resilience Framework to identify investments that enable Con Edison to better prevent negative impacts from changes in climate (avoiding equipment damage or failures and outages), mitigate the impacts from outage-inducing events (limiting the number of customers impacted or improving the customers' ability to cope with the outage), and recover quickly (restoring service more quickly and at a lower cost).

The Area and Transmission substations vulnerable to flooding when sea level rise projections are updated to include the latest climate data – i.e., to a Baseline Flood Elevation of FEMA + 5' – include 14 locations in Manhattan, five in Brooklyn/Queens, two in Bronx/Westchester, and 2 in Staten Island.
Seven of these substations need new flood protections, and the remaining sixteen (16) need to either have existing flood protections rebuilt and enhanced or to have existing flood protections extended.

Substations In-Scope	Flood Protection Enhancements Required
Academy	New flood protections needed
Bruckner	Rebuilt/extended flood protections needed
Cherry Street	New flood protections needed
East 13th Street	Rebuilt/extended flood protections needed

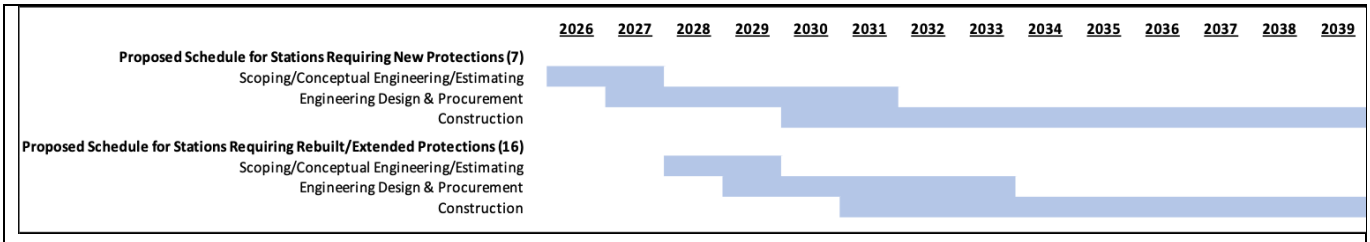
East 15th (East 16th) Street PURS	Rebuilt/extended flood protections needed
East 36th Street	Rebuilt/extended flood protections needed
East 75th Street	New flood protections needed
East River 69kV Yard	Rebuilt/extended flood protections needed
Farragut	Rebuilt/extended flood protections needed
Fresh Kills	Rebuilt/extended flood protections needed
Goethals	Rebuilt/extended flood protections needed
Gowanus	Rebuilt/extended flood protections needed
Hell Gate	Rebuilt/extended flood protections needed
Leonard Street	Rebuilt/extended flood protections needed
Parkview	New flood protections needed
Queensbridge	New flood protections needed
Rainey	Rebuilt/extended flood protections needed
Seaport	Rebuilt/extended flood protections needed
Sherman Creek	Rebuilt/extended flood protections needed
Trade Center	Rebuilt/extended flood protections needed
Vernon	Rebuilt/extended flood protections needed
West 42nd Street	New flood protections needed
West 49th Street	New flood protections needed

The specific changes to be made to revise each substation's design to the Design Flood Elevation (DFE) associated with the increase in Baseline Flood Elevation to the new FEMA + 5' requirement will be based on engineering analysis of each substation's design. The types of flood protections that are likely to be considered as protective measures include:

- Installation of moats and walls around critical station equipment
- Sealing of troughs, conduits, panels and cabinets, as well as any other critical station penetrations
- Installation of removable flood doors and barriers
- Installation of sump pumps in protected areas
- Migration of a substation control room to a higher elevation
- Elevation of critical relays and control panels
- Installation of nitrogen powered pumps for pressurization plants
- Installation of fiber optic communication lines
- Raising and sealing of moat walls, curbs, louvers and flood barriers

Specific work plans for program work at in-scope substations will be developed annually. Work is planned to optimize the time available in planned substation outages and to coordinate with other work planned at the same substation. The actual work performed each year, however, is subject to system conditions that can result in shortening planned outages; in these cases, remaining work may be delayed until a second outage can be planned. SSO Storm Hardening work will be prioritized based on a combination of the relative vulnerability to flooding (based on the substation's location and the robustness of the current substation design), the amount of work needed to upgrade substation equipment and infrastructure to the higher FEMA + 5' BFE, and, therefore, the amount of time needed to complete this work and the substation to be protected from increased risk of flooding.

An initial schedule for completing the new and enhanced flood protections at these substations has been developed that proposes completion of work on the initial 23 substations by the end of 2040. This schedule will be adjusted as needed once detailed design engineering is completed.



Justification Summary:
Following Superstorm Sandy, Con Edison worked with a Storm Hardening and Resiliency Collaborative to recommend storm hardening investments and one of the recommendations was to conduct a Climate Change Vulnerability Study (CCVS or the Study). The initial Climate Change Vulnerability Study was conducted in 2019 and was updated in 2023. The approach followed a multi-step process that cycled through the steps for each potential climate hazard, incorporating feedback from stakeholders throughout the evaluations. The Study used the best available science to evaluate the sensitivity of Con Edison's electric system to projections of potential climate hazards including:

- **Temperature and humidity** – from heat and coincident high heat and humidity (known as temperature variable or "TV")
- **Flooding** – coastal flooding from sea level rise and/or inland flooding from precipitation
- **Wind and ice**
- **Extreme and coincident weather events** – hurricanes/wind, extreme heat waves, nor'easters/cold snaps, and multiple concurrent or consecutive extreme events

The hazards that the Study found to pose an elevated risk to Con Edison's assets and operations include heat and humidity, major storms, wind and ice, and extreme events.

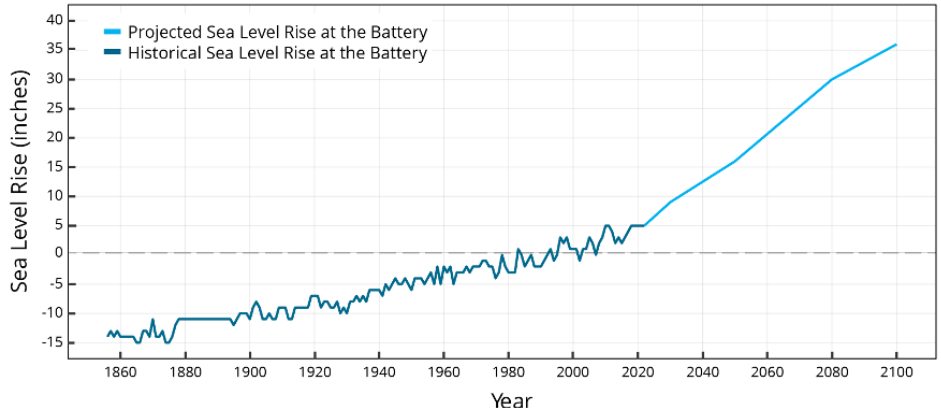
	Con Edison's service territory is projected to be impacted by rising temperatures. Those impacts are expected to be amplified during intense heat waves. Increasing TV will cause load to increase, potentially challenging the capacity of the system.
	Con Edison has previously experienced flooding events that have impacted its assets from major storms. Due to future climate projections, that risk is expected to expand in Con Edison's service area, and facilities like substations will be more exposed to flooding.
	Con Edison's overhead distribution system has historically been the most sensitive to wind and ice, due to its susceptibility to tree contact during high wind and icing events.
	Extreme events are low-likelihood, high-impact scenarios that can amplify and compound the types of impacts anticipated from changes in temperature, sea level rise, and other variables. These events pose risks to all aspects of the system and are especially impactful for emergency response planning.

Specific projections of future climate conditions, referred to as pathways (Pathways) were incorporated into the Company's forecasting and planning processes – including load forecasting, load relief planning, reliability planning for the sub-transmission and distribution systems, asset management planning, facility energy system planning, planning for emergency preparation and response, and worker safety – through the development of a new Climate Change Planning and Design Guideline document (Guidelines). This document specifies the methodologies to be used to evaluate the vulnerability of electric facilities to projected climate changes and establishes specific design standards to be met for each climate hazard over the useful life of the asset.

The primary vulnerabilities that the Study identified to Area and Transmission substations are Flooding and Heat. The SSO Storm Hardening Program is designed to address the risk of climate-driven flooding from

projected increases in sea level rise. Flooding due to sea level rise and coastal storm surge is a high priority vulnerability for Con Edison's electric system, and flooding from changes in precipitation is a secondary priority.

Following Superstorm Sandy in 2012, the Company implemented a minimum protection design standard of "FEMA plus three feet," allowing for 1 foot of sea level rise. At that time, Con Edison protected all infrastructure in the floodplain against future 100-year storms and 1 foot of sea level rise (e.g., submersible infrastructure, flood walls, pumps, elevation). CCVS projections show that sea level rise within the territory could reach 16 inches by the 2050s and 36 inches by 2100.

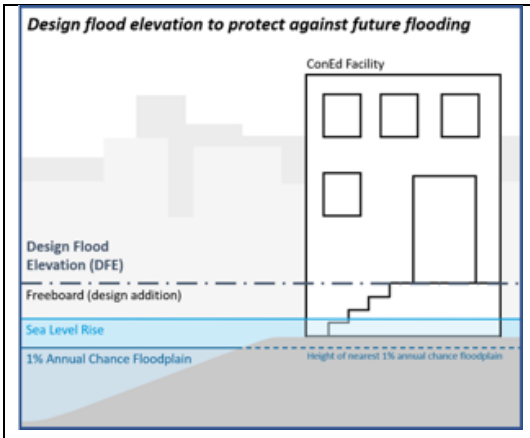


Historical and projected sea level rise at the Battery Tide Gauge in New York City under the combined SSP2-4.5 and SSP5-8.5 50th percentile. The dark blue line shows historical mean sea level at the Battery tide gauge (NOAA Tides & Currents). The light blue line shows the 50th percentile of projected sea level rise relative to the Battery tide gauge, with a historical baseline time period of 1995-2014. Since 1992, the Battery tide gauge has experienced approximately 5 inches of sea level rise.

Sea level rise will also have profound effects on coastal flooding and storm surge, increasing the severity of coastal flooding during extreme events such as hurricanes and deluge rain.

Based on sea level rise projections and findings from the 2019 CCVS, Con Edison updated its design standards to account for the projected amounts of sea level rise over an asset's useful life. More specifically, assets designed to be in place past 2050 will be designed to the elevation of the FEMA 1% annual chance flood (also known as the base flood elevation, or BFE) plus 5 feet (to account for projected 3 feet of sea level rise and 2 feet of freeboard). This requires redesign of assets currently designed with FEMA BFE plus 3 feet protections and new assets with a lifespan past 2050.

For below-grade assets, any asset determined to be within a future floodplain should be designed to include protection to mitigate flooding risks, such as upgrading to submersible equipment. For above-grade assets determined to be within a future floodplain the appropriate Design Flood Elevation (DFE) is determined, based on the asset's useful life, and used to determine the appropriate design interventions. The DFE includes the 1% annual chance BFE, a sea level rise adjustment, and additional freeboard representing a safety factor required by the NYC Building Code, as illustrated below.



The storm hardening measures implemented under the SSO Storm Hardening program at the 23 substations identified as at-risk will be designed to withstand flooding impacts from sea level rises at a FEMA 1% + 60" Design Flood Elevation.

Con Edison's Climate Change Vulnerability Study also concluded that Con Edison substations are also vulnerable to flooding caused by increases in periods of heavy precipitation and by storm surge from more frequent and severe storms, particularly in light of projected increases in sea levels. The latest climate data projects that there has been a small increase in projected heavy precipitation events. Specifically, projections show that annual days with precipitation exceeding 2 inches, relative to a baseline of three days, could reach five days in 2050 (the 2019 CCVS projection was four days). Days with more than 2 inches of rain per 24-hour period could cause flash flooding that could overwhelm drainage systems, which in turn could cause localized flooding onto Company property.

Variable	Study	Baseline	2030	2040	2050	2080
Annual days with precipitation exceeding 2 inches	Current Study	3 days	4 days	4 days	5 days	6 days
	2019 CCVS	3 days	4 days	4 days	4 days	5 days

The primary sensitivities of electric assets to projected changes in flooding are:

- Equipment damage: Floodwaters damage electric equipment and decrease the life expectancy of assets. Equipment damage costs Con Edison both capital (needed for repairs) and time (which results in longer outages and can be exacerbated if spare parts are limited). Saltwater spray can also cause arcing and failure of components. In addition, continued exposure to water can rot wooden assets such as poles.
- Equipment corrosion: Sea level rise and coastal storms pose a particular threat to coastal assets due to the corrosive properties of salt water, which can damage electronic components. These impacts may not be immediately evident but can present issues over time that may result in asset failures and outages.
- Soil weakening: Exposure to water can weaken or undermine the foundation of equipment in instances of prolonged inundation or erosion, increasing the overall risk of equipment damage. Increases in the projected flow and magnitude of floodwaters near riverbanks and the coast have the potential to alter and intensify how erosion occurs and may require intervention to avoid assets becoming destabilized or failing.
- Limited accessibility: Flooding presents issues of access. If assets are flooded or surrounded by water at high tide or during storms, it becomes more difficult to access the locations for maintenance and repair.

Substations contain equipment that is highly sensitive to flooding. The exposure assessment found that a 16-inch rise in sea level (2050 projection) would cause 23 substations to be inundated during a 1% annual chance flood. All of these locations could experience equipment damage, corrosion, soil weakening, and accessibility issues.

Seven of these locations do not currently have flood protection in place, while 16 have existing flood protection that would need to be modified or replaced to provide sufficient protection against future flood levels.

When choosing resilience strategies to address identified climate vulnerabilities, Con Edison follows a resilience framework that encompasses investments that:

- Prevent climate change impacts by hardening infrastructure
- Mitigate the impacts from outage-inducing events by minimizing disruptions
- Respond rapidly to disruptions by reducing recovery times and costs

The investments proposed under the SSO Storm Hardening program are focused on preventing potential substation damage and equipment failures from flooding, significantly increasing the ability of the transmission system to withstand climate change-driven weather events.

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

Impact on Disadvantaged Communities

The resilience strategies included in Con Edison's Resiliency Plan have been chosen in alignment with our Resiliency Framework that provides guidance for developing a comprehensive set of adaptation strategies to mitigate future climate change risks. This comprehensive set of strategies incudes investments that enable Con Edison's electric system to prevent climate change impacts by hardening infrastructure, mitigate the impacts from outage-inducing events by minimizing disruptions to customers, and respond rapidly to disruptions by reducing recovery times and costs.

While the programs included in the Plan are largely focused on withstanding climate changes and avoiding outages, most programs also enable Con Edison to limit outage impacts on customers (i.e., absorb outage impacts), and restore service more quickly than would otherwise have been possible (i.e., recover quickly). Many of the investments proposed to strengthen Con Edison's ability to withstand extreme climate conditions will also, naturally, reduce the risk of outages during "blue sky" conditions.

Disadvantaged communities (DACs) have fewer alternatives during energy system outages and will be more at risk from climate change. Because of this lack of alternatives, resilient and reliable energy service is an important priority for the communities and for Con Edison. Due to the size of Con Edison's electric system and the population density in the City, almost half of Con Edison's system serves at least one DAC. The Company has committed to tracking investments that benefit DACs specifically and to measuring and monitoring system performance in DACs and non-DACs. This tracking process will provide data and allow the Company to evaluate the benefits its investments to customers in DACs and revise its investment approach if needed.

The Company has also formed an Environmental Justice Working Group under an executive committee and plans to release a finalized Environmental Justice Policy Statement in 2023 to apply an equity lens to resilience-driven investments. Key components of the upcoming policy statement include:

- Operations will not disproportionately burden DACs.
- Con Edison will work to understand DAC concerns.
- Clean energy investments will benefit DACs.
- Con Edison will provide opportunities for employment in the clean energy future.

These equity considerations will help inform resilience plan investments moving forward.

Impact on Greenhouse Gas (GHG) Emissions

The primary goals of the programs and projects included in the Climate Vulnerability and Resiliency Plan, including the SSO Storm Hardening program, are to prevent, mitigate or recover from the impacts of future climate changes on Con Edison's electric system. While none of the programs are focused on reducing GHG emissions, some of the programs could have small but positive impacts on Con Edison's overall GHG emissions, and none of the programs should negatively impact Con Edison's overall GHG emissions.

All of the programs that prevent or reduce the number of "truck rolls" required to assess, operate, or restore the electric system (i.e., the number of physical trips made by operators, technicians, and other field personnel to physical field locations) will reduce Con Edison's overall GHG emissions by reducing vehicle emissions associated with each field trip prevented. The SSO Storm Hardening program reduces the need for field visits required to repair substation damage and equipment failures due to flooding. Actual program reductions in GHG emissions from reductions in physical trips to the field depend on the number of trips avoided, the miles driven per trip, the type of vehicle, the type of fuel burned, and the condition of the vehicle.

Impact on Clean Energy Commitment

The SSO Storm Hardening program supports Initiative 2 under Pillar 1 of the Clean Energy Commitment, Build the Grid of the Future.

Impact on 5-year and long-range plans (10-year)

This resilience program aligns with and supports Con Edison's integrated strategy, included in the January 2022 Long-Range Plan, focused on four strategic objectives related to Clean Energy, Climate Resilience, Core Service, and Customer Engagement. Con Edison's Climate Resilience strategic objective aims to increase the resilience of the energy infrastructure to adapt to climate change. Furthermore, Con Edison sees the role of utilities as changing from providing, "Universal access to energy that is safe and reliable" to providing, "Universal access to energy that is safe, reliable, and *resilient* (able to prevent, mitigate, and recover from events.)" (emphasis added)

The SSO Storm Hardening program provides resilient energy delivery by increasing the ability of area and transmission substations to withstand the impacts of climate changes without experiencing substation equipment failures from projected future flood levels accompanying rising sea levels, heavy precipitation, and storm surge from severe storms.

Impact on Company Risk Mitigation Activity

Resiliency, in simple terms, can be defined as having the capacity to withstand or to recover quickly from difficulties. While a bit more complex, Con Edison's Resilience Management Framework definition of resilience is very similar – i.e., the Framework identifies resilience strategies as investments that enable Con Edison to withstand changes in climate and avoid outages, absorb impacts from outage-inducing events by limiting the number of customers impacted or improving the customers' ability to cope with outages, recover quickly, and advance to a better state. Both equate resilience with the avoidance or limitation of difficulties or negative consequences – i.e., with the mitigation of risk.

The 2022 Electric Operations Risk Assessment and Mitigation plans include mitigation activities associated with increasing risks of major storms that could damage the Con Edison system and impact customers. Con Edison's comprehensive set of resiliency programs are designed to increase the ability of the electric system to withstand the impacts of climate change, including the increasing risk of storms, and limit potential impacts to customers. The SSO Storm Hardening program mitigates the risk of increased substation damage or equipment failures from projected climate-driven increases in future flood levels accompanying rising sea levels, heavy precipitation, and storm surge from severe storms.

2. Supplemental Information

Alternatives
There are no alternatives. This alternative does not meet the requirements of the Act to develop "… dedicated storm hardening programs … to reduce damage and costs from future weather events, as well as facilitate prompt restoration times."

Risk of No Action
The Climate Change Vulnerability Study concluded that Con Edison's electric system is vulnerable to risk of damages from extreme weather events like those that have been experienced in recent history. The Study also confirmed that a growing body of scientific evidence supports the conclusions that projected climate changes project these extreme storm events to be likely to increase in frequency and intensity in the future. Numerous evaluations following actual events have also revealed that the increased frequency of these types of events tends to erode the ability of communities and their residents to cope with and recover from the impacts of extreme events, with members of disadvantaged communities the least able to recover.

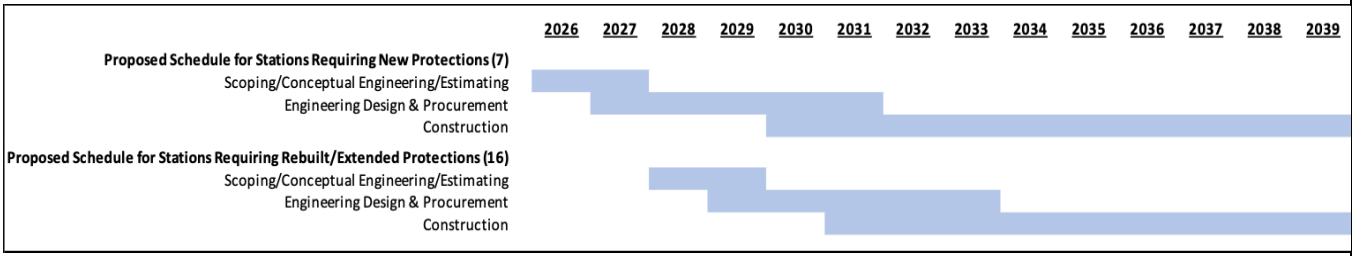
Without the proposed resiliency investments included in the SSO Storm Hardening program, Con Edison's transmission system will be less able to withstand the impacts of climate changes without experiencing substation equipment failures from projected future flood levels accompanying rising sea levels, heavy precipitation, and storm surge from severe storms.

Non-Financial Benefits
Performing the work proposed under the SSO Storm Hardening program, increases the overall resiliency of the transmission system to withstand the impacts of future climate-driven weather events by reducing the risk of failure of substation equipment from flooding. These equipment failures do not typically result in customer outages, but the probability of outages is increased with each system failure experienced.

Summary of Financial Benefits and Costs
1. Cost-benefit analysis
Con Edison 's transmission system is designed to be robust: in all areas of its service territory, no single failure should result in loss of load; and in much of its service territory (that system serving network distribution system load), no two failures should suffice to cause a loss of load. Consequently, while it is unlikely, though by no means impossible, that random failures of equipment will force load to be dropped, this may not hold true of a system confronted by the anticipated increases in load or undercut by vulnerabilities that allow the common cause failure of equipment. These vulnerabilities have led to previous major outages in Con Edison's service territory: extreme weather (e.g., tropical storm Sandy, 10/29/2012; a substation fire, 8/13/1990); and relaying problems (the Bronx, 6/20/2007, and on the west side of Manhattan, 7/13/2019). In addition, both rain and lightning are known to cause equipment failure and could be widespread in their effect.

Depending on the magnitude, a sizable load drop and potential long duration outage can make loss of load events on the transmission level more impactful. Although it is not possible to predict the potential cumulative costs to the community of a widespread loss of load event from a rare transmission system failure, the Company considers this risk significant and invests in programs designed to prevent or recover from even unlikely loss of load events. The programs included in Con Edison's Climate Change Resiliency Plan are designed to increase the transmission system's resilience given the vulnerabilities identified from projected climate-change-induced extreme weather events.

2. Basis for estimate
We anticipate the following project timeline will be necessary to complete the flood protection installations at these initial 23 substations, based on previous experiences with storm hardening measures performed by Con Edison following superstorm Sandy.



Previous storm hardening efforts expended $360M at 16 substations, an average of $22.5M per station. We assume that existing storm hardening measures will need to be removed and reinstalled to meet the new higher flood standards and increased forces that will be exerted on perimeter barriers during flooding conditions. We also believe that designing and installing flood barriers strong enough to withstand the potential flooding depths being projected will be more complex and likely to cost more than previous efforts. A "defense in depth" approach will be taken in the design of these flood protections, using multiple layers of barriers and solutions to strengthen the substation from multiple potential damage points. Given the expected scope and complexities, we believe that the cost of installing new flood protections will cost approximately $50M per station (in present day dollars) and that the cost of rebuilding and/or extending flood protections will cost approximately $45M per station (in present day dollars). Costs are subject and likely to change as specific scope is developed and detailed design is performed.

Project Risks and Mitigation Plan

Risk 1 – Outage scheduling conflicts with other initiatives.
Risk 1 Mitigation Plan – Outages to be coordinated with the Sequencing Group at System Operations to potentially incorporate other project/programs to avoid conflict with other program/ projects resulting in a more predictable budget and manageable outage scheduling.
Risk 2 – Delays due resources support coordination.
Risk 2 Mitigation Plan – Anticipate, schedule and pre-plan with resource requirements such as engineering, labor, and construction and outages to avoid performance delays alignment conflicts.

Risk 3 – Lack of alignment between resources support and outages.
Risk 3 Mitigation Plan – Anticipate, schedule and pre-plan with resource requirements such as engineering, labor and construction to avoid alignment conflicts with outages.

Technical Evaluation / Analysis
The initial 23 substations included in the scope of this program were identified by plotting the locations of existing Area and Transmission substations on the Con Edison FEMA + 5' flooding map. This map reflects the geographic areas vulnerable to flooding assuming a FEMA 100-yr flood plus three feet of sea level rise plus two feet of freeboard. This comparison identified 28 locations in Manhattan, Brooklyn, Queens, Staten Island and the Bronx that were inside the flood zone under these conditions. Assessment of each of these locations was conducted and 23 of the 28 locations were determined to need either new or enhanced flood protections.

Project Relationships (if applicable)
Given the dependence of completing this work on scheduled outages, the work in-scope for substations under this program should be carefully coordinated with work proposed at the substation for all other projects and programs, including other resiliency programs. This coordination may require that planned work be broken into smaller scopes of work that can optimize available outage time across projects and programs but may introduce sub-optimization of individual projects.

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	–	–	–	–	–	–
Capital	–	–	–	–	–	–

2025-2029 Request:

Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	–	–	–	–	–
Capital (Total)	**$0**	**$1,400**	**$4,900**	**$8,300**	**$10,700**
Labor	$0	$271	$947	$1,604	$2,068
M&S	$0	$257	$900	$1,524	$1,965
Contract Svcs.	$0	$385	$1,347	$2,282	$2,942
Other	$0	$23	$81	$138	$177
Overheads	$0	$464	$1,625	$2,752	$3,547

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	–	–	–
Capital	**$470,600**	**$502,500**	**$67,700**
Basis for funding direction:	Forecasted scope of work plus annual inflation-related increases estimated (3%)	Forecasted scope of work plus annual inflation-related increases estimated (3%)	Forecasted scope of work plus annual inflation-related increases estimated (3%)

Submersible Equipment Program

Electric Operations / DE

1. Project / Program Summary

Type: ☐ **Project** ☒ **Program**	**Category:** ☒ **Capital** ☐ **O&M**
Work Plan Category: ☐ **Regulatory Mandated** ☒ **Operationally Required** ☐ **Strategic**	
Project/Program Title: Submersible Equipment Program	
Project/Program Manager: Dan Chen	**Project/Program Number (Level 1):** 27207958
Status: ☒ **Initiation/Planning** ☐ **In-Progress (Projects Only)** ☐ **On-going (Programs Only)**	
Estimated Start Date: 2025	**Estimated Date In Service:** Ongoing
2025-2029 Funding Request ($000) **Capital: $45,900** **O&M: –**	

Work Description:

The Company has identified 391 locations where 120V/208V transformers and 460V transformers and network protector units (NWPs) on the underground electric distribution system need to be replaced with new, submersible equipment capable of withstanding the potential impacts of climate-driven flooding from sea-level rise, storms, and deluge rainfall.

After Superstorm Sandy, Con Edison undertook an extensive storm hardening program to install flood protections, including submersible equipment, for all existing facilities that were in the floodplain for 100-year storms to make the underground system more resilient to such storm events. Con Edison also changed design standards to require the installation of submersible equipment for all new underground distribution equipment installed in a flood zone. Once the work in-scope for that storm hardening program was completed, the program was closed.

The Submersible Equipment program revives some of the scope of the previous storm hardening program in response to findings in Con Edison's Climate Change Vulnerability Study (CCVS or the Study) [1] that underground distribution equipment would be highly vulnerable to risk of damage during severe inland flooding events projected to result from future climate changes. CCVS projections indicated that sea level rise may exceed Con Edison's current design standard for coastal flood protection (i.e., a 100-year storm with 1 foot of sea level rise and 2 feet of freeboard, FEMA + 3') between 2030 and 2080. To address these future climate-driven flooding risks, design standards in Con Edison's Climate Change Planning and Design Guideline Document establishes the sea-level rise adjusted Design Flood Elevation (DFE) criteria of a 100-year storm with 3 feet of sea level rise and 2 feet of freeboard (FEMA + 5').

The Company evaluated all vault locations when plotted on a survey map and identified all locations within the FEMA +5' floodplain. At the FEMA + 5' level, additional non-submersible underground distribution equipment is located in the projected floodplains and will be replaced with submersible equipment under this program. Equipment to be replaced includes 391 locations.

	Number of 120V/ 208V Transformers	Number of 460V Network Protectors
Brooklyn/Queens	130	33
Bronx/Westchester	39	8
Manhattan	178	3
Total	**347**	**44**

Note: All similar equipment on Staten Island has already been replaced with submersible equipment.

Each region has performed a preliminary evaluation of the equipment to be replaced at each of the locations and created initial replacement schedules for the 2025-2029 timeframe:

	2025		2026		2027		2028		2029	
	120V/ 208V Trans-formers	460V NWPs	120V/ 208V Trans-formers	460V NWPs	120V/ 208V Trans-formers	460V NWPs	120V/ 208V Trans-formers	460V NWPs	120V/ 208V Trans-formers	460V NWPs
Brooklyn/ Queens	14	16	14	10	17	6	20	1	13	0
Bronx/ Westchester	0	8	2	0	5	0	4	0	1	0
Manhattan	12	0	30	0	26	0	25	3	37	0
Total	**26**	**24**	**46**	**10**	**48**	**6**	**49**	**4**	**51**	**0**

This projected timeline for replacing these transformers and NWPs is dependent on system conditions and may be adjusted after further evaluations are completed. The schedule above results in 220 of the 347 transformer replacements and all of the 44 NWP installations completed by the end of 2029, leaving 127 transformers to be installed.

Justification Summary:
Following Superstorm Sandy, Con Edison worked with a Storm Hardening and Resiliency Collaborative to recommend storm hardening investments and one of the recommendations was to conduct a Climate Change Vulnerability Study (CCVS or the Study). The initial Climate Change Vulnerability Study was conducted in 2019 and was updated in 2023. The approach followed a multi-step process that cycled through the steps for each potential climate hazard, incorporating feedback from stakeholders throughout the evaluations. The Study used the best available science to evaluate the sensitivity of Con Edison's electric system to projections of potential climate hazards including:

- **Temperature and humidity** – from heat and coincident high heat and humidity (known as temperature variable or "TV")
- **Flooding** – coastal flooding from sea level rise and/or inland flooding from precipitation
- **Wind and ice**
- **Extreme and coincident weather events** – hurricanes/wind, extreme heat waves, nor'easters/cold snaps, and multiple concurrent or consecutive extreme events

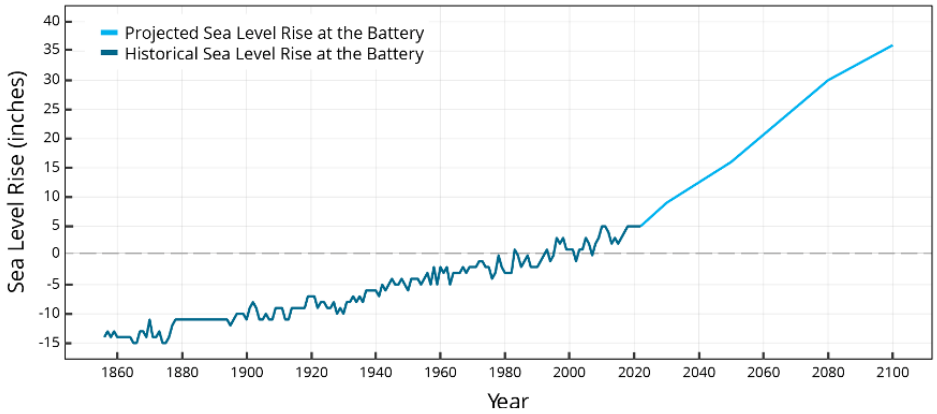
The hazards that the Study found to pose an elevated risk to Con Edison's assets and operations include heat and humidity, major storms, wind and ice, and extreme events.

	Con Edison's service territory is projected to be impacted by rising temperatures. Those impacts are expected to be amplified during intense heat waves. Increasing TV will cause load to increase, potentially challenging the capacity of the system.
	Con Edison has previously experienced flooding events that have impacted its assets from major storms. Due to future climate projections, that risk is expected to expand in Con Edison's service area, and facilities like substations will be more exposed to flooding.
	Con Edison's overhead distribution system has historically been the most sensitive to wind and ice, due to its susceptibility to tree contact during high wind and icing events.
	Extreme events are low-likelihood, high-impact scenarios that can amplify and compound the types of impacts anticipated from changes in temperature, sea level rise, and other variables. These events pose risks to all aspects of the system and are especially impactful for emergency response planning.

Specific projections of future climate conditions, referred to as pathways (Pathways) were incorporated into the Company's forecasting and planning processes – including load forecasting, load relief planning, reliability planning for the sub-transmission and distribution systems, asset management planning, facility energy system planning, planning for emergency preparation and response, and worker safety – through the development of a new Climate Change Planning and Design Guideline document (Guidelines). This document specifies the methodologies to be used to evaluate the vulnerability of electric facilities to projected climate changes and establishes specific design standards to be met for each climate hazard over the useful life of the asset.

One vulnerability that the Study identified to underground distribution is the risk of flooding with climate-driven changes in sea levels. Transformers and network protectors at risk from the projected increases in sea levels will be replaced with submersible versions that protect against damage from flooding under this program.

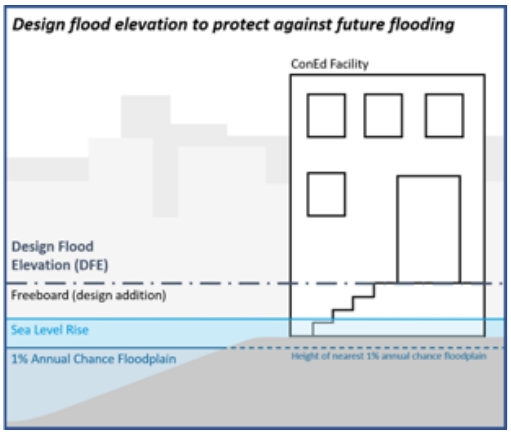
Following Superstorm Sandy in 2012, the Company implemented a minimum protection design standard of "FEMA plus three feet," allowing for 1 foot of sea level rise. At that time, Con Edison protected all infrastructure in the floodplain against future 100-year storms and 1 foot of sea level rise (e.g., submersible infrastructure, flood walls, pumps, elevation). CCVS projections show that sea level rise within the territory could reach 16 inches by the 2050s and 36 inches by 2100.



Historical and projected sea level rise at the Battery Tide Gauge in New York City under the combined SSP2-4.5 and SSP5-8.5 50th percentile. The dark blue line shows historical mean sea level at the Battery tide gauge (NOAA Tides & Currents). The light blue line shows the 50th percentile of projected sea level rise relative to the Battery tide gauge, with a historical baseline time period of 1995-2014. Since 1992, the Battery tide gauge has experienced approximately 5 inches of sea level rise.

Sea level rise will also have profound effects on coastal flooding and storm surge, increasing the severity of coastal flooding during extreme events such as hurricanes and deluge rain.

For below-grade assets, any asset determined to be within a future floodplain should be designed to include protection to mitigate flooding risks, such as upgrading to submersible equipment. For above-grade assets determined to be within a future floodplain the appropriate Design Flood Elevation (DFE) is determined, again based on the asset's useful life, and used to determine the appropriate design interventions. The DFE includes the 1% annual chance BFE, a sea level rise adjustment, and additional freeboard representing a safety factor required by the NYC Building Code, as illustrated below.



Con Edison's 2023 Climate Change Planning and Design Guideline includes the DFE planning levels below.

Planning horizon	BFE in NAVD 88[12]	+ Freeboard	+ Sea Level Rise Adjustment[13]	= Design Flood Elevation (DFE) in NAVD 88
through 2039	FEMA 1% (PFIRM)	24"	12"	FEMA 1% + 36"
2040-2069	FEMA 1% (PFIRM)	24"	16"	FEMA 1% + 40"
2070-2099	FEMA 1% (PFIRM)	24"	28"	FEMA 1% + 52"
2100+	FEMA 1% (PFIRM)	24"	36"	FEMA 1% + 60"

The submersible 120V/208V transformers and 460V Network Protectors will be installed in all underground electric distribution vaults evaluated to be vulnerable to flooding at the new, elevated DFE.

The primary sensitivities of electric assets to projected changes in flooding are:

- Equipment damage: Floodwaters damage electric equipment and decrease the life expectancy of assets. Equipment damage costs Con Edison both capital (needed for repairs) and time (which results in longer outages and can be exacerbated if spare parts are limited). Saltwater spray can also cause arcing and failure of components. In addition, continued exposure to water can rot wooden assets such as poles.
- Equipment corrosion: Sea level rise and coastal storms pose a particular threat to coastal assets due to the corrosive properties of salt water, which can damage electronic components. These impacts may not be immediately evident but can present issues over time that may result in asset failures and outages.
- Soil weakening: Exposure to water can weaken or undermine the foundation of equipment in instances of prolonged inundation or erosion, increasing the overall risk of equipment damage.

Increases in the projected flow and magnitude of floodwaters near riverbanks and the coast have the potential to alter and intensify how erosion occurs and may require intervention to avoid assets becoming destabilized or failing.
- Limited accessibility: Flooding presents issues of access. If assets are flooded or surrounded by water at high tide or during storms, it becomes more difficult to access the locations for maintenance and repair.

Installing submersible distribution equipment for underground locations in the sea level adjusted Design Flood Elevation of FEMA 1% + 5', will enable the Con Edison distribution system to withstand the project impacts of climate change without damage to this equipment from flooding, increasing the overall system resiliency.

When choosing resilience strategies to address identified climate vulnerabilities, Con Edison follows a resilience framework that encompasses investments that:

- Prevent climate change impacts by hardening infrastructure
- Mitigate the impacts from outage-inducing events by minimizing disruptions
- Respond rapidly to disruptions by reducing recovery times and costs

Investments in the Submersible Equipment program provide all of these resiliency benefits.

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

Impact on Disadvantaged Communities

The resilience strategies included in Con Edison's Resiliency Plan have been chosen in alignment with our Resiliency Framework that provides guidance for developing a comprehensive set of adaptation strategies to mitigate future climate change risks. This comprehensive set of strategies incudes investments that enable Con Edison's electric system to prevent climate change impacts by hardening infrastructure, mitigate the impacts from outage-inducing events by minimizing disruptions to customers, and respond rapidly to disruptions by reducing recovery times and costs.

While the programs included in the Plan are largely focused on withstanding climate changes and avoiding outages, most programs also enable Con Edison to limit outage impacts on customers (i.e., absorb outage impacts), and restore service more quickly than would otherwise have been possible (i.e., recover quickly). Many of the investments proposed to strengthen Con Edison's ability to withstand extreme climate conditions will also, naturally, reduce the risk of outages during "blue sky" conditions.

Disadvantaged communities (DACs) have fewer alternatives during energy system outages and will be more at risk from climate change. Because of this lack of alternatives, resilient and reliable energy service is an important priority for the communities and for Con Edison. Due to the size of Con Edison's electric system and the population density in the City, almost half of Con Edison's system serves at least one DAC. The company has committed to tracking investments that benefit DACs specifically and to measuring and monitoring system performance in DACs and non-DACs. This tracking process will provide data and allow the Company to evaluate the benefits its investments to customers in DACs and revise its investment approach if needed.

The Company has also formed an Environmental Justice Working Group under an executive committee and plans to release a finalized Environmental Justice Policy Statement in 2023 to apply an equity lens to resilience-driven investments. Key components of the upcoming policy statement include:

- Operations will not disproportionately burden DACs.

- Con Edison will work to understand DAC concerns.
- Clean energy investments will benefit DACs.
- Con Edison will provide opportunities for employment in the clean energy future.

These equity considerations will help inform resilience plan investments moving forward.

Impact on Greenhouse Gas (GHG) Emissions
The primary goals of the programs and projects included in the Climate Vulnerability and Resiliency Plan, including the Submersible Equipment program, are to withstand, absorb, or recover from the impacts of future climate changes on Con Edison's electric system. While none of the programs are focused on reducing GHG emissions, some of the programs could have small but positive impacts on Con Edison's overall GHG emissions, and none of the programs should negatively impact Con Edison's overall GHG emissions.

All of the programs that prevent or reduce the number of "truck rolls" required to assess, operate, or restore the electric system (i.e., the number of physical trips made by operators, technicians, and other field personnel to physical field locations) will reduce Con Edison's overall GHG emissions by reducing vehicle emissions associated with each field trip prevented. The Submersible Equipment program reduces the need for field visits by reducing the need for field assessment and restoration of the system from water damage to underground distribution equipment. Actual program reductions in GHG emissions from reductions in physical trips to the field depend on the number of trips avoided, the miles driven per trip, the type of vehicle, the type of fuel burned, and the condition of the vehicle.

Impact on Clean Energy Commitment
The Submersible Equipment program supports Initiative 2 under Pillar 1 of the Clean Energy Commitment, Build the Grid of the Future.

Impact on 5-year and long-range plans (10-year)
This resilience program aligns with and supports Con Edison's integrated strategy, included in the January 2022 Long-Range Plan, focused on four strategic objectives related to Clean Energy, Climate Resilience, Core Service, and Customer Engagement. Con Edison's Climate Resilience strategic objective aims to increase the resilience of the energy infrastructure to adapt to climate change. Furthermore, Con Edison sees the role of utilities as changing from providing, "Universal access to energy that is safe and reliable" to providing, "Universal access to energy that is safe, reliable, and *resilient* (able to prevent, mitigate, and recover from events.)" (emphasis added)

The Submersible Equipment program provides resilient energy by enabling underground electric distribution equipment to withstand projected climate-driven flooding impacts from sea level rise, storms, and deluge rain without equipment damage or failure from water intrusion.

Impact on Company Risk Mitigation Activity
Resiliency, in simple terms, can be defined as having the capacity to withstand or to recover quickly from difficulties. While a bit more complex, Con Edison's Resilience Management Framework definition of resilience is very similar – i.e., the Framework identifies resilience strategies as investments that enable Con Edison to withstand changes in climate and avoid outages, absorb impacts from outage-inducing events by limiting the number of customers impacted or improving the customers' ability to cope with outages, recover quickly, and advance to a better state. Both equate resilience with the avoidance or limitation of difficulties or negative consequences – i.e., with the mitigation of risk.

The 2022 Electric Operations Risk Assessment and Mitigation plans include mitigation activities associated with increasing risks of major storms that could damage the Con Edison system and impact

customers. Con Edison's comprehensive set of resiliency programs are designed to increase the ability of the electric system to withstand the impacts of climate change, including the increasing risk of storms, and limit potential impacts to customers. The Submersible Equipment Program mitigates the risks of equipment failures or damage from potential vulnerability to climate change-driven increases in flooding from sea-level rise, storm surge, and heavy precipitation.

2. Supplemental Information

Alternatives

Alternative 1 description and reason for rejection

Remove individual feeders from service that are at risk of flooding (i.e., in the FEMA 1% + 5' floodplain) during major storms. When a network cannot sustain the loss of these feeders, the entire network must be shut down to protect non-submersible equipment from catastrophic failure. This alternative, however, can result in forced outages for customers in the flooded areas and outside of the flooded areas, potentially during extended or severe storm conditions.

Risk of No Action

The Climate Change Vulnerability Study concluded that Con Edison's underground distribution system is vulnerable to risk of damage from extreme weather events like those that have been experienced in recent history. Modeling performed by climate science experts with input from Con Edison subject matter experts determined that the electric system is most vulnerable to climate-induced changes in temperature/humidity and sea level rise. The Study also confirmed that a growing body of scientific evidence supports the conclusions that projected climate changes project these extreme storm events to be likely to increase in frequency and intensity in the future. Numerous evaluations following actual events have also revealed that the increased frequency of these types of events tends to erode people's ability to cope with and recover from the impacts and that disadvantaged communities are the least able to recover.

Without the proposed resiliency investments in the electric distribution system, Con Edison's customers remain more vulnerable to both the short-term risks (of electrical outages) and long-term risks of not recovering from the effects of climate change.

Non-Financial Benefits

The replacement of non-submersible equipment in flood prone areas and the isolation of flood-prone areas, as described in the work description, will benefit public safety, network restoration, network integrity, and mitigate the cost of extensive damages caused by flood water. It will mitigate damage caused by fresh and saltwater infiltrating our electrical facilities. Overall, this program will reduce the number of component failures, thereby reducing our exposure to system failures and improving the resiliency of the electric distribution system.

Summary of Financial Benefits and Costs

1. Cost-benefit analysis

The initiative's objective is to replace non-submersible equipment in flood-prone areas to prevent equipment failure due to flooding which will enhance public safety, preserve network integrity, minimize potential damage from floodwaters affecting electrical facilities reducing network restoration efforts. The project involves upgrading 347 ventilated 120/208V transformers and forty-four 460V transformers with network protectors to submersible versions within the distribution system. The cumulative installed capacity of the 391 transformers is approximately 400 MVA. Loss of transformers and associated protection equipment during flooding greater than the Design Flood Elevation can cause cascading impacts, tripping supplying circuits. Such flooding events would require all transformation and protection equipment to be replaced prior to restoring service.

2. Basis for estimate
The estimated costs of replacing the existing underground transformers and NWPs were based on actual storm hardening projects to replace similar equipment. The average cost per project was calculated for 9 replacements of 120V/208V transformers (2016) and for 8 replacements of 460V Network Protectors (2014-2015). Then the average actual capital cost per replacement of $140,239 per transformer and $63,858 per NWP were escalated to 2025 dollars by applying inflation factors (from the Bureau of Labor Statistics and Deloitte) to arrive at per replacement estimates of $189,282 for replacing the transformers and for $89,610 for replacing NWPs.

Project Risks and Mitigation Plan
Risk 1 – Equipment Availability
Issues with transformer and NWP availability have occurred in the past and could impact future installation plans.
Risk 1 Mitigation plan
The Company's Supply Chain professionals continue to explore additional vendors, but the number of transformer manufacturers remains limited.

Risk 2 – Outage Windows
Outage windows are limited to non-summer months, and this program must compete with new business, system emergencies/reliability, and other capital programs.
Risk 2 Mitigation plan
Careful planning and coordination with other system work requiring outage windows is needed to replace the at-risk equipment with submersible equipment.

Technical Evaluation / Analysis
All currently installed 120V/208V underground distribution transformers and 460V Network Protectors that are not designed to withstand water submersion were evaluated for potential flood risk at the FEMA+5' Base Flood Elevation to identify all installed equipment needing replacing.

Project Relationships (if applicable)
N/A

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	–	–	–	–	–	–
Capital	–	–	–	–	–	–

2025-2029 Request:
Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	–	–	–	–	–
Capital (Total)	**$7,100**	**$9,700**	**$9,700**	**$9,700**	**$9,700**
Labor	$2,917	$3,986	$3,986	$3,986	$3,986
M&S	$1,334	$1,822	$1,822	$1,822	$1,822
Contract Svcs.	$71	$97	$97	$97	$97
Other	$1	$2	$2	$2	$2
Overheads	$2,777	$3,793	$3,793	$3,793	$3,793

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	**–**	**–**	**–**
Capital	**$24,400**	**$0**	**$0**
Basis for funding direction:	Projected work scopes with inflationary increases in cost (3%)		

Erosion Protection and Drainage Upgrade Program

Central Operations / SSO

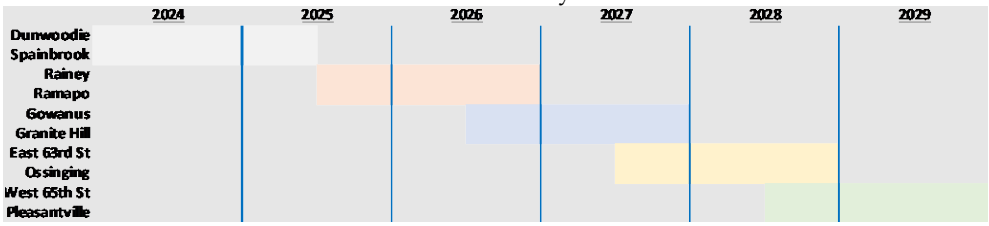
1. Project / Program Summary

Type: ☐ **Project** ☒ **Program**	**Category:** ☒ **Capital** ☐ **O&M**
Work Plan Category: ☐ **Regulatory Mandated** ☒ **Operationally Required** ☐ **Strategic**	
Project/Program Title: Erosion Protection and Drainage Upgrade Program	
Project/Program Manager: Holly Reilly	**Project/Program Number (Level 1):** 27204334
Status: ☐ **Initiation/Planning** ☐ **In-Progress (Projects Only)** ☒ **On-going (Programs Only)**	
Estimated Start Date: 2024	**Estimated Date In Service:** Ongoing
2025-2029 Funding Request ($000) **Capital: $21,800** **O&M: –**	

Work Description:

This program will install reinforcements and upgrade drainage systems in select substations to protect from erosion that may occur from extreme, deluge rain events or large storms (e.g., hurricanes and nor'easters). Extreme rain events, such as Tropical Storm Ida, have produced rainfall of 4 to 8 inches in just a few hours. The Climate Change Vulnerability Study projected average annual increases in precipitation of as much as 15% by 2050, with the heaviest 5-day precipitation amount at Central Park of 11.8 inches. This type of deluge can cause pooling and in some cases erosion that could undermine substation equipment. If extreme enough, these impacts could cause critical substation equipment to lose control power or inadvertently trip out, resulting in outages. Erosion caused by extreme rain events could also create unsafe conditions for substation personnel.

The program began in 2024 with six substations initially identified as in-scope for upgrades: Dunwoodie, Sprain Brook, Rainey, Ramapo, Gowanus, and Granite Hill. Erosion and drainage issues were discovered at these stations from hurricane Ida in late 2021. Erosion and drainage issues have also been noted at four additional stations – East 63rd Street, Ossining, West 65th Street, and Pleasantville – and upgrades at these stations will be included in this program. Erosion protection and drainage upgrades will begin with Dunwoodie and Sprain Brook and will target concurrent work on two substations per year. Typical upgrades at each station include replacement of below grade cable trays and installation of new retaining basins; however detailed engineering and evaluations will be performed at each station to determine the appropriate upgrades at each facility. Work for each station is expected to take 18-24 months to complete on average, including engineering, planning, and procurement, at an estimated cost of approximately $3 million per substation. The initial, high-level schedule for completing upgrades at the stations currently known to have erosion and drainage issues projects that issues at these stations will be addressed by the end of 2029.



Although the stations initially included in the scope of this program have existing erosion and/or drainage issues, the Company believes that to increase the system's resiliency, given projections for more frequent and intense climate-driven storms and deluge rain events, a proactive approach to avoiding future issues of this type is needed. Accordingly, Con Edison will be evaluating current substation designs to identify design elements that may allow erosion poor drainage when experiencing heavy precipitation from hurricanes or deluge rain events and will assess the substations built with these design elements for the potential need for upgrades.

The Erosion and Drainage Upgrade program is part of the comprehensive set of strategies included in Con Edison's Climate Vulnerability and Resiliency Plan (the Plan) to address the vulnerabilities of the electric system to the impacts of climate change – from heat/temperature variable, flooding (caused by sea-level rise, storm surges or heavy precipitation), or extreme events (such as hurricanes, nor'easters, or heat waves) – identified in the 2019 and 2023 Climate Change Vulnerabilities Studies (CCVS, the Study, or the Studies). These strategies were developed by following Con Edison's Resilience Management Framework to identify investments that enable Con Edison to (1) better withstand changes in climate (avoiding outages), (2) absorb impacts from outage-inducing events (limiting the number of customers impacted or improving the customers' ability to cope with the outage), (3) recover quickly (restoring service more quickly and at a lower cost), and (4) advance to a better state (by incorporating additional data and feedback from events into future plans, standards, and processes). This program increases the ability of the transmission system to withstand the impacts of increasingly intense and frequent storms and heavy precipitation driven by projected climate changes.

Justification Summary:
Following Superstorm Sandy, Con Edison worked with a Storm Hardening and Resiliency Collaborative to recommend storm hardening investments and one of the recommendations was to conduct a Climate Change Vulnerability Study (CCVS or the Study). The initial Climate Change Vulnerability Study was conducted in 2019 and was updated in 2023. The approach followed a multi-step process that cycled through the steps for each potential climate hazard, incorporating feedback from stakeholders throughout the evaluations. The Study used the best available science to evaluate the sensitivity of Con Edison's electric system to projections of potential climate hazards including:

- **Temperature and humidity** – from heat and coincident high heat and humidity (known as temperature variable or "TV")
- **Flooding** – coastal flooding from sea level rise and/or inland flooding from precipitation
- **Wind and ice**
- **Extreme and coincident weather events** – hurricanes/wind, extreme heat waves, nor'easters/cold snaps, and multiple concurrent or consecutive extreme events

The hazards that the Study found to pose an elevated risk to Con Edison's assets and operations include heat and humidity, major storms, wind and ice, and extreme events.

	Con Edison's service territory is projected to be impacted by rising temperatures. Those impacts are expected to be amplified during intense heat waves. Increasing TV will cause load to increase, potentially challenging the capacity of the system.
	Con Edison has previously experienced flooding events that have impacted its assets from major storms. Due to future climate projections, that risk is expected to expand in Con Edison's service area, and facilities like substations will be more exposed to flooding.
	Con Edison's overhead distribution system has historically been the most sensitive to wind and ice, due to its susceptibility to tree contact during high wind and icing events.
	Extreme events are low-likelihood, high-impact scenarios that can amplify and compound the types of impacts anticipated from changes in temperature, sea level rise, and other variables. These events pose risks to all aspects of the system and are especially impactful for emergency response planning.

Specific projections of future climate conditions, referred to as pathways (Pathways) were incorporated into the Company's forecasting and planning processes – including load forecasting, load relief planning, reliability planning for the sub-transmission and distribution systems, asset management planning, facility energy system planning, planning for emergency preparation and response, and worker safety – through the development of a new Climate Change Planning and Design Guideline document (Guidelines). This document specifies the methodologies to be used to evaluate the vulnerability of electric facilities to projected climate changes and establishes specific design standards to be met for each climate hazard over the useful life of the asset.

The Study identified that Area and Transmission substations were at risk from damage caused by heavy rainfall, often associated with extreme storms. Con Edison's service area experiences a range of precipitation types, including rainfall and frozen precipitation (i.e., snow, sleet, and freezing rain). The region has experienced several tropical cyclones producing heavy precipitation over the last century. For example, in 2011, Hurricane Irene produced up to 12 inches of rain in the service area, with nearly 7 inches in Central Park. More recently, remnants of Hurricane Ida in 2021 brought over 7 inches of rain to Central Park. Alternatively, nor'easters have brought some of the heaviest snowfall on record to New York City, along with freezing rain; the January 2021 nor'easter accumulated up to 2 feet of snow in New York City.

Climate change is projected to drive heavier precipitation events because a warmer atmosphere holds more water vapor and provides more energy for storms, among other factors. Looking forward, projections show climate change could drive stronger and more frequent storms in the region, bringing heavy precipitation, wind, and storm surge. Tropical cyclone rainfall totals are projected to increase by approximately 10%-15% in the North Atlantic basin by the late 21st century. In addition, extratropical cyclones could become 5%-25% more wet in the future relative to present day. In contrast, climate change could reduce the frequency of snowfall and other frozen precipitation in future decades. Projections in the Study show that heavy precipitation in the service area could increase throughout the century relative to the baseline.

Variable	Study	Baseline	2030	2040	2050	2080
Annual days with precipitation exceeding 2 inches	Current Study	3 days	4 days	4 days	5 days	6 days
	2019 CCVS	3 days	4 days	4 days	4 days	5 days

The primary sensitivities of electric assets to projected changes in flooding are:

- Equipment damage: Floodwaters damage electric equipment and decrease the life expectancy of assets. Equipment damage costs Con Edison both capital (needed for repairs) and time

(which results in longer outages and can be exacerbated if spare parts are limited). Saltwater spray can also cause arcing and failure of components. In addition, continued exposure to water can rot wooden assets such as poles.

- Equipment corrosion: Sea level rise and coastal storms pose a particular threat to coastal assets due to the corrosive properties of salt water, which can damage electronic components. These impacts may not be immediately evident but can present issues over time that may result in asset failures and outages.
- Soil weakening: Exposure to water can weaken or undermine the foundation of equipment in instances of prolonged inundation or erosion, increasing the overall risk of equipment damage. Increases in the projected flow and magnitude of floodwaters near riverbanks and the coast have the potential to alter and intensify how erosion occurs and may require intervention to avoid assets becoming destabilized or failing.
- Limited accessibility: Flooding presents issues of access. If assets are flooded or surrounded by water at high tide or during storms, it becomes more difficult to access the locations for maintenance and repair.

The Substation Erosion Protection and Drainage Upgrade program is focused on mitigating risks to substation equipment associated with all of these sensitivities during periods of heavy precipitation.

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

Impact on Disadvantaged Communities

The resilience strategies included in Con Edison's Resiliency Plan have been chosen in alignment with our Resiliency Framework that provides guidance for developing a comprehensive set of adaptation strategies to mitigate future climate change risks. This comprehensive set of strategies incudes investments that enable Con Edison's electric system to prevent climate change impacts by hardening infrastructure, mitigate the impacts from outage-inducing events by minimizing disruptions to customers, and respond rapidly to disruptions by reducing recovery times and costs.

While the programs included in the Plan are largely focused on withstanding climate changes and avoiding outages, most programs also enable Con Edison to limit outage impacts on customers (i.e., absorb outage impacts), and restore service more quickly than would otherwise have been possible (i.e., recover quickly). Many of the investments proposed to strengthen Con Edison's ability to withstand extreme climate conditions will also, naturally, reduce the risk of outages during "blue sky" conditions.

Disadvantaged communities (DACs) have fewer alternatives during energy system outages and will be more at risk from climate change. Because of this lack of alternatives, resilient and reliable energy service is an important priority for the communities and for Con Edison. Due to the size of Con Edison's electric system and the population density in the City, almost half of Con Edison's system serves at least one DAC. The Company has committed to tracking investments that benefit DACs specifically and to measuring and monitoring system performance in DACs and non-DACs. This tracking process will provide data and allow the Company to evaluate the benefits its investments to customers in DACs and revise its investment approach if needed.

The Company has also formed an Environmental Justice Working Group under an executive committee and plans to release a finalized Environmental Justice Policy Statement in 2023 to apply an equity lens to resilience-driven investments. Key components of the upcoming policy statement include:

- Operations will not disproportionately burden DACs.
- Con Edison will work to understand DAC concerns.

- Clean energy investments will benefit DACs.
- Con Edison will provide opportunities for employment in the clean energy future.

These equity considerations will help inform resilience plan investments moving forward.

Impact on Greenhouse Gas (GHG) Emissions
The primary goals of the programs and projects included in the Climate Vulnerability and Resiliency Plan, including the Erosion Protection and Drainage Upgrade program, are to withstand, absorb, or recover from the impacts of future climate changes on Con Edison's electric system. While none of the programs are focused on reducing GHG emissions, some of the programs could have small but positive impacts on Con Edison's overall GHG emissions, and none of the programs should negatively impact Con Edison's overall GHG emissions.

All of the programs that prevent or reduce the number of "truck rolls" required to assess, operate, or restore the electric system (i.e., the number of physical trips made by operators, technicians, and other field personnel to physical field locations) will reduce Con Edison's overall GHG emissions by reducing vehicle emissions associated with each field trip prevented. The Erosion and Drainage Upgrade program reduces the need for field visits by eliminating customer outages from damaged equipment caused by erosion from heavy precipitation. Actual program reductions in GHG emissions from reductions in physical trips to the field depend on the number of trips avoided, the miles driven per trip, the type of vehicle, the type of fuel burned, and the condition of the vehicle.

Impact on Clean Energy Commitment
The Erosion and Drainage Upgrade program supports Initiative 2 under Pillar 1 of the Clean Energy Commitment, Build the Grid of the Future.

Impact on 5-year and long-range plans (10-year)
This resilience program aligns with and supports Con Edison's integrated strategy, included in the January 2022 Long-Range Plan, focused on four strategic objectives related to Clean Energy, Climate Resilience, Core Service, and Customer Engagement. Con Edison's Climate Resilience strategic objective aims to increase the resilience of the energy infrastructure to adapt to climate change. Furthermore, Con Edison sees the role of utilities as changing from providing, "Universal access to energy that is safe and reliable" to providing, "Universal access to energy that is safe, reliable, and *resilient* (able to prevent, mitigate, and recover from events.)" (emphasis added)

The Erosion Protection and Drainage Upgrade program provides resilient energy delivery by mitigating the potential risk of equipment failures and outages at vulnerable substations from flooding and water intrusion associated with climate-driven storms and heavy precipitation.

Impact on Company Risk Mitigation Activity
Resiliency, in simple terms, can be defined as having the capacity to withstand or to recover quickly from difficulties. While a bit more complex, Con Edison's Resilience Management Framework definition of resilience is very similar – i.e., the Framework identifies resilience strategies as investments that enable Con Edison to withstand changes in climate and avoid outages, absorb impacts from outage-inducing events by limiting the number of customers impacted or improving the customers' ability to cope with outages, recover quickly, and advance to a better state. Both equate resilience with the avoidance or limitation of difficulties or negative consequences – i.e., with the mitigation of risk.

The 2022 Electric Operations Risk Assessment and Mitigation plans include mitigation activities associated with increasing risks of major storms that could damage the Con Edison system and

impact customers. Con Edison's comprehensive set of resiliency programs are designed to increase the ability of the electric system to withstand the impacts of climate change, including the increasing risk of storms, and limit potential impacts to customers. The Erosion and Drainage Upgrade program mitigates the risk of increased substation equipment outages from climate change, while also mitigating risks to customers served by each of the substations customers by hardening the substation to withstand the impacts of increasing periods of heavy precipitation.

2. Supplemental Information

Alternatives

Alternative 1

One alternative is to reconfigure outdoor facilities as indoor facilities that are better protected against extreme weather. This alternative would require extensive outages to complete and is cost prohibitive.

Alternative 2

The only alternative to making the proposed investments is to do nothing and accept the risks of substation equipment damage and customer outages from erosion resulting from projected climate-driven increases in heavy precipitation. This alternative does not meet the requirements of the Act to develop "… dedicated storm hardening programs … to reduce damage and costs from future weather events, as well as facilitate prompt restoration times."

Risk of No Action

Doing nothing means that Con Edison is willing to accept the risks of substation equipment damage and customer outages from erosion resulting from projected climate-driven increases in heavy precipitation. This alternative does not meet the requirements of the Act to develop "… dedicated storm hardening programs … to reduce damage and costs from future weather events, as well as facilitate prompt restoration times."

Non-Financial Benefits

Upgrades under this program mitigate the risk of damage to substation equipment caused when equipment shifts and becomes unstable when periods of heavy precipitation cause the ground to erode. Shifts in equipment position are likely not only to damage the equipment but also, possibly, to result in loss of service for large numbers of customers served from the substation. Erosion conditions also represent safety hazards to crews working in the substation. Proactive investments in erosion protections and drainage upgrades mitigate these risks.

Summary of Financial Benefits and Costs

1. Cost-benefit analysis

Con Edison 's transmission system is designed to be robust: in all areas of its service territory, no single failure should result in loss of load; and in much of its service territory (that system serving network distribution system load), no two failures should suffice to cause a loss of load. Consequently, while it is unlikely, though by no means impossible, that random failures of equipment will force load to be dropped, this may not hold true of a system confronted by the anticipated increases in load or undercut by vulnerabilities that allow the common cause failure of equipment. These vulnerabilities have led to previous major outages in Con Edison's service territory: extreme weather (e.g., tropical storm Sandy, 10/29/2012; a substation fire, 8/13/1990); and relaying problems (the Bronx, 6/20/2007, and on the west side of Manhattan, 7/13/2019). In addition, both rain and lightning are known to cause equipment failure and could be widespread in their effect.

Depending on the magnitude, a sizable load drop and potential long duration outage can make loss of load events on the transmission level more impactful. Although it is not possible to predict the potential cumulative costs to the community of a widespread loss of load event from a rare

transmission system failure, the Company considers this risk significant and invests in programs designed to prevent or recover from even unlikely loss of load events. The programs included in Con Edison's Climate Change Resiliency Plan are designed to increase the transmission system's resilience given the vulnerabilities identified from projected climate-change-induced extreme weather events.

2. Basis for estimate

Each substation upgraded under this program is estimated to cost approximately $3 million, based on previous projects. Upgrades to each substation are expected to take an average of 18 months to complete, including engineering, planning, and procurement (expected to average 6 months).

The estimated annual cost of substation upgrades under this program for the stations with identified issues and based on the initial high-level schedule are below. However, as discussed above, increasing system resiliency and mitigating erosion and drainage vulnerabilities associated with climate change requires that the Company proactively assess future risks, and it is expected that upgrades will need to be made other substations.

	Currently In-scope Substations *Only*				
	2025*	2026	2027	2028	2029
Rainey	$ 2,429	$ -	$ -	$ -	$ -
Ramapo	$ 2,429	$ -	$ -	$ -	$ -
Gowanus	$ 607	$ 2,502	$ -	$ -	$ -
Granite Hill	$ 607	$ 2,502	$ -	$ -	$ -
East 63rd St	$ -	$ 625	$ 2,577	$ -	$ -
Ossinging	$ -	$ 625	$ 2,577	$ -	$ -
West 65th St	$ -	$ -	$ 644	$ 2,654	$ -
Total estimated cost ($000)	**$ 6,072**	**$ 6,254**	**$ 5,798**	**$ 2,654**	**$ -**

* 2025 costs funded through rate case

	Currently In-scope Substations Plus Additional Substations				
	2025*	2026	2027	2028	2029
Rainey	$ 2,429	$ -	$ -	$ -	$ -
Ramapo	$ 2,429	$ -	$ -	$ -	$ -
Gowanus	$ 607	$ 2,502	$ -	$ -	$ -
Granite Hill	$ 607	$ 2,502	$ -	$ -	$ -
East 63rd St	$ -	$ 625	$ 2,577	$ -	$ -
Ossinging	$ -	$ 625	$ 2,577	$ -	$ -
West 65th St	$ -	$ -	$ 644	$ 2,654	$ -
Pleasantville	$ -	$ -	$ 644	$ 2,654	$ -
Substation TBD	$ -	$ -	$ -	$ 664	$ 2,734
Substation TBD	$ -	$ -	$ -	$ 664	$ 2,734
Total estimated cost ($000)	**$ 6,072**	**$ 6,254**	**$ 6,442**	**$ 6,635**	**$ 5,468**

* 2025 costs funded through rate case

Project Risks and Mitigation Plan

Risk 1 –Delays due resource/support coordination

Risk 1 Mitigation Plan – Anticipate, schedule and pre-plan with resource requirements such as engineering, labor, and construction and outages to avoid performance delays alignment conflicts.

Technical Evaluation / Analysis

N/A

Project Relationships (if applicable)

N/A

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	–	–	–	–	–	–
Capital	**$0**	**$0**	**$0**	**$0**	**$0**	**$3,500**

2025-2029 Request:

Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	–	–	–	–	–
Capital (Total)	**$0**	**$5,200**	**$5,400**	**$5,500**	**$5,700**
Labor	$0	$713	$740	$754	$781
M&S	$0	$2,184	$2,268	$2,310	$2,394
Contract Svcs.	$0	$624	$648	$660	$684
Other	$0	$251	$261	$266	$275
Overheads	$0	$1,428	$1,483	$1,510	$1,565

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	–	–	–
Capital	**$31,000**	**$36,000**	**$41,600**
Basis for funding direction:	Annual inflation-related increases estimated (3%)	Annual inflation-related increases estimated (3%)	Annual inflation-related increases estimated (3%)

Green Infrastructure and Rewilding

Environment, Health, & Safety

1. Project / Program Summary

Type: ☐ Project ☒ Program	**Category: ☒ Capital ☐ O&M**
Work Plan Category: ☐ Regulatory Mandated ☐ Operationally Required ☒ Strategic	
Project/Program Title: Green Infrastructure and Rewilding	
Project/Program Manager: Stanley Lewis	**Project/Program Number (Level 1): N/A**
Status: ☒ Initiation/Planning ☐ In-Progress (Projects Only) ☐ On-going (Programs Only)	
Estimated Start Date: 1/25	**Estimated Date In Service: On-going**
2025-2029 Funding Request ($000) **Capital: $6.0M** **O&M: $0**	

Work Description:

Con Edison is a leader in sustainability and plans to use its expertise to install more green infrastructure and rewild with native vegetation on various types of Company property (e.g., service centers, transmission line rights-of-ways, substations, etc.) in order to mitigate the impacts of climate change. The main climate change hazards this white paper mitigates against are increased precipitation from deluge rain events, an extended growing season from warmer temperatures, and protection against extreme weather events.

Green infrastructure systems like rain gardens, green roofs, bioswales, natural retention ponds, and permeable pavements absorb rainwater as it falls. In certain circumstances, green infrastructure can replace traditional forms of stormwater management such as gutters and pipes (e.g., gray infrastructure), which are built with the intent of rerouting stormwater to treatment facilities or into waterways. In general, stormwater runoff can carry various forms of pollution that can damage the natural ecosystem and harm local species. Green infrastructure are low-cost systems that absorb rainwater, reduce runoff, achieve biodiversity and protect waterways from pollution while helping to prevent or reduce flooding. Removal of current concrete/paved surfaces is needed to empower green infrastructure systems like permeable pavement or bioswales. Permeable pavement/asphalt is porous to allow water to run through it reducing flood risks while supporting the health of adjacent vegetation. Porous pavement infiltrates water which can in return replenish groundwater reserves, relieving stress on local water supply. Permeable pavement can be installed in low-traffic areas, parking lots, and walkways of the Company. Bioswales are linearly sloped retention areas designed to convey and capture water, while allowing for water to infiltrate into the soil and be soaked up by supporting native vegetation. Bioswales can be installed alongside roadways or on walkways of the Company. Green roofs can be utilized on most Company roofs. Green roofs can reduce energy use year-round by insulating against heat loss in the winter and heat absorption in the summer. Not only do green roofs manage energy consumption they create a more biodiverse environment while further reducing stormwater runoff and flooding effects. The use of green infrastructure systems can manage flooding, prepare for drought, reduce the urban heat island effect, lower building energy demands, and decrease amount of energy used managing water by reducing water flows into gray infrastructure.

Rewilding is a conservation approach that allows the land and its ecosystems to return to a more natural state supported by natural systems. One way to rewild is to actively replant an area with

native species, which allows for an expedited repopulation of native animals and insects. Restoring native vegetation is the best practice for reducing runoff and erosion. Adding a mixture of vegetation will naturally draw water out of the soil and return it to the atmosphere, reduce rainwater energy and water runoff energy, and root systems will add structure and strength to soil. Company operations provide potential opportunities for rewilding that provide crucial resilience benefits.

Utility vegetation management has evolved from the planting and maintaining of monoculture grass lawns, to the planting of native and biologically diverse (biodiverse) vegetation of today. A biodiverse habitat begins with a real property survey, followed by an existing conditions analysis of the target location and surrounding area, leading to a planting or "rewilding" plan. The plan may include the removal of vegetation that poses a risk to either a) the local environment (such as non-native or invasive species or species not supportive of pollinators) or b) utility equipment (such as line clearance). The plan may further call for changes from non-porous hardscapes such as concrete or asphalt where not operationally needed, to topsoil or an engineered porous medium if load bearing or compressional strength is needed. Following vegetation removal, the existing topsoil may require tilling to remove existing root structure and to provide proper aeration for the newly planted desired species. Further topsoil preparation may include the removal of any debris and rocks as well as the adding of organic matter and or fertilizers to improve its nutrient content. Following topsoil preparation, the plan's list of native vegetation will be installed or seeded. The project plan may further include installation of bird boxes, bat boxes, bee blocks, and osprey nests platforms, if the habitat is suitable for such fauna species.

To monitor, quantify and maintain biodiversity and resilience, the project may include the installation of autonomous remote reporting wildlife trail cameras with backend AI (Artificial Intelligence). The estimated cost per acre rewilded is $1.2M for an existing commercially or industrially developed setting and $0.01M for a natural undisturbed space that does not require concrete removal. One contributor to the green infrastructure cost of commercially and industrially developed space is concrete demolition and removal. Concrete demolition and removal of approximately 2,000 sq. ft. or 10% of the proposed footprint may cost over $50k. The subsequent replacement of the concrete with a rain garden, bioswale, retention pond, or permeable concrete solution may add $100k, just in the area of concrete removal. The average cost for a professionally installed rain garden ranges between $20-40 per sq ft. Seed mixes which incorporate native NY species could be more costly as acquiring the seeds through DEC related programs to increase the rarity/diversity in planted mixtures is approximately $3,500 to $4,500 per acre of seedings. The type of seeds needed will be site specific to each proposed rewilding area. The range of costs for all spaces will greatly depend on location accessibility to people and equipment. Program overheads are estimated to be 20%. Actual costs may improve with experience and programmatic management as opposed to ad-hoc project management.

The cost per rewilded acre would be about $20,000 for undeveloped land with minimal clearing, and would be higher if concrete and other debris removal would be factored in. For the other types of green infrastructure, the costs per unit are included below:

Type of Green infrastructure	Installation Costs	Maintenance Costs	Total cost	Maintenance per year
Rain Gardens	**Soil tests:** $90 **Percolation test:** $150 **Bioremediation:** $0.09 per square ft **Installation:** $40 per square ft	$4 per square ft	$ 28,971.17	$ 2,866.67
Bioswales	**Installation:** $58 per linear ft (9 ft-16 ft wide)	$4.31 per linear ft	$ 2,552.00	$ 189.64
Green Roofs	**Inspection:** $500 **Installation:** $15 per square ft (extensive)	$0.75 to $1.50 per square ft	$ 150,500.00	$ 15,000.00
Permeable Pavement	**Installation:** $20 per square ft	$0.75 to $1.50 per square ft	$ 14,333.33	$ 1,075.00

Justification Summary:
Biological diversity, or biodiversity, refers to the diversity of flora and fauna for a given area, and recognizes the value of maintaining a variety of living species. Biodiversity not only emphasizes mutually beneficial plantings, but also includes insects and animals that taken together contribute to the ecosystem, reduced operational maintenance and increased resiliency. Biodiverse habitats, even with greater vegetation growth seasons in New York, due to climate change, can naturally limit their height - thus maintaining better equipment clearances while requiring minimal upkeep after establishment. Moreover, to reliability and resiliency, biodiverse habitats can include supplemental infrastructure for birds to nest that supplant their use of utility infrastructure. In terms of climate change, rain inundation from extreme weather events may result in storm water runoff and flooding that affects nearby water bodies and combined sewer systems. Water quality of streams, lakes, and rivers is impaired by the soil and debris that results from runoff. With rewilding and strategically planted vegetation at Company facilities and substations, these facilities will increase their storm water retention and become more resilient to climate change. Thus, where practical, plans will advance stormwater retention along with the incorporation of wetland species that would thrive in the increased hydrologic conditions.

Removal of current pavement/concrete will allow for installation of green infrastructure such as porous pavement to reduce flooding on Company property or assets. Porous pavement can store a large number of gallons of deluge rain or snow in an event of a storm. Porous pavement can also filter out pollutants that may be contained within water runoff. The water captured by this green system can be used to replenish local water aquifers or can attribute to nearby vegetation water needs. Currently, water is being stored at surface level causing flooding, erosion, and overwhelming an aging sewage system. Bioswales and raingardens are another method of storing and filtering out water to be used by native vegetation within the system or to be slowly drained into the ground water. Use of these green infrastructure systems will decrease flooding, increase biodiversity, increase health of local waterways, reduce carbon footprint, cool temperatures, and beautify neighborhoods.

Green roofs may also be considered as part of the program. A non-green roof will lead to a loss of energy, decreased water retention, and decreased biodiversity. Green roofs can yield an annual saving of $0.23 per sq ft of a roof's surface. A conservative number of roof area owned by the Company is 10,000sqft, incorporating yearly savings that would be $2,300 a year. Green roofs effective lifespan is around 50 years causing an overall energy saving of $115,000 for 50 years on 10,000 sqft of roof. Green roofs reduce and filter stormwater runoff protecting Company property and assets from flash flooding. Green roofs absorb pollutants and carbon dioxide reducing the Company carbon footprint. Use of a green roof will further push the Company biodiversity goals attributing to increased bee, bird, butterfly, and bat populations. Proper green roof installation will consist of ensuring structures ability to support a green roof. Selection of various native vegetation to be used in the green roof along with a minimal maintenance schedule to follow.

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act
Increasing biodiversity of local ecosystems decreases greenhouse gas contributions and mitigates climate change through carbon sequestration. One acre of mowed lawn sequesters ~15 tons of carbon per year, where a native wildflower acre sequesters ~*10,000-15,000* tons of carbon. This work further supports climate change resiliency plans by decreasing physical lawn mowing which in return reduces use of fertilizers, pesticides/herbicides and minimizes air emissions that contribute to greenhouse gases. Moreover, the vegetation selection, allows for the absorption of carbon dioxide from the air. That carbon dioxide absorption can later be stored in the biomass or soil of the tree or other plant. This method of absorbing and storing is an effective tool for combating climate change. Also, since manufacturing concrete is carbon intensive, substituting greenery for concrete avoids an additional carbon source.

2. Supplemental Information

Alternatives
Alternative is to continue with the current IVM practices for the transmission right of way (ROW) corridors, which include mechanical cut/stump for trees, cutting of existing tall shrubs and approved use of herbicides. This process safeguards the power transmission with continued maintenance costs and least contribution to the natural habitat.

For Company owned facilities and substations, landscaped manicured lawns may require treatments in addition to lawn mowing with fossil fueled mechanical equipment. A biodiverse natural habitat that includes expanded hardscape alternatives can better channel rain and storm water back to the earth and reduce flooding elsewhere.

Risk of No Action
A cyclical schedule for vegetation management exists and has been effective in maintaining right of way vegetation. It cannot be determined if this management schedule will be effective with increased growing periods and precipitation.

Not changing the current lawn mowing schedule at corporate facilities could result in increased costs, as growing seasons lengthen, and some municipalities are beginning to limit use of gas-powered landscaping equipment. For example, the City of Yonkers no longer allows gas powered leaf blowers, which are commonly used to clear mowed lawns of grass clippings. Landscapers are required to replace working equipment with expensive new equipment, a cost they will pass onto their customers, which includes our Company.

Not using green infrastructure systems will increase flooding potential on Company property including areas with substations. Flooding of Company property or assets may create additional repair costs and decrease overall system reliability. The need for utilizing green infrastructure has become evident as New York recently has reached record rainfalls causing flash flooding.

Non-Financial Benefits
Rewilding with native, biodiverse species enhances communities by embracing natural landscapes and replacing impervious surfaces with natural habitat. Disadvantaged communities in America are three times as likely to be located within nature-deprived areas than in wealthy communities which is why it is imperative to revitalize these areas. Bringing natural settings into disadvantaged communities brings not only a more beautiful, natural aesthetic, but also increases the understanding of sciences within those communities, as the inhabitants get to see new species, such as birds and butterflies, attracted to their otherwise urban landscape. Improved water quality in rivers, lakes, and streams as soil and debris in water runoff from weather events will be greatly reduced due to the addition of

biodiverse species capturing such soil/debris. Decreasing water runoff energy flow by the addition of native plant species will decrease erosion and flood damage to homes and property within DACs. The utilization of permeable concrete can reduce local flooding and minimize recurrent losses during heavy rainfall events. Green roofs can reduce air pollution and decrease overall heat from air a few degrees though evapotranspiration creating a more comfortable living environment for those within disadvantage communities.

Summary of Financial Benefits and Costs

Cost-benefit analysis

The financial benefit of creating a biodiverse habitat for ROWs is a decrease in routine maintenance costs. Mowing one-acre costs approximately $50/week. The typical growing and mowing season in New York runs from April through October, or approximately 30 weeks, for a total cost of $1,500/acre/year. Rewilding with biodiverse, native species, costs approximately $20,000, for a breakeven point of roughly 13.3 years. However, the reduction in greenhouse gas emissions and increase in positive public relations is immeasurable.

Basis for estimate

Mowing costs and timelines were discussed with one of the contracted landscapers who performs both mowing and rewilding at our Westchester corporate facilities.

Project Risks and Mitigation Plan

Risk: Selected native species are overrun by invasive species.

Mitigation plan: Inspection and management of invasive species and or alternate local species are planted.

Technical Evaluation / Analysis

Con Edison Releases Biodiversity Plan, Broadening Environmental Goals | Con Edison

Con Edison Tree Maintenance

Con Edison Climate Change Vulnerability Study

Project Relationships (if applicable)

This project supports Con Edison's efforts to become more resilient to climate change.

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	N/A	N/A	N/A	N/A	N/A	N/A
Capital	N/A	N/A	N/A	N/A	N/A	N/A

2025-2029 Request:

Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M					
Capital (Total)	**$1,200**	**$1,200**	**$1,200**	**$1,200**	**$1,200**
Labor					
M&S					
Contract Svcs.	**$1,200**	**$1,200**	**$1,200**	**$1,200**	**$1,200**
Other					
Overheads					

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M			
Capital	$6,000	$6,000	$6,000
Basis for funding direction:	This program will be reevaluated every five years during each Resilience Plan update and based on the latest science. The goal of this program is to prioritize and invest in various types of green infrastructure and rewilding projects at different facilities across Con Edison's service territory. The operational needs and locations will vary over time and be coordinated in conjunction with the Company's experts to maintain operational resiliency.		

Living Shorelines and Nature-Based Solutions

Environment, Health, & Safety

1. Project / Program Summary

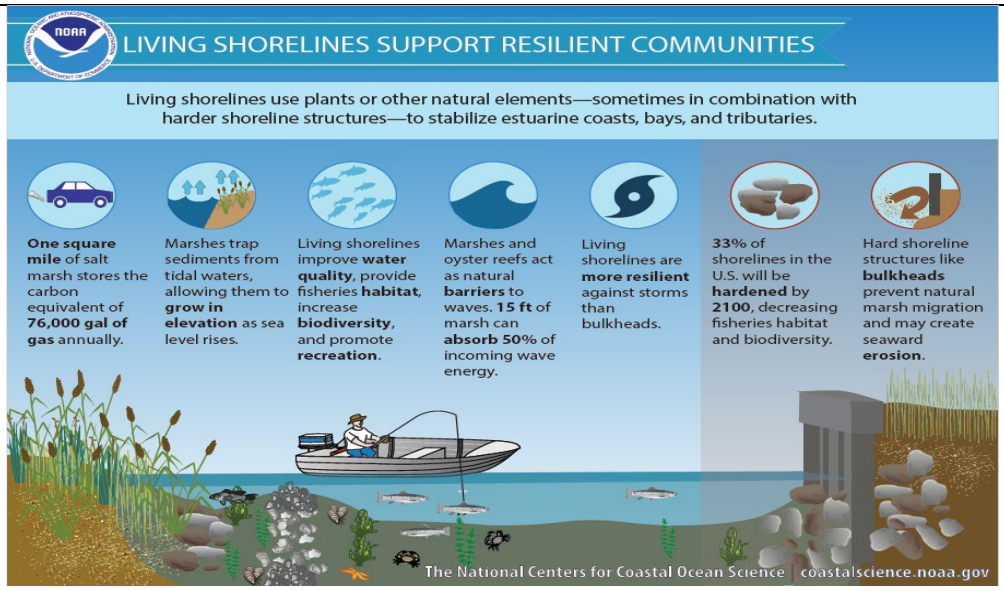
Type: ☒ Project ☐ Program	**Category: ☒ Capital ☒ O&M**
Work Plan Category: ☐ Regulatory Mandated ☐ Operationally Required ☒ Strategic	
Project/Program Title: Living Shorelines and Nature-Based Solutions	
Project/Program Manager: Stanley Lewis	**Project/Program Number (Level 1):**
Status: ☒ Initiation/Planning ☐ In-Progress (Projects Only) ☐ On-going (Programs Only)	
Estimated Start Date: 2025	**Estimated Date In Service: 2027**
2025-2029 Funding Request ($000) **Capital: $3.0M** **O&M: $0.3M**	

Work Description:

Con Edison's 2023 CCVS recognizes a multitude of upcoming challenges such as sea level rise, stronger wind gusts, and increased frequency and magnitude of extreme weather events. The Company owns multiple coastal properties that contain infrastructure, equipment and or materials, assets, that are necessary to service and routine business functions. These assets are at risk from storm surges, rising sea levels, costal storm events, and wind erosion. In an effort to combat these risks this project proposes the construction of living shorelines—a nature-based solution that may alone or in synergy with other efforts effectively address these vulnerabilities.

Living shorelines are a type of nature based, green coastal protection that use natural materials such as plants, rocks, and shells to stabilize the shoreline, reduce erosion, and protect against rising sea levels. They provide a habitat for which flora and fauna can thrive and ultimately increase biodiversity. Tidal salt marshes, a type of living shoreline, are known to be among the most productive ecosystem types on Earth, sequestering tens of thousands of tons of carbon annually. They can help purify water, reduce erosion, and store carbon. During major storms, living shorelines have shown to perform better than hardened shorelines by dissipating wave energy and therefore reducing wave action, rather than just deflecting it downstream like hardened shorelines. Living shorelines are also more cost-effective than hardened structures, in aspects of both installation and maintenance costs.

Con Edison seeks to make Company shoreline properties more resilient to rising sea levels and storm surges while at the same time providing surrounding communities with an aesthetically pleasing living shoreline comprised of native species. Con Edison shoreline candidates for living shorelines include but are not limited to: Service center on Neptune Ave in Brooklyn utilizing Coney Island Creek, Astoria complex utilizing the upper East River, Howland Hook Substation in Staten Island utilizing wetland in the marine terminal, Farragut substation, and Rainey substation. The living shoreline project also aims to increase community resiliency in disadvantaged communities, depending on the selected location.



To develop an active shoreline, the main steps include planning, obtaining permits, site preparation, and installation of erosion control measures. Erosion control measures include the placement of rocks, the planting of vegetation, and the limited but ongoing maintenance of the site to ensure the success of the living shoreline. The permitting process may include obtaining approvals from local, state, and federal agencies. Permits would relate to wetlands (fill), water quality, coastal zone management, and construction activities, with possibility for essential fish habitat (EFH) approval, floodplain, threatened/endangered species work restrictions and other permits as necessary. NYSDEC may require mitigation for any open water they deem "taken" by living shorelines. In addition to contracting an environmental engineering firm, Con Edison would explore partnering with local conservation groups such as the Nature Conservancy and the Environmental Defense Fund for advice and recommendations.

The living shoreline's selection in design would start as early as 2024 with construction spanning 2025 and 2026. Site selection will be based on technical resiliency, community value, biodiversity, and concurrent work plans and access.

The unit cost of a living shoreline is estimated at $3,000 per linear foot construction and $100 per linear foot maintenance. The living shoreline would only require minor upkeep after construction is completed including additional and or replacement plants and animals. The capital construction and maintenance estimates are based on studies by NOAA Fisheries. As construction is over two concurrent years and the maintenance for the following three years, escalation, if any, is considered within the estimates.

	2024	2025	2026	2027	2028	2029
Feet yr.	0	500	500	0	0	0
Feet Agg.	0	500	1,000	1,000	1,000	1,000
Cap. ($M)	0.1	1.5	1.5	0	0	0
O&M ($M)	0.0	0.0	0.0	0.1	0.1	0.1

Justification Summary:
Climate change is projected to increase sea levels, precipitation and drive stronger, more frequent storms. These climate driven risks to our infrastructure's lifespan and system reliability can be reduced, in part, by robust living shorelines.

Key challenges facing the Company's waterfront properties and associated assets include increased flooding events, more frequent and severe storms, and rising temperatures. The number of days per year with more than 2 inches of precipitation is projected to increase 33% by 2030 and 88% by 2080 from the historical baseline. Severe weather events are expected to increase by 5% between 2040 and 2050. The number of days per year with a heat index over 90˚F is projected to increase by threefold by 2030. And lastly, maximum wind gusts in NYC are projected to increase from 80 mph to 110 mph by midcentury.

Living shorelines can help mitigate flooding by absorbing excess rainfall and providing a buffer against rising sea levels. They offer increased resiliency to severe storm events by dissipating wave energy. Living shorelines provide shade and cooling to reduce nearby temperatures during heatwaves. They can also act as natural windbreak, minimizing any intense wind energy that would have hit shoreline. Thus, living shorelines offer a holistic solution to multiple hazards simultaneously, providing a more resilient defense against climate change.

Underground assets in certain areas can be susceptible to flooding damage from sea level rise and coastal storms. Con Edison understands this substantial risk and acted after Superstorm Sandy, protecting all infrastructure in the floodplain against future 100-year storms and 3 feet of sea level rise as explained in the Con Edison's 2023 Climate Change Vulnerability Study. This shoreline resiliency project will use marshes and vegetation to trap sediments from tidal waters allowing the shoreline to constantly grow in elevation consistent with the rising sea level. The conventional method of hardening a shoreline is to create or expand a bulkhead. Bulkheads, however, may create secondary problems like seaward erosion and will not contribute to the areas biodiversity. As sea levels rise the effectiveness of the bulkhead will decrease due to its fixed elevation. A living shoreline, in contrast, will have a noticeably longer asset lifespan as the shoreline will grow in elevation with the increase in sea level and storms.

The living shorelines will be designed in size and shape, and of materials that will account for increasing sea levels and periodic storm surges, providing a useful measure of energy dissipation and shore protection from storm waves.

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

- Living shorelines reduce greenhouse gases through carbon sequestration. These living habitats have been estimated to capture 73 to 283 grams C/m2/yr. See NOAA Blue Carbon Potential of Living Shorelines

- Living shorelines, located within DACs, will supplement and supplant current seawalls or bulkheads with beautiful natural habitats, replacing concrete with green vegetation and diverse marine animals. A change that is not only aesthetically pleasing, but also physically beneficial as greenhouse gases are removed from the air. Living shorelines also provide wildlife habitat which provides unique, in-person learning experiences for local residents. Majority of the proposed living shoreline locations allow for public viewing and enjoyment. Living shorelines in candidate locations such as the service center on Neptune Ave. will protect critical community facilities such as schools and first responder facilities.

- In contribution to our Clean Energy Commitment, Living shorelines will require us to partner with various local, state and federal administrative agencies (including the USACE Coastal Storm Risk Management project) and leaders to design and build these shorelines.
- This project addresses, in part, Con Edison's Climate Change and Resilience Adaptation Plan's §9 focus on sea level and storm resilience.
- This project helps protect critical infrastructure and facilities from the impacts of climate change and extreme weather events. It enhances the resilience of coastal areas, reducing the potential for disruptions and costly repairs.
- Living Shorelines are sustainable and self-sustaining, and follow Con Edison's Biodiversity Action Plan objectives. They are economical, environmentally friendly and community enhancing.

Creating an active shoreline aligns with Company initiatives and stakeholder plans. It helps protect and restore natural habitats, enhances biodiversity, and improves the resilience of coastal areas against erosion and storm damage. Living shorelines also demonstrate the Company's commitment to environmental stewardship and contributes to a more sustainable and resilient future.

2. Supplemental Information

Alternatives
The design of an industrial seawall or bulkhead can be accomplished by steel, concrete, wood, and/or riprap. These conventional designs do not incorporate nor add any aesthetic value; they are purely utilitarian in design. Moreover, these walls serve no other purpose than soil retainment and flood prevention at water interfaces. Studies have shown that, over time, green infrastructure outperforms traditional, gray infrastructure approaches.

Risk of No Action
A conventional bulkhead or riprap wall will not last in perpetuity. Chemical and physical degradation are inevitable. While maintenance can be performed, it is limited. This degradation combined with sea level rise and storm surge could compromise equipment operation and reliability of station equipment.

Non-Financial Benefits
A living shoreline would benefit the communities we serve by greening the landscape and capturing harmful greenhouse gases, while also increasing the resiliency for Company and community facilities. Active shorelines can enhance ecological biodiversity attracting aquatic life, plants, and birds/bats. An active shoreline creates an ecotone between the land and aquatic habitat which leads to species diversity and growth of unique ecosystems.

Summary of Financial Benefits and Costs
NOAA has estimated living shorelines to cost between $1,000 and $5,000 per linear foot. While many factors will affect the shoreline's cost from logistics to plant and animal selection, the underlying design is one of the more significant factors. A living shoreline wall built without artificial augmentation will cost less than a wall that is augmented. The living shoreline's augmentation is in the utilization of terraced or nook concrete or equivalent to create points of attachment for natural vegetation and animals. Selecting artificial augmentation to help advance the habitat could add $2M to a given shoreline's total cost.

Using conservative estimates, a 1000 square foot living shoreline would capture approximately 0.04 tons of greenhouse gases. Direct capture from the air is more expensive than point of generation, but all mechanisms of capture solve different challenges.

Return on Investment Estimation (10-year period):

Total Cost = Construction cost ~3M + Maintenance cost ~1M + Permits ~ 0.1M =4.1 M
Total Benefit = Infrastructure protection ~100M+Carbon sequestration ~0.5M+ Property value~15M =115.5M
ROI=(115.5M-4.1M)/4.1M= 27.2%
This demonstrates a substantial positive return on investment, indicating that the project is economically viable and offers a clear cost-effective strategy for addressing climate change-related risks and protecting critical infrastructure.

Basis for estimate:
Estimated rates of carbon sequestration were taken from NOAA's peer reviewed/published documents and extrapolated to realistic project sizes.

Project Risks and Mitigation Plan
Risk 1: Inclement Weather
Mitigation plan: Monitor weather forecasts/plan for delays.

Risk 2: Challenge obtaining permits
Mitigation plan: Engage with relevant authorities to ensure timely permit approvals. Pre-application meetings with NYSDEC and USACE would be beneficial.

Technical Evaluation / Analysis
- Nature-Based Solutions: Real-World Applications and Benefits, EPRI 2023.
- Is carbon capture too expensive, IEA 2023 https://www.iea.org/commentaries/is-carbon-capture-too-expensive
- Con Edison Climate Change Vulnerability Study 2023

Project Relationships (if applicable)
N/A

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	New Project					$0.0
Capital	Not Applicable					$0.0

2025-2029 Request:
Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	$0.0	$0.0	$100	$100	$100
Capital (Total)	$1,500	$1,500	$0.0	$0.0	$0.0
Labor					
M&S					
Contract Svcs.	$1,500	$1,500			
Other					
Overheads					

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	$300	$300	$300
Capital	$6,000M		
Basis for funding direction:	Upon review of successful implementation and construction, the next phase would be to install an additional 1,000 linear feet of living shorelines at either the same or different location, depending on the site location. The O&M costs are based on USACE estimates but are expected to decrease over time as the shoreline fully develops and grows.		

Selective Undergrounding

Electric Operations / DE

1. Project / Program Summary

Type: ☐ **Project** ☒ **Program**	**Category:** ☒ **Capital** ☐ **O&M**
Work Plan Category: ☐ **Regulatory Mandated** ☒ **Operationally Required** ☐ **Strategic**	
Project/Program Title: Selective Undergrounding	
Project/Program Manager: Jeffrey Mah	**Project/Program Number (Level 1):** 27207956, 27207957, 27207975
Status: ☐ **Initiation/Planning** ☒ **In-Progress (Projects Only)** ☐ **On-going (Programs Only)**	
Estimated Start Date: Ongoing	**Estimated Date In Service:** Ongoing
2025-2029 Funding Request ($000) **Capital: $ 333,000** **O&M: –**	

Work Description

The overhead distribution system is comprised of non-network circuits, including primarily 4kV primary grids and 4kV, 13kV, and 27kV auto loops, and 33 kV circuits. The primary vulnerability of the overhead non-network system identified by the Study is risk to system failures resulting from increases in wind and ice, with additional vulnerability from extreme storms, and heat. Increased temperatures can lead to line sag, presenting safety concerns in areas with vegetation clearance limitations, and the overhead system is at risk of damage from high winds, wind-blown debris, downed trees, and ice during storms. Over the past two decades, New York has experienced multiple significant storm events – both hurricanes and nor'easters – bringing high winds that downed trees and overhead facilities, resulting in widespread power outages. Climate science projects that such storms will become more frequent and more intense. The goal of the Selective Undergrounding program is to mitigate the risks of outage during these heat waves and high-winds, and storm events by placing the most vulnerable segments of the non-network system underground. The program prioritizes segments of the overhead system that are most vulnerable to wind damage, such as main runs in heavily wooded areas and radial spur installations where damage is more likely to result in customer outages.

For the period from 2025 to 2029, Con Edison proposes to convert approximately 70 miles of the non-network system from overhead to underground under the Selective Undergrounding program. During the 2025-2029 timeframe, Con Edison is planning to ramp up our capacity to perform undergrounding from an average of approximately 8 miles per year in 2025 to approximately 20 miles per year in 2028 by increasing our efficiency through the implementation of standard designs, increasing internal resources, and putting contracts in place with other vendors.

Con Edison uses the Overhead Program Optimization Tool (OHPOT) model to review data at the 4, 13 or 27kV primary "segment" or "protective device" level (e.g., Spur, Sub-Spur or main Run segment). The OHPOT provides Con Edison with statistics and information for that segment of the system. The statistics provided by OHPOT are primarily based on the Outage History (PSC Outage Database) and consist of the number of outage events for that segment, and customers impacted. (Outages on the overhead non-network system are primarily driven by weather events.) This, and other information, such as available fault current and the length of the segment, helps determine the appropriate mitigating measures. In late 2021, Environmental Justice (EJ) metrics were added as another input. These inputs can then be used by the system to automatically prioritize jobs.

OHPOT selects overhead circuits to be considered for undergrounding based on the best available data and current circuit configuration. For example, the tool may be configured to mark circuits as warranting "U – underground review" based on meeting any of these four criteria:

i. An EJ area containing 10% of population in the LMI category AND a line segment experiencing four (4) or more outage events in last 6 years.
ii. The segment experienced four (4) or more outage events in last 6 years AND the segment outages resulted in a total of 1,500 or more customer outages in last 6 years
iii. The segment experienced eight (8) or more outage events in last 6 years
iv. The segment experienced three (3) or more outage events in last 3 years

Circuits meeting the selected criteria are then forwarded for engineering review and analysis. This review includes detailed engineering and constructability analyses to determine the solution that best mitigates the circuit vulnerabilities, including:

- Selectively undergrounding a problematic portion of the circuit
- Selectively undergrounding a portion of the circuit and creating a tie to a neighboring circuit
- Selectively undergrounding the entire circuit
- Pursue other appropriate design enhancements under other programs

Coincident with engineering analysis of the best solution for mitigating risks to an individual circuit, the expected benefits of undergrounding the circuits meeting the selection criteria are compared and used to create an initial prioritization ranking. Recommended solutions from the engineering analyses are then incorporated and the relative cost-effectiveness of undergrounding alternative circuits are used to adjust the prioritization. This rigorous analysis and prioritization require up-to-date data to be effective, and Con Edison, therefore, only creates detailed program work plans twelve to eighteen months in advance.

Potential locations to be considered for undergrounding in the 2025 – 2029 timeframe were identified using the prioritization process described above, based on current system conditions. The top priorities for potential undergrounding were identified using OHPOT, based on current system conditions and circuit performance data from Jan 2017 through July 2023. The top circuits identified as undergrounding priorities (priority U1, U2, and U3) will be reevaluated annually to reflect current system conditions and the most recent circuit data.

	Top Priorities (U1)		**Second Priorities (U2)**		**Third Priorities (U3)**	
	Number of Circuits	Number of Miles	Number of Circuits	Number of Miles	Number of Circuits	Number of Miles
Brooklyn/ Queens	9	2	10	3	4	3
Bronx/ Westchester	38	11	48	24	25	24
Staten Island	8	2	3	1	0	0
Total	**55**	**14**	**61**	**28**	**29**	**27**

Justification Summary:

Following Superstorm Sandy, Con Edison worked with a Storm Hardening and Resiliency Collaborative to recommend storm hardening investments and one of the recommendations was to conduct a Climate Change Vulnerability Study (CCVS or the Study). The initial Climate Change Vulnerability Study was conducted in 2019 and was updated in 2023. The approach followed a multi-step process that cycled through the steps for each potential climate hazard, incorporating feedback from stakeholders throughout the evaluations. The Study used the best available science to evaluate the sensitivity of Con Edison's electric system to projections of potential climate hazards including:

- **Temperature and humidity** – from heat and coincident high heat and humidity (known as temperature variable or "TV")
- **Flooding** – coastal flooding from sea level rise and/or inland flooding from precipitation

- **Wind and ice**
- **Extreme and coincident weather events** – hurricanes/wind, extreme heat waves, nor'easters/cold snaps, and multiple concurrent or consecutive extreme events

The hazards that the Study found to pose an elevated risk to Con Edison's assets and operations include heat and humidity, major storms, wind and ice, and extreme events.

	Con Edison's service territory is projected to be impacted by rising temperatures. Those impacts are expected to be amplified during intense heat waves. Increasing TV will cause load to increase, potentially challenging the capacity of the system.
	Con Edison has previously experienced flooding events that have impacted its assets from major storms. Due to future climate projections, that risk is expected to expand in Con Edison's service area, and facilities like substations will be more exposed to flooding.
	Con Edison's overhead distribution system has historically been the most sensitive to wind and ice, due to its susceptibility to tree contact during high wind and icing events.
	Extreme events are low-likelihood, high-impact scenarios that can amplify and compound the types of impacts anticipated from changes in temperature, sea level rise, and other variables. These events pose risks to all aspects of the system and are especially impactful for emergency response planning.

Specific projections of future climate conditions, referred to as pathways (Pathways) were incorporated into the Company's forecasting and planning processes – including load forecasting, load relief planning, reliability planning for the sub-transmission and distribution systems, asset management planning, facility energy system planning, planning for emergency preparation and response, and worker safety – through the development of a new Climate Change Planning and Design Guideline document (Guidelines). This document specifies the methodologies to be used to evaluate the vulnerability of electric facilities to projected climate changes and establishes specific design standards to be met for each climate hazard over the useful life of the asset.

The primary vulnerability of the overhead non-network system identified by the Study is risk to system failures resulting from increases in wind and ice, with additional vulnerability from extreme storms, and heat also identified. For all of these climate-driven hazards, the common failure mode is contact – conductors, poles, or other overhead equipment – with vegetation, wind-blown debris, nearby structures, or the ground.

The Con Edison Climate Change Vulnerability Studies project increases in average and maximum air temperatures throughout the century relative to historical conditions, with the 2023 Study projecting that temperatures will increase faster than projected in the 2019 Study. By all measures evaluated in the Studies – maximum daily temperature, number of days per year in which maximum temperature exceeds 95°F, and number of days per year the daily average temperature exceeds 86°F – climate-related increases in heat are projected to occur roughly a decade faster than projected in the first Study.

Variable	Study	Baseline	2030	2040	2050	2080
Highest annual maximum daily temperature	Current Study	97°F	103°F	104°F	106°F	112°F
	2019 CCVS	97°F	101°F	103°F	104°F	108°F
The number of days per year in which maximum temperatures exceed 95°F	Current Study	4 days	17 days	27 days	32 days	69 days
	2019 CCVS	4 days	11 days	18 days	23 days	47 days
The number of days per year in which daily average temperatures exceed 86°F	Current Study	3 days	16 days	22 days	31 days	68 days
	2019 CCVS	3 days	11 days	16 days	21 days	45 days

High temperatures can cause overhead distribution lines to experience sagging and loss of material strength. Line sagging reduces the clearance between overhead assets and surrounding vegetation, which can increase the potential for contact with vegetation, leading to asset failure and safety risks. Derating lines helps mitigate the risk of line sag but could necessitate adding capacity to meet demand.

Wind and ice have historically been difficult to model due to their highly localized nature. To inform this Study, Con Edison sought the best available information by acquiring an additional dataset from MIT, which covers the Northeast, and provides insight into future wind speeds and radial icing potential. This data and other studies demonstrate that wind speeds will likely increase, and the risk of ice accumulation on wires (radial icing) will remain. The dataset developed by MIT covers the Northeast and shows the 2025-2041 projected and baseline observed annual maximum and average wind speeds at Central Park, JFK, and LaGuardia.

	Central Park		JFK		LaGuardia	
Wind Speed	1-min Baseline	MIT Projection	1-min Baseline	MIT Projection	1-min Baseline	MIT Projection
Annual maximum (mph)	51.0	60.2	46.1	57.5	55.0	62.4
Annual mean (mph)	14.0	17.6	18.1	19.2	20.1	18.5

Extreme storms such as hurricanes can cause wind speeds to increase far beyond typical average speeds. Wind speeds of the most intense hurricanes are projected to increase. Freezing rain frequency and radial icing are also projected to increase, although the magnitude of the trend remains highly uncertain due to the specific atmospheric conditions required for ice storms to occur.

Con Edison's service area experiences a range of precipitation types, including rainfall and frozen precipitation (i.e., snow, sleet, and freezing rain). The region has experienced several tropical cyclones producing heavy precipitation over the last century. For example, in 2011, Hurricane Irene produced up to 12 inches of rain in the service area, with nearly 7 inches in Central Park. More recently, remnants of Hurricane Ida in 2021 brought over 7 inches of rain to Central Park. Alternatively, nor'easters have brought some of the heaviest snowfall on record to New York City, along with freezing rain; the January 2021 nor'easter accumulated up to 2 feet of snow in New York City.

Climate change is projected to drive heavier precipitation events because a warmer atmosphere holds more water vapor and provides more energy for storms, among other factors. Looking forward, projections show climate change could drive stronger and more frequent storms in the region, bringing heavy precipitation, wind, and storm surge. Tropical cyclone rainfall totals are projected to increase by approximately 10%-15% in the North Atlantic basin by the late 21st century. In addition, extratropical cyclones could become 5%-25% more wet in the future relative to present day. In contrast, climate change could reduce the frequency of snowfall and other frozen precipitation in future decades. Projections in the Study show that heavy precipitation in the service area could increase throughout the century relative to the baseline.

Variable	Study	Baseline	2030	2040	2050	2080
Annual days with precipitation exceeding 2 inches	Current Study	3 days	4 days	4 days	5 days	6 days
	2019 CCVS	3 days	4 days	4 days	4 days	5 days

These potential changes in wind, precipitation, and ice present an especially large risk to overhead distribution equipment. Overhead distribution assets, including conductors, attachments, and cross-arms, are built to withstand defined design tolerances for combined ice and wind loading, but they are frequently adjacent to neighboring vegetation that may be downed during these events. Fallen vegetation and wind-blown debris can come into contact with lines and cause them to disconnect, fall, or even lead to pole collapse. This can result in asset failure, leading to outages and incurring restoration costs.

When choosing resilience strategies to address identified climate vulnerabilities, Con Edison follows a resilience framework that encompasses investments that:

- Prevent climate change impacts by hardening infrastructure
- Mitigate the impacts from outage-inducing events by minimizing disruptions
- Respond rapidly to disruptions by reducing recovery times and costs

The investments made in the overhead distribution system under this program proactively increase Con Edison's resiliency by preventing likely outages from climate-induced extreme weather events by eliminating the circuits exposure to the extreme weather.

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

Impact on Disadvantaged Communities

The resilience strategies included in Con Edison's Resiliency Plan have been chosen in alignment with our Resiliency Framework that provides guidance for developing a comprehensive set of adaptation strategies to mitigate future climate change risks. This comprehensive set of strategies incudes investments that enable Con Edison's electric system to prevent climate change impacts by hardening infrastructure, mitigate the impacts from outage-inducing events by minimizing disruptions to customers, and respond rapidly to disruptions by reducing recovery times and costs.

While the programs included in the Plan are largely focused on withstanding climate changes and avoiding outages, most programs also enable Con Edison to limit outage impacts on customers (i.e., absorb outage impacts), and restore service more quickly than would otherwise have been possible (i.e., recover quickly). Many of the investments proposed to strengthen Con Edison's ability to withstand extreme climate conditions will also, naturally, reduce the risk of outages during "blue sky" conditions.

Disadvantaged communities (DACs) have fewer alternatives during energy system outages and will be more at risk from climate change. Because of this lack of alternatives, resilient and reliable energy service is an important priority for these communities and for Con Edison. Due to the size of Con Edison's electric system and the population density in the City, almost half of Con Edison's system serves at least one DAC. The Company has committed to tracking investments that benefit DACs specifically and to measuring and monitoring system performance in DACs and non-DACs. This tracking process will provide data and allow the Company to evaluate the benefits its investments to customers in DACs and revise its investment approach if needed.

The Company has also formed an Environmental Justice Working Group under an executive committee and plans to release a finalized Environmental Justice Policy Statement in 2023 to apply an

equity lens to resilience-driven investments. Key components of the upcoming policy statement include:

- Operations will not disproportionately burden DACs.
- Con Edison will work to understand DAC concerns.
- Clean energy investments will benefit DACs.
- Con Edison will provide opportunities for employment in the clean energy future.

These equity considerations will help inform resilience plan investments moving forward.

Impact on Greenhouse Gas (GHG) Emissions

The primary goals of the programs and projects included in the Climate Vulnerability and Resiliency Plan, including the Selective Undergrounding program, are to withstand, absorb, or recover from the impacts of future climate changes on Con Edison's electric system. While none of the programs are focused on reducing GHG emissions, some of the programs could have small but positive impacts on Con Edison's overall GHG emissions, and none of the programs should negatively impact Con Edison's overall GHG emissions.

All of the programs that prevent or reduce the number of "truck rolls" required to assess, operate, or restore the electric system (i.e., the number of physical trips made by operators, technicians, and other field personnel to physical field locations) will reduce Con Edison's overall GHG emissions by reducing vehicle emissions associated with each field trip prevented. The Selective Undergrounding program reduces the need for field visits by reducing outages on the overhead non-network system by placing vulnerable circuits underground. Actual program reductions in GHG emissions from reductions in physical trips to the field depend on the number of trips avoided, the miles driven per trip, the type of vehicle, the type of fuel burned, and the condition of the vehicle.

Impact on Clean Energy Commitment

The Selective Undergrounding program supports Initiative 2 under Pillar 1 of the Clean Energy Commitment, Build the Grid of the Future.

Impact on 5-year and long-range plans (10-year)

This resilience program aligns with and supports Con Edison's integrated strategy, included in the January 2022 Long-Range Plan, focused on four strategic objectives related to Clean Energy, Climate Resilience, Core Service, and Customer Engagement. Con Edison's Climate Resilience strategic objective aims to increase the resilience of the energy infrastructure to adapt to climate change. Furthermore, Con Edison sees the role of utilities as changing from providing, "Universal access to energy that is safe and reliable" to providing, "Universal access to energy that is safe, reliable, and *resilient* (able to prevent, mitigate, and recover from events.)" (emphasis added)

The Selective Undergrounding program provides resilient energy delivery by increasing the ability of the electric distribution system to withstand the impacts of climate changes without experiencing failures from wind and wind-blown debris during more frequent and intense climate-driven storms.

Impact on Company Risk Mitigation Activity

Resiliency, in simple terms, can be defined as having the capacity to withstand or to recover quickly from difficulties. While a bit more complex, Con Edison's Resilience Management Framework definition of resilience is very similar – i.e., the Framework identifies resilience strategies as investments that enable Con Edison to withstand changes in climate and avoid outages, absorb impacts from outage-inducing events by limiting the number of customers impacted or improving the customers' ability to cope with outages, recover quickly, and advance to a better state. Both equate resilience with the avoidance or limitation of difficulties or negative consequences – i.e., with the mitigation of risk.

The 2022 Electric Operations Risk Assessment and Mitigation plans include mitigation activities associated with increasing risks of major storms that could damage the Con Edison system and impact customers. Con Edison's comprehensive set of resiliency programs, including the Selective Undergrounding program, are designed to increase the ability of the electric system to withstand the impacts of climate change, including the increasing risk of storms, and limit potential impacts to customers. The Selective Undergrounding program mitigates the risk of increased network outages from climate change, while also mitigating risks to customers on the non-network system by mitigating risks of damage to overhead circuits vulnerable to impacts of wind, wind-blown debris, downed trees, and ice under climate change projections that include forecasts of more frequent and more intense storms.

2. Supplemental Information

Alternatives

Alternative 1

Aggressive vegetation management has historically been and will continue to be the first line of defense against storm related outages in areas served by overhead distribution. However, since the intensity of storms is increasing due to climate change, further enhanced vegetation management would require removal of more hazardous trees and further expansions of the clearance zones (beyond the current right-of-way). It is also unlikely to be sufficient to address other causes for outage.

Alternative 2

A second alternative is to continue hardening the overhead system. Installation of stronger poles and aerial cables to higher construction standards can help the system withstand higher wind speeds and potentially some number of tree limb caused outages. However, the risk of outage from weather exposure is not eliminated, only reduced.

As this program is "selective" in nature, it is intended to identify specific spurs or spur segments which are optimal recipients of undergrounding. This program will rank spurs by performance and by customer attributes. Spurs with lower ranking targets may be hardened in the intermediate years prior to eventually being undergrounded.

Alternative 3

Underground the entire Con Edison overhead system. This would mitigate a substantial portion of the weather and climate related risks. This blanket undergrounding approach, however, will be very costly in terms of the physical work to be done and time needed to carry out. The undergrounding of the entire system will improve overall system resiliency and reliability but will be amongst the most intrusive and expensive options to address the risks faced.

Non-Financial Benefits

One benefit Con Edison expects from undergrounding spur lines is a reduction in the number of outages that occur on overhead lines due to weather exposure, trees, wind, and ice. An additional benefit is that this reduction in outages allows for the restoration crews who normally would be tasked with restoring these spur lines to work to restore other parts of the system.

As a result of undergrounding, Con Edison's customers will see fewer outages. For every outage that is eliminated by undergrounding, the system will experience a reduction in instances of high fault current going through it, reduce the stresses put on the cable connections and splice joints, and fewer operations on breakers, switches, and reclosers, all potentially leading to longer equipment life.

The overall restoration post major event will be shorter – the exact duration reduction of the restoration will depend on the path and damage of the storm. However, undergrounding spurs will prevent outages from happening on the undergrounded portions of the system. There is a benefit in returning the system back to normal operating conditions and power restoration to the Con Edison service territory faster. Public safety will be enhanced by the Con Edison undergrounding program. Burying wires reduces the chances of downed conductors and the public safety issues they cause. Further, by reducing the number of potentially downed wires, the need for wire-guards would decrease as well, which could potentially further reduce storm restoration costs associated with contract wire-guards, and free up Con Edison wire guard personnel to take on other restoration duties that can better serve the community or directly affect the restoration process.

Customer resiliency to the impacts of climate change should increase as a result of the undergrounding program. There will be fewer outage incidents, and overall shorter outage durations, which should help customers cope with extreme weather events both during the event and while recovering afterward.

Summary of Financial Benefits and Costs

1. Cost-benefit analysis

Con Edison's undergrounding initiative bolsters system resiliency and customer service by moving spur lines below ground. This is intended to reduce weather-induced outages, optimize restoration team deployment, and prolong equipment lifespan by lessening electrical system stress. Enhanced safety is another benefit, as it reduces the risks associated with downed power lines. This is increasingly vital due to climate change, which is expected to intensify storm frequency and severity. The project will convert 70 miles of overhead lines, potentially averting about 15,000 outages annually.

Previous studies indicate that while total grid undergrounding in New York may not be cost-effective, it is most advantageous in high-density, high-risk areas such as those served by Con Edison. By focusing on crucial sections, the cost-effectiveness of undergrounding improves. The program's average cost is approximately $20,000 per affected customer, but this figure can decrease by over 25% when combined with other resiliency measures, such as upgrading aerial cables and installing sectionalizing switches, based on preliminary estimates for the proposed scopes of work. Therefore, selective undergrounding is a key part of a broader strategy to enhance overhead systems and shield them from the escalating effects of climate change, thereby boosting customer service resiliency.

2. Basis for estimate

The estimated cost of placing overhead distribution circuits underground is $4 million per mile, beginning in 2025, and is based on undergrounding pilots conducted in 2022. This estimated cost per mile is based on the actual cost of the two undergrounding pilots conducted in 2022 and the estimated cost of six in-flight projects. This average cost per circuit mile is assumed to escalate with annual inflation (3%).

Based on this estimated cost per mile and the Company's annual targeted undergrounding miles, the cost of funding these resiliency improvements for 2025-2029 are:

	2025*	2026	2027	2028	2029
Estimated cost/mile ($000)	$4,393	$4,524	$4,660	$4,800	$4,944
Targeted miles/year	8.0	11.1	15.0	20.8	20.8
Total estimated costs ($000)	$35,000	$50,000	$70,000	$100,000	$103,000
Rate Case Funding ($000)	$25,000	$0	$0	$0	$0
Resiliency Filing Funding ($000)	$10,000	$50,000	$70,000	$100,000	$103,000

*Total estimated miles to be undergrounded in 2025 is 8.0 miles, with 2.3 miles funded through the resiliency filing.

The average cost per mile in the estimate above is based on recent/planned undergrounding projects:

Status	Project Name	Trench Foot total	Cost($Mil)	$/trenchfoot	$/mile
COMPLETED	Westchester-Yorktown14U2	3700	2.1	$ 568	$ 2,999,040
	Queens-JuniperValley	3400	2.73	$ 803	$ 4,239,840
IN-FLIGHT	StatenIsland-HighviewAve	3400	3	$ 882	$ 4,656,960
	Westchester-Cortlandt73U1	23596	14.9	$ 631	$ 3,331,680
	Westchester-Greenburgh106U2	16013	10.4	$ 649	$ 3,426,720
	Brooklyn-Feeder3028	7399	6.9	$ 933	$ 4,926,240
	Queens-JuniperValleyPhase2	5620	7.9	$ 1,406	$ 7,423,680
	StatenIsland-33R27/30	5900	6.2	$ 1,051	$ 5,549,280
IN-FLIGHT	StatenIsland-VictoryBlvd/TravisAve	N/A(inexistingconduit)	2.2	N/A	n/a

Total costs (for jobs with Trench Foot amounts)	$	54.13	Million
Total Trench Feet		69,028	feet
Cost / Trench Foot	$	784.17	$/trenchfoot
Blended Cost / Mile	**$**	**4,140,442**	**$/mile**

Project Risks and Mitigation Plan

Risk 1 - Lack of customer engagement
The most substantial risk is related to customers withholding necessary easements needed for project completion. This can add considerable time to the project schedule and require potential reworking or redesign of a portion of the project, which can further exacerbate the schedule impact.

Risk 1 Mitigation plan
This risk can be mitigated through a variety of efforts, but most important is that this program become a core component of Con Edison's long-term strategy and therefore be driven internally by a dedicated team across engineering, customer communications, legal, regulatory, strategy, and marketing. All functions must work in concert to de-risk potential roadblocks to a project efficiently progressing from feasibility analysis through construction. Second, Con Edison has, and will continue to make, use of lessons learned from peer utility undergrounding programs as it relates to design, customer planning, and execution strategies. Third, detailed tracking of project progression over time (including lessons learned from the pilots) will be critical to maintain cost accuracy over the 10+ years of this anticipated program.

Considering the impact that undergrounding may have upon customers in terms of trenching, excavation, changing of tap line connections etc., customer's willingness to participate is critical. If customers do not provide approval, a project may fail. As such, customer outreach and proper sequencing of outreach is critical. Depending on the specific portion of the service territory, Con Edison will need to establish clear and consistent channels to communicate the benefits of this program through the appropriate municipalities as well as individually with customers. Conducting this outreach early in the process will provide the opportunity to alleviate any customer concerns or assess whether a certain project is not feasible before meaningful time and capital is expended.

Risk 2 - Inability to achieve scale and standardization

The second substantial risk to the program is not being able to execute the engineering and/ or construction at the planned scale, relying on existing resources as currently organized. This could have additional consequences in terms of standardization of design and equipment used, or in the construction methods and techniques used. Without engineering and construction resources scaled to scope, there will be risks to current construction costs, future repair, and maintenance costs (due to

potential lack of standardization in engineering, design, and construction). This could significantly alter the project costs.

Risk 2 Mitigation plan

This risk can be mitigated by deploying a dedicated team, like the mitigation plan for Risk 1. This dedicated team would be scaled to scope and bring about a specific set of knowledge drawn from peer utility undergrounding programs and previous projects completed at Con Edison.

Technical Evaluation / Analysis

Con Edison developed a quantitative model (OHPOT) and the qualitative justification for this program. This analysis reflects a combination of environmental, demographic, and system performance data to determine spur rankings for undergrounding. The investigation calculates the implied improvement of total system restoration from previous storms (such as Isaias). This analysis is flexible such that it can be updated over time with tree density / hazard tree data, socio-economic data, and major storm restoration performance. The focus of this analysis and justification was on improving system resilience which is quantitatively reflected by customer minutes of interruption (CMI) following major events and the customer experience.

Project Relationships (if applicable)

To maximize benefit, this program should be incorporated with existing hardening and resiliency capital programs and customer engagement initiatives. The undergrounding program will entail involvement and leadership from a broad cross section of the Company, from engineering to customer outreach to regulatory and legal. Establishing a dedicated team within Con Edison to spearhead this program may be desired.

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	**–**	**–**	**–**	**–**	**–**	**–**
Capital	**$70**	**$14**	**$3,743**	**$1,486**	**$14,200**	**$25,000**

2025-2029 Request:

Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	**–**	**–**	**–**	**–**	**–**
Capital (Total)	**$10,000**	**$50,000**	**$70,000**	**$100,000**	**$103,000**
Labor	$4,296	$21,480	$30,073	$42,961	$44,250
M&S	$626	$3,128	$4,380	$6,257	$6,444
Contract Svcs.	$2,007	$10,037	$14,052	$20,074	$20,676
Other	$53	$266	$373	$533	$549
Overheads	$3,018	$15,088	$21,123	$30,176	$31,081

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	**–**	**–**	**–**
Capital	**$563,500**	**$653,100**	**$757,100**

Basis for funding direction:	Annual inflation-related increases estimated (3%)	Annual inflation-related increases estimated (3%)	Annual inflation-related increases estimated (3%)

Non-Network Resiliency Program

Electric Operations / DE

1. Project / Program Summary

Type: ☐ **Project** ☒ **Program**	**Category:** ☒ **Capital** ☐ **O&M**
Work Plan Category: ☐ **Regulatory Mandated** ☒ **Operationally Required** ☐ **Strategic**	
Project/Program Title: Non-Network Resiliency Program	
Project/Program Manager: Frantz Phar	**Project/Program Number (Level 1):** 27207976, 27208001, 27208000, 27207998, 27207999
Status: ☐ **Initiation/Planning** ☐ **In-Progress (Projects Only)** ☒ **On-going (Programs Only)**	
Estimated Start Date: Ongoing	**Estimated Date In Service:** Ongoing
2025-2029 Funding Request ($000) **Capital: $60,600** **O&M: –**	

Work Description:

The overhead distribution system is comprised of non-network circuits, including primarily 4kV primary grids and 4kV, 13kV, and 27kV auto loops, and 33 kV circuits. The Climate Change Vulnerability Study concluded that Con Edison's overhead distribution system is primarily vulnerable to wind and ice, with additional vulnerabilities from increased frequency and intensity of storms and from heat. Increased temperatures can lead to line sag, presenting safety concerns in areas with vegetation clearance limitations. The overhead distribution system is also at risk of damage from high winds, wind-blown debris, downed trees, and ice during storms. Over the past two decades, New York has experienced multiple significant storm events – both hurricanes and nor'easters – that brought high winds which downed trees and overhead facilities, resulting in widespread power outages. Climate science projects that such storms will become both more frequent and more intense.

The Company follows two primary approaches to strengthening the non-network system: (1) addressing primary reliability, which involves replacing overhead and underground feeder cables which connect the distribution system to the substations, (2) replacing portions of the open wire system and failure prone aerial cable. The specific investment options included under the Non-Network Resiliency program to accomplish these goals include:

- **Improving Source Reliability** – The non-network system is supplied by a combination of underground and aerial feeder cable systems. In areas where poor performing vintages of aerial and underground cable (PILC, Okonite etc.) leave our customers vulnerable to outages, we will proactively replace the cable with more reliable alternatives. We will also introduce a second primary source to 4kV Unit Substations and install Automatic Transfer Switches (ATSs).
- **Replacing Open Wire Conductors –** Replace portions of the open wire system, particularly long spans (greater than 1000') with no load and single-phase with aerial and/or spacer cable. Replace sections of failure prone cables on Staten Island's 33kV system.

The Non-Network Resiliency program is part of the comprehensive set of strategies included in Con Edison's Climate Vulnerability and Resiliency Plan (the Plan) to address the vulnerabilities of the electric system to the impacts of climate change – from heat/temperature variable, flooding (caused by sea-level rise, storm surges or heavy precipitation), or extreme events (such as hurricanes, nor'easters, or heat waves) – identified in the Climate Change Vulnerabilities Study (CCVS or the Study). These

strategies were developed by following Con Edison's Resilience Management Framework to identify investments that enable Con Edison to (1) better withstand changes in climate (by avoiding outages), (2) absorb impacts from outage-inducing events (by limiting the number of customers impacted or improving the customers' ability to cope with the outage), and (3) recover quickly (by restoring service more quickly).

The investments in the overhead distribution system under the Non-Network Resiliency Program are focused on hardening this system to increase the system's ability to withstand the impacts of storms, including projections of more frequent and more intense storms driven by climate change. Work under this program is prioritized within each operating area, with priorities based on a combination of the use of the Overhead Program Optimization Tool (OHPOT) and in-depth engineering analysis of individual circuits to identify and ranking potential circuits for hardening by ranking the feeders based on statistics and historical information about the feeder. The statistics provided by OHPOT are primarily based on the Outage History (PSC Outage Database) and consist of the number of outage events for the feeder, and customers impacted. Additional information that is provided which can help determine the appropriate solution includes the available fault current, the length of the segment and links to feeder prints. In late 2021, Environmental Justice (EJ) metrics were added as an input. OHPOT ranks feeders for investment based on these statistics, then these rankings are evaluated and adjusted by additional engineering analysis, as needed.

The number of circuits initially identified for resiliency enhancements under this program and by region, are summarized below. Each region evaluates capital work priorities annually and creates specific work plans accordingly.

Region	Number of Loops or Circuits In Scope for Aerial Cable Installation	Length of Open Wire Cable to be Replaced with Aerial Cable	Number of ATS Installations In Scope
Brooklyn/Queens	18 (27 kV autoloops)	32.2 miles	0
Bronx/Westchester	66 (13 kV autoloops)	57.8 miles	30 - 40
Staten Island	11 (33kV circuits)	13.3 miles	0
Totals	90 circuits	103.3 miles	30 - 40

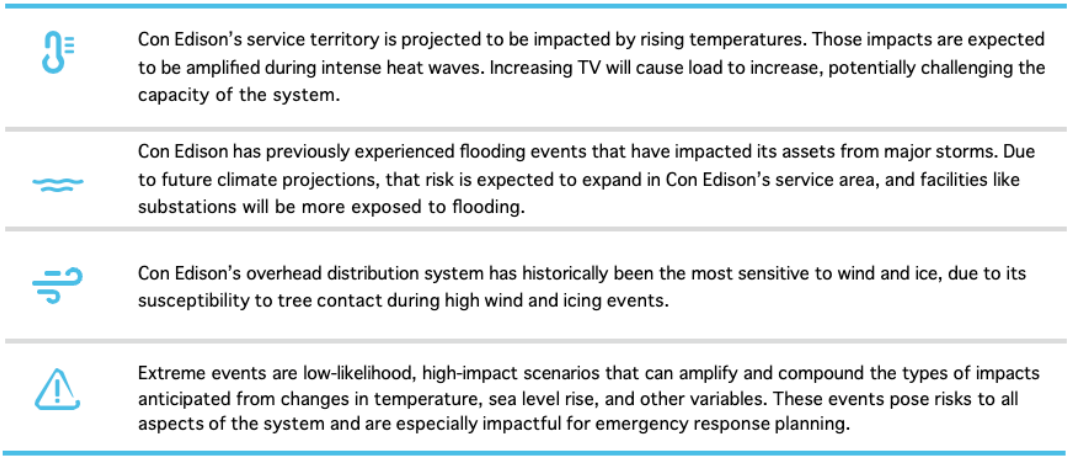
On average, the resiliency-related program work targeted for completion annually, by region, varies from year-to-year. The *average* number of miles targeted annually is below. These annual plans will be re-evaluated each year and may be adjusted due to system conditions; however, all work in scope is projected to be completed within 20 years. Bronx/Westchester plans to install two Automatic Transfer Switches in 2025 and to ramp up to installation of five switches in 2029, with all ATSs within ten years.

Region	*Average* Length of Aerial Cable to be Installed Annually (Miles)	*Average* Number of Automatic Transfer Switches to be Installed Annually
Brooklyn/Queens	1.6 miles	–
Bronx/Westchester	2.9 miles	2-5
Staten Island	0.7 miles	–

Justification Summary:
Following Superstorm Sandy, Con Edison worked with a Storm Hardening and Resiliency Collaborative to recommend storm hardening investments and one of the recommendations was to conduct a Climate Change Vulnerability Study (CCVS or the Study). The initial Climate Change Vulnerability Study was conducted in 2019 and was updated in 2023. The approach followed a multi-step process that cycled through the steps for each potential climate hazard, incorporating feedback from stakeholders throughout the evaluations. The Study used the best available science to evaluate the sensitivity of Con Edison's electric system to projections of potential climate hazards including:

- **Temperature and humidity** – from heat and coincident high heat and humidity (known as temperature variable or "TV")
- **Flooding** – coastal flooding from sea level rise and/or inland flooding from precipitation
- **Wind and ice**
- **Extreme and coincident weather events** – hurricanes/wind, extreme heat waves, nor'easters/cold snaps, and multiple concurrent or consecutive extreme events

The hazards that the Study found to pose an elevated risk to Con Edison's assets and operations include heat and humidity, major storms, wind and ice, and extreme events.



Specific projections of future climate conditions, referred to as pathways (Pathways) were incorporated into the Company's forecasting and planning processes – including load forecasting, load relief planning, reliability planning for the sub-transmission and distribution systems, asset management planning, facility energy system planning, planning for emergency preparation and response, and worker safety – through the development of a new Climate Change Planning and Design Guideline document (Guidelines). This document specifies the methodologies to be used to evaluate the vulnerability of electric facilities to projected climate changes and establishes specific design standards to be met for each climate hazard over the useful life of the asset.

The primary vulnerability of the overhead non-network system identified by the Study is risk to system failures resulting from increases in wind and ice, with additional vulnerability from extreme storms, and heat also identified. For all of these climate-driven hazards, the common failure mode is contact – conductors, poles, or other overhead equipment – with vegetation, wind-blown debris, nearby structures, or the ground.

The Con Edison Climate Change Vulnerability Studies project increases in average and maximum air temperatures throughout the century relative to historical conditions, with the 2023 Study projecting that temperatures will increase faster than projected in the 2019 Study. By all measures evaluated in the Studies – maximum daily temperature, number of days per year in which maximum temperature exceeds 95°F, and number of days per year the daily average temperature exceeds 86°F – climate-related increases in heat are projected to occur roughly a decade faster than projected in the first Study.

Variable	Study	Baseline	2030	2040	2050	2080
Highest annual maximum daily temperature	Current Study	97°F	103°F	104°F	106°F	112°F
	2019 CCVS	97°F	101°F	103°F	104°F	108°F
The number of days per year in which maximum temperatures exceed 95°F	Current Study	4 days	17 days	27 days	32 days	69 days
	2019 CCVS	4 days	11 days	18 days	23 days	47 days
The number of days per year in which daily average temperatures exceed 86°F	Current Study	3 days	16 days	22 days	31 days	68 days
	2019 CCVS	3 days	11 days	16 days	21 days	45 days

High temperatures can cause overhead distribution lines to experience sagging and loss of material strength. Line sagging reduces the clearance between overhead assets and surrounding vegetation, which can increase the potential for contact with vegetation, leading to asset failure and safety risks. Derating lines helps mitigate the risk of line sag but could necessitate adding capacity to meet demand.

Wind and ice have historically been difficult to model due to their highly localized nature. To inform this Study, Con Edison sought the best available information by acquiring an additional dataset from MIT, which covers the Northeast, and provides insight into future wind speeds and radial icing potential. This data and other studies demonstrate that wind speeds will likely increase, and the risk of ice accumulation on wires (radial icing) will remain. The dataset developed by MIT covers the Northeast and shows the 2025-2041 projected and baseline observed annual maximum and average wind speeds at Central Park, JFK, and LaGuardia.

	Central Park		JFK		LaGuardia	
Wind Speed	1-min Baseline	MIT Projection	1-min Baseline	MIT Projection	1-min Baseline	MIT Projection
Annual maximum (mph)	51.0	60.2	46.1	57.5	55.0	62.4
Annual mean (mph)	14.0	17.6	18.1	19.2	20.1	18.5

Extreme storms such as hurricanes can cause wind speeds to increase far beyond typical average speeds. Wind speeds of the most intense hurricanes are projected to increase. Freezing rain frequency and radial icing are also projected to increase, although the magnitude of the trend remains highly uncertain due to the specific atmospheric conditions required for ice storms to occur.

Con Edison's service area experiences a range of precipitation types, including rainfall and frozen precipitation (i.e., snow, sleet, and freezing rain). The region has experienced several tropical cyclones producing heavy precipitation over the last century. For example, in 2011, Hurricane Irene produced up to 12 inches of rain in the service area, with nearly 7 inches in Central Park. More recently, remnants of Hurricane Ida in 2021 brought over 7 inches of rain to Central Park. Alternatively, nor'easters have brought some of the heaviest snowfall on record to New York City, along with freezing rain; the January 2021 nor'easter accumulated up to 2 feet of snow in New York City.

Climate change is projected to drive heavier precipitation events because a warmer atmosphere holds more water vapor and provides more energy for storms, among other factors. Looking forward, projections show climate change could drive stronger and more frequent storms in the region, bringing heavy precipitation, wind, and storm surge. Tropical cyclone rainfall totals are projected to increase by approximately 10%-15% in the North Atlantic basin by the late 21st century. In addition, extratropical cyclones could become 5%-25% more wet in the future relative to present day. In contrast, climate change could reduce the frequency of snowfall and other frozen precipitation in future decades. Projections in the Study show that heavy precipitation in the service area could increase throughout the century relative to the baseline.

Variable	Study	Baseline	2030	2040	2050	2080
Annual days with precipitation exceeding 2 inches	Current Study	3 days	4 days	4 days	5 days	6 days
	2019 CCVS	3 days	4 days	4 days	4 days	5 days

These potential changes in wind, precipitation, and ice present an especially large risk to overhead distribution equipment. Overhead distribution assets, including conductors, attachments, and cross-arms, are built to withstand defined design tolerances for combined ice and wind loading, but they are frequently adjacent to neighboring vegetation that may be downed during these events. Fallen vegetation and wind-blown debris can come into contact with lines and cause them to disconnect, fall, or even lead to pole collapse, especially older poles or those with existing damage. This can result in asset failure, leading to outages and incurring restoration costs.

When choosing resilience strategies to address identified climate vulnerabilities, Con Edison follows a resilience framework that encompasses investments that:

- Prevent climate change impacts by hardening infrastructure
- Mitigate the impacts from outage-inducing events by minimizing disruptions
- Respond rapidly to disruptions by reducing recovery times and costs

The investments made in the overhead distribution system under this program proactively increase Con Edison's resiliency. Replacing open wire cables with Aerial cable "hardens" the overhead system by eliminating current vulnerabilities to failures due to heat, wind, ice, and storms, reducing the risk of outages. Previous post-storm reviews of the overhead distribution system have shown that Aerial cable is more reliable than open wire conductors. The investments made in the overhead distribution system under this program proactively increase Con Edison's resiliency in three of these areas.

Adding a second primary source in 4kV grids by installing Automatic Transfer Switches (ATS) limits the number of customers that are impacted by outage events that do occur, mitigating the impacts of outage-inducing events.

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

Impact on Disadvantaged Communities

The resilience strategies included in Con Edison's Resiliency Plan have been chosen in alignment with our Resiliency Framework that provides guidance for developing a comprehensive set of adaptation strategies to mitigate future climate change risks. This comprehensive set of strategies incudes investments that enable Con Edison's electric system to prevent climate change impacts by hardening infrastructure, mitigate the impacts from outage-inducing events by minimizing disruptions to customers, and respond rapidly to disruptions by reducing recovery times and costs.

While the programs included in the Plan are largely focused on withstanding climate changes and avoiding outages, most programs also enable Con Edison to limit outage impacts on customers (i.e., absorb outage impacts), and restore service more quickly than would otherwise have been possible (i.e., recover quickly). Many of the investments proposed to strengthen Con Edison's ability to withstand extreme climate conditions will also, naturally, reduce the risk of outages during "blue sky" conditions.

Disadvantaged communities (DACs) have fewer alternatives during energy system outages and will be more at risk from climate change. Because of this lack of alternatives, resilient and reliable energy service is an important priority for the communities and for Con Edison. Due to the size of Con Edison's electric system and the population density in the City, almost half of Con Edison's system serves at least one DAC. The Company has committed to tracking investments that benefit DACs specifically and to measuring and monitoring system performance in DACs and non-DACs. This

tracking process will provide data and allow the Company to evaluate the benefits its investments to customers in DACs and revise its investment approach if needed.

The Company has also formed an Environmental Justice Working Group under an executive committee and plans to release a finalized Environmental Justice Policy Statement in 2023 to apply an equity lens to resilience-driven investments. Key components of the upcoming policy statement include:

- Operations will not disproportionately burden DACs.
- Con Edison will work to understand DAC concerns.
- Clean energy investments will benefit DACs.
- Con Edison will provide opportunities for employment in the clean energy future.

These equity considerations will help inform resilience plan investments moving forward.

Impact on Greenhouse Gas (GHG) Emissions

The primary goals of the programs and projects included in the Climate Vulnerability and Resiliency Plan, including the Non-Network Resiliency program, are to withstand, absorb, or recover from the impacts of future climate changes on Con Edison's electric system. While none of the programs are focused on reducing GHG emissions, some of the programs could have small but positive impacts on Con Edison's overall GHG emissions, and none of the programs should negatively impact Con Edison's overall GHG emissions.

All of the programs that prevent or reduce the number of "truck rolls" required to assess, operate, or restore the electric system (i.e., the number of physical trips made by operators, technicians, and other field personnel to physical field locations) will reduce Con Edison's overall GHG emissions by reducing vehicle emissions associated with each field trip prevented. The Non-Network Resiliency Program reduces the need for field visits by eliminating outages through system hardening and by eliminating the extent of outages, i.e., the number of circuits forced out and the number of customers impacted by individual failures. Actual program reductions in GHG emissions from reductions in physical trips to the field depend on the number of trips avoided, the miles driven per trip, the type of vehicle, the type of fuel burned, and the condition of the vehicle.

Impact on Clean Energy Commitment

The Non-Network Resiliency Program supports Initiative 2 under Pillar 1 of the Clean Energy Commitment, Build the Grid of the Future.

Impact on 5-year and long-range plans (10-year)

This resilience program aligns with and supports Con Edison's integrated strategy, included in the January 2022 Long-Range Plan, focused on four strategic objectives related to Clean Energy, Climate Resilience, Core Service, and Customer Engagement. Con Edison's Climate Resilience strategic objective aims to increase the resilience of the energy infrastructure to adapt to climate change. Furthermore, Con Edison sees the role of utilities as changing from providing, "Universal access to energy that is safe and reliable" to providing, "Universal access to energy that is safe, reliable, and *resilient* (able to prevent, mitigate, and recover from events.)" (emphasis added)

The Non-Network Resiliency Program provides resilient energy delivery by accelerating investments in reliability to increase the ability of the overhead distribution system to withstand increases in climate-driven changes in weather events.

Impact on Company Risk Mitigation Activity

Resiliency, in simple terms, can be defined as having the capacity to withstand or to recover quickly from difficulties. Con Edison's Resilience Framework definition of resilience is similar - the Framework

identifies resilience strategies as investments that enable Con Edison to withstand changes in climate and avoid outages, absorb impacts from outage-inducing events by limiting the number of customers impacted or improving the customers' ability to cope with outages, recover quickly, and advance to a better state. Both equate resilience with the avoidance or limitation of difficulties or negative consequences – i.e., with the mitigation of risk.

The 2022 Electric Operations Risk Assessment and Mitigation plans include mitigation activities associated with increasing risks of major storms that could damage the Con Edison system and impact customers. Con Edison's comprehensive set of resiliency programs are designed to increase the ability of the electric system to withstand the impacts of climate change, including the increasing risk of storms, and limit potential impacts to customers. The Non-Network Resiliency Program mitigates the risk of increased outages on the overhead, non-network system from climate change, customers by hardening the overhead distribution system and by limiting the number of customers impacted by network failures and enabling faster network restoration.

2. Supplemental Information

Alternatives
The alternative to making the investments in the overhead distribution system proposed in the Non-Network Resiliency Program, is to choose not to proactively harden Con Edison's overhead distribution system for projected climate changes. This alternative does not meet the requirements of the Act to develop "… dedicated storm hardening programs … to reduce damage and costs from future weather events, as well as facilitate prompt restoration times."

Risk of No Action
The Climate Change Vulnerability Study concluded that Con Edison's overhead distribution system is vulnerable to risk of damages from extreme weather events like those that have been experienced in recent history. Modeling performed by climate science experts with input from Con Edison subject matter experts determined that the electric system is most vulnerable to climate-induced changes in temperature/humidity and sea level rise. The Study also confirmed that a growing body of scientific evidence supports the conclusions that projected climate changes project these extreme storm events to be likely to increase in frequency and intensity in the future. Numerous evaluations following actual events have also revealed that the increased frequency of these types of events tends to erode people's ability to cope with and recover from the impacts and that disadvantaged communities are the least able to recover.

Without the proposed resiliency investments in the non-network system, Con Edison's customers remain more vulnerable to both the short-term risks (of electrical outages) and long-term risks of not recovering from the effects of climate change.

Non-Financial Benefits
The improvements made in the overhead distribution system under this program proactively increase Con Edison's resiliency by reducing outages, limiting the number of customers impacted by customers, and facilitating faster system recovery.

Replacing feeder cables and open wire cables "hardens" the overhead system by eliminating current vulnerabilities to failures due to both heat and storms, reducing the risk of outages. Other program investments – e.g., reconfiguration of autoloops, spurs, and 4kV feeders, the addition of supply feeders to URD developments with Automatic Transfer Switches (ATS) – limit the number of customers that are impacted by outage events, and still other investments facilitate quicker system recovery – including, installation of breakaway service connectors, reconfiguration of 13kV autoloops, and relocation of 33kV feeders installed in Staten Island Railroad rights-of-way.

Summary of Financial Benefits and Costs

1. Cost-benefit analysis

A projected increase in severe storm frequency (5–20% per 1°C warming) and intensity (2-5%) due to climate change is expected to magnify, and considerably impact the resilience of Con Edison's overhead distribution system. The system faces multiple threats due to shifting weather patterns. strong winds heighten the risk of conductors contacting vegetation or debris. Moreover, extended periods of extreme heat can lead to sagging in overhead distribution conductors, impacting older cable vintages' performance. Additionally, heavy rains can loosen soil, resulting in uprooted trees that interfere with conductors.

Con Edison is expecting a significant rise in storm-related conditions that would result in damage to the thousands of miles of overhead cable annually, resulting in customer outages. To combat this, the replacement of 103.5 miles of overhead conductors with robust high-strength aerial cables is projected to prevent around 10,000 customer outages each year based on historical performance of targeted circuits. The investment in the aerial cable upgrades, as part of the non-network resiliency program, is estimated to cost on average about $4,800 per affected customer, based on preliminary estimates for the proposed scope of work. Furthermore, approximately 58% of non-network customers connect to the 4kV system, which is similarly susceptible to storm-related climate impacts. To enhance this system's resiliency, particularly in the Bronx and Westchester areas, the installation of 30-40 Automatic Transfer Switches (ATS), including a new 4-Way ATS switch, is planned. These upgrades will improve resiliency for half of the overhead customers, mitigating the risk of outages or blackouts in 4kV grids.

2. Basis for estimate

The estimated annual cost of upgrading the candidate non-network circuits to install Aerial cable and Automatic Transfer Switches, by region, is below. Annual inflationary cost increases of 3% are assumed.

Cost of installing Aerial Cable	Cost/mile (2023 $000)	Miles Installed 2025-2029	2025 Miles	2026 Miles	2027 Miles	2028 Miles	2029 Miles	2025-2029	2025	2026	2027	2028	2029
Brooklyn/Queens	$ 2,600	5.6	0.7	1.0	1.2	1.2	1.5		$ 1,931	$ 2,841	$ 3,512	$ 3,617	$ 4,657
Bronx/Westchester	$ 986	17.0	2.5	3.0	4.0	4.5	3.0		$ 2,616	$ 3,233	$ 4,440	$ 5,145	$ 3,533
Staten Island	$ 2,335	5.0	1.0	1.0	1.0	1.0	1.0		$ 2,477	$ 2,551	$ 2,628	$ 2,706	$ 2,788
		27.6	4.2	5.0	6.2	6.7	5.5	$ 48,675	$ 7,024	$ 8,625	$ 10,580	$ 11,469	$ 10,978
Cost of installing ATS	Cost/ATS (2023 $000)	ATS Installations 2025-2029	2025 ATSs	2026 ATSs	2027 ATSs	2028 ATSs	2029 ATSs						
Bronx/Westchester	$ 687	14	2	2	2	3	5	$ 11,003	$ 1,459	$ 1,502	$ 1,547	$ 2,391	$ 4,104
	TOTAL ESTIMATED COST							$ 59,677	$ 8,482	$ 10,128	$ 12,127	$ 13,859	$ 15,081

Project Risks and Mitigation Plan

Risk 1 – Equipment Availability

In past years, equipment availability has been challenged. The work proposed under this program would be impacted by equipment manufacturing shortages or delivery issues.

Risk 1 Mitigation Plan

We continue to work with manufacturers, stores, and supply chain to maintain inventory and anticipate requirements prior to project commencement.

Risk 2 – Storms and ICS Deployments

Storms present a risk as contractors used to supplement the field forces for construction may be called to assist in storm impacted regions.

Risk 2 Mitigation Plan

We maintain timely release of layouts and work requests and active management of our projects and resources to allow us to maintain contractors on site.

Technical Evaluation / Analysis N/A
Project Relationships (if applicable) N/A

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	–	–	–	–	–	–
Capital	–	–	–	–	–	–

2025-2029 Request:

Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	–	–	–	–	–
Capital (Total)	**$8,600**	**$10,300**	**$12,100**	**$13,900**	**$15,700**
Labor	$1,256	$1,504	$1,767	$2,029	$2,292
M&S	$2,902	$3,476	$4,083	$4,690	$5,298
Contract Svcs.	$2,449	$2,934	$3,446	$3,959	$4,472
Other	$30	$36	$42	$48	$55
Overheads	$1,963	$2,351	$2,762	$3,173	$3,584

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	–	–	–
Capital	**$78,300**	**$73,400**	**$54,800**
Basis for funding direction:	Similar work scopes with inflationary increases in cost (3%)	Similar work scopes with inflationary increases in cost (3%)	Work scopes ramping down with inflationary increases in cost (3%)

Non-Network Resiliency Cutout Upgrades

Electric Operations / DE

1. Project / Program Summary

Type: ☐ **Project** ☒ **Program**	**Category:** ☒ **Capital** ☐ **O&M**
Work Plan Category: ☐ **Regulatory Mandated** ☒ **Operationally Required** ☐ **Strategic**	
Project/Program Title: Non-Network Resiliency Cutout Upgrades	
Project/Program Manager: Kevin Oehlmann	**Project/Program Number (Level 1):** 27207997, 27208007, 27208008, 27208006
Status: ☐ **Initiation/Planning** ☐ **In-Progress (Projects Only)** ☒ **On-going (Programs Only)**	
Estimated Start Date: Ongoing	**Estimated Date In Service:** Ongoing
2025-2029 Funding Request ($000) **Capital: $ 10,000** **O&M: –**	

Work Description:

The Climate Change Vulnerability Study concluded that Con Edison's overhead distribution system is vulnerable to future increases in heat waves and increased frequency and intensity of storms from climate change. The overhead distribution system is also at risk of damage from high winds, wind-blown debris, downed trees, and ice during storms.

Most of Con Edison's non-network system is comprised of 4 kV primary grids and 4/13/27 kV autoloops. The 4 kV primary grids consist of multiple 4 kV feeders fed from multiple stations connected in parallel to feed customer loads. Autoloops consist of two feeders with multiple reclosers connected via a normally open tie recloser. Typically, if there is a fault on either feeder, the reclosers re-configure such that the two devices closest to the fault open while all others are closed. A typical non-network circuit runs for several miles. Without reclosers that can automatically re-configure the system to isolate a fault, all customers fed through the circuit would lose service from a single event, such as a downed tree during a storm.

The Non-Network Resiliency Cutout Upgrades program increases the resiliency of the distribution system by expanding the deployment of reclosers on the non-network system to limit the extent of the impacts from outage-inducing events on spurs. This program installs automatic, Trip Saver reclosures at locations with less than 6 kA of available fault current and Single Triple Single (STS) reclosers (also automatic and fuse-less) at locations with between 6 kA and 15 kA of available fault current. Traditional cutouts with fuses are more likely to lead to extended outages on a spur during a high wind event than cutouts with Trip Saver reclosers and poles with STS reclosers. After a traditional cutout operates, the fuse needs to be replaced before service can be restored. Reclosers, on the other hand, can be programmed to close and reconnect the circuit for a pre-determined number of operations, automatically shortening the length of time that the circuit is out of service. This capability is most beneficial during storms with high winds that often cause temporary faults due to tree contact and contact between live phase conductors. Expanded deployment of reclosers on spurs will reduce the number of outages caused by these temporary faults and shorten many of the outages that cannot be avoided, as resources are able to focus on those. Additionally, installation of reclosures on non-network circuits facilitate the addition of branch protection technology that enables greater coordination of the devices and reduces the number of customers affected by faults at the end of a radial spur line.

The Non-Network Resiliency Cutout Upgrades program is part of the comprehensive set of strategies included in Con Edison's Climate Vulnerability and Resiliency Plan (the Plan) to address the vulnerabilities of the electric system to the impacts of climate change identified in the 2019 and 2023 Climate Change Vulnerabilities Studies (CCVS, the Study, or the Studies). The Non-Network Resiliency Cutout Upgrades program substantially increases the resiliency of the system to mitigate the impacts of climate-driven outage events and limit the impact to customers, by reducing the number of customers experiencing outages.

Given the potential impacts of projected climate changes on this system, the Company plans to extend recloser capabilities throughout the non-network system. Seventy-seven (77) automatic reclosers have been installed on the non-network system under this program since 2021, and the Company is targeting similar levels of recloser installations annually going forward. The specific work required to install these switches varies by location. In some cases, replacement of cutouts with an STS recloser requires pole replacement. In locations in which TripSavers are installed, crossarms may need to be replaced and new cutouts installed. Each device needs to be programmed and tested by Con Edison technicians before it can be placed in service.

There are over 650 locations where cutouts with fuses are currently installed that have experienced three or more outages since January 1, 2017. Cutout upgrades will be prioritized using Con Edison's Overhead Program Optimization Tool (OHPOT) based on high outage event counts and high customer outage counts. OHPOT is used to support prioritization of the cutout locations that the Company is targeting to upgrade. TripSavers will be installed on circuits with fault currents less than or equal to 6 kA, and reclosers will be installed on circuits with fault currents greater than 6 kA and less than or equal to 15 kA.

Region	Cutouts to be Upgraded*	Estimated Number of TripSavers to be Installed	Estimated Number of Reclosers to be Installed
Brooklyn/Queens	24	4	20
Bronx/Westchester	224	126	98
Staten Island	19	11	8
All Regions	**267**	**141**	**126**

Given the number of devices to be installed, Brooklyn/Queens is projected to have all devices installed at the identified locations by the end of 2027and Staten Island will have all devices installed at the identified locations by the end of 2026. Bronx/Westchester is projected to complete all cutout upgrades at the 224 locations identified by the end of 2031.

Justification Summary:
Following Superstorm Sandy, Con Edison worked with a Storm Hardening and Resiliency Collaborative to recommend storm hardening investments and one of the recommendations was to conduct a Climate Change Vulnerability Study (CCVS or the Study). The initial Climate Change Vulnerability Study was conducted in 2019 and was updated in 2023. The approach followed a multi-step process that cycled through the steps for each potential climate hazard, incorporating feedback from stakeholders throughout the evaluations. The Study used the best available science to evaluate the sensitivity of Con Edison's electric system to projections of potential climate hazards including:

- **Temperature and humidity** – from heat and coincident high heat and humidity (known as temperature variable or "TV")
- **Flooding** – coastal flooding from sea level rise and/or inland flooding from precipitation

- **Wind and ice**
- **Extreme and coincident weather events** – hurricanes/wind, extreme heat waves, nor'easters/cold snaps, and multiple concurrent or consecutive extreme events

The hazards that the Study found to pose an elevated risk to Con Edison's assets and operations include heat and humidity, major storms, wind and ice, and extreme events.

	Con Edison's service territory is projected to be impacted by rising temperatures. Those impacts are expected to be amplified during intense heat waves. Increasing TV will cause load to increase, potentially challenging the capacity of the system.
	Con Edison has previously experienced flooding events that have impacted its assets from major storms. Due to future climate projections, that risk is expected to expand in Con Edison's service area, and facilities like substations will be more exposed to flooding.
	Con Edison's overhead distribution system has historically been the most sensitive to wind and ice, due to its susceptibility to tree contact during high wind and icing events.
	Extreme events are low-likelihood, high-impact scenarios that can amplify and compound the types of impacts anticipated from changes in temperature, sea level rise, and other variables. These events pose risks to all aspects of the system and are especially impactful for emergency response planning.

Specific projections of future climate conditions, referred to as pathways (Pathways) were incorporated into the Company's forecasting and planning processes – including load forecasting, load relief planning, reliability planning for the sub-transmission and distribution systems, asset management planning, facility energy system planning, planning for emergency preparation and response, and worker safety – through the development of a new Climate Change Planning and Design Guideline document (Guidelines). This document specifies the methodologies to be used to evaluate the vulnerability of electric facilities to projected climate changes and establishes specific design standards to be met for each climate hazard over the useful life of the asset.

The primary vulnerability of the overhead non-network system identified by the Study is risk to system failures resulting from increases in wind and ice, with additional vulnerability from extreme storms, and heat also identified. For all of these climate-driven hazards, the common failure mode is contact – conductors, poles, or other overhead equipment – with vegetation, wind-blown debris, nearby structures, or the ground.

The Con Edison Climate Change Vulnerability Studies project increases in average and maximum air temperatures throughout the century relative to historical conditions, with the 2023 Study projecting that temperatures will increase faster than projected in the 2019 Study. By all measures evaluated in the Studies – maximum daily temperature, number of days per year in which maximum temperature exceeds 95°F, and number of days per year the daily average temperature exceeds 86°F – climate-related increases in heat are projected to occur roughly a decade faster than projected in the first Study.

Variable	Study	Baseline	2030	2040	2050	2080
Highest annual maximum daily temperature	Current Study	97°F	103°F	104°F	106°F	112°F
	2019 CCVS	97°F	101°F	103°F	104°F	108°F
The number of days per year in which maximum temperatures exceed 95°F	Current Study	4 days	17 days	27 days	32 days	69 days
	2019 CCVS	4 days	11 days	18 days	23 days	47 days
The number of days per year in which daily average temperatures exceed 86°F	Current Study	3 days	16 days	22 days	31 days	68 days
	2019 CCVS	3 days	11 days	16 days	21 days	45 days

High temperatures can cause overhead distribution lines to experience sagging and loss of material strength. Line sagging reduces the clearance between overhead assets and surrounding vegetation, which can increase the potential for contact with vegetation, leading to asset failure and safety risks. Derating lines helps mitigate the risk of line sag but could necessitate adding capacity to meet demand.

Wind and ice have historically been difficult to model due to their highly localized nature. To inform this Study, Con Edison sought the best available information by acquiring an additional dataset from MIT, which covers the Northeast, and provides insight into future wind speeds and radial icing potential. This data and other studies demonstrate that wind speeds will likely increase, and the risk of ice accumulation on wires (radial icing) will remain. The dataset developed by MIT covers the Northeast and shows the 2025-2041 projected and baseline observed annual maximum and average wind speeds at Central Park, JFK, and LaGuardia.

	Central Park		JFK		LaGuardia	
Wind Speed	1-min Baseline	MIT Projection	1-min Baseline	MIT Projection	1-min Baseline	MIT Projection
Annual maximum (mph)	51.0	60.2	46.1	57.5	55.0	62.4
Annual mean (mph)	14.0	17.6	18.1	19.2	20.1	18.5

Extreme storms such as hurricanes can cause wind speeds to increase far beyond typical average speeds. Wind speeds of the most intense hurricanes are projected to increase. Freezing rain frequency and radial icing are also projected to increase, although the magnitude of the trend remains highly uncertain due to the specific atmospheric conditions required for ice storms to occur.

Con Edison's service area experiences a range of precipitation types, including rainfall and frozen precipitation (i.e., snow, sleet, and freezing rain). The region has experienced several tropical cyclones producing heavy precipitation over the last century. For example, in 2011, Hurricane Irene produced up to 12 inches of rain in the service area, with nearly 7 inches in Central Park. More recently, remnants of Hurricane Ida in 2021 brought over 7 inches of rain to Central Park. Alternatively, nor'easters have brought some of the heaviest snowfall on record to New York City, along with freezing rain; the January 2021 nor'easter accumulated up to 2 feet of snow in New York City.

Climate change is projected to drive heavier precipitation events because a warmer atmosphere holds more water vapor and provides more energy for storms, among other factors. Looking forward, projections show climate change could drive stronger and more frequent storms in the region, bringing heavy precipitation, wind, and storm surge. Tropical cyclone rainfall totals are projected to increase by approximately 10%-15% in the North Atlantic basin by the late 21st century. In addition, extratropical cyclones could become 5%-25% more wet in the future relative to present day. In contrast, climate change could reduce the frequency of snowfall and other frozen

precipitation in future decades. Projections in the Study show that heavy precipitation in the service area could increase throughout the century relative to the baseline.

Variable	Study	Baseline	2030	2040	2050	2080
Annual days with precipitation exceeding 2 inches	Current Study	3 days	4 days	4 days	5 days	6 days
	2019 CCVS	3 days	4 days	4 days	4 days	5 days

These potential changes in wind, precipitation, and ice present an especially large risk to overhead distribution equipment. Overhead distribution assets, including conductors, attachments, and cross-arms, are built to withstand defined design tolerances for combined ice and wind loading, but they are frequently adjacent to neighboring vegetation that may be downed during these events. Fallen vegetation and wind-blown debris can come into contact with lines and cause them to disconnect, fall, or even lead to pole collapse, especially older poles or those with existing damage. This can result in asset failure, leading to outages and incurring restoration costs.

When choosing resilience strategies to address identified climate vulnerabilities, Con Edison follows a resilience framework that encompasses investments that:

- Prevent climate change impacts by hardening infrastructure
- Mitigate the impacts from outage-inducing events by minimizing disruptions
- Respond rapidly to disruptions by reducing recovery times and costs

The investments made in the Non-Network Resiliency Cutout Upgrade program mitigate the impacts of outage-causing events on the non-network system and limit the number of customers impacted by climate change by automatically segmenting circuits and isolating faults to reduce the number of customers impacted from a single point of damage on the system. The installation of additional switches with SCADA communications will facilitate quicker system restoration from outages by more quickly identifying the fault in the Outage Management System (OMS) and updating the operator on the state of the system. In addition to the benefit of automatic operation, having additional devices that can be controlled remotely provides greater flexibility for restoring the system when a failure occurs.

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

Impact on Disadvantaged Communities

The resilience strategies included in Con Edison's Resiliency Plan have been chosen in alignment with our Resiliency Framework that provides guidance for developing a comprehensive set of adaptation strategies to mitigate future climate change risks. This comprehensive set of strategies incudes investments that enable Con Edison's electric system to prevent climate change impacts by hardening infrastructure, mitigate the impacts from outage-inducing events by minimizing disruptions to customers, and respond rapidly to disruptions by reducing recovery times and costs.

While the programs included in the Plan are largely focused on withstanding climate changes and avoiding outages, most programs also enable Con Edison to limit outage impacts on customers (i.e., absorb outage impacts), and restore service more quickly than would otherwise have been possible (i.e., recover quickly). Many of the investments proposed to strengthen Con Edison's ability to withstand extreme climate conditions will also, naturally, reduce the risk of outages during "blue sky" conditions.

Disadvantaged communities (DACs) have fewer alternatives during energy system outages and will be more at risk from climate change. Because of this lack of alternatives, resilient and reliable energy

service is an important priority for the communities and for Con Edison. Due to the size of Con Edison's electric system and the population density in the City, almost half of Con Edison's system serves at least one DAC. The Company has committed to tracking investments that benefit DACs specifically and to measuring and monitoring system performance in DACs and non-DACs. This tracking process will provide data and allow the Company to evaluate the benefits its investments to customers in DACs and revise its investment approach if needed.

The Company has also formed an Environmental Justice Working Group under an executive committee and plans to release a finalized Environmental Justice Policy Statement in 2023 to apply an equity lens to resilience-driven investments. Key components of the upcoming policy statement include:

- Operations will not disproportionately burden DACs.
- Con Edison will work to understand DAC concerns.
- Clean energy investments will benefit DACs.
- Con Edison will provide opportunities for employment in the clean energy future.

These equity considerations will help inform resilience plan investments moving forward.

Impact on Greenhouse Gas (GHG) Emissions

The primary goals of the programs and projects included in the Climate Vulnerability and Resiliency Plan, including the Non-Network Resiliency Cutout Upgrade program, are to withstand, absorb, or recover from the impacts of future climate changes on Con Edison's electric system. While none of the programs are focused on reducing GHG emissions, some of the programs could have small but positive impacts on Con Edison's overall GHG emissions, and none of the programs should negatively impact Con Edison's overall GHG emissions.

All of the programs that prevent or reduce the number of "truck rolls" required to assess, operate, or restore the electric system (i.e., the number of physical trips made by operators, technicians, and other field personnel to physical field locations) will reduce Con Edison's overall GHG emissions by reducing vehicle emissions associated with each field trip prevented. The Non-Network Resiliency Cutout Upgrade program reduces the need for field visits by limiting the impacts of temporary faults on spurs and, therefore, eliminating field visits related to system restoration. Actual program reductions in GHG emissions from reductions in physical trips to the field depend on the number of trips avoided, the miles driven per trip, the type of vehicle, the type of fuel burned, and the condition of the vehicle.

Impact on Clean Energy Commitment

The Non-Network Resiliency cutout upgrade program supports Initiative 2 under Pillar 1 of the Clean Energy Commitment, Build the Grid of the Future.

Impact on 5-year and long-range plans (10-year)

This resilience program aligns with and supports Con Edison's integrated strategy, included in the January 2022 Long-Range Plan, focused on four strategic objectives related to Clean Energy, Climate Resilience, Core Service, and Customer Engagement. Con Edison's Climate Resilience strategic objective aims to increase the resilience of the energy infrastructure to adapt to climate change. Furthermore, Con Edison sees the role of utilities as changing from providing, "Universal access to energy that is safe and reliable" to providing, "Universal access to energy that is safe, reliable, and resilient (able to prevent, mitigate, and recover from events.)"

The Non-network Resiliency with Cutout Upgrade program provides capabilities that enable Con Edison to mitigate the impacts of temporary faults through installation of reclosers and reducing the number of customers impacted.

Impact on Company Risk Mitigation Activity
Resiliency, in simple terms, can be defined as having the capacity to withstand or to recover quickly from difficulties. While a bit more complex, Con Edison's Resilience Management Framework definition of resilience is very similar – i.e., the Framework identifies resilience strategies as investments that enable Con Edison to withstand changes in climate and avoid outages, absorb impacts from outage-inducing events by limiting the number of customers impacted or improving the customers' ability to cope with outages, recover quickly, and advance to a better state. Both equate resilience with the avoidance or limitation of difficulties or negative consequences – i.e., with the mitigation of risk.

The 2022 Electric Operations Risk Assessment and Mitigation plans include mitigation activities associated with increasing risks of major storms that could damage the Con Edison system and impact customers. Con Edison's comprehensive set of resiliency programs are designed to increase the ability of the electric system to withstand the impacts of climate change, including the increasing risk of storms, and limit potential impacts to customers. The Non-Network Resiliency cutout upgrade program mitigates the risk of increased non-network outages from climate change, while also mitigating risks to customers fed by the overhead distribution system by reducing outages.

2. Supplemental Information

Alternatives
The only alternative to making the proposed investments in Non-Network Resiliency is to rely on existing fuses that operate due to temporary faults. This alternative does not meet the requirements of the Act to develop "… dedicated storm hardening programs … to reduce damage and costs from future weather events, as well as facilitate prompt restoration times."

Risk of No Action
The Climate Change Vulnerability Study concluded that Con Edison's overhead distribution system is vulnerable to risk of damages from extreme weather events like those that have been experienced in recent history. The Study also confirmed that a growing body of scientific evidence supports the conclusions that projected climate changes project these extreme storm events to be likely to increase in frequency and intensity in the future. Numerous evaluations following actual events have also revealed that the increased frequency of these types of events tends to erode people's ability to cope with and recover from the impacts and that disadvantaged communities are the least able to recover.

Without the proposed resiliency investments in the non-network system, Con Edison's customers remain more vulnerable to both the short-term risks (of electrical outages) and long-term risks of not recovering from the effects of climate change.

Non-Financial Benefits
Installing reclosers on spurs on the non-network system increases the resiliency and reliability of this system by providing capabilities that enable Con Edison to avoid some outages, and restoring the system to normal operations more quickly than would be possible without these investments.

Summary of Financial Benefits and Costs

1. Cost-benefit analysis
Anticipated changes in storm patterns — with increases in frequency by 5–20% per 1°C warming and intensity by 2-5% — pose a significant threat to Con Edison's overhead electric distribution system. This program will invest $10M toward the installation of 141 TripSavers and 126 reclosers across 169 distinct feeders. The projected outcome is a 17% reduction in outage based on historic weather impacts for customers served by these overhead lines, improving the resilience of approximately 328 miles of overhead circuit. This upgrade strategy, focusing on feeders with large customer bases, is expected to avert around

6,000 outages annually, equating to a one-time cost of $1,725 per affected customer based on preliminary estimates for the proposed scope of work, marking it as a cost-effective approach to increase service resiliency for future climate conditions.

2. Basis for estimate

The estimated cost of upgrading fused cutouts to modern automatic, fuse-less cutouts was based on the actual cost of the 77 similar upgrades made under this program to date. The average cost per cutout upgrade, $46,274, was used to estimate the annual program cost at the target level of cutoff upgrades per year.

The average cost per installation to date are below:

Device Type Installed	Number of Devices Installed to Date	Avg Cost by Device Type	Total Costs by Device Type
Recloser	**33**	**$ 82,757**	$ 2,730,990
Tripsaver Recloser	**44**	**$ 9,791**	$ 430,784

Based on the number of cutoff upgrades targeted for completion each year in each region, results in the projected program costs below for 2025 – 2029.

Total All Regions	2025	2026	2027	2028	2029
TripSavers	14	18	22	20	21
Estimated TripSaver Costs	$ 436,245	$ 577,713	$ 727,276	$ 680,995	$ 736,496
STS Reclosers	22	20	18	18	18
Estimated STS Recloser Costs	$ 1,931,538	$ 1,808,622	$ 1,676,593	$ 1,726,891	$ 1,778,697
Total Devices Installed	36	38	40	38	39
Total Estimated Costs	$ 2,367,783	$ 2,386,335	$ 2,403,869	$ 2,407,885	$ 2,515,193

Project Risks and Mitigation Plan

Risk 1 –
Switchgear unavailable due to supply chain issues.

Mitigation plan –
Approve multiple suppliers.
Order material well in advance of expected installation.

Risk 2 –
Manpower required for completion unavailable.

Mitigation plan –
Use Company and contractor workforces.

Technical Evaluation / Analysis
N/A

Project Relationships (if applicable)
N/A

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	–	–	–	–	–	–
Capital	–	–	–	–	–	–

2025-2029 Request:
Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	–	–	–	–	–
Capital (Total)	**$0**	**$2,400**	**$2,500**	**$2,500**	**$2,600**
Labor	$0	$437	$455	$455	$474
M&S	$0	$1,177	$1,226	$1,226	$1,275
Contract Svcs.	$0	$204	$213	$213	$221
Other	$0	$0	$0	$0	$0
Overheads	$0	$581	$605	$605	$630

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	–	–	–
Capital	**$4,900**	**$0**	**$0**
Basis for funding direction:	Projected annual scope plus inflation-related cost increases estimated (3%)		

Critical Facilities Program

Electric Operations / DE

1. Project / Program Summary

Type: ☐ **Project** ☒ **Program**	**Category:** ☒ **Capital** ☐ **O&M**
Work Plan Category: ☐ **Regulatory Mandated** ☒ **Operationally Required** ☐ **Strategic**	
Project/Program Title: Critical Facilities Program	
Project/Program Manager: Frantz St. Phar	**Project/Program Number (Level 1):** 27208051, 27208052, 27208050
Status: ☐ **Initiation/Planning** ☐ **In-Progress (Projects Only)** ☒ **On-going (Programs Only)**	
Estimated Start Date: Ongoing	**Estimated Date In Service:** Ongoing
2025-2029 Funding Request ($000) **Capital: $ 39,000** **O&M: –**	

Work Description:

Critical Facilities (as defined in Con Edison procedure, CPS 4-5-4) include facilities important to our communities' emergency response (e.g., hospitals, police, fire, EMS operations, etc.), facilities housing critical infrastructure (e.g., transportation facilities, water pollution control plants, etc.), facilities providing critical public services (e.g., prisons and correction facilities, shelters/care facilities, etc.), and residential facilities considered more vulnerable (e.g., developments with large elderly populations, nursing homes, high-rises, etc.). The Critical Facilities program enhances the facilities located on or fed via non-network distribution circuits to withstand storms by implementing one or more of the following strategies:

- **Undergrounding of overhead cables and equipment** – While other circuit hardening measures (including those below) can mitigate risks to overhead distribution facilities during storms, undergrounding is the other way to eliminate potential damage from downed trees or large, wind-blown debris.
- **Replacement of open-wire conductors with Aerial Cable** – The non-current carrying steel cable used to suspend the Aerial cable is far stronger and better able to withstand increased impacts from vegetation and wind-blown debris during storms. Additionally, insulated Aerial cables may still operate if downed and provide greater levels of public safety when downed compared to open-wire conductors.
- **Redundancy of supply through the use of SCADA, loop and bypass design** – Installation of additional source feeders to Critical Facilities to allow the facility to be served by SCADA switching schemes and/or automatic switching devices.
- **Configuration for rapid deployment of emergency backup generation** – For Critical Facilities that do not have permanently installed emergency backup generation, pre-configuring distribution circuits for the deployment of auxiliary generation can reduce the time to provide backup generation to emergency loads within the facility.

There are over 2,000 Critical Facilities served by the non-network distribution system currently. These facilities are tracked through the Company's Emergency Operating System (EMOPSYS so that the status of service to these facilities during emergency events is visible, tracked, and prioritized.

Critical Facilities on the Non-Network System		
A	66	Residential with large elderly or vulnerable
D	28	Dialysis centers
E	173	Elevator (residential, 6-11 stories)
H	36	Hospitals
M	201	Major customers
N	98	Nursing homes
O	268	Office of Emergency Management (OEM) - Police Dept., Fire & EMS, Cooling Centers, Emergency Shelters, Military Bases, Government Agencies, Critical Control Structures)
P	0	Prisons and correctional facilities
R	76	Residential buildings (12 stories or greater)
S	654	Schools and colleges
T	73	Transportation Facilities (Tunnels, bridges, airports, ferry terminals, train facilities, fuel transfer/loading, ports)
U	97	Major utility facilities (electric, gas, water, communications,
W	342	Water pollution control plants, pumping stations
	2,112	
Level 1	816	Critical to Public Health and Safety
Level 2	126	Provide significant public services
Level 3	1,170	Provide public services considered somewhat less critical by government agencies
	2,112	

This program began in Bronx/Westchester in 2020 and expanded to Brooklyn/Queens and Staten Island in 2021. To-date, 14 projects have been completed (or are in progress) under this program to strengthen non-network circuits serving 38 Critical Facilities including:

Brooklyn/Queens	Bronx/Westchester	Staten Island
1 school (shelter)	3 Department of Environmental Protection facilities	2 hospitals
22 Life-saving equipment (LSE)/medical hardship	2 NYC Housing Authority (NYCHA) complexes	1 high school (evacuation center)
1 DOE facility	1 dialysis center	1 NYCHA complex
	2 senior centers/nursing homes	1 Staten Island Rapid Transit Traction Supply Substation
	1 home care center	

Most of the projects have been multi-year with most projects taking 2 to 3 years to complete and half of the projects involving more than one Critical Facility. Total program work to-date and average costs are below:

Region	Total Number of Projects	Average Cost per Project	Average Cost per Critical Facility	Average Program Spend per Year
Brooklyn/Queens	4	$1,330,557	$221,759	$1,774,075
Bronx/Westchester	7	$924,782	$719,275	$1,618,369
Staten Island	3	$1,464,330	$878,598	$1,464,330
All Regions	14	$1,156,335	$426,018	$4,047,172

Given the projected climate changes with the potential to impact not only the Company's electric delivery systems but many other critical infrastructure supporting the communities in the service territory, the Company realizes that ensuring that availability of the infrastructure and public services provided by the facilities identified as Critical Facilities will be more important than ever and plans to be proactive in strengthening the electric distribution circuits serving Critical Facilities where beneficial. Since, as noted in the discussion of previous program work, the scope of work needed to strengthen service to each Critical Facility is unique to that facility and the circuits serving it, it is not possible to estimate what a "typical" project would involve, what it might cost, or how long the project may take. The Company proposes to leverage existing Emergency Preparedness coordination

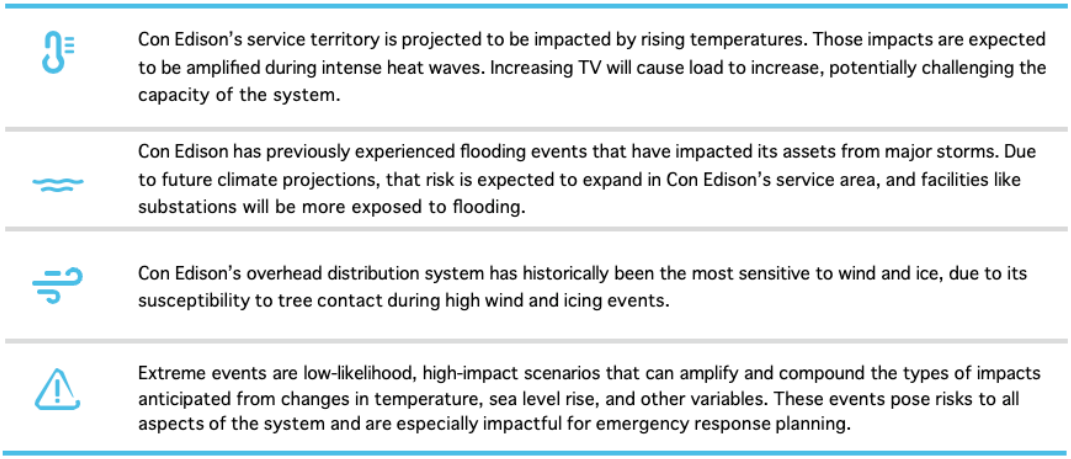
processes to prioritize the resiliency enhancements to be made to circuits serving Critical Facilities, given the program funding.

The Critical Facilities program is part of the comprehensive set of strategies included in Con Edison's Climate Vulnerability and Resiliency Plan (the Plan) to address the vulnerabilities of the electric system to the impacts of climate change – from heat/temperature variable, flooding (caused by sea-level rise, storm surges or heavy precipitation), or extreme events (such as hurricanes, nor'easters, or heat waves) – identified in the 2019 and 2023 Climate Change Vulnerabilities Studies (CCVS, the Study, or the Studies). These strategies were developed by following Con Edison's Resilience Framework and decrease the risk of losing electrical services during increasingly likely, climate-driven storms while also decreasing the time required to restore service to the facility. The Critical Facilities program increases the resiliency of the upgraded facilities by increasing their ability to withstand climate change impacts without outages and ensuring that they are able to continue providing important community support and services during extreme events.

Justification Summary:
Following Superstorm Sandy, Con Edison worked with a Storm Hardening and Resiliency Collaborative to recommend storm hardening investments and one of the recommendations was to conduct a Climate Change Vulnerability Study (CCVS or the Study). The initial Climate Change Vulnerability Study was conducted in 2019 and was updated in 2023. The approach followed a multi-step process that cycled through the steps for each potential climate hazard, incorporating feedback from stakeholders throughout the evaluations. The Study used the best available science to evaluate the sensitivity of Con Edison's electric system to projections of potential climate hazards including:

- **Temperature and humidity** – from heat and coincident high heat and humidity (known as temperature variable or "TV")
- **Flooding** – coastal flooding from sea level rise and/or inland flooding from precipitation
- **Wind and ice**
- **Extreme and coincident weather events** – hurricanes/wind, extreme heat waves, nor'easters/cold snaps, and multiple concurrent or consecutive extreme events

The hazards that the Study found to pose an elevated risk to Con Edison's assets and operations include heat and humidity, major storms, wind and ice, and extreme events.



Specific projections of future climate conditions, referred to as pathways (Pathways) were incorporated into the Company's forecasting and planning processes – including load forecasting, load relief planning, reliability planning for the sub-transmission and distribution systems, asset management planning, facility energy system planning, planning for emergency preparation and response, and

worker safety – through the development of a new Climate Change Planning and Design Guideline document (Guidelines). This document specifies the methodologies to be used to evaluate the vulnerability of electric facilities to projected climate changes and establishes specific design standards to be met for each climate hazard over the useful life of the asset.

The Critical Facilities program is focused on strengthening non-network circuits serving Critical Facilities and preventing potential impacts from climate-driven extreme weather events. The primary vulnerability of the overhead non-network system identified by the Study is risk to system failures resulting from increases in wind and ice, with additional vulnerability from extreme storms, and heat also identified. For all of these climate-driven hazards, the common failure mode is contact – conductors, poles, or other overhead equipment – with vegetation, wind-blown debris, nearby structures, or the ground.

The Con Edison Climate Change Vulnerability Studies project increases in average and maximum air temperatures throughout the century relative to historical conditions, with the 2023 Study projecting that temperatures will increase faster than projected in the 2019 Study. By all measures evaluated in the Studies – maximum daily temperature, number of days per year in which maximum temperature exceeds 95°F, and number of days per year the daily average temperature exceeds 86°F – climate-related increases in heat are projected to occur roughly a decade faster than projected in the first Study.

Variable	Study	Baseline	2030	2040	2050	2080
Highest annual maximum daily temperature	Current Study	97°F	103°F	104°F	106°F	112°F
	2019 CCVS	97°F	101°F	103°F	104°F	108°F
The number of days per year in which maximum temperatures exceed 95°F	Current Study	4 days	17 days	27 days	32 days	69 days
	2019 CCVS	4 days	11 days	18 days	23 days	47 days
The number of days per year in which daily average temperatures exceed 86°F	Current Study	3 days	16 days	22 days	31 days	68 days
	2019 CCVS	3 days	11 days	16 days	21 days	45 days

High temperatures can cause overhead distribution lines to experience sagging and loss of material strength. Line sagging reduces the clearance between overhead assets and surrounding vegetation, which can increase the potential for contact with vegetation, leading to asset failure and safety risks. Derating lines helps mitigate the risk of line sag but could necessitate adding capacity to meet demand.

Wind and ice have historically been difficult to model due to their highly localized nature. To inform this Study, Con Edison sought the best available information by acquiring an additional dataset from MIT, which covers the Northeast, and provides insight into future wind speeds and radial icing potential. This data and other studies demonstrate that wind speeds will likely increase, and the risk of ice accumulation on wires (radial icing) will remain. The dataset developed by MIT covers the Northeast and shows the 2025-2041 projected and baseline observed annual maximum and average wind speeds at Central Park, JFK, and LaGuardia.

	Central Park		JFK		LaGuardia	
Wind Speed	1-min Baseline	MIT Projection	1-min Baseline	MIT Projection	1-min Baseline	MIT Projection
Annual maximum (mph)	51.0	60.2	46.1	57.5	55.0	62.4
Annual mean (mph)	14.0	17.6	18.1	19.2	20.1	18.5

Extreme storms such as hurricanes can cause wind speeds to increase far beyond typical average speeds. Wind speeds of the most intense hurricanes are projected to increase. Freezing rain frequency

and radial icing are also projected to increase, although the magnitude of the trend remains highly uncertain due to the specific atmospheric conditions required for ice storms to occur.

Con Edison's service area experiences a range of precipitation types, including rainfall and frozen precipitation (i.e., snow, sleet, and freezing rain). The region has experienced several tropical cyclones producing heavy precipitation over the last century. For example, in 2011, Hurricane Irene produced up to 12 inches of rain in the service area, with nearly 7 inches in Central Park. More recently, remnants of Hurricane Ida in 2021 brought over 7 inches of rain to Central Park. Alternatively, nor'easters have brought some of the heaviest snowfall on record to New York City, along with freezing rain; the January 2021 nor'easter accumulated up to 2 feet of snow in New York City.

Climate change is projected to drive heavier precipitation events because a warmer atmosphere holds more water vapor and provides more energy for storms, among other factors. Looking forward, projections show climate change could drive stronger and more frequent storms in the region, bringing heavy precipitation, wind, and storm surge. Tropical cyclone rainfall totals are projected to increase by approximately 10%-15% in the North Atlantic basin by the late 21st century. In addition, extratropical cyclones could become 5%-25% more wet in the future relative to present day. In contrast, climate change could reduce the frequency of snowfall and other frozen precipitation in future decades. Projections in the Study show that heavy precipitation in the service area could increase throughout the century relative to the baseline.

Variable	Study	Baseline	2030	2040	2050	2080
Annual days with precipitation exceeding 2 inches	Current Study	3 days	4 days	4 days	5 days	6 days
	2019 CCVS	3 days	4 days	4 days	4 days	5 days

These potential changes in wind, precipitation, and ice present an especially large risk to overhead distribution equipment. Overhead distribution assets, including conductors, attachments, and cross-arms, are built to withstand defined design tolerances for combined ice and wind loading, but they are frequently adjacent to neighboring vegetation that may be downed during these events. Fallen vegetation and wind-blown debris can come into contact with lines and cause them to disconnect, fall, or even lead to pole collapse, especially older poles or those with existing damage. This can result in asset failure, leading to outages and incurring restoration costs.

When choosing resilience strategies to address identified climate vulnerabilities, Con Edison follows a resilience framework that encompasses investments that:

- Prevent climate change impacts by hardening infrastructure
- Mitigate the impacts from outage-inducing events by minimizing disruptions
- Respond rapidly to disruptions by reducing recovery times and costs

The strategies developed using this framework and included in the Critical Facilities program implement measures that decrease the risk of outages to non-network overhead circuits serving Critical Facilities and that facilitate a more rapid restoration of service to the system. Hardening these circuits reduces the risk of outages at the facility, freeing Company response resources to restore other portions of the system and providing confidence that these facilities will continue to function and support the community during extreme events.

Extreme events can present outsized risks compared to chronic events—risks that, in some cases, also extend to larger geographic areas. For example, impacts from hurricanes can overwhelm multiple facets of Con Edison's system and surrounding communities. The combination of governmental, technological, and financial systems based in the Con Edison service territory increases the potential impacts of risks associated with extreme events related to climate change beyond the typical outage

risks. While the City of New York has primary responsibility for coordinating resident emergency response efforts, Con Edison can play a role in decreasing customer impacts and increasing customer resilience. This includes helping customers cope with reduced energy service if an extreme event leads to prolonged outages (e.g., supporting on-site energy storage, access to locations in the community with power, etc.)

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

Impact on Disadvantaged Communities

The resilience strategies included in Con Edison's Resiliency Plan have been chosen in alignment with our Resiliency Framework that provides guidance for developing a comprehensive set of adaptation strategies to mitigate future climate change risks. This comprehensive set of strategies incudes investments that enable Con Edison's electric system to prevent climate change impacts by hardening infrastructure, mitigate the impacts from outage-inducing events by minimizing disruptions to customers, and respond rapidly to disruptions by reducing recovery times and costs.

While the programs included in the Plan are largely focused on withstanding climate changes and avoiding outages, most programs also enable Con Edison to limit outage impacts on customers (i.e., absorb outage impacts), and restore service more quickly than would otherwise have been possible (i.e., recover quickly). Many of the investments proposed to strengthen Con Edison's ability to withstand extreme climate conditions will also, naturally, reduce the risk of outages during "blue sky" conditions.

Disadvantaged communities (DACs) have fewer alternatives during energy system outages and will be more at risk from climate change. Because of this lack of alternatives, resilient and reliable energy service is an important priority for the communities and for Con Edison. Due to the size of Con Edison's electric system and the population density in the City, almost half of Con Edison's system serves at least one DAC. The Company has committed to tracking investments that benefit DACs specifically and to measuring and monitoring system performance in DACs and non-DACs. This tracking process will provide data and allow the Company to evaluate the benefits its investments to customers in DACs and revise its investment approach if needed.

The Company has also formed an Environmental Justice Working Group under an executive committee and plans to release a finalized Environmental Justice Policy Statement in 2023 to apply an equity lens to resilience-driven investments. Key components of the upcoming policy statement include:

- Operations will not disproportionately burden DACs.
- Con Edison will work to understand DAC concerns.
- Clean energy investments will benefit DACs.
- Con Edison will provide opportunities for employment in the clean energy future.

These equity considerations will help inform resilience plan investments moving forward.

Impact on Greenhouse Gas (GHG) Emissions

The primary goals of the programs and projects included in the Climate Vulnerability and Resiliency Plan, including the Critical Facilities program, are to withstand, absorb, or recover from the impacts of future climate changes on Con Edison's electric system. While none of the programs are focused on reducing GHG emissions, some of the programs could have small but positive impacts on Con Edison's overall GHG emissions, and none of the programs should negatively impact Con Edison's overall GHG emissions.

All of the programs that prevent or reduce the number of "truck rolls" required to assess, operate, or restore the electric system (i.e., the number of physical trips made by operators, technicians, and other field personnel to physical field locations) will reduce Con Edison's overall GHG emissions by reducing vehicle emissions associated with each field trip prevented. The Critical Facilities program may reduce the need for field visits by investing in circuit hardening that prevents outages at Critical Facilities or through installation of technology that will automatically or remotely restore service. Actual program reductions in GHG emissions from reductions in physical trips to the field depend on the number of trips avoided, the miles driven per trip, the type of vehicle, the type of fuel burned, and the condition of the vehicle.

Impact on Clean Energy Commitment
The Critical Facilities program supports Initiative 2 under Pillar 1 of the Clean Energy Commitment, Build the Grid of the Future.

Impact on 5-year and long-range plans (10-year)
This resilience program aligns with and supports Con Edison's integrated strategy, included in the January 2022 Long-Range Plan, focused on four strategic objectives related to Clean Energy, Climate Resilience, Core Service, and Customer Engagement. Con Edison's Climate Resilience strategic objective aims to increase the resilience of the energy infrastructure to adapt to climate change. Furthermore, Con Edison sees the role of utilities as changing from providing, "Universal access to energy that is safe and reliable" to providing, "Universal access to energy that is safe, reliable, and *resilient* (able to prevent, mitigate, and recover from events.)" (emphasis added)

The Critical Facility program provides resilient energy by:

- Preventing the risk of outage events at Critical Facilities through investments in additional storm hardening measures
- Mitigating the impacts of potential outages by enabling quick-connect backup generation
- Enabling communities to respond to climate-driven weather events and provide essential services to community residents

Impact on Company Risk Mitigation Activity
Resiliency, in simple terms, can be defined as having the capacity to withstand or to recover quickly from difficulties. While a bit more complex, Con Edison's Resilience Management Framework definition of resilience is very similar – i.e., the Framework identifies resilience strategies as investments that enable Con Edison to withstand changes in climate and avoid outages, absorb impacts from outage-inducing events by limiting the number of customers impacted or improving the customers' ability to cope with outages, recover quickly, and advance to a better state. Both equate resilience with the avoidance or limitation of difficulties or negative consequences – i.e., with the mitigation of risk.

The 2022 Electric Operations Risk Assessment and Mitigation plans include mitigation activities associated with increasing risks of major storms that could damage the Con Edison system and impact customers. Con Edison's comprehensive set of resiliency programs are designed to increase the ability of the electric system to withstand the impacts of climate change, including the increasing risk of storms, and limit potential impacts to customers. The Critical Facilities program mitigates the risk of increased outages at Critical Facilities by hardening the overhead distribution circuits serving the facility.

2. Supplemental Information

Alternatives
The entire focus of the Critical Facilities program is to decrease the impacts of future weather events on all of the communities that Con Edison serves by enhancing the distribution system serving facilities

critical the community's ability to respond to emergencies and resident's abilities to cope during the event. Investments under this program extend beyond what is typical to meet reliability goals and prioritize the most vulnerable facilities. Alternative solutions for enhancing service to each critical facility are considered (see Work Description above) and engineering evaluations performed to determine the best set of solutions for each situation.

The only alternative that Con Edison has to making investments under this program is to continue making investment decisions for these facilities based solely on established reliability standards. This alternative does not meet the requirements of the Act to develop "… dedicated storm hardening programs … to reduce damage and costs from future weather events, as well as facilitate prompt restoration times."

Risk of No Action

The Climate Change Vulnerability Study concluded that Con Edison's overhead distribution system is vulnerable to risk of damages from extreme weather events like those that have been experienced in recent history. The Study also confirmed that a growing body of scientific evidence supports the conclusions that projected climate changes project these extreme storm events to be likely to increase in frequency and intensity in the future. Numerous evaluations following actual events have also revealed that the increased frequency of these types of events tends to erode the ability of communities and their residents to cope with and recover from the impacts of extreme events, with members of disadvantaged communities the least able to recover.

When there is a weather event that causes power outages, the damage is not limited to the electric system. In these emergency conditions it is important for civic leaders and first responder organizations to be at full capability. Loss of power to first responder facilities can cause a delay in response to emergencies. Designated shelter facilities are an important community resource in such times, and loss of power to these facilities can be a safety concern. Blocked streets, lost power and expensive repairs take their toll on the NYC and Westchester County areas. Loss of power to critical customers such as first responders and designated shelter facilities could increase the impact of these events, hampering the ability to execute a coordinated and timely response and recovery effort.

Without the proposed resiliency investments proposed in the Critical Facilities program, Con Edison's communities and most vulnerable customers who use or are served by the facilities identified as critical are at higher risk of outages from the increasing likelihood and severity of storms driven by climate changes.

Non-Financial Benefits

Investments made under the Critical Facilities program strengthen the distribution system serving community facilities vital to the ability of the community and its residents to cope with and recover from the impact of increasingly frequent and more severe weather events. These enhanced facilities have higher probabilities of maintaining electric service and of being restored more quickly than they would have without these investments. The ability of these Critical Facilities to operate during extreme weather events can, in turn, enhance public health and safety, support the provision of emergency response and vital medical care, and support overall community resiliency.

Summary of Financial Benefits and Costs

1. Cost-benefit analysis

The Critical Facilities program targets investments that bolster the electric distribution system serving essential community facilities. These enhancements are crucial to ensure communities can effectively manage and recover from the more frequent and intense extreme weather events. Facilities upgraded through this program will be more capable of maintaining their electric service or to recover faster post-disaster than those not receiving such investments. These Critical Facilities play a pivotal role during such crises by ensuring public health and safety, facilitating emergency responses, providing vital medical

services, and enhancing overall community resilience. While it's challenging for the Company to precisely quantify the benefits these facilities provide to the community, the very act of classifying them as 'Critical' by stakeholders and prioritizing them as such underscores their significant value to the community.

2. Basis for estimate

Given the projected climate changes with the potential to impact not only the Company's electric delivery systems but many other critical infrastructure supporting the communities in the service territory, the Company realizes that ensuring that availability of the infrastructure and public services provided by the facilities identified as Critical Facilities will be more important than ever and plans to be more aggressive in strengthening the electric distribution circuits serving Critical Facilities where beneficial. Since, as noted in the discussion of previous program work, the scope of work needed to strengthen service to each Critical Facility is unique to that facility and the circuits serving it, and it is not possible to estimate what a "typical" project would involve, what it might cost, or how long the project may take. The Company proposes to work with community leaders and providers of critical infrastructure and services to identify and prioritize the resiliency enhancements to be made to the electric distribution system given the program funding.

Project Risks and Mitigation Plan

Risk 1 – Resource availability from contractors

Risk 1 Mitigation Plan – The Company has committed to secure adequate contractor resources to complete the required work. If unable to honor that commitment, Company crews will be diverted to complete the associated projects.

Technical Evaluation / Analysis

N/A

Project Relationships (if applicable)

Where undergrounding of overhead distribution circuits is selected as the best way to harden service to a Critical Facility against climate-driven storms, the funding for undergrounding the identified circuits will be provided through the Selective Undergrounding program.

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	**–**	**–**	**–**	**–**	**–**	**–**
Capital	**$0**	**$1,556**	**$6,139**	**$6,189**	**$9,000**	**$9,000**

2025-2029 Request:

Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	**–**	**–**	**–**	**–**	**–**
Capital (Total)	**$0**	**$9,300**	**$9,600**	**$9,900**	**$10,200**
Labor	$0	$1,386	$1,431	$1,476	$1,520
M&S	$0	$2,090	$2,158	$2,225	$2,292
Contract Svcs.	$0	$3,624	$3,741	$3,858	$3,974
Other					
Overheads	$0	$2,200	$2,271	$2,342	$2,413

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	–	–	–
Capital	**$57,000**	**$67,300**	**$79,500**
Basis for funding direction:	Annual inflation-related increases estimated (3%)	Annual inflation-related increases estimated (3%)	Annual inflation-related increases estimated (3%)

Substation Loss Contingency Program

Central Operations / SSO

1. Project / Program Summary

Type: ☐ **Project** ☒ **Program**	**Category:** ☒ **Capital** ☒ **O&M**
Work Plan Category: ☐ **Regulatory Mandated** ☒ **Operationally Required** ☐ **Strategic**	
Project/Program Title: Substation Loss Contingency Program – Rapid Recovery of an Area Substation/Transmission Resiliency Transformers	
Project/Program Manager: John McCoy	**Project/Program Number (Level 1):** 27204329
Status: ☐ **Initiation/Planning** ☐ **In-Progress (Projects Only)** ☒ **On-going (Programs Only)**	
Estimated Start Date: Ongoing	**Estimated In-Service Date:** 2027
2025-2029 Funding Request ($000) **Capital: $25,600** **O&M: $143**	

Work Description:

The Substation Loss Contingency program invests in the purchase of additional equipment that can be deployed to facilitate rapid recovery from either the loss of an area substation or to partially recover from the loss of a bulk power substation. While Con Edison's system is constructed to high standards and many of the programs included in the Climate Vulnerability and Resiliency Plan strengthen the system further, the system remains vulnerable to low-frequency, high-impact extreme events, such as hurricanes and nor'easters. The loss of a single area substation would result in a significant interruption of electric service to our customers. With the equipment to be purchased under this program, Con Edison will have the capability to construct a "Rapid Deployment Area Substation" near the location of a failed substation within five to seven days and restore service to large numbers of customers much more quickly than without this capability. (Full restoration may take two to three weeks.) Rapid Deployment Area Substations can also be used to provide load relief to area substations when the capacity at a substation must be reduced, such as in instances when equipment may be vulnerable to damage or failure from excessive, sustained heat or when forecast load is predicted to exceed substation capacity.

In the rare case of loss of service to a bulk power station, the Transmission Resiliency Transformers will allow the Company to restore partial functionality to the bulk power station. A review of all Con Edison's area substations shows the ability to restore customers by using portable generation and transfers to a nearby area substation is not always feasible due to the station loading, distance or impracticality due to the amount and locations of shunts and/or mobile generators that would be required. As a result, alternate sources of power to restore customers must be developed. In response to a loss of an area substation for 24 hours or longer at some of our area substations, the only means to quickly restore electric service to all of the customers affected includes the construction of a Rapid Deployment Area Substation in the vicinity of the failed substation. The Rapid Deployment Area Substation is for use at any of the 64 area substations. In some instances, this solution is implemented with a distribution solution (a hybrid solution) to restore all customers.

The equipment being purchased under this program to provide Rapid Deployment Area Substation capability is shown in the table below. The purchase of this equipment was begun in 2021 and is forecast to be completed in 2026. Only a portion of the required equipment has been received. The remainder is pending procurement, design, construction, and delivery, with associated milestones and milestone payments scheduled throughout 2023 to 2026.

Rapid Deployment Area Substation

• **138 kV HPFF to Solid Dielectric transition joints (4 sets)**
• **Mobile resiliency transformers (2 each)**
• **Grounding mats**
• **Relay panels (8)**
• **138 kV circuit breakers (3)**
• **35 kV TR-Bus Cable Pothead Comp (3)**
• **138 kV/3-phase 500 ft resiliency cable and PotHead set (3)**
• **35 kV switchgear potheads & tool kits (connectors)**
• **13/27 kV capacitor banks (2)**
• **138 kV Bushing Potential Devices, BPDs (9)**
• **Battery monitoring equipment**
• **Spare Area Substation Transformers**
  ○ **58 MVA transformer**
  ○ **65 MVA transformer**
  ○ **93 MVA transformer**

The equipment needed to restore partial functionality to the bulk power station, in the rare case of a loss of service, the Transmission Resiliency Transformers is shown below.

Transmission Resiliency Transformers
• **Two sets of bulk power resiliency transformers (6 transformers)** • **Four sets of mobile relay panels**

The Company is also proposing the inclusion of a mobile control center in this program. The proposed mobile control center is a Mobile Control Center (MCC) designed with core operational systems such as an Energy Management System (EMS), Feeder Management System (FMS), Pi-Historian, Local Area Networks and Communications systems. In cases of emergencies, the MCC will be capable of performing the functions of Con Edison's Energy Control Center or the Alternate Energy Control Center (the ECC and AECC) to support both the system in case of a loss of either an Area Substation or a Transmission Substation.

Mobile Resiliency Control Center

• **Contains core operational systems**
  ○ **Energy Management System (EMS)**
  ○ **Feeder Management System (FMS), Pi-Historian**
  ○ **Local Area Networks**
  ○ **Communications Systems**

Together, the three components of the Substation Loss Contingency program – the Rapid Deployment Area Substation, the Transmission Resiliency Transformers, and the Mobile Control Center – will provide multi-pronged solutions that will enable the Company to recover from near-catastrophic failures on the transmission system and extensive, prolonged outages to customers.

Justification Summary:
Following Superstorm Sandy, Con Edison worked with a Storm Hardening and Resiliency Collaborative to recommend storm hardening investments and one of the recommendations was to conduct a Climate Change Vulnerability Study (CCVS or the Study). The initial Climate Change Vulnerability Study was conducted in 2019 and was updated in 2023. The approach followed a multi-step process that cycled through the steps for each potential climate hazard, incorporating feedback from stakeholders throughout the evaluations. The Study used the best available science to evaluate the sensitivity of Con Edison's electric system to projections of potential climate hazards including:

- **Temperature and humidity** – from heat and coincident high heat and humidity (known as temperature variable or "TV")

- **Flooding** – coastal flooding from sea level rise and/or inland flooding from precipitation
- **Wind and ice**
- **Extreme and coincident weather events** – hurricanes/wind, extreme heat waves, nor'easters/cold snaps, and multiple concurrent or consecutive extreme events

The hazards that the Study found to pose an elevated risk to Con Edison's assets and operations include heat and humidity, major storms, wind and ice, and extreme events.

	Con Edison's service territory is projected to be impacted by rising temperatures. Those impacts are expected to be amplified during intense heat waves. Increasing TV will cause load to increase, potentially challenging the capacity of the system.
	Con Edison has previously experienced flooding events that have impacted its assets from major storms. Due to future climate projections, that risk is expected to expand in Con Edison's service area, and facilities like substations will be more exposed to flooding.
	Con Edison's overhead distribution system has historically been the most sensitive to wind and ice, due to its susceptibility to tree contact during high wind and icing events.
	Extreme events are low-likelihood, high-impact scenarios that can amplify and compound the types of impacts anticipated from changes in temperature, sea level rise, and other variables. These events pose risks to all aspects of the system and are especially impactful for emergency response planning.

Specific projections of future climate conditions, referred to as pathways (Pathways) were incorporated into the Company's forecasting and planning processes – including load forecasting, load relief planning, reliability planning for the sub-transmission and distribution systems, asset management planning, facility energy system planning, planning for emergency preparation and response, and worker safety – through the development of a new Climate Change Planning and Design Guideline document (Guidelines). This document specifies the methodologies to be used to evaluate the vulnerability of electric facilities to projected climate changes and establishes specific design standards to be met for each climate hazard over the useful life of the asset.

The primary vulnerabilities that the Study identified to Area and Transmission substations are Flooding and Heat.

The Con Edison Climate Change Vulnerability Studies project increases in average and maximum air temperatures throughout the century relative to historical conditions, with the 2023 Study projecting that temperatures will increase faster than projected in the 2019 Study. By all measures evaluated in the Studies – maximum daily temperature, number of days per year in which maximum temperature exceeds 95°F, and number of days per year the daily average temperature exceeds 86°F – climate-related increases in heat are projected to occur roughly a decade faster than projected in the first Study.

Variable	Study	Baseline	2030	2040	2050	2080
Highest annual maximum daily temperature	Current Study	97°F	103°F	104°F	106°F	112°F
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The number of days per year in which maximum temperatures exceed 95°F	Current Study	4 days	17 days	27 days	32 days	69 days
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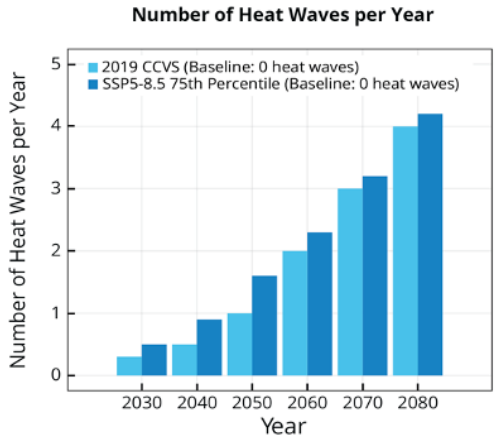
The number of days per year in which daily average temperatures exceed 86°F	Current Study	3 days	16 days	22 days	31 days	68 days
	2019 CCVS	3 days	11 days	16 days	21 days	45 days

In addition, projections of Temperature Variable (TV) – an index that is similar to a heat index but which considers the persistence of heat and humidity over several days – that historically occur only once a year (e.g., 86°F) are forecast to become common occurrences within a generation, occurring as many as 16 times per year by 2050 and as many as 49 times per year by 2080.

Variable	Study	Baseline	2030	2040	2050	2080
Days per year with maximum summer TV exceeding 86°F	Current Study	1 day	6 days	10 days	16 days	49 days
	2019 CCVS	1 day	6 days	10 days	15 days	35 days

Multiday heat events, known as heat waves, are also impactful because they drive demand for air conditioning and can strain infrastructure. Heat waves of three or more consecutive days with maximum daily temperatures above 90°F occurred approximately twice per year in New York City between 1981 and 2010. Recent heat waves in New York City include events in July 2022, July 2019, July 1999, and July 1993, which featured 6, 4, 10, and 1 consecutive days, respectively, with maximum daily temperatures at or above 90°F, respectively.

Projections show that the number of three-day heat waves with temperatures averaging above 90°F for each day will increase (see figure below). While heat waves with daily average temperatures above 90°F provide a measure of sustained heat during the daytime and nighttime hours, heat waves with daily maximum temperatures above 95°F represent periods of prolonged daytime heat. The number of consecutive days with peak temperatures above 95°F at Central Park was up to two days on average between 1981 and 2010. By 2050, this could be seven consecutive days.



Extreme heat can manifest as heat waves or other tail-end heat events, such as heat domes, that increase demand for air conditioning and, in turn, limit the capability of efficiency reductions.
Unlike hurricanes or other extreme storms, heat wave intensity and frequency are tightly linked to long-term changes in atmospheric temperature and are thus comparatively well-simulated in climate model projections. Additionally, higher temperatures associated with urbanization, a phenomenon referred to as the Urban Heat Island (UHI), such as from lower surface reflectivity of built surfaces and waste heat from buildings, can exacerbate the impacts of extreme heat events. Heat waves are intensified by events such as heat domes, which are areas of high pressure in the atmosphere that trap hot air. The Climate Change Vulnerability Study projections increases in the frequency, duration, and intensity of extreme heat days in the service territory by the late 21st century. Across Con Edison's service area, approximately 9 heat waves are projected to occur in 2050 compared to a baseline of 2 heat waves per year.

The Study also identified that Area and Transmission substations were at risk from damage caused by heavy rainfall, often associated with extreme storms. Con Edison's service area experiences a range of precipitation

types, including rainfall and frozen precipitation (i.e., snow, sleet, and freezing rain). The region has experienced several tropical cyclones producing heavy precipitation over the last century. For example, in 2011, Hurricane Irene produced up to 12 inches of rain in the service area, with nearly 7 inches in Central Park. More recently, remnants of Hurricane Ida in 2021 brought over 7 inches of rain to Central Park. Alternatively, nor'easters have brought some of the heaviest snowfall on record to New York City, along with freezing rain; the January 2021 nor'easter accumulated up to 2 feet of snow in New York City.

Climate change is projected to drive heavier precipitation events because a warmer atmosphere holds more water vapor and provides more energy for storms, among other factors. Looking forward, projections show climate change could drive stronger and more frequent storms in the region, bringing heavy precipitation, wind, and storm surge. Tropical cyclone rainfall totals are projected to increase by approximately 10%-15% in the North Atlantic basin by the late 21st century. In addition, extratropical cyclones could become 5%-25% more wet in the future relative to present day. In contrast, climate change could reduce the frequency of snowfall and other frozen precipitation in future decades. Projections in the Study show that heavy precipitation in the service area could increase throughout the century relative to the baseline.

Variable	Study	Baseline	2030	2040	2050	2080
Annual days with precipitation exceeding 2 inches	Current Study	3 days	4 days	4 days	5 days	6 days
	2019 CCVS	3 days	4 days	4 days	4 days	5 days

The primary sensitivities of electric assets to projected changes in flooding are:

- Equipment damage: Floodwaters damage electric equipment and decrease the life expectancy of assets. Equipment damage costs Con Edison both capital (needed for repairs) and time (which results in longer outages and can be exacerbated if spare parts are limited). Saltwater spray can also cause arcing and failure of components. In addition, continued exposure to water can rot wooden assets such as poles.
- Equipment corrosion: Sea level rise and coastal storms pose a particular threat to coastal assets due to the corrosive properties of salt water, which can damage electronic components. These impacts may not be immediately evident but can present issues over time that may result in asset failures and outages.
- Soil weakening: Exposure to water can weaken or undermine the foundation of equipment in instances of prolonged inundation or erosion, increasing the overall risk of equipment damage. Increases in the projected flow and magnitude of floodwaters near riverbanks and the coast have the potential to alter and intensify how erosion occurs and may require intervention to avoid assets becoming destabilized or failing.
- Limited accessibility: Flooding presents issues of access. If assets are flooded or surrounded by water at high tide or during storms, it becomes more difficult to access the locations for maintenance and repair.

When choosing resilience strategies to address identified climate vulnerabilities, Con Edison follows a resilience framework that encompasses investments that:

- Prevent climate change impacts by hardening infrastructure
- Mitigate the impacts from outage-inducing events by minimizing disruptions
- Respond rapidly to disruptions by reducing recovery times and costs

The investments to be made as part of this Substation Loss Contingency program mitigate climate change impacts that may result in substation equipment failures, allowing the Company to restore normal operations much more quickly.

This strategy can be deployed in conjunction with other operational measures which may include load management initiatives such as voltage reductions, rolling blackouts, network cutouts, temporary generator installations, and other temporary solutions for restoring service.

Large transmission substations interconnect circuits to form the transmission grid, sending and receiving power, transforming voltages, and directing flows so that the circuits operate within their current carrying capacity and voltage limits. Potential causes of the loss of transformers include items such as weather events like heavy flooding or wind, a fire or building collapse at a property adjacent to a substation or acts of terrorism or vandalism.

The Company's current spare transformer process makes sure that we have at least a 90% probability of having a spare when a failure occurs. The number of spares is determined using a Poisson probability distribution function considering the number of in-service transformers, failure rates, and lead times for replacements. This process creates sufficient spare transformers on-hand for historical type failures, not high-impact low-frequency (HILF) events. To recover from HILF events, dedicated equipment will be required.

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

Impact on Disadvantaged Communities

The resilience strategies included in Con Edison's Resiliency Plan have been chosen in alignment with our Resiliency Framework that provides guidance for developing a comprehensive set of adaptation strategies to mitigate future climate change risks. This comprehensive set of strategies incudes investments that enable Con Edison's electric system to prevent climate change impacts by hardening infrastructure, mitigate the impacts from outage-inducing events by minimizing disruptions to customers, and respond rapidly to disruptions by reducing recovery times and costs.

While the programs included in the Plan are largely focused on withstanding climate changes and avoiding outages, most programs also enable Con Edison to limit outage impacts on customers (i.e., absorb outage impacts), and restore service more quickly than would otherwise have been possible (i.e., recover quickly). Many of the investments proposed to strengthen Con Edison's ability to withstand extreme climate conditions will also, naturally, reduce the risk of outages during "blue sky" conditions.

Disadvantaged communities (DACs) have fewer alternatives during energy system outages and will be more at risk from climate change. Because of this lack of alternatives, resilient and reliable energy service is an important priority for the communities and for Con Edison. Due to the size of Con Edison's electric system and the population density in the City, almost half of Con Edison's system serves at least one DAC. The Company has committed to tracking investments that benefit DACs specifically and to measuring and monitoring system performance in DACs and non-DACs. This tracking process will provide data and allow the Company to evaluate the benefits its investments to customers in DACs and revise its investment approach if needed.

The Company has also formed an Environmental Justice Working Group under an executive committee and plans to release a finalized Environmental Justice Policy Statement in 2023 to apply an equity lens to resilience-driven investments. Key components of the upcoming policy statement include:

- Operations will not disproportionately burden DACs.
- Con Edison will work to understand DAC concerns.
- Clean energy investments will benefit DACs.
- Con Edison will provide opportunities for employment in the clean energy future.

These equity considerations will help inform resilience plan investments moving forward.

Impact on Greenhouse Gas (GHG) Emissions

The primary goals of the programs and projects included in the Climate Vulnerability and Resiliency Plan, including the Substation Loss Contingency program, are to withstand, absorb, or recover from the impacts of future climate changes on Con Edison's electric system. While none of the programs are focused on reducing GHG emissions, some of the programs could have small but positive impacts on Con Edison's overall GHG emissions, and none of the programs should negatively impact Con Edison's overall GHG emissions.

All of the programs that prevent or reduce the number of "truck rolls" required to assess, operate, or restore the electric system (i.e., the number of physical trips made by operators, technicians, and other field personnel to physical field locations) will reduce Con Edison's overall GHG emissions by reducing vehicle emissions associated with each field trip prevented. The Substation Loss Contingency program may or may not reduce the need for field visits. Actual program reductions in GHG emissions from reductions in physical trips to the field depend on the number of trips avoided, the miles driven per trip, the type of vehicle, the type of fuel burned, and the condition of the vehicle.

Impact on Clean Energy Commitment
The Substation Loss Contingency program supports Initiative 2 under Pillar 1 of the Clean Energy Commitment, Build the Grid of the Future.

Impact on 5-year and long-range plans (10-year)
This resilience program aligns with and supports Con Edison's integrated strategy, included in the January 2022 Long-Range Plan, focused on four strategic objectives related to Clean Energy, Climate Resilience, Core Service, and Customer Engagement. Con Edison's Climate Resilience strategic objective aims to increase the resilience of the energy infrastructure to adapt to climate change. Furthermore, Con Edison sees the role of utilities as changing from providing, "Universal access to energy that is safe and reliable" to providing, "Universal access to energy that is safe, reliable, and *resilient* (able to prevent, mitigate, and recover from events.)" (emphasis added)

The Substation Loss Contingency program provides resilient energy delivery by enabling the Company to restore service to much of the system lost in the event of loss of an area substation or bulk power station much more quickly than would otherwise be possible.

Impact on Company Risk Mitigation Activity
Resiliency, in simple terms, can be defined as having the capacity to withstand or to recover quickly from difficulties. While a bit more complex, Con Edison's Resilience Management Framework definition of resilience is very similar – i.e., the Framework identifies resilience strategies as investments that enable Con Edison to withstand changes in climate and avoid outages, absorb impacts from outage-inducing events by limiting the number of customers impacted or improving the customers' ability to cope with outages, recover quickly, and advance to a better state. Both equate resilience with the avoidance or limitation of difficulties or negative consequences – i.e., with the mitigation of risk.

The 2022 Electric Operations Risk Assessment and Mitigation plans include mitigation activities associated with increasing risks of major storms that could damage the Con Edison system and impact customers. Con Edison's comprehensive set of resiliency programs are designed to increase the ability of the electric system to withstand the impacts of climate change, including the increasing risk of storms, and limit potential impacts to customers. The Substation Loss Contingency program mitigates the risk of extended outages from damage to area and bulk power substations.

2. Supplemental Information

Alternatives
The alternative solution to losing an area substation or a bulk power substation considered was to reduce the size of the networks and/or build additional new area substations and transfer load accordingly. This is not cost effective because too many new area substations would have to be built at considerable cost.

Risk of No Action
Doing nothing means that Con Edison is willing to accept the risks of substation equipment damage leading to extended customer outages. System power flow control issues, system reliability concerns, and/or possible

outages at multiple area substations resulting in a significant number of customer outages for an extended period. This is not recommended due to the potential inability to maintain reliable system power flows, or the inability to restore electric service to all of our affected customers during a loss of one or multiple substations. This alternative also does not meet the requirements of the Act to develop "… dedicated storm hardening programs … to reduce damage and costs from future weather events, as well as facilitate prompt restoration times."

Non-Financial Benefits

The construction of a Rapid Deployment Area Substation provides a method of re-energizing customers impacted by the loss of an area substation in a timely manner. Additionally, Rapid Deployment Area Substations can be used for load relief at operating area substations in circumstances where substation capacity is projected to be exceeded or must be reduced for a sustained amount of time. The availability of Transmission Resiliency Transformers reduces the likelihood of the loss of a transmission substation and promotes controllability to mitigate the loss of a substation increasing reliability, resilience (including climate adaptation) improving our response to changing climate and enhancing customers' coping abilities.

The resiliency transformers are for use at any of the 33 transmission substations. The loss of any of these transmission substations would result in severe issues with system power flows and stability and/or a loss of supply to several area substations that serve critical load in our service territory potentially impacting many customers.

The project addresses the current inability to quickly restore power to customers following the loss of an area substation for 24 hours or longer in instances where it is either impractical or not viable to restore electric service via typical distribution solutions (generators, shunts, switching). In such cases, a new rapid deployment area substation will be installed adjacent to the failed substation to restore power to those customers not able to be restored via other means. This also assists in addressing the current inability to quickly restore reliable power flows through one or more area substations during certain catastrophic events. In such cases, these new transformers would be dispatched to the transmission stations to restore reliable power flows, or to feed area substations to restore power to those substations, hence to the customers supplied by those area substations.

Summary of Financial Benefits and Costs

1. Cost-benefit analysis

Con Edison 's transmission system is designed to be robust: in all areas of its service territory, no single failure should result in loss of load; and in much of its service territory (that system serving network distribution system load), no two failures should suffice to cause a loss of load. Consequently, while it is unlikely, though by no means impossible, that random failures of equipment will force load to be dropped, this may not hold true of a system confronted by the anticipated increases in load or undercut by vulnerabilities that allow the common cause failure of equipment. These vulnerabilities have led to previous major outages in Con Edison's service territory: extreme weather (e.g., tropical storm Sandy, 10/29/2012; a substation fire, 8/13/1990); and relaying problems (the Bronx, 6/20/2007, and on the west side of Manhattan, 7/13/2019). In addition, both rain and lightning are known to cause equipment failure and could be widespread in their effect.

Depending on the magnitude, a sizable load drop and potential long duration outage can make loss of load events on the transmission level more impactful. Although it is not possible to predict the potential cumulative costs to the community of a widespread loss of load event from a rare transmission system failure, the Company considers this risk significant and invests in programs designed to prevent or recover from even unlikely loss of load events. The programs included in Con Edison's Climate Change Resiliency Plan are designed to increase the transmission system's resilience given the vulnerabilities identified from projected climate-change-induced extreme weather events.

2. Basis for estimate

As discussed in the Work Description above, this program proposes three solutions to increase the resilience of Con Edison's electric system by enabling faster recovery from failures of area substations or bulk power

substations – Rapid Deployment Area Substation, Transmission Resiliency Transformers, and a Mobile Resiliency Control Center. The basis for the estimated costs of each of the solutions is below. The combined, estimated annual cost of the program totals $25.6 M for 2025-2029.

The estimated costs of the Rapid Deployment Area Substation during this filing timeline are based on remaining milestone payments for large equipment not yet received under established purchase orders and on vendor quotes and prior purchases for smaller equipment. The time required to procure and receive this equipment depends on design progress, manufacturing timelines, testing, and delivery and can vary widely. Procurement of the remaining equipment for the Rapid Deployment Area Substation is currently projected to cost $6 million.

Rapid Deployment Area Substation

- 138 kV HPFF to SD transition joints (4 sets)
- Mobile transformers (2 each)
- Grounding mats
- Relay panels (8)
- 138 kV circuit breakers (3)
- 35 kV TR-Bus Cable P/H Comp (3)
- 138 kV 3-phase 500 ft resiliency cable and PTI set (3)
- 35 kV switchgear potheads & tool kits (connectors)
- 13/27 kV capacitor banks (2)
- 138 kV PBDs (9)
- Battery monitoring equipment
- Transformer – switchgear transition cabinet
- Spare Area Substation Transformers
  - 58 MVA transformer
  - 65 MVA transformer
  - 93 MVA transformer

Rapid Deployment Area Substation	2025	2026	2027	2028	2029	2025-2029 TOTAL
Element of Expense						
Capital Overheads	$829,201	$ -	$ -	$ -	$ -	$ 829,201
Contract Services	$ -	$ -	$ -	$ -	$ -	$ -
Labor	$592,000	$ -	$ -	$ -	$ -	$ 592,000
Materials and Supplies	$1,827,330	$ -	$ -	$ -	$ -	$ 1,827,330
Other	$430,000	$ -	$ -	$ -	$ -	$ 430,000
Contingency (NO OVERHEADS APPLIED)	$42,000	$ -	$ -	$ -	$ -	$ 42,000
Total Funding Request	$ 3,720,531	$ -	$ -	$ -	$ -	$ 3,720,531

The estimated costs of the Transmission Resiliency Transformers are based on the remaining milestone payments for the transformers. Remaining costs for this equipment are currently projected to total $15.7 million.

Transmission Resiliency Transformers

- 58 MVA transformer
- 65 MVA transformer
- 93 MVA transformer

Element of Expense	2025	2026	2027	2028	2029	2025-2029 TOTAL
Capital Overheads	$ 1,452,156	$ 817,058	$ 800,209	$ -	$ -	$ 3,069,422
Contract Services	$ -	$ -	$ -	$ -	$ -	$ -
Labor	$ 266,140	$ 266,140	$ 266,140	$ -	$ -	$ 798,420
Materials and Supplies	$ 80,661	$ 150,000	$ 150,000	$ -	$ -	$ 380,661
TR Transformers Cost	$ 5,760,000	$ 2,834,048	$ 2,759,363	$ -	$ -	$ 11,353,411
Contingency (NO OVERHEADS APPLIED)		$ 41,600	$ 41,600	$ -	$ -	$ 83,200
Total Funding Request	$ 7,558,957	$ 4,108,846	$ 4,017,312	$ -	$ -	$ 15,685,115

The estimated cost of the Mobile Resiliency Control Center was determined through extensive research with equipment vendors, system integrators, NAS Pax River and Sandia test facilities. Budgetary quotations were solicited and provided by multiple vendors for all major equipment and services. The remaining costs for this component is projected to be $6.0 million.

Mobile Resiliency Control Center

- Contains core operational systems:
  - Energy Management System (EMS)
  - Feeder Management System (FMS)
  - Pi-Historian
  - Local Area Networks
  - Communications Systems

Element of Expense	2025	2026	2027	2028	2029	2025-2029 TOTAL
Capital Overheads	$ -	$ -	$ -	$ -	$ -	$ -
Contract Services	$ -	$ -	$ -	$ -	$ -	$ -
Labor	$ -	$ -	$ -	$ -	$ -	$ -
Materials and Supplies	$ -	$ -	$ -	$ -	$ -	$ -
Other	$ 3,000,000	$ 3,000,000	$ -	$ -	$ -	$ 6,000,000
Contingency (NO OVERHEADS APPLIED)	$ -	$ -	$ -	$ -	$ -	$ -
Total Funding Request	$ 3,000,000	$ 3,000,000	$ -	$ -	$ -	$ 6,000,000

Project Risks and Mitigation Plan
Risk 1 – Outage scheduling conflicts with other initiatives

Risk 1 Mitigation Plan – Outages to be coordinated with the Sequencing Group at System Operations to potentially incorporate other project/programs to avoid conflicts with other work, resulting in a more predictable budget and manageable outage scheduling.

Risk 2 – Delays due to resource support coordination

Risk 2 Mitigation Plan – Anticipate, schedule and pre-plan with resource requirements such as engineering, labor, and construction and outages to avoid performance delays alignment conflicts.

Technical Evaluation / Analysis
A technical study to evaluate the loss of each area substation for 24 hours or longer has been updated by Electric Operations / Regional Engineering. It is estimated that as many as twenty-two stations may need a rapid deployment solution, and a rapid deployment station may be the most viable solution since a distribution solution is estimated to take longer. Additionally, the complete loss of any of our eleven double area substations likely requires a distribution solution and a rapid deployment solution to pick up the two substations. Finally, Electric Operations / Regional Engineering is reviewing the ability to restore a substation with the likely availability of emergency diesel generators during a "blue sky" day. Generator availability has been reviewed with our vendors and was identified to be lower than anticipated, thus it is likely the number of stations needing a rapid deployment solution will increase. Although technical solutions exist for each station, there are multiple cases where the solution is not readily feasible or practical due to various reasons as previously noted.

Project Relationships (if applicable)
N/A.

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	–	–	–	–	–	–
Capital	$3,194	$5,963	$1,358	$4,596	$10,865	$8,000

2025-2029 Request:
Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	$27.0	$27.8	$28.6	$29.5	$30.3
Capital (Total)	$14,300	$7,200	$4,100	$0	$0
Labor	$697	$351	$200	$0	$0
M&S	$6,841	$3,444	$1,961	$0	$0

Contract Svcs.	$0	$0	$0	$0	$0
Other	$4,798	$2,416	$1,376	$0	$0
Overheads	$1,964	$989	$563	$0	$0

Long Range Funding Projections

	2030-2034	**2035-2039**	**2040-2044**
O&M	**$165.9**	**$192.4**	**$223.0**
Capital	**$0**	**$0**	**$0**
Basis for funding direction:	Ongoing equipment maintenance including annual inflation-related increases (3%)	Ongoing equipment maintenance including annual inflation-related increases (3%)	Ongoing equipment maintenance including annual inflation-related increases (3%)

Substation Enclosure Upgrade Program

Central Operations / SSO

1. Project / Program Summary

Type: ☐ **Project** ☒ **Program**	**Category:** ☒ **Capital** ☐ **O&M**
Work Plan Category: ☐ **Regulatory Mandated** ☒ **Operationally Required** ☐ **Strategic**	
Project/Program Title: Substation Enclosure Upgrade Program	
Project/Program Manager: Holly Reilly	**Project/Program Number (Level 1):** 27204330
Status: ☐ **Initiation/Planning** ☐ **In-Progress (Projects Only)** ☒ **On-going (Programs Only)**	
Estimated Start Date: Ongoing	**Estimated Date In Service:** Ongoing
2025-2029 Funding Request ($000) **Capital: $5,700** **O&M: –**	

Work Description:

The Substation Enclosure Upgrades program will upgrade selected substation outdoor enclosures throughout the system by providing weatherproof enclosures for switchgear cubicles & relay cabinets. This is typically supplemented with sealing existing metal enclosures with a sealing material (typically Kemper Seal) or providing the installation enclosures as long-term solutions. In some cases, cubicle doors are replaced or refurbished, the enclosure structural supports are reinforced, or other steel/sheet metal work is performed to preclude deterioration of equipment while providing for safe inspection, maintenance, and repairs under most weather conditions.

The installation of the enclosures is a long-term solution to protect relay cabinets & switchgear cubicles from inclement weather and enhance the reliability of the electric system, with installed enclosures projected to last 30 years. The enclosures will consist of a structural frame with a roof and siding to protect the top and upper sides of the cabinets. In some cases, the canopy frames can be mounted onto the existing relay cabinet foundations.

The Substation Enclosure Upgrades program is part of the comprehensive set of strategies included in Con Edison's Climate Vulnerability and Resiliency Plan (the Plan) to address the vulnerabilities of the electric system to the impacts of climate change – from heat/temperature variable, flooding (caused by sea-level rise, storm surges or heavy precipitation), or extreme events (such as hurricanes, nor'easters, or heat waves) – identified in the 2019 and 2023 Climate Change Vulnerabilities Studies (CCVS, the Study, or the Studies). These strategies were developed by following Con Edison's Resilience Management Framework to identify investments that enable Con Edison to better withstand changes in climate (avoiding failures), absorb impacts from outage-inducing events (limiting the number of customers impacted or improving the customers' ability to cope with the outage), and recover quickly (restoring service more quickly and at a lower cost.

The switchgear and relay enclosures to be constructed under this program will decrease the risk of equipment damage and failures from water intrusion during the increased and more severe storms and periods of heavy rainfall projected to result from future climate changes. These equipment failures do not typically result in outages to customers because of the overall robust designs of the transmission system, but they do decrease the system's resiliency by limiting the ability for the system to withstand additional challenges during extreme weather events.

Specific work plans for work at in-scope substations under this program are developed for each region annually, with work prioritized based on the current conditions of switchgear cubicles and relay cabinets (assessed by visual inspection) and risks of exposure to weather conditions. Work is planned to optimize the time available in planned substation outages and to coordinate with other work planned at the same substation. The actual work performed each year, however, is subject to system conditions that can result in shortening planned outages; in these cases, remaining work may be delayed until a second outage can be planned. The Company is targeting installation of two enclosures each year.

Justification Summary:
Following Superstorm Sandy, Con Edison worked with a Storm Hardening and Resiliency Collaborative to recommend storm hardening investments and one of the recommendations was to conduct a Climate Change Vulnerability Study (CCVS or the Study). The initial Climate Change Vulnerability Study was conducted in 2019 and was updated in 2023. The approach followed a multi-step process that cycled through the steps for each potential climate hazard, incorporating feedback from stakeholders throughout the evaluations. The Study used the best available science to evaluate the sensitivity of Con Edison's electric system to projections of potential climate hazards including:

- **Temperature and humidity** – from heat and coincident high heat and humidity (known as temperature variable or "TV")
- **Flooding** – coastal flooding from sea level rise and/or inland flooding from precipitation
- **Wind and ice**
- **Extreme and coincident weather events** – hurricanes/wind, extreme heat waves, nor'easters/cold snaps, and multiple concurrent or consecutive extreme events

The hazards that the Study found to pose an elevated risk to Con Edison's assets and operations include heat and humidity, major storms, wind and ice, and extreme events.

	Con Edison's service territory is projected to be impacted by rising temperatures. Those impacts are expected to be amplified during intense heat waves. Increasing TV will cause load to increase, potentially challenging the capacity of the system.
	Con Edison has previously experienced flooding events that have impacted its assets from major storms. Due to future climate projections, that risk is expected to expand in Con Edison's service area, and facilities like substations will be more exposed to flooding.
	Con Edison's overhead distribution system has historically been the most sensitive to wind and ice, due to its susceptibility to tree contact during high wind and icing events.
	Extreme events are low-likelihood, high-impact scenarios that can amplify and compound the types of impacts anticipated from changes in temperature, sea level rise, and other variables. These events pose risks to all aspects of the system and are especially impactful for emergency response planning.

Specific projections of future climate conditions, referred to as pathways (Pathways) were incorporated into the Company's forecasting and planning processes – including load forecasting, load relief planning, reliability planning for the sub-transmission and distribution systems, asset management planning, facility energy system planning, planning for emergency preparation and response, and worker safety – through the development of a new Climate Change Planning and Design Guideline document (Guidelines). This document specifies the methodologies to be used to evaluate the vulnerability of electric facilities to projected climate changes and establishes specific design standards to be met for each climate hazard over the useful life of the asset.

The Study identified that Area and Transmission substations were at risk from damage caused by heavy rainfall, often associated with extreme storms. Con Edison's service area experiences a range of precipitation types, including rainfall and frozen precipitation (i.e., snow, sleet, and freezing rain). The region has experienced several tropical cyclones producing heavy precipitation over the last century. For example, in 2011, Hurricane Irene produced up to 12 inches of rain in the service area, with nearly 7 inches in Central Park. More recently, remnants of Hurricane Ida in 2021 brought over 7 inches of rain to Central Park. Alternatively, nor'easters have brought some of the heaviest snowfall on record to New York City, along with freezing rain; the January 2021 nor'easter accumulated up to 2 feet of snow in New York City.

Climate change is projected to drive heavier precipitation events because a warmer atmosphere holds more water vapor and provides more energy for storms, among other factors. Looking forward, projections show climate change could drive stronger and more frequent storms in the region, bringing heavy precipitation, wind, and storm surge. Tropical cyclone rainfall totals are projected to increase by approximately 10%-15% in the North Atlantic basin by the late 21st century. In addition, extratropical cyclones could become 5%-25% more wet in the future relative to present day. In contrast, climate change could reduce the frequency of snowfall and other frozen precipitation in future decades. Projections in the Study show that heavy precipitation in the service area could increase throughout the century relative to the baseline.

Variable	Study	Baseline	2030	2040	2050	2080
Annual days with precipitation exceeding 2 inches	Current Study	3 days	4 days	4 days	5 days	6 days
	2019 CCVS	3 days	4 days	4 days	4 days	5 days

The primary sensitivities of electric assets to projected changes in flooding are:

- Equipment damage: Floodwaters damage electric equipment and decrease the life expectancy of assets. Equipment damage costs Con Edison both capital (needed for repairs) and time (which results in longer outages and can be exacerbated if spare parts are limited). Saltwater spray can also cause arcing and failure of components. In addition, continued exposure to water can rot wooden assets such as poles.
- Equipment corrosion: Sea level rise and coastal storms pose a particular threat to coastal assets due to the corrosive properties of salt water, which can damage electronic components. These impacts may not be immediately evident but can present issues over time that may result in asset failures and outages.
- Soil weakening: Exposure to water can weaken or undermine the foundation of equipment in instances of prolonged inundation or erosion, increasing the overall risk of equipment damage. Increases in the projected flow and magnitude of floodwaters near riverbanks and the coast have the potential to alter and intensify how erosion occurs and may require intervention to avoid assets becoming destabilized or failing.
- Limited accessibility: Flooding presents issues of access. If assets are flooded or surrounded by water at high tide or during storms, it becomes more difficult to access the locations for maintenance and repair.

When choosing resilience strategies to address identified climate vulnerabilities, Con Edison follows a resilience framework that encompasses investments that:

- Prevent climate change impacts by hardening infrastructure
- Mitigate the impacts from outage-inducing events by minimizing disruptions
- Respond rapidly to disruptions by reducing recovery times and costs

The investments planned for the Substation Enclosure Upgrades program are focused on preventing potential water damage to switchgear and relays during storms or periods of heavy

precipitation, increasing the ability of the transmission system to withstand these climate change-driven weather events.

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

Impact on Disadvantaged Communities

The resilience strategies included in Con Edison's Resiliency Plan have been chosen in alignment with our Resiliency Framework that provides guidance for developing a comprehensive set of adaptation strategies to mitigate future climate change risks. This comprehensive set of strategies incudes investments that enable Con Edison's electric system to prevent climate change impacts by hardening infrastructure, mitigate the impacts from outage-inducing events by minimizing disruptions to customers, and respond rapidly to disruptions by reducing recovery times and costs.

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Disadvantaged communities (DACs) have fewer alternatives during energy system outages and will be more at risk from climate change. Because of this lack of alternatives, resilient and reliable energy service is an important priority for the communities and for Con Edison. Due to the size of Con Edison's electric system and the population density in the City, almost half of Con Edison's system serves at least one DAC. The Company has committed to tracking investments that benefit DACs specifically and to measuring and monitoring system performance in DACs and non-DACs. This tracking process will provide data and allow the Company to evaluate the benefits its investments to customers in DACs and revise its investment approach if needed.

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- Con Edison will work to understand DAC concerns.
- Clean energy investments will benefit DACs.
- Con Edison will provide opportunities for employment in the clean energy future.

These equity considerations will help inform resilience plan investments moving forward.

Impact on Greenhouse Gas (GHG) Emissions

The primary goals of the programs and projects included in the Climate Vulnerability and Resiliency Plan, including the Substation Enclosure Upgrade program, are to withstand, absorb, or recover from the impacts of future climate changes on Con Edison's electric system. While none of the programs are focused on reducing GHG emissions, some of the programs could have small but positive impacts on Con Edison's overall GHG emissions, and none of the programs should negatively impact Con Edison's overall GHG emissions.

All of the programs that prevent or reduce the number of "truck rolls" required to assess, operate, or restore the electric system (i.e., the number of physical trips made by operators, technicians, and other field personnel to physical field locations) will reduce Con Edison's overall GHG emissions by reducing vehicle emissions associated with each field trip

prevented. The Substation Enclosure Upgrades program reduces the need for field visits by required to repair switchgear and relay equipment damaged by water intrusion by protecting the equipment from exposure to rain and snow or ice. Actual program reductions in GHG emissions from reductions in physical trips to the field depend on the number of trips avoided, the miles driven per trip, the type of vehicle, the type of fuel burned, and the condition of the vehicle.

Impact on Clean Energy Commitment
The Substation Enclosure Upgrades program supports Initiative 2 under Pillar 1 of the Clean Energy Commitment, Build the Grid of the Future.

Impact on 5-year and long-range plans (10-year)
This resilience program aligns with and supports Con Edison's integrated strategy, included in the January 2022 Long-Range Plan, focused on four strategic objectives related to Clean Energy, Climate Resilience, Core Service, and Customer Engagement. Con Edison's Climate Resilience strategic objective aims to increase the resilience of the energy infrastructure to adapt to climate change. Furthermore, Con Edison sees the role of utilities as changing from providing, "Universal access to energy that is safe and reliable" to providing, "Universal access to energy that is safe, reliable, and *resilient* (able to prevent, mitigate, and recover from events.)" (emphasis added)

The Substation Enclosure Upgrades program provides resilient energy delivery by preventing equipment failure from water intrusion due to climate-driven extreme storms and heavy precipitation.

Impact on Company Risk Mitigation Activity
Resiliency, in simple terms, can be defined as having the capacity to withstand or to recover quickly from difficulties. While a bit more complex, Con Edison's Resilience Management Framework definition of resilience is very similar – i.e., the Framework identifies resilience strategies as investments that enable Con Edison to withstand changes in climate and avoid outages, absorb impacts from outage-inducing events by limiting the number of customers impacted or improving the customers' ability to cope with outages, recover quickly, and advance to a better state. Both equate resilience with the avoidance or limitation of difficulties or negative consequences – i.e., with the mitigation of risk.

The 2022 Electric Operations Risk Assessment and Mitigation plans include mitigation activities associated with increasing risks of major storms that could damage the Con Edison system and impact customers. Con Edison's comprehensive set of resiliency programs are designed to increase the ability of the electric system to withstand the impacts of climate change, including the increasing risk of storms, and limit potential impacts to customers. The Substation Enclosure Upgrades program mitigates the risk of increased switchgear or relay failures from the impacts of climate change by preventing equipment failure from water intrusion due to climate-driven extreme storms and heavy precipitation.

2. Supplemental Information

Alternatives
There is no practical alternative to work under this program that will mitigate potential risks of damage to switchgear and relays from water intrusion during climate-driven increases in storm frequency and severity and more frequent heavy precipitation. Fully enclosing substations would be cost prohibitive and would require the same or greater outages than the current plan, extending the total amount of time required to protect all in-scope switchgear and relays and making Con Edison's transmission system less resilient.

Risk of No Action
The Climate Change Vulnerability Study concluded that Con Edison's overhead distribution system is vulnerable to risk of damages from extreme weather events like those that have been experienced in recent history. The Study also confirmed that a growing body of scientific evidence supports the conclusions that projected climate changes project these extreme storm events to be likely to increase in frequency and intensity in the future. Numerous evaluations following actual events have also revealed that the increased frequency of these types of events tends to erode the ability of communities and their residents to cope with and recover from the impacts of extreme events, with members of disadvantaged communities the least able to recover.

Without accelerating the proposed resiliency investments included in the Substation Enclosure Upgrades program, Con Edison's transmission system will be less able to withstand the impacts of more frequent and severe weather events driven by climate changes without experiencing switchgear and relay failures resulting from water intrusion.

Non-Financial Benefits
The work included under the Substation Enclosure Upgrades program, increases the overall resiliency of the transmission system to withstand the impacts of future climate-driven weather events by maintaining the robust, three-contingency design of the system – i.e., by reducing the risk of failure of switchgear and relays due to water intrusion as one of the three "contingencies" that the system is designed for. These equipment failures do not typically result in customer outages, but the probability of outages is increased with each system failure experienced.

Summary of Financial Benefits and Costs
1. Cost-benefit analysis
Con Edison 's transmission system is designed to be robust: in all areas of its service territory, no single failure should result in loss of load; and in much of its service territory (that system serving network distribution system load), no two failures should suffice to cause a loss of load. Consequently, while it is unlikely, though by no means impossible, that random failures of equipment will force load to be dropped, this may not hold true of a system confronted by the anticipated increases in load or undercut by vulnerabilities that allow the common cause failure of equipment. These vulnerabilities have led to previous major outages in Con Edison's service territory: extreme weather (e.g., tropical storm Sandy, 10/29/2012; a substation fire, 8/13/1990); and relaying problems (the Bronx, 6/20/2007, and on the west side of Manhattan, 7/13/2019). In addition, both rain and lightning are known to cause equipment failure and could be widespread in their effect.

Depending on the magnitude, a sizable load drop and potential long duration outage can make loss of load events on the transmission level more impactful. Although it is not possible to predict the potential cumulative costs to the community of a widespread loss of load event from a rare transmission system failure, the Company considers this risk significant and invests in programs designed to prevent or recover from even unlikely loss of load events. The programs included in Con Edison's Climate Change Resiliency Plan are designed to increase the transmission system's resilience given the vulnerabilities identified from projected climate-change-induced extreme weather events.

The primary financial benefits of this program are savings associated with not having to replace degraded switchgear and relays that become damaged or degraded from water intrusion. Additional savings stemming from this program include reduced costs associated with equipment trips caused by water intrusion.

2. Basis for estimate
Basis for Estimate for Switchgear Enclosures: This funding request is based on the cost of actual work done in prior years under this program. The average cost per unit is $600K and is budgeted for one unit per year.

Basis for Estimate for Relay Enclosures: This funding request is based on the cost of actual work done in prior years under these programs. The average cost per unit is $600-800k with one enclosure budgeted per year.

Project Risks and Mitigation Plan

Risk 1 – Outage scheduling conflicts with other initiatives.

Risk 1 Mitigation Plan – Outages to be coordinated with the Sequencing Group at System Operations to potentially incorporate other project/programs to avoid conflict with other program/ projects resulting in a more predictable budget and manageable outage scheduling.

Risk 2 – Delays due resources support coordination.

Risk 2 Mitigation Plan – Anticipate, schedule and pre-plan with resource requirements such as engineering, labor, and construction and outages to avoid performance delays alignment conflicts.

Risk 3 – Lack of alignment between resources support and outages.

Risk 3 Mitigation Plan – Anticipate, schedule and pre-plan with resource requirements such as engineering, labor and construction to avoid alignment conflicts with outages.

Technical Evaluation / Analysis

N/A

Project Relationships (if applicable)

N/A

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	**–**	**–**	**–**	**–**	**–**	**–**
Capital	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

2025-2029 Request:

Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	**–**	**–**	**–**	**–**	**–**
Capital (Total)	**$0**	**$1,400**	**$1,400**	**$1,400**	**$1,500**
Labor	$0	$218	$218	$218	$234
M&S	$0	$448	$448	$448	$480
Contract Svcs.	$0	$350	$350	$350	$375
Other	$0	$0	$0	$0	$0
Overheads	$0	$384	$384	$384	$411

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	–	–	–
Capital	**$8,100**	**$9,400**	**$10,800**
Basis for funding direction:	Similar scopes of work with annual inflationary cost escalation (3%)	Similar scopes of work with annual inflationary cost escalation (3%)	Similar scopes of work with annual inflationary cost escalation (3%)

Storm Resilience Center

Electric Operations / DE

1. Project / Program Summary

Type: ☐ **Project** ☒ **Program**	**Category:** ☒ **Capital** ☒ **O&M**
Work Plan Category: ☐ **Regulatory Mandated** ☒ **Operationally Required** ☐ **Strategic**	
Project/Program Title: Con Edison and O&R Storm Resilience Center	
Project/Program Manager: George Czerniewski	**Project/Program Number (Level 1):** 27207949
Status: ☒ **Initiation/Planning** ☐ **In-Progress (Projects Only)** ☐ **On-going (Programs Only)**	
Estimated Start Date: 2025	**Estimated Date In-Service:** 2030
2025-2029 Funding Request ($000) **Capital: $177,650 (Total for both Companies)** **O&M: $5,200 (Total for both Companies)**	

Work Description:

Over the past decade, New York City and the surrounding area has experienced an increasing number of named storms (i.e., nor'easters, hurricanes, and tropical storms), tornadoes, severe/straight-line wind events, heavy rains/severe flash floods, heat waves, and other extreme weather events that have resulted in unprecedented challenges to Con Edison's and O&R's customers and the communities we serve. As a result of these challenges, the State of New York passed an amendment to the public service law, in relation to storm hardening and system resiliency plans (Part A of the Act). As stated in the Act, the Legislature declared, "that, due to the rise in storm intensity, and effects of climate change, dedicated storm hardening programs need to be developed and implemented throughout New York State to reduce damage and costs from future weather events, as well as facilitate prompt restoration times." The Act states further that, "It is in the state's interest for each utility to mitigate restoration costs and outage times to utility customers when developing transmission and distribution storm protection plans…."

As part of the effort to reduce outage duration times and costs for customers, Con Edison and O&R will enhance our storm readiness and response programs through the development of a state-of-the-art storm response facility, the Con Edison and O&R Storm Resilience Center (the Center). The Storm Resilience Center will serve as a centralized staging area for crews, including mutual aid, during recovery from extreme weather events. It will also serve as a bed down location for mutual aid crews. Finally, the Center will serve as the year-round home for what will eventually be 250+ bucket trucks that the Companies maintain for fly-in mutual aid crews.

Con Edison and O&R plan to design and construct a facility that will include space to permanently keep and maintain storm vehicles for use by mutual aid crews, store storm materials and equipment, a Mutual Aid Storm Operations Management Center, indoor space for meetings and training, an outdoor training area, sleeper trailers to bed down and associated support space to house up to 500 mutual aid crew members. Since the focus of the Storm Resilience Center is to serve as a hub for the response to the most extreme weather impacts to the service territory, the facility itself will be hardened against those impacts as well. This will include backup power generation, flood protection, canopies for vehicles, fueling stations, and other features to allow the facility to be self-sustaining during an extreme weather event. Planning for the design and construction of the Storm Resilience Center is in the initial stages as the Company is currently working to determine a site for purchase or repurposing.

The Company currently leases a site in Pomona, NY to store its mutual aid bucket trucks and stage for major weather events. The lease for the Pomona site ends in 2026, with plans to extend through 2027. However, it is not clear if the Company will be able to continue the lease beyond that. Further, the Pomona site is not big enough to accommodate 250+ mutual aid bucket trucks that the Con Edison and O&R will have by that time. In addition, this site cannot accommodate material storing, staging and on-stie lodging of mutual aid. Furthermore, most Con Edison sites (e.g., existing service centers and other work locations) do not have any room to store and maintain the mutual aid bucket trucks.

One of the key benefits of the Storm Resilience Center related to the reduction of outage recovery times for customers is its ability to house and provide equipment and support to mutual aid crews flown in from outside the region. The Company relies on mutual assistance resources when planning for and recovering from major storm events. Ideally, commitments can be obtained from neighboring utilities for the provision of support because of their proximity and familiarity with the area. Unfortunately, for most impactful storms, neighboring utilities need to retain resources for their own readiness for potential storm impacts and may also be attempting to acquire additional support through mutual assistance as well. Instead, the Company typically secures mutual aid support crews from utilities and contractors that are far enough away from the storm's path to be reasonably confident of no local impacts. The mutual assistance resources then, typically, either wait until the storm has passed before deploying to Con Edison's and O&R's service territories or travel part of the way and stage closer but still far enough away to avoid potential storm impacts, traveling the remaining distance once the storm has passed. These resources typically travel in their own bucket trucks or other utility vehicles that they then use while assisting with the restoration of Con Edison's and O&R's systems.

The Storm Resilience Center expands the pool of available mutual assistance resources and facilitates faster deployment of these resources by providing full, on-site support for these resources including vehicles and tools needed for system restoration. Without the need to also supply their own utility trucks and tools, resources from further distances (away from any possible storm impacts) can be committed to support Con Edison and O&R early, can be flown in prior to the storm, and housed on-site, ready to begin restoration activities as soon as the storm has safely passed without additional travel time. In addition, if the impacts of a weather event turn out to be more extreme than anticipated, Storm Resilience Center also provides the same flexibility to fly in additional mutual aid resources immediately after an event, avoiding the same delays associated with mutual air resources driving as described above.

The primary enabler of this reduction in the time to restore the system is elimination of the need for all mutual assistance workers to drive the utility vehicles that they will need to perform field work on Con Edison's system from their base location. Instead, the vehicles and tools needed by these crews will be purchased and housed and maintained at the Storm Resilience Center expressly for this purpose. Provision of on-site lodging and personal support for up to 500 mutual assistance resources at the Center enables on-site training/system familiarization of resources prior to, during, and immediately after the storm and faster deployment to the field.

In addition to directly supporting restoration crews during extreme weather events, the Storm Resilience Center will also serve as a year-round resiliency center of excellence. The Center will be able to centralize expertise and training in order to enhance the Company's ability to respond to extreme weather events through training, exercises, and drills.

The training value of the Storm Resilience Center will also extend beyond Con Edison and O&R employees. The Center will be able to offer training as well as opportunities to coordinate and conduct drills with first responders, municipal officials, telecom companies, and other utilities. One example could be crew guide training for both Company resources and those from other utilities.

Another example of this training for municipal officials and first responders could be on the identification of downed wires and associated hazards. Instruction on being able to identify a downed electric wire, versus things such as telecom wires or guide wires would create greater accuracy in the identification process as well as allowing the Company to get the right resources needed for the job to the location in a more efficient manner. The Center could also serve to provide education to the public related to extreme weather events (such as education on storm preparedness, safety education (e.g., down wires), and conservation measures during heat events for example).

Further, during actual extreme weather events, real-time coordination between all the above stakeholders can take place at or be based at the Storm Resilience Center. Finally, if the situation permits, the Storm Resilience Center could also be used by neighboring utilities during extreme weather events impacting their service territories. For example, during Winter Storm Sage in March 2023 the impacts to Con Edison and O&R service territories were less severe than anticipated, but the impacts in neighboring Central Hudson territory were more significant. Mutual aid resources flown in by Con Edison were released and successfully repurposed to support Central Hudson recovery efforts. This included the use of the Con Edison vehicles purchased and maintained for mutual aid resources. In this case, Central Hudson provided the funding for the use of these resources from the point when they were released by the Company.

Justification Summary:
Following Superstorm Sandy, Con Edison worked with a Storm Hardening and Resiliency Collaborative to recommend storm hardening investments and one of the recommendations was to conduct a Climate Change Vulnerability Study (CCVS or the Study). The initial Climate Change Vulnerability Study was conducted in 2019 and was updated in 2023. The approach followed a multi-step process that cycled through the steps for each potential climate hazard, incorporating feedback from stakeholders throughout the evaluations. The Study used the best available science to evaluate the sensitivity of Con Edison's electric system to projections of potential climate hazards including:

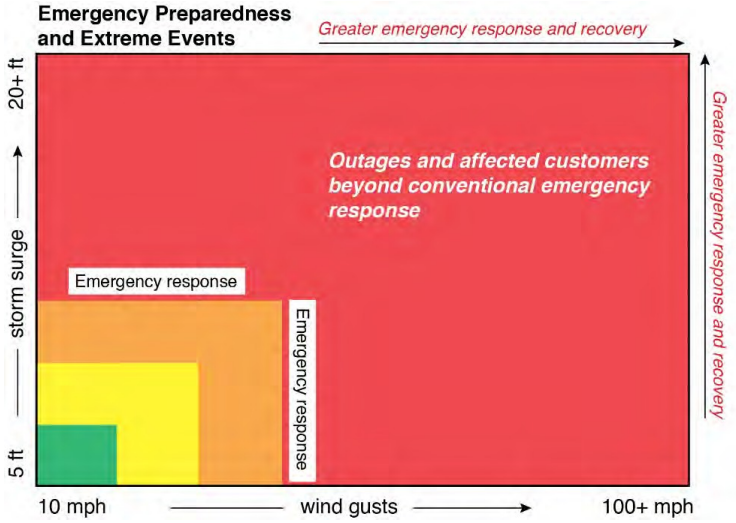
- **Temperature and humidity** – from heat and coincident high heat and humidity (known as temperature variable or "TV")
- **Flooding** – coastal flooding from sea level rise and/or inland flooding from precipitation
- **Wind and ice**
- **Extreme and coincident weather events** – hurricanes/wind, extreme heat waves, nor'easters/cold snaps, and multiple concurrent or consecutive extreme events

The hazards that the Study found to pose an elevated risk to Con Edison's assets and operations include heat and humidity, major storms, wind and ice, and extreme events.

	Con Edison's service territory is projected to be impacted by rising temperatures. Those impacts are expected to be amplified during intense heat waves. Increasing TV will cause load to increase, potentially challenging the capacity of the system.
	Con Edison has previously experienced flooding events that have impacted its assets from major storms. Due to future climate projections, that risk is expected to expand in Con Edison's service area, and facilities like substations will be more exposed to flooding.
	Con Edison's overhead distribution system has historically been the most sensitive to wind and ice, due to its susceptibility to tree contact during high wind and icing events.
	Extreme events are low-likelihood, high-impact scenarios that can amplify and compound the types of impacts anticipated from changes in temperature, sea level rise, and other variables. These events pose risks to all aspects of the system and are especially impactful for emergency response planning.

Specific projections of future climate conditions, referred to as pathways (Pathways) were incorporated into the Company's forecasting and planning processes – including load forecasting, load relief planning, reliability planning for the sub-transmission and distribution systems, asset management planning, facility energy system planning, planning for emergency preparation and response, and worker safety – through the development of a new Climate Change Planning and Design Guideline document (Guidelines). This document specifies the methodologies to be used to evaluate the vulnerability of electric facilities to projected climate changes and establishes specific design standards to be met for each climate hazard over the useful life of the asset.

On an operational level, the increasing frequency and intensity of extreme weather events may exceed Con Edison's and O&R's currently robust emergency preparedness efforts, outpacing current levels of emergency planning and preparedness. The increasing impacts during an extreme event (e.g., hurricane with extreme wind gusts and storm surge) demand correspondingly large emergency response efforts that may exceed those experienced historically. Such events also tend to play an outsized role in shaping the public's perception of climate change vulnerability and how institutions should address its unique challenges.



When choosing resilience strategies to address identified climate vulnerabilities, Con Edison follows a resilience management framework that encompasses investments that:

- Prevent climate change impacts by hardening infrastructure
- Mitigate the impacts from outage-inducing events by minimizing disruptions
- Respond rapidly to disruptions by reducing recovery times and costs

The resilience management framework facilitates long-term adaptation and creates positive resilience feedback so that Con Edison's systems achieve better functionality through time. To succeed, each component of a resilient system requires proactive planning and investments. Con Edison has already undertaken a range of measures to increase the resilience of its systems. For example, lessons learned, and vulnerabilities exposed during past events, including Superstorm Sandy (2012) and the back-to-back nor'easters (winter storms Riley and Quinn, 2018), resulted in significant capital investments to harden the system. With extreme weather events such as these projected to increase in frequency and severity, Con Edison has previously adopted measures that targeted improvements in emergency preparedness including (but are not limited to):

- Improving contractor and material bases for post-storm repair crews and equipment, including the following:
  - Expanding and diversifying spare material inventories
  - Ensuring that all spare materials are housed in safe locations

- Maintaining a fleet of OH storm response vehicles
- Conducting post-event debriefings to understand the impact of weather conditions on system performance
- Engaging with major telecommunications providers and enhancing communications systems among customer networks
- Facilitating equipment-sharing programs across New York State allows access to supplies during emergency response

Looking forward, as Con Edison is investing in the system of the future—one with greater monitoring capabilities, flexibility, and reliability—and simultaneously building a system that is more resilient to extreme weather events and climate change, Con Edison's comprehensive set of resiliency strategies includes strategies focused on emergency preparedness that limit customer impacts and improve customer coping, including:

- Using smart meters to implement targeted load shedding to limit the impact to fewer customers during extreme events
- Strengthening staff skills for streamlined emergency response
- Planning for resilient and efficient supply chains
- Coordinating extreme event preparedness plans with external stakeholders
- Incorporating low-probability events into long-term plans
- Expanding extreme heat worker safety protocols
- Examining and reporting on the levels of workers necessary to prepare for and recover from extreme climate events

Provision of many of these emergency preparedness services will be implemented through the proposed Storm Resilience Center. Acquiring mutual assistance resources when planning for a storm event is challenging. Neighboring utilities are reluctant to release internal employees or contractor resources until after a storm has passed and this will result in delayed restoration for our customers. Having a storm operations facility with trucks, tools, and materials provides additional options to acquiring resources further away from our service territory quickly and reducing outage durations for our customers. Further, managing the restoration work plan in one location with well-trained and experienced employees will promote safety, consistency, and efficiency.

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

Impact on Disadvantaged Communities

The resilience strategies included in Con Edison's Resiliency Plan have been chosen in alignment with our Resiliency Framework that provides guidance for developing a comprehensive set of adaptation strategies to mitigate future climate change risks. This comprehensive set of strategies incudes investments that enable Con Edison's electric system to prevent climate change impacts by hardening infrastructure, mitigate the impacts from outage-inducing events by minimizing disruptions to customers, and respond rapidly to disruptions by reducing recovery times and costs.

While the programs included in the Plan are largely focused on withstanding climate changes and avoiding outages, most programs also enable Con Edison to limit outage impacts on customers (i.e., absorb outage impacts), and restore service more quickly than would otherwise have been possible (i.e., recover quickly). Many of the investments proposed to strengthen Con Edison's ability to withstand extreme climate conditions will also, naturally, reduce the risk of outages during "blue sky" conditions.

Disadvantaged communities (DACs) have fewer alternatives during energy system outages and will be more at risk from climate change. Because of this lack of alternatives, resilient and reliable energy service is an important priority for the communities and for Con Edison. Due to the size of Con Edison's electric system and the population density in the City, almost half of Con Edison's system

serves at least one DAC. The Company has committed to tracking investments that benefit DACs specifically and to measuring and monitoring system performance in DACs and non-DACs. This tracking process will provide data and allow the Company to evaluate the benefits its investments to customers in DACs and revise its investment approach if needed.

The Company has also formed an Environmental Justice Working Group under an executive committee and plans to release a finalized Environmental Justice Policy Statement in 2023 to apply an equity lens to resilience-driven investments. Key components of the upcoming policy statement include:

- Operations will not disproportionately burden DACs.
- Con Edison will work to understand DAC concerns.
- Clean energy investments will benefit DACs.
- Con Edison will provide opportunities for employment in the clean energy future.

These equity considerations will help inform resilience plan investments moving forward.

Impact on Greenhouse Gas (GHG) Emissions

The primary goals of the programs and projects included in the Climate Change Resilience Plan, including the Storm Resilience Center program, are to withstand, absorb, or recover from the impacts of future climate changes on Con Edison's electric system. While none of the programs are focused on reducing GHG emissions, some of the programs could have small but positive impacts on Con Edison's overall GHG emissions, and none of the programs should negatively impact Con Edison's overall GHG emissions.

All of the programs that prevent or reduce the number of "truck rolls" required to assess, operate, or restore the electric system (i.e., the number of physical trips made by operators, technicians, and other field personnel to physical field locations) will reduce Con Edison's overall GHG emissions by reducing vehicle emissions associated with each field trip prevented. The proposed Storm Resilience Center is likely to reduce overall GHG emissions by eliminating mutual assistance long-distance trips in utility trucks, by assigning work to field crews based on location proximity, and by eliminating individual crew trips to warehouses to pick up material. Actual program reductions in GHG emissions from reductions in physical trips to the field depend on the number of trips avoided, the miles driven per trip, the type of vehicle, the type of fuel burned, and the condition of the vehicle.

Impact on Clean Energy Commitment

N/A

Impact on 5-year and long-range plans (10-year)

The Store Resilience Center supports Con Edison's integrated strategy, included in the January 2022 Long-Range Plan, focused on four strategic objectives related to Clean Energy, Climate Resilience, Core Service, and Customer Engagement. Con Edison's Climate Resilience strategic objective aims to increase the resilience of the energy infrastructure to adapt to climate change. Furthermore, Con Edison sees the role of utilities as changing from providing, "Universal access to energy that is safe and reliable" to providing, "Universal access to energy that is safe, reliable, and *resilient* (able to prevent, mitigate, and recover from events.)" (emphasis added)

The Storm Resilience Center directly supports the Company's goal of recovering from outage events quickly.

Impact on Company Risk Mitigation Activity
Resiliency, in simple terms, can be defined as having the capacity to withstand or to recover quickly from difficulties. While a bit more complex, Con Edison's Resilience Management Framework definition of resilience is very similar – i.e., the Framework identifies resilience strategies as investments that enable Con Edison to withstand changes in climate and avoid outages, absorb impacts from outage-inducing events by limiting the number of customers impacted or improving the customers' ability to cope with outages, recover quickly, and advance to a better state. Both equate resilience with the avoidance or limitation of difficulties or negative consequences – i.e., with the mitigation of risk. The Storm Resilience Center helps reduce the risk of prolonged outages caused by more frequent and severe weather events.

2. Supplemental Information

Alternatives

Alternative 1
Regarding creating a storm resilience facility for out of area mutual aid crews and have designated vehicles and equipment, an alternative would be to increase our internal Company overhead workforce and purchase vehicles and/or increase contractor resources. These options were considered but deemed not practical because non-storm related work does not support additional resources in the order of magnitude required to effectively respond to major storms. It is more effective to have storm vehicles ready at a moment's notice and acquire mutual aid resources from further away to help meet customer expectations.

Alternative 2
An alternative to having a storm resilience facility for out-of-area mutual aid crews and designated vehicles would be to secure needed mutual aid resources before a major storm. This would be done based upon the weather forecasts. This approach often results in difficulties securing needed resources. Specifically, there are a finite number of mutual aid resources and events impacting the east coast will result in all local mutual aid resources being secured by near-by utilities in the storm's path. Thus, requiring utilities to seek mutual aid resources from further way before the projected storm reaches the service territory. This now increases travel time/delays resource arrivals or results in non-productive time for mutual aid crews arriving at the site prior to the storm. Both options extend the period of time mutual aid crews are engaged and elevate restoration costs.

Alternative 3
The Company constantly monitors the weather and develops a weather risk assessment based upon each forecast. Unfortunately, as we have seen many times, the accuracy of the weather models is very unpredictable with the highest confidence coming the day of a forecasted event. Having vehicles available and ready for deployment allows for the Company to quickly pivot and secure additional resources when needed to support storm response and overall outage duration reductions. Not having this storm resilience facility and vehicles ready will reduce the Company's ability to quickly secure resources during unanticipated and or weather events resulting in more system impact than expected.

Alternative 4
An alternative for having a storm operations center is to manage a major event from multiple Company locations. This is not a practical and or desired approach since coordinating storm response priorities, dispatching crews, and overseeing individuals performing their system emergency assignment role in a centrally located area has proven very effective during training and recent mobilizations. More experienced system operators would have the ability to provide direct oversight of cell leads making switch moves on the distribution system. This is a unique skill set and having multiple locations would diminish the Company's ability to provide direct on-site support, closely coordinate crew restoration activities, and efficiently restore the system.

Alternative 5
An alternative to not having a storm resilience facility suitable for onboarding mutual aid, staging vehicles and materials, and housing resources on-site would be to secure various staging areas for vehicles and materials and to utilize available hotels to house resources, as we typically do. This approach has been getting more difficult; in recent, smaller mobilizations, many of our go-to staging areas and hotels have not been available. In larger events, many local hotels are occupied by the public. This results in using other, disperse staging areas and hotels, causing as much as four hours of non-productive travel time daily from hotels to staging areas, reducing crew efficiency and extending outage durations.

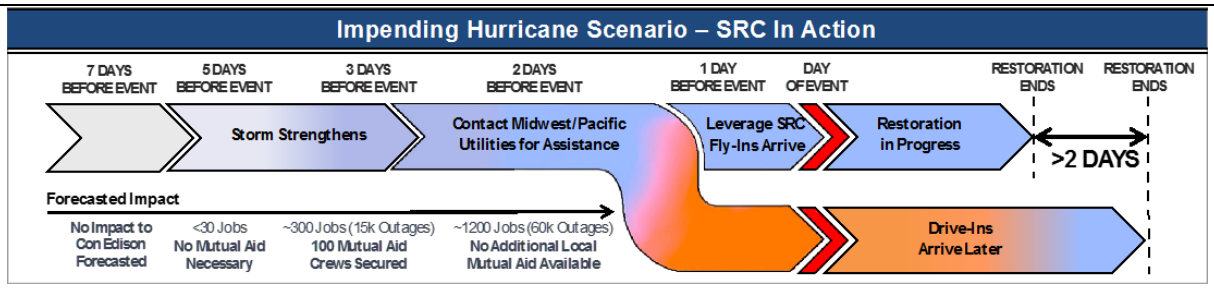
Risk of No Action
The Climate Change Vulnerability Study concluded that Con Edison's distribution system is vulnerable to risk of damage from extreme weather events like those that have been experienced in recent history. Modeling performed by climate science experts with input from Con Edison subject matter experts determined that the electric system is most vulnerable to climate-induced changes in temperature/humidity and sea level rise. The Study also confirmed that a growing body of scientific evidence supports the conclusions that projected climate changes project these extreme storm events to be likely to increase in frequency and intensity in the future. Numerous evaluations following actual events have also revealed that the increased frequency of these types of events tends to erode people's ability to cope with and recover from the impacts and that disadvantaged communities are the least able to recover. Not having the storm resilience center supporting the maintenance and storage of 250+ mutual aid vehicles, along with the ability to house resources, will reduce crew productivity and overall restoration efficiency, increasing ou

Non-Financial Benefits
The Storm Resilience Center will better accommodate mutual assistance crews and prepare them for long hours and challenging tasks. The Center will also allow the Company to more effectively and efficiently deploy field crews to address outages. Further, the Center will offer training as well as opportunities to coordinate and conduct drills with first responders, municipal officials, telecom companies, and other utilities. Collectively, the Center will result in reduced outage times, reduced outage costs, and both the Company and community being more prepared to respond to extreme weather events.

Summary of Financial Benefits and Costs
1. Cost-benefit analysis
The design and functionality of the Storm Resilience Center (the SRC) are focused on increasing the safe, effective, and efficient restoration of the Con Edison electric system following major storms. While the functions proposed to be served by the Storm Resilience Center will support this goal in multiple ways, the largest contributors to reductions in overall outage time come from the ability to:

- Decrease the time needed to engage mutual aid resources and for them to travel to the service territory, and from
- Increases in productivity of mutual aid resources housed on-site

As depicted in the conceptual scenario below, mutual aid crews are typically engaged two to three days prior to a major storm event and take two or more days to drive their own Company vehicles to the site with some crews arriving days after the event. With 250+ storm response vehicles stored at the SRC, as many as 250 mutual aid crews (500 people, assuming two-man crews working 12-hour shifts) could fly in to support restoration either right before the event or immediately after, shortening the time needed to restore the system by as much as potentially two or more days.



For each 24-hour period that an outage is reduced in the Company's service territory, Con Edison's customers and its communities benefit.

In addition, efficiencies enabled by the SRC can reduce the cost of the mutual aid resources needed for restoration by reducing the unproductive crew time involved in typical mobilizations, e.g., unproductive time in transit to and from the Company service territory and unproductive commuting time each day while supporting restoration efforts.

- Typically, mutual aid crews take two to three days to drive to (and from) the service territory, unproductive time that is included in the cost of the restoration. However, the SRC enables 500 mutual aid resources to fly in rather than drive, reducing unproductive time during transit, one to two days per person.
- The SRC will be designed to support lodging for 500 mutual aid personnel on site, eliminating the daily unproductive time these crews spend commuting daily from where they are being housed to the location where equipment is staged and back at the end of their shift.

The actual reduction in mutual aid costs enabled by the SRC cannot be predicted since storm events vary in intensity and the extent of system damage, resulting in differing levels of mutual aid support needed. However, using actual data from one region's experience during hurricane Isaias (mobilizing over 1400 mutual aid resources to restore customers over nine days), we estimated that the overall cost of mutual aid crews could have been reduced by more than 10% if the Storm Resilience Center had been available. This savings comes from reductions in unproductive time that the Company pays for including time in transit to and from Con Edison's service territory and time commuting to and from dispersed lodging daily. Similar savings in mutual aid costs would be enabled by having the Storm Resilience Center each time mutual aid resources beyond what is locally available are needed for system restoration.

2. Basis for estimate

Planning estimates for the proposed scope (Total Company, with CECONY incurring 92.9% and O&R incurring 7.1%) are below.

Storm Resilience Center - Capital Cost Estimate By Year

Component	2025 Cost ($M)	2026 Cost ($M)	2027 Cost ($M)	2028 Cost ($M)	2029 Cost ($M)	Totals ($M)
Land Purchase	26.00	0.00	0.00	0.00	0.00	26.00
Site Planning / Preparation / Drainage / Paving	3.00	18.00	18.00	0.00	0.00	39.00
Main Building Design, Construction, Buildout	0.00	0.00	30.00	30.00	18.00	78.00
Equipment, Furniture, Cabinets	0.00	0.00	0.00	0.00	4.40	4.40
Personnel Support Facilities	0.00	0.00	0.00	0.00	8.25	8.25
Car Port / Clean Energy Solar Farm	0.00	0.00	0.00	11.00	11.00	22.00
Total	**$29.0**	**$18.0**	**$48.0**	**$41.0**	**$41.7**	**$177.650**

Storm Resilience Center - O&M Cost Estimate By Year

Initiative	Component	2025 Cost ($M)	2026 Cost ($M)	2027 Cost ($M)	2028 Cost ($M)	2029 Cost ($M)	Totals ($M)
Annual Maintenance for Land, Property including Security, Landscaping, Miscellaneous Permits	General Property Maintenance / Landscaping	0.000	0.100	0.400	0.750	2.500	3.750
	Security (Fencing, Cameras, Monitoring)	0.000	0.250	0.500	0.150	0.250	1.150
	Miscellaneous Permits and Fees	0.000	0.050	0.100	0.050	0.100	0.300
	Initiative Total	**$0.000**	**$0.400**	**$1.000**	**$0.950**	**$2.850**	**$5.200**

Project Risks and Mitigation Plan

Risk 1 – Disruption to Critical Operations

Risk 1 Mitigation plan Complete the ongoing feasibility study of two Company owned sites for the Storm Resilience Center. In parallel develop a detailed schedule to design, construct, test, and commission the Storm Resilience Center and have any services provided by the Pomona location today in place before terminating the lease on the current Pomona facility. **Risk 2 –** Schedule Delays (including ability to locate a suitable property) **Risk 2 Mitigation plan** Continue to refine the scope and cost of all Storm Resilience Center focus areas; monitor and update preliminary cost estimates as required. Adjust prioritization, if needed, to establish initial operational capabilities for the Center.
Technical Evaluation / Analysis N/A
Project Relationships (if applicable) N/A

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend – TOTAL COMPANY

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	–	–	–	–	–	–
Capital	–	–	–	–	–	–

2025-2029 Request:

Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	**$0**	**$400**	**$1,000**	**$950**	**$2,850**
Capital (Total)	**$29,000**	**$18,000**	**$48,000**	**$41,000**	**$41,650**
Labor	$376	$388	$489	$493	$500
M&S	$188	$698	$4,644	$3,540	$12,650
Contract Svcs.	$2,989	$12,338	$30,305	$26,149	$17,337
Other	$18,197	$78	$562	$567	$750
Overheads	$7,250	$4,500	$12,000	$10,250	$10,413

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	**$15,585**	**$18,067**	**$20,945**
Capital	**$0**	**$0**	**$0**
Basis for funding direction:	Final building commissioning and ongoing facility maintenance escalated annually for inflation-related increases (3%)	Mutual assistance mobilization enhancements, ongoing facility maintenance escalated annually for inflation-related increases (3%)	Mutual assistance mobilization enhancements, ongoing facility maintenance escalated annually for inflation-related increases (3%)

2019-2024 Actual/Forecast Spend – CECONY (92.9%)

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	–	–	–	–	–	–
Capital	–	–	–	–	–	–

2025-2029 Request:

Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	**$0**	**$372**	**$929**	**$883**	**$2,648**
Capital (Total)	**$26,941**	**$16,722**	**$44,592**	**$38,089**	**$38,693**
Labor	$349	$360	$454	$458	$465
M&S	$174	$648	$4,314	$3,288	$11,752
Contract Svcs.	$2,777	$11,462	$28,154	$24,293	$16,106
Other	$16,905	$72	$522	$527	$697
Overheads	$6,736	$4,180	$11,148	$9,523	$9,674

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	**$14,478**	**$16,784**	**$19,458**
Capital	**$0**	**$0**	**$0**
Basis for funding direction:	Final building commissioning and ongoing facility maintenance escalated annually for inflation-related increases (3%)	Mutual assistance mobilization enhancements, ongoing facility maintenance escalated annually for inflation-related increases (3%)	Mutual assistance mobilization enhancements, ongoing facility maintenance escalated annually for inflation-related increases (3%)

2019-2024 Actual/Forecast Spend – O&R (7.1%)

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	–	–	–	–	–	–
Capital	–	–	–	–	–	–

2025-2029 Request:

Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	**$0**	**$28**	**$71**	**$67**	**$202**
Capital (Total)	**$2,059**	**$1,278**	**$3,408**	**$2,911**	**$2,957**
Labor	$27	$28	$35	$35	$36
M&S	$13	$50	$330	$251	$898
Contract Svcs.	$212	$876	$2,152	$1,857	$1,231
Other	$1,292	$6	$40	$40	$53
Overheads	$515	$319	$852	$728	$739

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	**$1,107**	**$1,283**	**$1,487**
Capital	**$0**	**$0**	**$0**
Basis for funding direction:	Final building commissioning and ongoing facility maintenance escalated annually for inflation-related increases (3%)	Mutual assistance mobilization enhancements, ongoing facility maintenance escalated annually for inflation-related increases (3%)	Mutual assistance mobilization enhancements, ongoing facility maintenance escalated annually for inflation-related increases (3%)

Storm Response Technology Advancements

Electric Operations / DE

1. Project / Program Summary

Type: ☐ **Project** ☒ **Program**	**Category:** ☒ **Capital** ☒ **O&M**
Work Plan Category: ☐ **Regulatory Mandated** ☒ **Operationally Required** ☐ **Strategic**	
Project/Program Title: **Storm Response Technology Advancements**	
Project/Program Manager: George Czerniewski	**Project/Program Number (Level 1):**
Status: ☒ **Initiation/Planning** ☐ **In-Progress (Projects Only)** ☐ **On-going (Programs Only)**	
Estimated Start Date: **2025**	**Estimated Date In-Service:**
2025-2029 Funding Request ($000) **Capital: $18,004** **O&M: $3,900**	

Work Description:

Over the past decade, New York City and the surrounding area has experienced an increasing number of named storms (i.e., nor'easters, hurricanes, and tropical storms), tornadoes, severe/straight-line wind events, heavy rains/severe flash floods, heat waves, and other extreme weather events that have resulted in unprecedented challenges to Con Edison's and O&R's customers and the communities we serve. As a result of these challenges, the State of New York passed an amendment to the public service law, in relation to storm hardening and system resiliency plans (Part A of the Act). As stated in the Act, the Legislature declared, "that, due to the rise in storm intensity, and effects of climate change, dedicated storm hardening programs need to be developed and implemented throughout New York State to reduce damage and costs from future weather events, as well as facilitate prompt restoration times." The Act states further that, "It is in the state's interest for each utility to mitigate restoration costs and outage times to utility customers when developing transmission and distribution storm protection plans…."

As part of the effort to reduce outage duration times and costs for customers, Con Edison will improve responses to extreme weather events through the development and use of various technologies. The Company has identified some potential systems and capabilities to leverage in order to reduce outage time and duration. In addition to the potential initiatives described below, Con Edison will continue to evaluate additional opportunities based on industry trends and available technologies.

The tools and systems used to manage outage restoration continue to become more complex. This requires infrequent users (those that support storm response (i.e., Electric Ops – Cell Leads) through their system emergency assignment) to maintain a higher level of proficiency to effectively fulfill their response role. To this end, the Storm Resilience Center will include a dynamic distribution system event simulator. This simulator will be designed and used for Distribution System Operators to hone their skills and, more importantly, help cell leads, who manage mutual aid during storm response, to develop and maintain proficiency. Availability of qualified and proficient individuals in these key emergency response roles provide essential support for mutual assistance crews and reduce the demand on main switching desk resources in the Control Center. Simulation training will also enable the training of additional operators to support the Control Center switching desk and support increased safety and efficiency in execution and in granting permission to operate system equipment. (See the associated supplemental detail/work paper, at the end of this document – "Distribution

System Event Simulator" – for additional details on the plan for developing the distribution system event simulator.)

The development and use of multiple types of leading-edge technology will reduce the time between the start of restoration, the time when field crews can safely begin repair operations, and when service is restored to customers. Critical to the response is the ability to quickly capture the full breadth of the storm's impact and infrastructure damage. This will allow the Company to accurately define the resource needs and confirm all material needs to effectively restore all customers. The Company will explore several technology-supported processes to expedite damage assessment and ultimately lead to right sizing crewing, addressing material needs, and increasing overall productivity. Some of these technologies will include:

- Assess damage using unmanned aerial vehicles (UAVs), infrastructure monitoring using overhead sensors, expediting the creation of priority work packages using aerial imagery combined with machine learning.
- Acquire and integrate information on the status of overhead distribution transformers into the Outage Management System (OMS)
- Utilize self-service technologies to reduce onboarding times
- Provide global positioning system (GPS) devices, to be installed in all non-Company owned mutual aid field crew vehicles to improve job dispatch
- Employ an electronic mobile application that can connect material supply vehicles with restoration crews requiring materials in the field

Satellite imagery, unmanned aerial vehicles including high altitude robots, and other remotely operated devices can be used to provide aerial assessment of storm damage. Traditional, in-person assessment of system damage through physical observation and manual entry of specific damages can be very time consuming, especially during major events. Progress is often hampered by road closures, flooding, or other conditions that delay the inspection progress. Instead, Con Edison and O&R will explore using remotely piloted and controlled aerial devices equipped with cameras to capture imagery of damage to supplement traditional damage assessment. Then, using AI/computer vision for evaluation, high-resolution images can be electronically overlaid on baseline images taken before the storm to identify specific damages and create electronic work packages. Use of these remote aerial assessment tools combined with digital technology may reduce the time needed to identify restoration work in heavily damaged areas.

Digital assessment of storm damage to the distribution system will also be provided through a pilot installation of circuit fault detection devices (with communication capabilities) on overhead distribution transformers with notifications of transformer status ultimately integrated into the OMS and into a dashboard for status monitoring. Additional sensors could be added to transformers and poles to sense and report other damage assessment information such as leaning poles or downed circuits, and to report critical operational information such as transformer voltages, loading and temperatures. Without the additional information on transformer status provided by sensors such as these, crews may be dispatched to complete field work on a circuit only to find they do not have the required skills and or equipment when they arrive, leading to additional delays in the time to restore service to the circuit.

The Company is also evaluating the installation of self-service kiosks. These kiosks will expedite the onboarding process of mutual assistance contractors. Similar to airport self-service kiosks, employees can check in when they arrive and possibly print out a temporary ID card that can be used for specific items (invoicing, materials, expenses, etc.). These will be portable kiosks that can be deployed to various onboarding sites as needed, such as the Storm Resilience Center.

The Company plans to use additional technological applications that will reduce the time needed to restore the distribution system to normal. This will be achieved by increasing field crew efficiency,

through opportunistic assignment of open outage events to crews and by enhancing the efficiency of the storm material delivery process.

Global positioning system (GPS) devices will be evaluated for installation in all non-Company owned mutual aid field crew vehicles. Positioning data from the vehicle will be integrated into a graphical view, identifying open outage events in the Outage Management System that are near the field crew's location. Crew locations and open outage events from OMS will be displayed on a dashboard with the recommended assignment of work crews. These assignments will be recommended automatically based on field crew qualifications and proximity to the outage area. The incorporation of this GPS technology will potentially reduce crew travel time on subsequent job assignments resulting in more efficient restoration times and costs.

Additional field crew efficiencies will be realized from the deployment of an electronic mobile material application (i.e., similar to a mobile phone application or "app") that can be used to identify a "material truck" (already in the field) that is stocked with the material needed to complete assigned outage work and route it to the outage site, much like personal ride-share services are viewed, selected and routed to someone's location. This innovative application focuses on maximizing crew wrench time by confirming which of the "material trucks" in the field at any given time has the material needed and is closest to the field crew's location prior to automatically dispatching the truck to deliver the material, avoiding potential crew inactivity while they wait for required materials to be delivered to their location from warehouses or storage locations.
(See the associated supplemental detail/work paper – "Improve responses to extreme weather events through the use of technology", at the end of this document - for additional details on the development approach and estimated costs of the technologies above.)

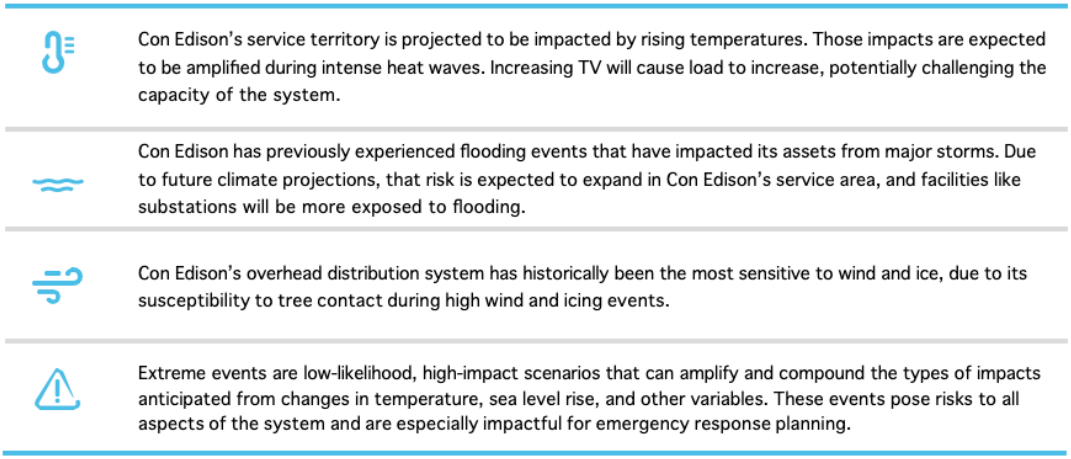
Through development and implementation of industry-leading storm response processes and deployment of leading-edge technologies, the Company will have the foundation for continuous analysis of Con Edison's weather-related outages and present potential opportunities to improve outage responses. Specifically, weather modeling and impact analysis are essential factors required to right size our response resources necessary to achieve desired restoration outcomes. Con Edison intends to develop and deploy a modern and robust weather modeling impact application. This new application will be a fully integrated platform that will analyze various inputs (i.e., historical outage events, weather data, vegetation management, etc.), with the intended output of the number of outage events expected from the storm impact. This information will be used to aid in optimizing resource requirements needed to achieve a desired estimated time of restoration for the event.

Also, this application will store weather and related data that will be used to train a machine learning based model to drive continuous improvements. Incorporating additional weather stations will provide more granular weather data to correlate with actual damage. This weather station data will then be an input to the machine learning model to further drive improvements by deriving damage impact in more targeted areas of the service territory. This level of detail will allow for strategic staging of crews and deployment of material laydown areas creating greater response efficiencies. This improved modeling and impact forecasting will lead to reduced customer outage durations and costs.

Justification Summary:
Following Superstorm Sandy, Con Edison worked with a Storm Hardening and Resiliency Collaborative to recommend storm hardening investments and one of the recommendations was to conduct a Climate Change Vulnerability Study (CCVS or the Study). The initial Climate Change Vulnerability Study was conducted in 2019 and was updated in 2023. The approach followed a multi-step process that cycled through the steps for each potential climate hazard, incorporating feedback from stakeholders throughout the evaluations. The Study used the best available science to evaluate the sensitivity of Con Edison's electric system to projections of potential climate hazards including:

- **Temperature and humidity** – from heat and coincident high heat and humidity (known as temperature variable or "TV")
- **Flooding** – coastal flooding from sea level rise and/or inland flooding from precipitation
- **Wind and ice**
- **Extreme and coincident weather events** – hurricanes/wind, extreme heat waves, nor'easters/cold snaps, and multiple concurrent or consecutive extreme events

The hazards that the Study found to pose an elevated risk to Con Edison's assets and operations include heat and humidity, major storms, wind and ice, and extreme events.

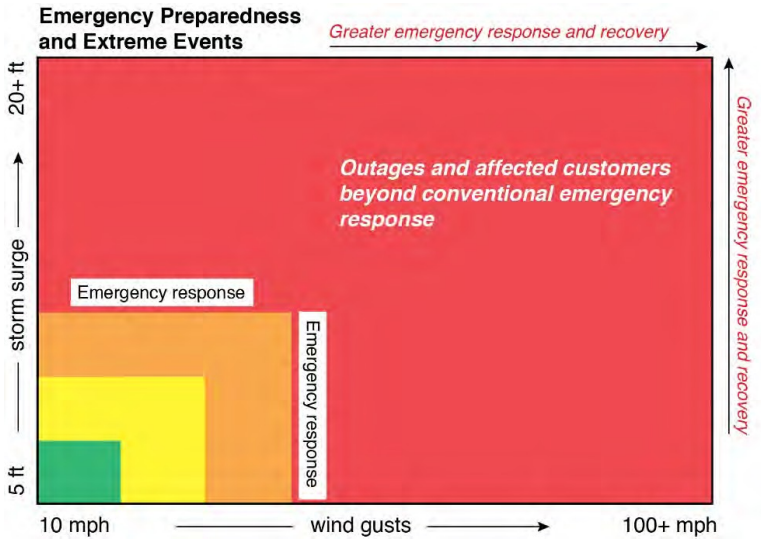


Specific projections of future climate conditions, referred to as pathways (Pathways) were incorporated into the Company's forecasting and planning processes – including worker safety, load forecasting, load relief planning, reliability planning for the sub-transmission and distribution systems, asset management planning, facility energy system planning, and planning for emergency preparation and response – through the development of a new Climate Change Planning and Design Guideline document (Guidelines). This document specifies the methodologies to be used to evaluate the vulnerability of electric facilities to projected climate changes and establishes specific design standards to be met for each climate hazard over the useful life of the asset.

On an operational level, the increasing frequency and intensity of extreme weather events may exceed Con Edison's and O&R's currently robust emergency preparedness efforts. The Company's current "full- scale" response, which calls for all Con Edison and O&R resources and extensive mutual assistance, is initiated when the number of customers out of service reaches approximately 100,000. However, low-probability high-impact extreme events can increase customer outages and outage durations by orders of magnitude, outpacing current levels of emergency planning and preparedness.

The increasing impacts during an extreme event (e.g., hurricane with extreme wind gusts and storm surge) demand correspondingly large emergency response efforts that may exceed those experienced

historically. Such events also tend to play an outsized role in shaping the public's perception of climate change vulnerability and how institutions should address its unique challenges.



When choosing resilience strategies to address identified climate vulnerabilities, Con Edison follows a resilience framework that encompasses investments that:

- Prevent climate change impacts by hardening infrastructure
- Mitigate the impacts from outage-inducing events by minimizing disruptions
- Respond rapidly to disruptions by reducing recovery times and costs

The resilience management framework facilitates long-term adaptation and creates positive resilience feedback so that Con Edison's systems achieve better functionality through time. To succeed, each component of a resilient system requires proactive planning and investments. Con Edison has already undertaken a range of measures to increase the resilience of its systems. For example, lessons learned and vulnerabilities exposed during past events, including Superstorm Sandy (2012) and the back-to-back nor'easters (winter storms Riley and Quinn, 2018), resulted in significant capital investments to harden the system. With extreme weather events such as these projected to increase in frequency and severity, Con Edison has previously adopted measures that targeted improvements in emergency preparedness including (but are not limited to):

- Improving contractor and material bases for post-storm repair crews and equipment, including the following:
- Expanding and diversifying spare material inventories
- Ensuring that all spare materials are housed in safe locations
- Maintaining a fleet of OH storm response vehicles
- Conducting post-event debriefings to understand the impact of weather conditions on system performance
- Engaging with major telecommunications providers and enhancing communications systems among customer networks
- Facilitating equipment-sharing programs across New York State to ensure access to supplies during emergency response

Looking forward, as Con Edison is investing in the system of the future—one with greater monitoring capabilities, flexibility, and reliability—and simultaneously building a system that is more resilient to extreme weather events and climate change, Con Edison's comprehensive set of resiliency strategies includes strategies focused on emergency preparedness that limit customer impacts, including:

- Using smart meters to implement targeted load shedding to limit the impact to fewer customers during extreme events
- Strengthening staff skills for streamlined emergency response
- Planning for resilient and efficient supply chains
- Coordinating extreme event preparedness plans with external stakeholders
- Incorporating low-probability events into long-term plans
- Expanding extreme heat worker safety protocols
- Examining and reporting on the levels of workers necessary to prepare for and recover from extreme climate events

Employing technologies that help in the quick assessment of the storm's damage and automate manual processes will enable crews to safely and more effectively and efficiently respond to outages, contributing to reduced restoration times and costs.

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

Impact on Disadvantaged Communities

The resilience strategies included in Con Edison's Resiliency Plan have been chosen in alignment with our Resiliency Framework that provides guidance for developing a comprehensive set of adaptation strategies to mitigate future climate change risks. This comprehensive set of strategies incudes investments that enable Con Edison's electric system to prevent climate change impacts by hardening infrastructure, mitigate the impacts from outage-inducing events by minimizing disruptions to customers, and respond rapidly to disruptions by reducing recovery times and costs.

While the programs included in the Plan are largely focused on withstanding climate changes and avoiding outages, most programs also enable Con Edison to limit outage impacts on customers (i.e., absorb outage impacts), and restore service more quickly than would otherwise have been possible (i.e., recover quickly). Many of the investments proposed to strengthen Con Edison's ability to withstand extreme climate conditions will also, naturally, reduce the risk of outages during "blue sky" conditions.

Disadvantaged communities (DACs) have fewer alternatives during energy system outages and will be more at risk from climate change. Because of this lack of alternatives, resilient and reliable energy service is an important priority for the communities and for Con Edison. Due to the size of Con Edison's electric system and the population density in the City, almost half of Con Edison's system serves at least one DAC. The Company has committed to tracking investments that benefit DACs specifically and to measuring and monitoring system performance in DACs and non-DACs. This tracking process will provide data and allow the Company to evaluate the benefits its investments to customers in DACs and revise its investment approach if needed.

The Company has also formed an Environmental Justice Working Group under an executive committee and plans to release a finalized Environmental Justice Policy Statement in 2023 to apply an equity lens to resilience-driven investments. Key components of the upcoming policy statement include:

- Operations will not disproportionately burden DACs.
- Con Edison will work to understand DAC concerns.
- Clean energy investments will benefit DACs.
- Con Edison will provide opportunities for employment in the clean energy future.

These equity considerations will help inform resilience plan investments moving forward.

Impact on Greenhouse Gas (GHG) Emissions
The primary goals of the programs and projects included in the Climate Vulnerability and Resiliency Plan, including the Storm Response Technology Advancements program, are to withstand, absorb, or recover from the impacts of future climate changes on Con Edison's electric system. While none of the programs are focused on reducing GHG emissions, some of the programs could have small but positive impacts on Con Edison's overall GHG emissions, and none of the programs should negatively impact Con Edison's overall GHG emissions.

All of the programs that prevent or reduce the number of "truck rolls" required to assess, operate, or restore the electric system (i.e., the number of physical trips made by operators, technicians, and other field personnel to physical field locations) will reduce Con Edison's overall GHG emissions by reducing vehicle emissions associated with each field trip prevented. Technology Advancements will likely reduce overall GHG emissions by eliminating mutual assistance long-distance trips in utility trucks, by assigning work to field crews based on location proximity, and by eliminating individual crew trips to warehouses to pick up material. Actual program reductions in GHG emissions from reductions in physical trips to the field depend on the number of trips avoided, the miles driven per trip, the type of vehicle, the type of fuel burned, and the condition of the vehicle.

Impact on Clean Energy Commitment
N/A

Impact on 5-year and long-range plans (10-year)
The Storm Response Technology Advancements program supports Con Edison's integrated strategy, included in the January 2022 Long-Range Plan, focused on four strategic objectives related to Clean Energy, Climate Resilience, Core Service, and Customer Engagement. Con Edison's Climate Resilience strategic objective aims to increase the resilience of the energy infrastructure to adapt to climate change. Furthermore, Con Edison sees the role of utilities as changing from providing, "Universal access to energy that is safe and reliable" to providing, "Universal access to energy that is safe, reliable, and *resilient* (able to prevent, mitigate, and recover from events.)" (emphasis added)

The Storm Response Technology Advancements program directly supports the Company's goal of recovering from outage events quickly.

Impact on Company Risk Mitigation Activity
Resiliency, in simple terms, can be defined as having the capacity to withstand or to recover quickly from difficulties. While a bit more complex, Con Edison's Resilience Management Framework definition of resilience is very similar – i.e., the Framework identifies resilience strategies as investments that enable Con Edison to withstand changes in climate and avoid outages, absorb impacts from outage-inducing events by limiting the number of customers impacted or improving the customers' ability to cope with outages, recover quickly, and advance to a better state. Both equate resilience with the avoidance or limitation of difficulties or negative consequences – i.e., with the mitigation of risk.

The Storm Response Technology Advancements program helps reduce the risk of prolonged outages caused by more frequent and severe weather events by developing technologies and approaches that will reduce the duration and cost of outage restoration.

2. Supplemental Information

Alternatives

Alternative 1

An alternative would be to not pursue advanced technologies associated with storm response. However, this approach was not chosen because it would not take advantage of continually evolving technological advances in this industry that are critical to enhancing response efforts. This would cause the Company to miss out on industry-leading technology approaches that will lead to more efficiently reducing the duration and costs of extreme weather event-related outages.

Risk of No Action

The Climate Change Vulnerability Study concluded that Con Edison's distribution system is vulnerable to risk of damage from extreme weather events like those that have been experienced in recent history. Modeling performed by climate science experts with input from Con Edison subject matter experts determined that the electric system is most vulnerable to climate-induced changes in temperature/humidity and sea level rise. The Study also confirmed that a growing body of scientific evidence supports the conclusions that projected climate changes project these extreme storm events to be likely to increase in frequency and intensity in the future. Numerous evaluations following actual events have also revealed that the increased frequency of these types of events tends to erode people's ability to cope with and recover from the impacts and that disadvantaged communities are the least able to recover.

The proposed Storm Response Technology Advancements program will provide advanced support capabilities for Con Edison's communities and customers that currently are not available (see discussion under Non-Financial Benefits). Without these capabilities, Con Edison and the communities they support could experience further extended outage periods in cases of severe storms with extensive damage.

Non-Financial Benefits

The Storm Response Technology Advancements program and associated capabilities and technologies will allow the Company to more effectively and efficiently deploy field crews to address outages. Collectively, the program efforts will result in reduced outage times and reduced outage costs.

Summary of Financial Benefits and Costs

1. Cost-benefit analysis

Con Edison has consistently adapted to the ever-evolving technological landscape, with a primary focus on enhancing customer service and resiliency. Our use of technology to improve our ability to respond to system outages safely, effectively, and efficiently has also demonstrated this commitment to leveraging the best technology available.

- **Outage Management System Evolution:** The Company's use of technology to improve outage responses began with the implementation of an Outage Management System, designed to minimize disruptions and enhance customer service. This system was designed to capture outages in a work agenda (table format) and display graphically, on a viewer. The work agenda and graphical view allows for efficient work prioritization, more effective outage restoration management, and enhanced communication to our customers. We have made continuous upgrades to ensure alignment with business needs and develop a more robust solution to meet industry demands.
- **Outage Prediction and Data Utilization:** Recognizing the significance of weather prediction in our operations, we have proactively developed and refined our outage prediction and forecasting tools to ensure improved preparedness for storm response and planning. We are also using technology platforms like Advanced Metering Infrastructure (AMI) to gain a

deeper understanding of our system's performance under a broad range of conditions as well as enhancing customer outage communication via automated validation using AMI data.

- **Transition to Data-Driven Operations:** Further efficiency improvements occurred when operations shifted from manual processes, such as using pen and paper for damage assessment when responding to storms, to the use of modern tools like iPhone Apps that are fully integrated and transmit real-time damage information from field capture to our outage management system.

The Company is continuing to ensure that our customers benefit from our use of advanced technology including current initiatives such as:

- **Predictive Maintenance for Customer Impact Mitigation:** To minimize customer impact during storms, we invested in upgrading system isolation equipment. Future goals through this program include using technology to monitor equipment health, offering early warnings of impending failures and/or actual damage events to aid in further reducing costs, enhancing system reliability and improving outage response, leading to reduced outage durations.
- **Machine Learning and Artificial Intelligence:** With a planned implementation of Machine Learning and Artificial Intelligence promising to drive data-driven efficiency in our preparedness and response to weather events, currently in the early stages, Con Edison is actively collaborating with experts, including Brookhaven National Labs for outage and wind gust modeling and the University of Albany for applying the NY Mesonet to utility outage modeling. As part of our initial work with the NY Mesonet, our aim is to use NY Mesonet data and AI/ML to improve local forecasting tools. This will help the Company optimize mobilization strategies and be better prepared to respond to impactful weather events.

The Storm Response Technology Advancement program is proposed to continue the Company's focus on leveraging technology to respond to system outages safely, effectively and efficiently. Each of the technologies included will enable reductions in overall outage times and restoration costs, increasing overall resiliency given projections of increasingly more frequent and intense storms.

Use of unmanned aerial vehicles (UAVs) such as drones or high-altitude robots to perform damage assessment will speed system restoration by allowing assessment of areas that may not be accessible by vehicles due to post-storm conditions. Additionally, UAVs can provide aerial photographs that will aid in the preparation of work packages. Similarly, implementation of technology like airborne sensors (like pole-top and cable height sensors) and transformer monitoring systems will provide critical information on the system status, without the need for crews to be dispatched to the field to assess status conditions. These capabilities will provide better information on system conditions to outage managers sooner, allowing more effective and efficient outage planning. Using technology to obtain information increases crew safety by reducing the risks associated with exposure to unsafe physical environments post-storm to obtain the information needed to effectively restore the system.

Many of the proposed technologies will enable digital data capture which, by integrating digital data streams into systems used for outage planning and management, will reduce planning time and enable more efficient restoration management. Digital data may also enable future use of artificial intelligence to expedite damage assessments and planning even further. Similarly, advanced weather modelling will enable more precise storm timing and intensity forecasting, also enabling the Company to predict and plan for restoration resources.

Although it is not possible to estimate the extent of the financial benefit of these resiliency improvements at this time, reductions in the amount of time required to restore the system to normal operations undoubtedly result in reductions to total outage costs. However, avoided outages benefit customers and their communities.

2. Basis for estimate

Planning estimates for the proposed scope are below.

Storm Technology Advancements - Capital Costs by Year

Initiative	Component	2025 Cost ($M)	2026 Cost ($M)	2027 Cost ($M)	2028 Cost ($M)	2029 Cost ($M)	Totals ($M)
* Expedite field crew deployment through the use of technology * Improve field crew efficiency through the use of technology * Document and analyze outage events and use data/feedback for continuous improvement	UAVs and Airborne Sensors	1.100	1.100	0.000	0.000	0.000	2.200
	OH Distribution Transformer Monitoring System	1.784	0.000	0.000	0.000	0.000	1.784
	Distribution System Event Simulator	3.130	3.130	2.000	0.000	0.000	8.260
	Self-service technologies for onboarding	0.250	0.300	0.000	0.000	0.000	0.550
	GPS for Mutual Aid Trucks	0.300	0.310	0.000	0.000	0.000	0.610
	Storm Material Delivery Application	2.000	0.000	0.000	0.000	0.000	2.000
	Outage documentation and analysis	0.000	0.500	0.600	0.000	0.000	1.100
	Management Support Resources	0.750	0.450	0.300	0.000	0.000	1.500
	Grand Total	**$9.314**	**$5.790**	**$2.900**	**$0.000**	**$0.000**	**$18.004**

Storm Technology Advancements - O&M Cost Estimate By Year

Initiative	Component	2025 Cost ($M)	2026 Cost ($M)	2027 Cost ($M)	2028 Cost ($M)	2029 Cost ($M)	Totals ($M)
Annual Maintenance for New Technology Solutions including accessories, repairs, connectivity, storage	UAVs and Airborne Sensors	0.00	0.015	0.015	0.015	0.015	0.06
	OH Distribution Transformer Monitoring System	0.00	0.025	0.050	0.050	0.100	0.23
	Distribution System Event Simulator	0.00	0.050	0.075	0.175	0.250	0.55
	Self-service technologies for onboarding	0.00	0.000	0.000	0.200	0.250	0.45
	GPS for Mutual Aid Trucks	0.00	0.010	0.010	0.010	0.010	0.04
	Storm Material Delivery Application	0.00	0.000	0.050	0.050	0.050	0.15
	Weather Modeling Application	0.00	0.000	0.050	0.050	0.075	0.18
	Management Resources	0.00	0.300	0.450	0.750	0.750	2.25
	Initiative Total	**$0.000**	**$0.400**	**$0.700**	**$1.300**	**$1.500**	**$ 3.900**

Project Risks and Mitigation Plan

N/A

Technical Evaluation / Analysis

N/A

Project Relationships (if applicable)

N/A

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	–	–	–	–	–	–
Capital	–	–	–	–	–	–

2025-2029 Request:

Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	**$0**	**$400**	**$700**	**$1,300**	**$1,500**
Capital (Total)	**$9,314**	**$5,790**	**$2,900**	**$0**	**$0**
Labor	$750	$450	$300	$0	$0
M&S	$2,195	$1,350	$600	$0	$0
Contract Svcs.	$4,000	$2,442	$1,250	$0	$0
Other	$40	$100	$25	$0	$0
Overheads	$2,329	$1,448	$725	$0	$0

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	**$6,152**	**$7,132**	**$8,268**
Capital	**$ 2,051**	**$ 2,377**	**$ 2,756**
Basis for funding direction:	Ongoing O&M escalated by annual inflation (3%); some management	Ongoing O&M escalated by annual inflation (3%); some management	Ongoing O&M escalated by annual inflation (3%); some management resource time (50%) charged to capital.

	resource time (50%) charged to capital.	resource time (50%) charged to capital.	

Additional Detail – Storm Response Technology Advancements

White Paper Reference/Topic:	Distribution System Event Simulator

Supplemental Content:

Distribution System Event Simulator

This project involves designing and building a dynamic distribution system event simulator that will help drive storm restoration readiness and efficient response to unplanned system events. This will result in reduced outage times and costs during major storm events and system contingencies through greater employee proficiency in their system emergency assignment roles. At a high level, it entails developing and documenting detailed requirements, establishing a Request for Proposal (RFP) with vendors, and ultimately selecting a qualified vendor to develop and deliver the distribution system event simulator. The simulation technology is intended to be interactive and realistic and will track an individual's proficiency and historical performance. Once the simulator is built, a training schedule will be established for control center employees and non-control center employees.

Having well trained and proficient distribution system operators and storm cell leads during a major storm promotes safe and efficient restoration. This technology will assist with identifying critical knowledge gaps and honing operator skills and will help maintain skill proficiency for all participants. Implementing this simulator program will result in more efficient outage restoration. Training individuals to be proficient in the technology is a critical aspect in driving effective responses. Through a regular cadence of simulator training, this simulation tool will help build and maintain proficiency for those who have a switching desk and/or cell lead storm role. Increasing the pool of qualified and efficient distribution system operators will help make restoration efforts more efficient. This program is designed to develop and enhance operator and cell lead skills which will result in an increased number of proficient operators.

Cost Estimates

The expected cost of this project is currently being evaluated. Simulation technology is used in many industries. The computer hardware is estimated at $2,000,000. The design, build and testing for all distribution system scenarios will cost approximately $5,000,000. Establishing the proper environment to house each simulator will cost approximately $500,000. Estimates are based on historical projects (including estimated contingency). The Company will need to continue benchmarking other utilities currently utilizing simulator technology. Implementation schedule is as follows: vendor selection in Q3 2025, computer equipment purchases in Q4 2025, design, build and test distribution system scenarios in 2026, simulator deployment Q1 2027.

Additional Detail – Storm Response Technology Advancements

White Paper Reference/Topic:	Improve field crew efficiency through the use of technology

Supplemental Content:

Damage Assessment Using Unmanned Aerial Vehicles (UAVs)

This project is focused on expediting the damage assessment process after storms impact our service territory, which helps reduce outage restoration times and costs. It entails conducting various pilot programs with vendors that utilize satellites, drones, and high-altitude robot technology to acquire storm damage information. This damage information is then transmitted electronically and digitally superimposed onto a feeder print to create an electronic work package.

Damage assessment is typically done by trained employees who are dispatched to outage events in OMS. These assessors get in their vehicle, drive to the location, and then patrol the circuit, identifying damage and entering that data into a computer application. This is very difficult and time-consuming during major events since many roads are blocked by downed trees or other damage and it may take

many hours to complete the inspection. Having technology that can help mitigate the impact from blocked roads and subsequently overlay imagery after a storm on baseline imagery taken before a storm can help identify damage expeditiously, dispatch the right resources and material and advance the restoration process. Electronic work packages can be issued, and field crews dispatched without waiting for a manually created package.
Mutual assistance resources are typically onboarded and ready for mobilization before a storm impacts the service territory. Work packages start to get issued on day two of restoration, following a full day of damage assessment. If work packages can be provided to field crews sooner, the restoration process would be more efficient. Material lists can be generated based on high resolution imagery when damage information can be received quickly.

Cost Estimate

The expected cost for this project is $2,200,000 ($2,000,000 plus 10% contingency). The UAV and overhead sensor project will likely include a number of different efforts, some of which may include:

1. Satellites – Planning to begin as a pilot program in Q2 2025.
2. Drones – Currently benchmarking with other utilities and evaluating feasibility of use in damage assessment in our service territory.
3. High Altitude Robots (I.e., Swifty 3) - Is currently under evaluation for use in damage assessment.
4. Automated Electronic Work Packages – Once the data is acquired by the satellite and/or drone, the feeder print would get updated with any areas displaying anomalies.
5. These pilot projects will be evaluated and if successful, the Company may invest in longer term strategies using these technological approaches to advance damage assessment.

Additional Considerations

Federal Aviation Administration restrictions must be studied and understood prior to purchasing drones or establishing long-term contracts.

Overhead Distribution Transformer Monitoring and other Pole Top Sensors

This project involves reducing outage restoration time and costs using distribution transformer monitoring technology and Pole top sensors. It entails purchasing circuit fault detection devices with communication capabilities, installing them on overhead distribution transformers, creating a monitoring dashboard to provide visibility to these locations, training a task force to respond to these locations, and integrating notifications with our Outage Management System. Additional sensors and devices can be included in this effort to indicate leaning poles, height sensors for wires down, and other critical information such as transformer voltages, loading, and temperature. Operating costs to conduct training and run functional exercises would be included in this effort.
Having overhead distribution transformer data available and or pole top sensors during a major storm will help prioritize events and restore customers sooner. As an example, service crews are often sent to customer outage jobs but do not always know the status of the equipment and may not have the skill set required to complete the field work, potentially requiring additional resources or other delays as they wait for equipment. This technology will help identify transformers that have the secondary breaker tripped but primary bushings energized. A special task force can be trained to address any secondary repairs and reenergize the transformer instead of waiting for other mutual assistance crews working on major restoration jobs.
Implementing this program will result in more efficient storm event scheduling. This will drive reductions in outage durations and restoration costs. Real-time analytics and automated damage assessments allow field crews to be assigned to jobs that better match their specific skillsets or limitations. This technology can also help identify equipment anomalies resulting in proactive prevention of outages. This is done through the identification of equipment or pole issues based upon the additional data points provided by this technology. The technology will lead to reduced restoration times for customers.

Cost Estimates

The expected cost of this project is currently being evaluated. A small, targeted pilot program utilizing overhead distribution transformers in Westchester County will be developed. In total, approximately 610 units are being considered for this pilot program at an estimated cost of $1,784,000. This consists of purchasing the devices, installation, monitoring, and system integration. Implementation schedule is as follows: selecting a vendor in 2025, installing the devices in 2025, and developing integrations with our Outage Management System in 2027.

GPS for Mutual Assistance Trucks

This project involves researching and purchasing global positioning system (GPS) devices that can provide field crew location information and display on a map along with open outage jobs. The ideal GPS devices will be easily affixed to mutual assistance vehicles or installed expeditiously and will feed data directly into a graphical view of open outages. Visibility to field crew locations and open outage events will be available on a reporting dashboard. The project includes resources to complete the following tasks:

1. Research and purchase GPS devices that meet requirements, such as extended battery life and ability to integrate with the Company's current telematics platform
2. Identify and develop a mapping view of vehicles and open outage jobs by integrating the GPS data and Outage Management System (OMS) events
3. Create a reporting dashboard that provides visibility into field crew location and open outage events from OMS

During major storm response events, it is likely that there will be hundreds of mutual assistance crews supporting the event. Assigning a second job/work package manually can become cumbersome and inefficient since multiple individuals are searching for work in OMS concurrently. This technology will streamline the process and provide operators with quick visibility of open jobs and crew locations, making it easier to assign appropriate near-by crews to assist and/or start new work. This will reduce unnecessary travel time and distance for field crews and ultimately reduce overall restoration time.

Estimated Costs

High level estimate for this project is $610,500 ($555,000 plus 10% contingency). Below is a high-level breakdown of costs:

1. GPS devices for 800 mutual assistance crews - $80,000
2. GPS device storage and charging units - $100,000
3. GPS device connectivity $70,000
4. Reporting Dashboard – included in platform
5. Training Environments (Hardware, Servers, etc.) - $250,000
6. Training (Labor) - $55,000

The cost estimate used is $100 per device. Storage units with charging stations includes labor, delivery, and installation fees. Connectivity is estimated at $7 per unit per month and is based on historical projects that have already been completed. The same applies for the training and reporting estimates.

Storm Material Delivery Application

This project involves reducing outage restoration time and costs by automating the storm material delivery process. It entails developing a smart device application that allows field personnel to request a material delivery from the most convenient driver, purchasing smart devices for use by Overhead Crew Guides including retirees, and creating a reporting dashboard. Like ordering car service on the Uber App, this storm material delivery application will identify the closest material truck to the field crew and route them to their location. The application will first confirm the required material is available on that specific delivery truck before dispatch. Developing and testing the application will take place in 2025. Smart devices will be researched and purchased in 2025 for each crew guide assigned to a field crew. Training and functional exercises will be conducted in Q2 2025. Expected implementation is June 2025.

Typical mutual assistance crews consist of three trucks and five field workers. Today, when material is required, one or more of the trucks would have to go back to a material lay-down area to secure the

needed material. This results in significantly delaying restoration efforts and reducing overall available crew productive hours while waiting for material. This program's benefits will include reduced restoration costs and better support for our customers through reduced outage times.

Estimated Costs

The expected cost for this project is $2,000,000 ($1,600,000 plus 25% contingency). Below is a high-level breakdown of costs:

1. Smart Devices (ruggedized iPad) - 300 devices with connectivity plans for overhead crew guides that will allow access to the storm material delivery application, primary and secondary mapping systems, and applications such as Oracle Field Services, contractor invoicing, and OMS - $600,000.
    a. Implementation schedule: Out for bid in Q1 2025, preferred delivery Q2 2025.
    b. 300 devices x $2000 per device = $600,000.
2. Storage Cabinets with charging stations and connectivity for security updates - $100,000.
    a. Implementation schedule: Research in 2024, Preferred delivery Q2 2025.
    b. Includes delivery and set up.
3. Storm Material Delivery Application – Labor and infrastructure to develop, test and train - $500,000.
    a. Implementation schedule: Out for bid in Q1 2025, consultant onboarded Q2 2025, design Q2 2025, build Q3 2025, test Q3 2025, launch Q4 2025.
4. Reporting Dashboard – Visibility to field crews, material delivery trucks, pickup trucks outfitted with material storage caps and staging areas - $200,000.
    a. Implementation schedule: Out for bid in Q1 2025, consultant onboarded Q2 2025, design Q2 2025, build Q3 2025, test Q3 2025, launch Q4 2025.
5. Training and Reference Materials – Labor and materials for training end users and conducting functional exercises -$200,000.
    a. Implementation schedule: Q3 2025 after build phase.
    b. Estimated at 200 consultant hours to create training program and reference documents (user guide, job aids, eLearning, etc.) plus costs for handouts /hard copies.

Emergency Outage Communications Program

Customer Operations

1. Project / Program Summary

Type: ☐ Project ☒ Program	**Category: ☒ Capital ☒ O&M**
Work Plan Category: ☐ Regulatory Mandated ☐ Operationally Required ☐ Strategic	
Project/Program Title: Emergency Outage Communications Program	
Project/Program Manager: Edineria Soares	**Project/Program Number (Level 1):**
Status: ☒ Initiation/Planning ☐ In-Progress (Projects Only) ☐ On-going (Programs Only)	
Estimated Start Date: 01/2025	**Estimated Date In Service: On-going**
2025-2029 Funding Request ($000) **Capital: $10,610** **O&M: $10,000**	

Work Description:

The increased frequency and severity of climate events and related outages have elevated the importance of improving the speed and efficiency of communicating with large groups of customers to relay vital information before and during large impact emergencies. As the Company works to reinforce every aspect of its ability to respond to these potentially larger and more catastrophic weather-related events, it became clear that an upgrade in its customer communications systems is needed.

To support the Company's resiliency measures and the reinforced Emergency Response Plan, the Company's goal is to enhance its emergency communications program to be prepared to message its entire customer base (3.5 million account holders) in a faster manner than the current technology allows. For that, the Company proposes capital and expense initiatives for 2025 - 2029 that will enable the acquisition of the telecom bandwidth necessary to reach large numbers of customers quickly and reduce latency.

Capital funds will be used to purchase and build new technology that will enable the integrations needed for high performance message delivery and create improvements on internal coordination and execution of outage event responses. More specifically:

- The Company will work with its messaging provider to build a new infrastructure that will include, among other items:

    1. The acquisition and maintenance of Dedicated Ports for contracted throughput/bandwidth through Tier 1 telecom providers. This will ensure high message deliverability. (To clarify, Tier 1 telecom providers own or control their own portion of data transmission networks, while Tier 2 and 3 providers lease bandwidth from them.)
    2. The use of load balancers to evenly distribute incoming and outgoing data traffic across hundreds of servers.
    3. Auto-Scaling, ensuring the infrastructure scales up automatically when the traffic surges and scales down when it recedes.
    4. High Throughput APIs, which are designed to handle large batches of messages.
    5. Real-time Monitoring & Alerts for any anomalies such as failures, delays, or bottlenecks on messaging traffic.

6. AI-Powered Text to Speech Technology: For voice messages that are pre-recorded, the new TTS technology will allow the AI generation of raw audio waveforms, resulting in more natural-sounding voices than traditional TTS systems, and eliminating the time-consuming voice recording process for emergency messages.

This project will complement the work that already started with funding provided by the current Rate Case to expand the Company's Outage Communications Program, which includes:

- the creation of a new Outage Communications section under Customer Operations' Strategic Applications, with expanded dedicated staff, and
- the development of a more robust unified platform for planned and unplanned outages and no-notice, no-script emergency communications

The end result of this combined effort will be a highly efficient outage and emergency communications program that will allow the Company to reach out to its customers in massive scale with urgent and import messages via text, voice calls and e-mails at the fastest speed modern available technology allows.

Life Support Equipment (LSE) customers that have registered with the Company will also receive these notices. However, this does not change or modify the Company's existing LSE notification process where Customer Service Representatives reach out via telephone calls to check on the status of these customers.

Justification Summary:
The Company's Climate Vulnerability Study, published in 2019 in partnership with Columbia University's Earth Institute and updated in September 2023, lists a variety of extreme and multi-hazard events that will occur more frequently in our territory due to the effects of climate change. These events, including extreme temperatures, flooding from precipitation, sea level rise, and coastal storms, and extreme hurricane and nor'easter storms could cause catastrophic damage and widespread customer outages.

The customer communication capacity available to the Company via current contracted services is limited in its ability to reach the entire customer base quickly, since data and message transmission is done via shared bandwidth and shared throughput with telecom carriers. The current contracted services serve the Company well when the emergency communications target regionalized batches of customers on smaller and localized events. However, when the message needs to reach the customer base in massive scale at once – i.e., when the event impacts the Company's entire territory -, messaging speeds can suffer.

Since climate events usually hit many areas of the country simultaneously, relying on shared bandwidth and shared throughput communications services means that the delivery of messages will be slowed down, because many other companies will be using the same networks trying to message their own customers. In other words, without having dedicated bandwidth in a high throughput platform available, the Company is at the mercy of a "best effort" slow and inefficient messaging services when its customers need support the most.

Apart from the clear benefit to customers, the investment in the communications platform upgrade and dedicated telecom services will also result in cost efficiencies for the Company. High volumes of calls to the call centers represent one of the highest cost impacts of weather-related events to Customer Operations. A quicker and more efficient access to customers to proactively send them vital emergency communications will reduce the traffic to the call centers from customers looking for help with their services and restoration information.

In some cases, these more efficient communications will also help the Company prevent potential rolling outages and blackouts. An example, when energy loads are reaching their peaks during extreme temperature events, an efficient massive messaging campaign requesting customers to reduce usage could help balance the load and prevent "next-worst scenarios" that would require emergency power shutoffs or cause blackouts, which would result in exponentially less stress for customers and large savings for the Company.

The acquisition of dedicated capacity with carriers will allow the Company to overcome the challenges of network congestion to disseminate urgent messages in massive scale quickly without creating any issues for other messaging services from city or state agencies. Through carrier partnerships and by employing prioritized routing, random distribution, and call throttling, the Company's messaging vendor will ensure vital alerts are prioritized without overburdening local exchange carriers.

Relationship to Broader Company Plans, Initiatives and the NYS Climate Leadership and Community Protection Act

- This project will have a direct and beneficial impact to Disadvantaged Communities, by providing quick and efficient means for the Company to reach out to these communities of customers across its regions with vital emergency and safety messaging in a speedier manner, before or during events that could present treacherous conditions and require fast action.
- By investing in modern technology that will allow the Company to send communications in massive scale quickly, this project will help the Company to achieve its Emergency Response goals as described in its Climate Change Implementation Plan (Case Nos. 19-E-0065 and 19-G-0066), mainly by providing fast channels to broadcast crucial safety information to customers when climate change-driven events such as extreme temperatures, flooding, and precipitation are projected to generate large impact in the Company's territory
- The project also supports the Company on its risk mitigation activities by reducing the possibility of customers missing emergency communications or receiving them at a time that is too late to provide the adequate support customers deserve and need
- This project does not have a direct impact on Greenhouse Gas Emissions

2. Supplemental Information

Alternatives

The only alternative available would be continuing with the current contracted services for emergency customer communications with shared bandwidth and shared throughput.
Although the current services have served the Company well on past weather-related outage events, this alternative is rejected because it will hinder the Company's ability to provide adequate messaging to its entire customer base on climate change-driven events with widespread and catastrophic impact in our territory, projected to increase in size and frequency in the near future.

Risk of No Action

Risk 1

The first large risk of not having means to communicate with the Company's entire customer base quickly and at once is not achieving the required load reduction to prevent rolling outages, in situations in which extreme temperatures lead to high stress on Company's load. On benchmarking with other utilities that have already moved to telecom high throughput Service Level Agreements, there is clear evidence that fast speed messaging to customers results in energy usage reduction that prevents larger damage to the grid.

Risk 2
Another important risk is the possibility that urgent and important alerts will reach portions of our communities of customers too late, creating the potential of safety hazards. In an example not directly related to Con Edison's services, but that can help illustrate that risk, during hurricane Ida in 2021, 13 lives were lost in New York City because the crucial information that families needed to evacuate basement apartments on the path of rushing flooding waters didn't reach them in time.

Non-Financial Benefits

- Quick and reliable updates during extreme weather events enhance customer preparedness, safety and response
- Increase in customer satisfaction as a reflection of more timely communication
- Increase in message delivery rates and reduction of message latency
- Increase in equity of services, with all regions of the Company receiving the same messaging in a short window of time (today, messages are staggered by region, going from the region with the smallest customer count to the largest, in a process that could take several hours to complete.)
- Expanded ability to comply with regulatory mandates for customer communications during emergencies
- Improved customer engagement rates through data-driven campaign optimization
- Position the Company as an innovative communications leader, increasing brand reputation

Summary of Financial Benefits and Costs

1. Cost-benefit analysis
In order to provide an analysis of costs and benefits, we would need to have enough data to put together a calculation post event. The future benefits would be reported in the Company's biennial reporting efforts to measure the effectiveness of the program.

2. Basis for estimate
The basis for this estimate is from a proposal from the vendor "Message Broadcast" who is responsible for installing and managing the system.

Project Risks and Mitigation Plan

Risk 1
Technology could evolve faster than the Company's ability to deliver the project, which could mean the Company would end up with an expensive and outdated solution

Mitigation plan
Plan and develop a flexible design that could adapt to tech upgrades and evolution seamlessly

Technical Evaluation / Analysis

N/A

Project Relationships (if applicable)

N/A

3. Funding Detail ($000)

2019-2024 Actual/Forecast Spend

	Actual 2019	Actual 2020	Actual 2021	Actual 2022	Forecast 2023	Forecast 2024
O&M	$825	$1,082	$1,400	$1,174	$1,400	$2,000
Capital	$000	$000	$000	$000	$1,000	$1,600

2025-2029 Request:
Total Request by Year:

	Request 2025	Request 2026	Request 2027	Request 2028	Request 2029
O&M	$2,000	$2,000	$2,000	$2,000	$2,000
Capital (Total)	$2,210	$2,100	$2,100	$2,100	$2,100
Labor					
M&S					
Contract Svcs.					
Other					
Overheads					

Long Range Funding Projections

	2030-2034	2035-2039	2040-2044
O&M	$12,000	$15,000	$18,000
Capital	$15,000	$18,000	$21,000
Basis for funding direction:	Long range funding projection is based off an escalating cost per contractual basis over the project lifetime. This program is expected to continue into the future and will be reevaluated based on the latest operational needs and the latest technology.		

Appendix 5: State of the Literature on Resilience Performance Measures

Across the utility industry, there has been no universally accepted methodology to measure resilience. Development of resilience measures on the electric grid is an active area of research and current industry discussion. There is ongoing work in the National Labs to develop and implement metrics for appropriately quantifying resilience, including a multi-year project under the DOE's Grid Modernization Laboratory Consortium (GMLC) [29]. The GMLC work focused on outcome-based performance measures, which seek to provide a quantitative answer to the question, "How resilient is my system?" For example, the GMLC work proposed measures such as cumulative customer-hours of outages.

There are several other approaches for quantifying various elements of resilience that have emerged in industry literature and practice. For example, Sandia National Laboratories [30] has made progress toward developing an implementation approach for outcome-based metrics. As shown in Figure 12 below, this approach features the Resilience Analysis Process (RAP). This work notes that, "grid resilience metrics should quantify the consequences that occur as a result of strain on or disruption to the power grid." These consequences may be measured in terms of *direct* consequences, such as unserved energy, or *indirect* consequences, such as or population without power.

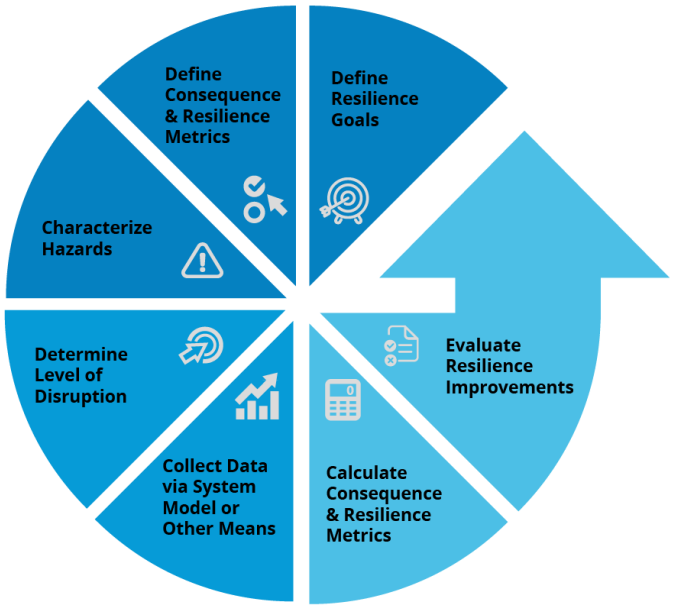


Figure 12. Resilience Analysis Process for Performance-Based Resilience Metrics (from Watson et al. 2014).

The RAP offers a framework for developing customized resilience metrics. These emerge from high-level resilience goals identified in the first step of the process, which includes consideration of key stakeholder needs. In this sense, the RAP does not necessarily guide users toward a standardized set of resilience metrics that can be applied uniformly.

Endnotes

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