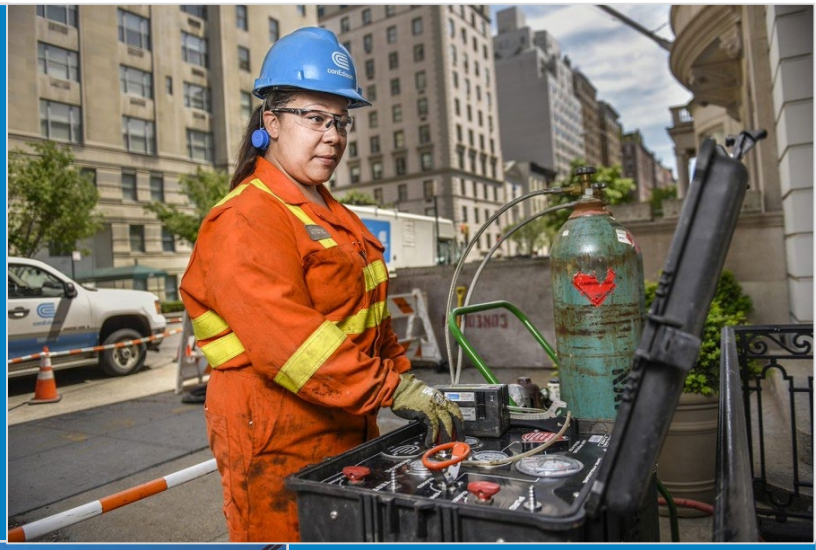
Con Edison Climate Change Resilience Plan Appendices

Case 22-E-0222

November 2023



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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. [1] 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. [2] According to an independent group of scientists, 78% of New York experiences at least 8°F higher temperatures due to the UHI effect. [3] 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. [i] 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. [4]
- 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. [5]
- 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.

[i] 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. [6]
- 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. [7]
- 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[8] 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. [9]

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." [10]

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. [11] The tracts are identified based off 45 indicators, some including potential pollution exposures, potential climate change risks, income, and race and ethnicity. [ii] 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.

[ii] 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.

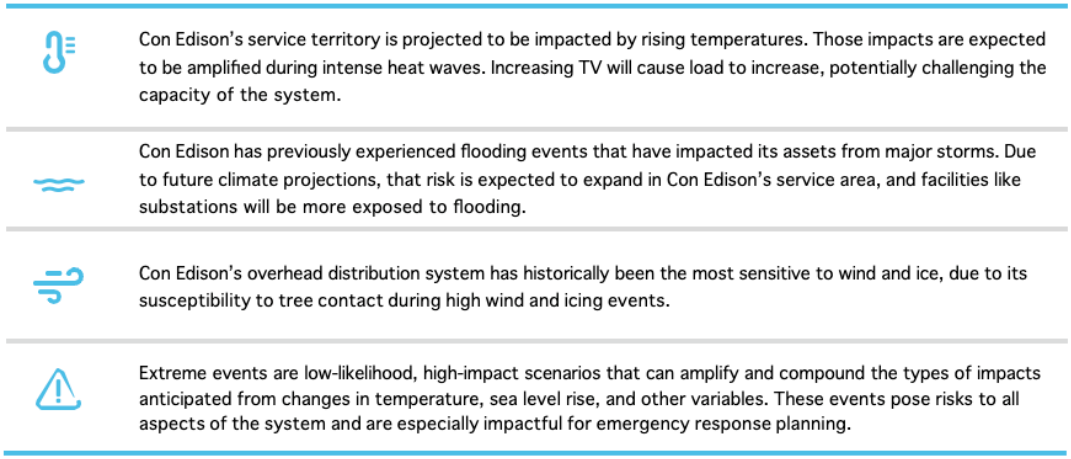
The program will prioritize program investments based on current projections of network and feeder reliability, increased resilience from limiting customer exposure to outages, support of clean energy, and support for the Company's clean energy and electrification goals.

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.



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.

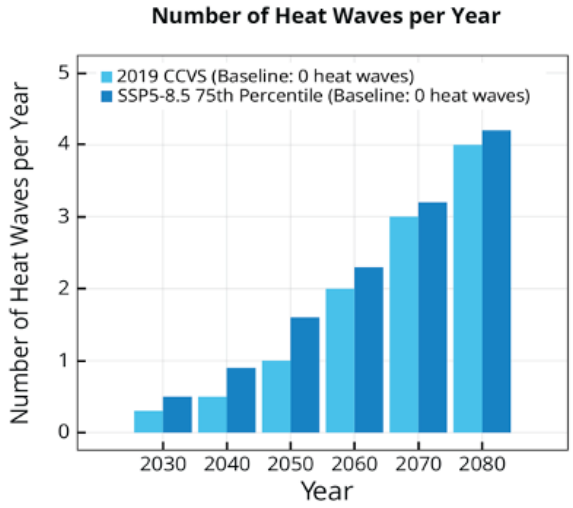
Variable	Study	Baseline	2030	2040	2050	2080
Highest annual maximum daily temperature	Current Study	97°F	103°F	104°F	106°F	112°F
	2019 CCVS	97°F	101°F	103°F	104°F	108°F
The number of days per year in which maximum temperatures exceed 95°F	Current Study	4 days	17 days	27 days	32 days	69 days
	2019 CCVS	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

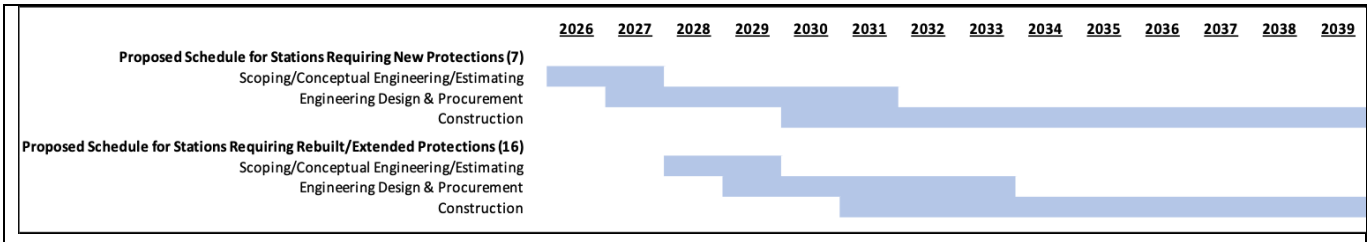
East 13th Street	Rebuilt/extended flood protections needed
East 15th (East 16th) Street PURS	Rebuilt/extended flood protections needed
East 36th Street	Rebuilt/extended flood protections needed
East 75th Street	New flood protections needed
East River 69kV Yard	Rebuilt/extended flood protections needed
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

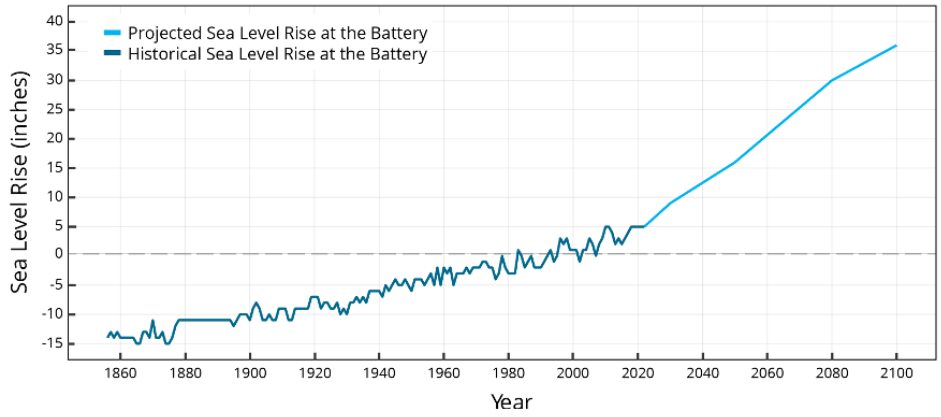
The hazards that the Study found to pose an elevated risk to Con Edison's assets and operations include heat and humidity, major storms, wind and ice, and extreme events.

	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.

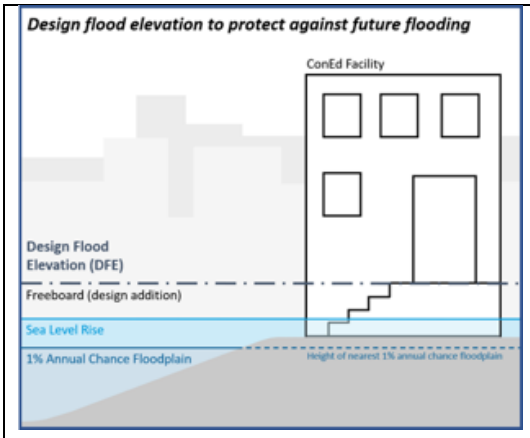


Historical and projected sea level rise at the Battery Tide Gauge in New York City under the combined SSP2-4.5 and SSP5-8.5 50th percentile. The dark blue line shows historical mean sea level at the Battery tide gauge (NOAA Tides & Currents). The light blue line shows the 50th percentile of projected 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.

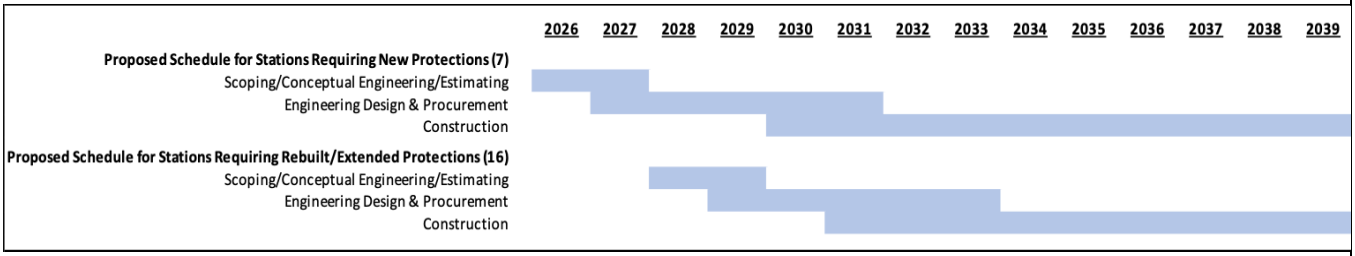
Summary of Financial Benefits and Costs
1. Cost-benefit analysis
Con Edison 's transmission system is designed to be robust: in all areas of its service territory, no single failure should result in loss of load; and in much of its service territory (that system serving network distribution system load), 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

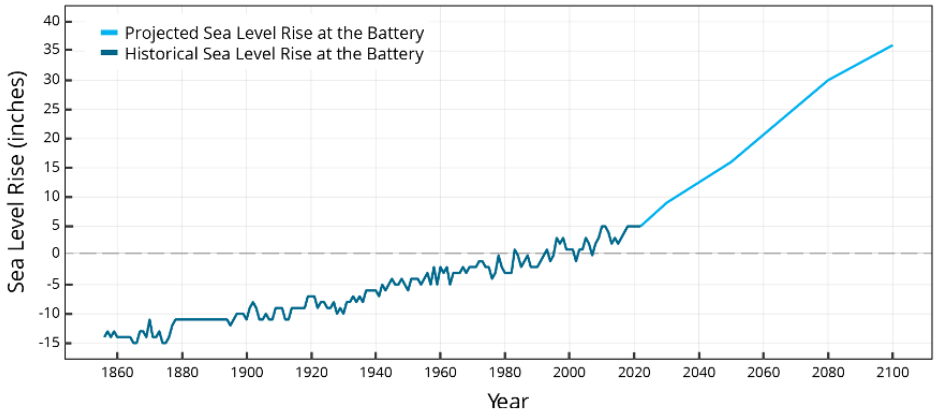
The hazards that the Study found to pose an elevated risk to Con Edison's assets and operations include heat and humidity, major storms, wind and ice, and extreme events.

	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.

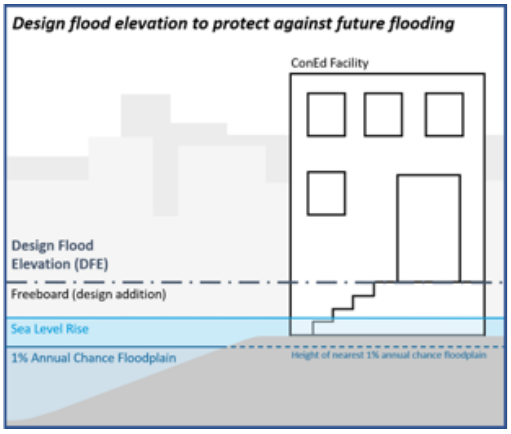
Following Superstorm Sandy in 2012, the Company implemented a minimum protection design standard of "FEMA plus three feet," allowing for 1 foot of sea level rise. At that time, Con Edison protected all infrastructure in the floodplain against future 100-year storms and 1 foot of sea level rise (e.g., 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

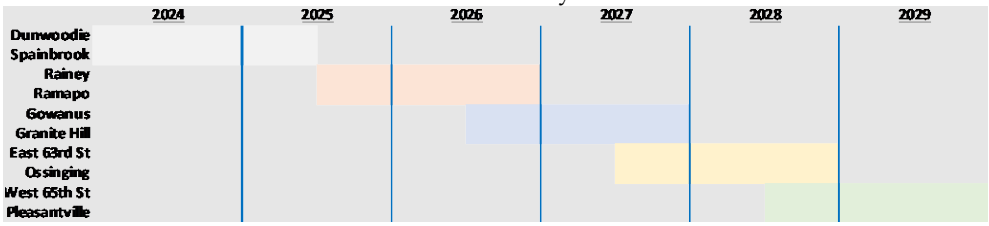
1. Project / Program Summary

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

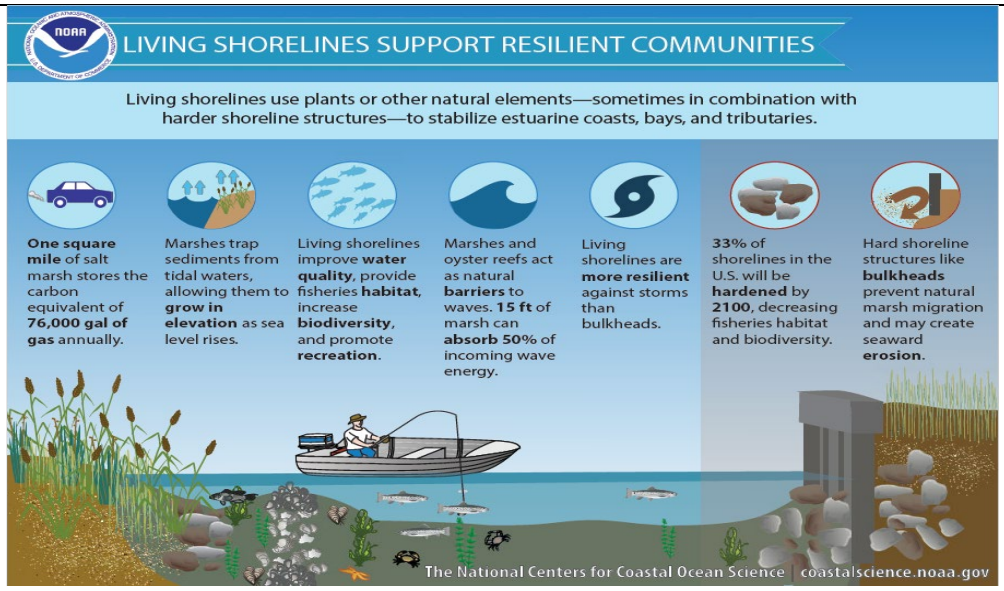
Type: ☒ Project ☐ Program	**Category: ☒ Capital ☒ O&M**
Work Plan Category: ☐ Regulatory Mandated ☐ Operationally Required ☒ Strategic	
Project/Program Title: Living Shorelines and Nature-Based Solutions	
Project/Program Manager: Stanley Lewis	**Project/Program Number (Level 1):**
Status: ☒ Initiation/Planning ☐ 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

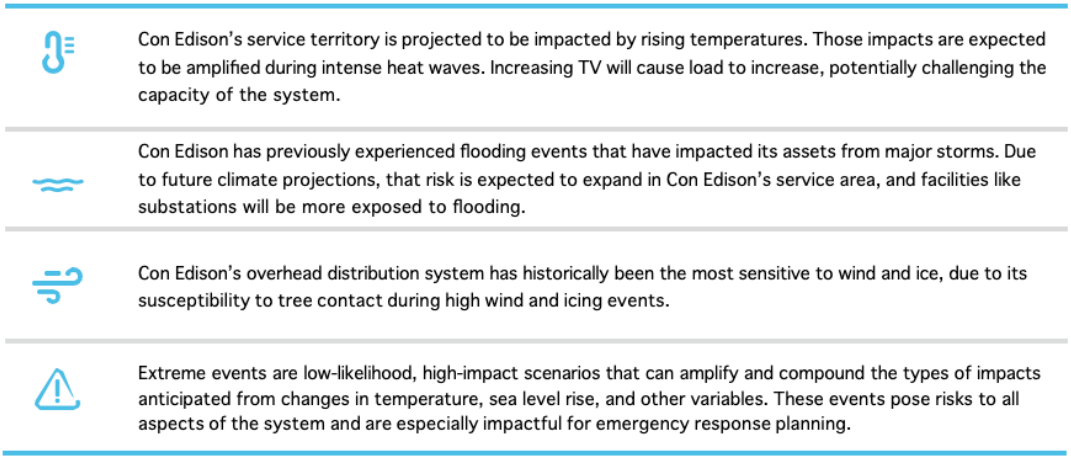
Coincident with engineering analysis of the best solution for mitigating risks to an individual circuit, the expected benefits of undergrounding the circuits meeting the selection criteria are compared and used to create an initial prioritization ranking. Recommended solutions from the engineering analyses 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.



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.

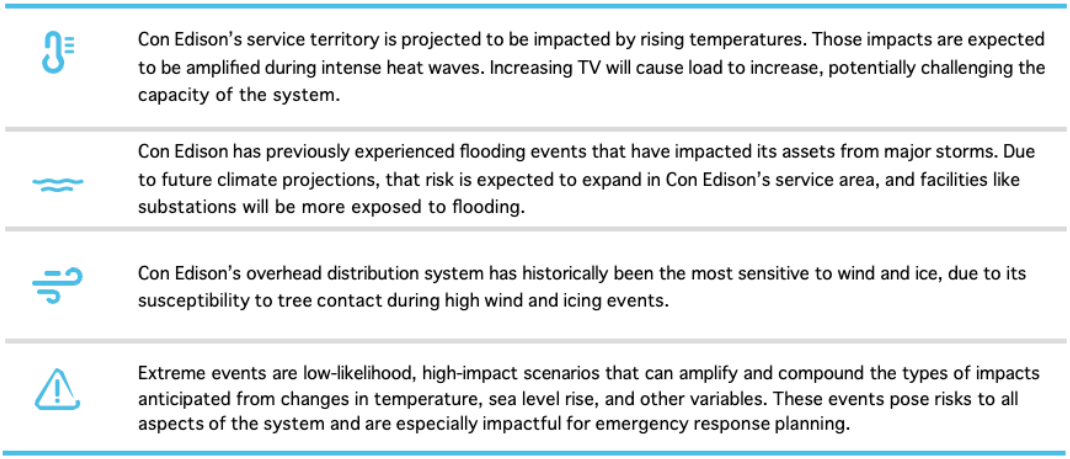
Region	*Average* Length of Aerial Cable to be Installed Annually (Miles)	*Average* Number of Automatic Transfer Switches to be Installed Annually
Brooklyn/Queens	1.6 miles	–
Bronx/Westchester	2.9 miles	2-5
Staten Island	0.7 miles	–

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	$ 10,976
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
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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.

	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 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
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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.

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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 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**

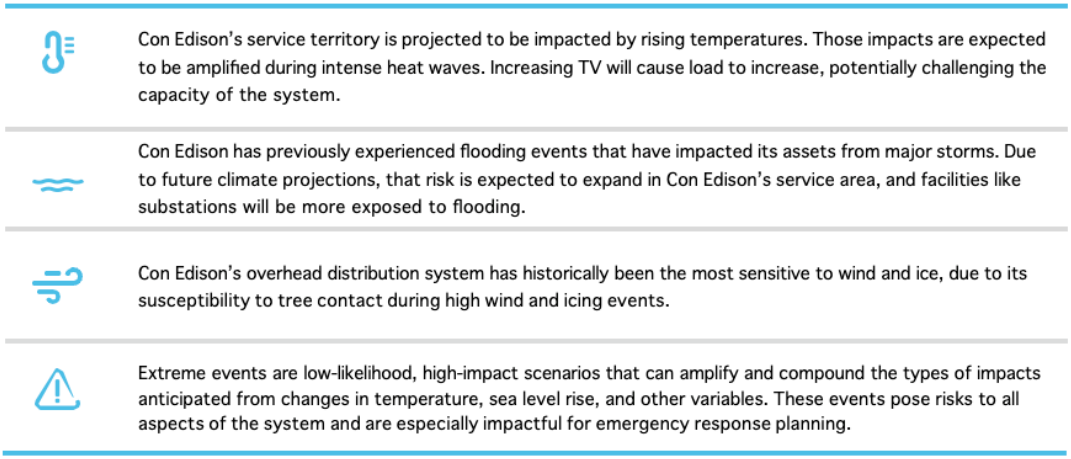
Together, the three components of the Substation Loss Contingency program – the Rapid Deployment Area Substation, the Transmission Resiliency Transformers, and the Mobile Control Center – will provide multi-pronged solutions that will enable the Company to recover from near-catastrophic failures on the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



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.

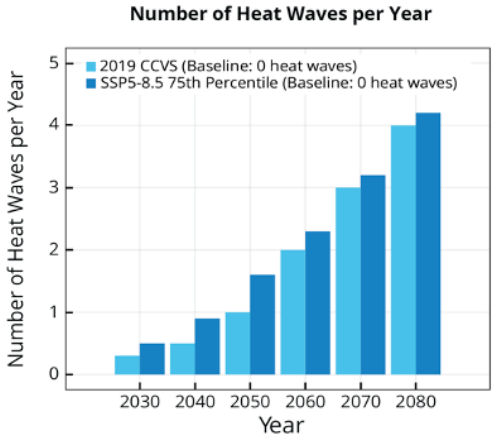
Variable	Study	Baseline	2030	2040	2050	2080
Highest annual maximum daily temperature	Current Study	97°F	103°F	104°F	106°F	112°F
	2019 CCVS	97°F	101°F	103°F	104°F	108°F
The number of days per year in which maximum temperatures exceed 95°F	Current Study	4 days	17 days	27 days	32 days	69 days
	2019 CCVS	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 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 PH 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.

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 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:

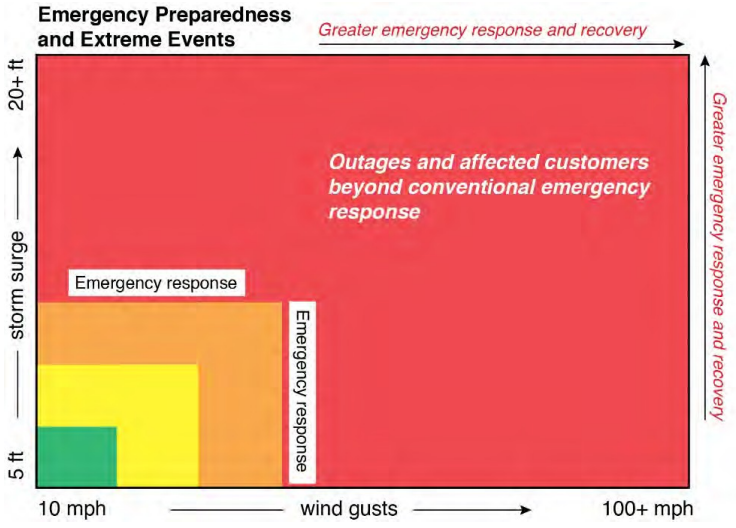
- **Temperature and humidity** – from heat and coincident high heat and humidity (known as temperature variable or "TV")
- **Flooding** – coastal flooding from sea level rise and/or inland flooding from precipitation
- **Wind and ice**
- **Extreme and coincident weather events** – hurricanes/wind, extreme 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.

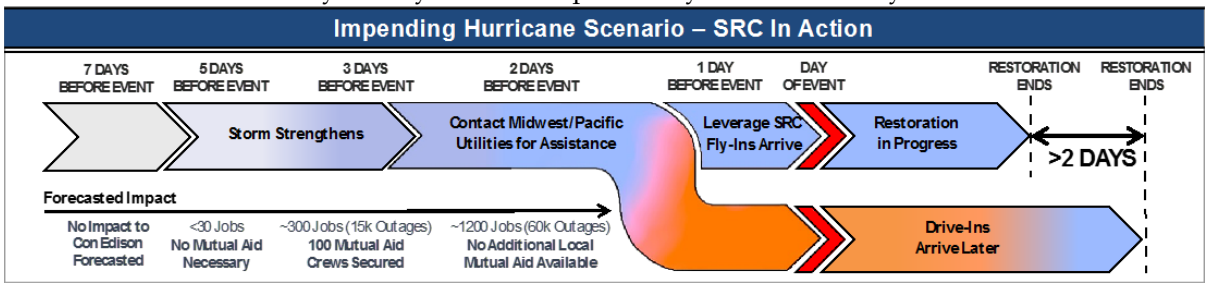
Summary of Financial Benefits and Costs

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.

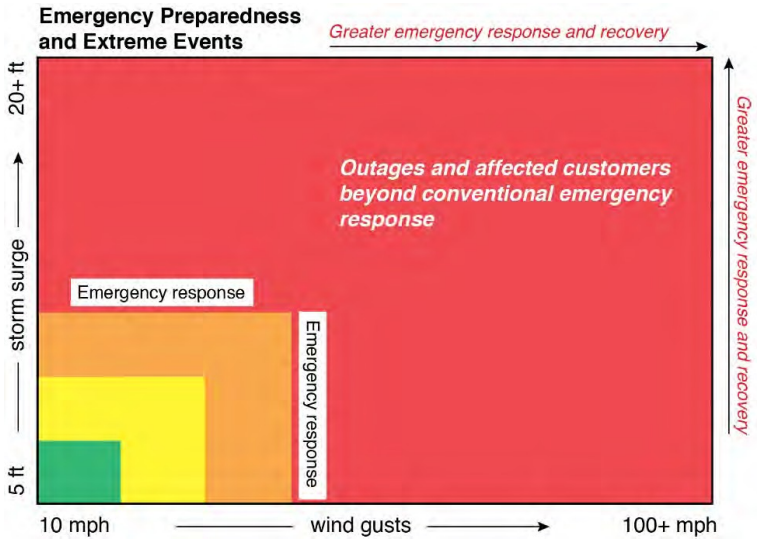
	Con Edison's service territory is projected to be impacted by rising temperatures. Those impacts are expected to be amplified during intense heat waves. Increasing TV will cause load to increase, potentially challenging the capacity of the system.
	Con Edison has previously experienced flooding events 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 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 resource time (50%) charged to capital.	Ongoing O&M escalated by annual inflation (3%); some management resource time (50%) charged to capital.	Ongoing O&M escalated by annual inflation (3%); some management 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) [12]. 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 [13] 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.

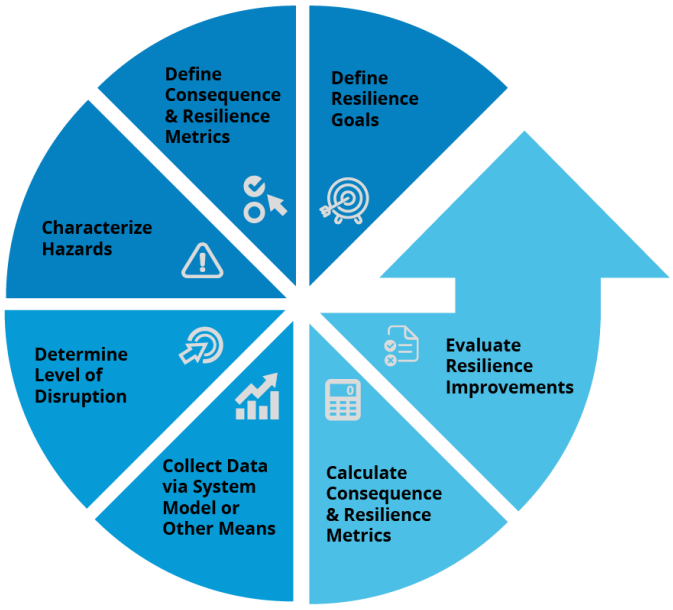


Figure 1. Resilience Analysis Process for Performance-Based Resilience Metrics (from Watson et al. 2014).

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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