CENTRAL HUDSON

CLIMATE CHANGE RESILIENCE PLAN

People. Power. Possibilities.

Central Hudson

A FORTIS COMPANY

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Acronym Glossary

ACSR: Aluminum-Conductor Steel-Reinforced

CCRP: Climate Change Resilience Plan

CCVS: Climate Change Vulnerability Study

CJWG: Climate Justice Working Group

CRWG: Climate Resilience Working Group

DACs: Disadvantaged Communities

DMS: Distribution Management System

FEMA: Federal Emergency Management Agency

FLISR: Fault Location, Isolation, and Service Restoration

GIS: Geographic Information System

HILL: High-Impact Low-Likelihood

HTLS: High Temperature Low Sag

ICF: ICF Incorporated, L.L.C.

IED: Intelligent Electronic Device

LSE: Life Support Equipment

MCDA: Multi-Criteria Decision Analysis

NYS: New York State

NYSERDA: New York State Energy Research and Development Authority

O&M: Operations and Maintenance

PSC: Public Service Commission

SMEs: Subject Matter Experts

TUL: Typical Useful Life

Executive Summary

Background. Central Hudson Gas & Electric (Central Hudson) has long been committed to the safe and reliable delivery of energy to its customers throughout New York State's Mid-Hudson River Valley. As the climate changes and extreme weather events (such as heat waves, intense precipitation, and high wind events) become more frequent and intense, Central Hudson is working to anticipate and respond to these changes in a way that will mitigate impacts to the Company's assets, and most importantly, to its customers.

This Climate Change Resilience Plan (CCRP) identifies the most suitable, cost-effective, and equitable infrastructure-strengthening investments and process changes to combat the impacts of extreme weather and climate change on Central Hudson's electric system. The investments in this plan encompass the distribution, substation and transmission systems. The CCRP builds on Central Hudson's Climate Change Vulnerability Study (CCVS), which examined the impact of higher temperatures, intense precipitation and flooding, wind, and extreme weather across the service territory. **The CCVS found that overall, heat, flooding and high wind were the most pressing hazards to the Central Hudson system.** Both reports respond to a law that was passed in New York State in 2022 that seeks to respond to climate hazards and encourage climate resilience.

Engagement. Central Hudson is committed to working with a diverse range of stakeholders to provide transparency into the study and planning processes and collect feedback to ensure that community and consumer needs are considered in the face of climate change. To accomplish this goal, Central Hudson formed a Climate Resilience Working Group (CRWG) with a variety of stakeholders, including planners, emergency response officials, municipal leaders, first responders, and customer and environmental advocates. This resilience plan incorporates comments and addresses concerns identified through engagement with the CRWG. Central Hudson will continue to meet with this group at least twice per year to keep stakeholders apprised of Resilience Plan progress.

Equity. Recognizing that the impacts of climate change are not equitably felt across all communities, New York State's Climate Leadership and Community Protection Act of 2019 directs the entire state government to consider equity in climate risk planning and analysis. Central Hudson is taking steps to incorporate equity into its planning, design, and operations processes by explicitly accounting for benefits to disadvantaged communities in the methodology used to prioritize and select resilience measures identified in this CCRP.

Resilience Strategy. Central Hudson has a long-standing commitment to enhancing asset resiliency, and that commitment continues. Due to the complex nature of climate-related risks, no single measure is sufficient to address all vulnerabilities, so Central Hudson has adopted an approach that spans all facets of electrical service, including physical infrastructure, operational practices, and technological solutions. This multi-pronged resilience strategy allows for strategic planning and implementation at every level of the Company's organization.

There are four key dimensions of Central Hudson's resilience framework: 1) **withstand**—strengthening assets and operations to resist adverse climate impacts, 2) **absorb**—increase the system's ability to anticipate climate hazard events and absorb their effects, 3) **recover**—improve the system's ability to respond to and recover from climate hazard events, and 4) **adapt**—advance and adapt the system to keep up with a continuously changing climate threat landscape.

In order to withstand both gradual risks (such as increasing temperatures) and infrequent but intense risks (such as floods or intense storms), Central Hudson has integrated resilience into its operational and planning processes and is committed to continually improving these practices to better serve its customers in the face of a changing climate.

Multi-Criteria Decision Analysis. In developing an actionable resilience plan, resilience measures had to be identified and then prioritized, creating a framework for future action. To accomplish this goal, Central Hudson partnered with ICF Incorporated, L.L.C. (ICF) to conduct a multi-criteria decision analysis (MCDA) that would allow for the consideration of multiple objectives and evaluation criteria, both qualitative and quantitative, providing a comprehensive evaluation of potential measures. The MCDA process involved selecting decision criteria and weights, scoring each measure against the criteria, and determining benefits. Then, the efficiency of each measure was determined by relating its benefits to its costs and calculating the cost efficiency ratio. The key outcome of the MCDA was a cost efficiency ratio-based rank order of resilience measures that was used to guide Central Hudson in prioritizing resilience measures for implementation. This MCDA is consistent with the Company's policy of using a holistic approach when evaluating proposed projects and programs and it was used as an input in the Company's Resilience Plan decision-making process.

Investment Plan. Central Hudson developed both process-focused and asset-focused resilience programs and projects designed to protect the system against identified climate change risks over the next five, ten and twenty years. Examples of process-focused resilience measures include incremental inspections of substations following climate hazard events and installing protective physical barriers at the base of new poles that must be installed in floodplains. Asset-focused resilience programs include strategic undergrounding of existing overhead critical distribution infrastructure, targeted ground-to-sky tree trimming, and rebuilding select lines with more durable composite poles. Details about each program and project—including costs, timelines, and benefits—are included in this CCRP.

Governance & Performance Measures. Central Hudson's Electric Engineering and Operations group will oversee the implementation of measures identified in this CCRP. Costs of this resilience work will be tracked separately from the Company's business-as-usual work, but the projects, programs, and procedural changes will be constructed and managed as part of Central Hudson's broader capital and maintenance programs. Central Hudson will continue to provide status updates and file updated plans in accordance with regulatory requirements. Additionally, Central Hudson will continue to coordinate and engage with the CRWG, the Joint Utilities of New York, and with other industry organizations to keep abreast of best practices as well as new methodologies, tools, and availability of data in the resilience sector.

Central Hudson will incorporate performance measures into its biennial reporting on the status of resilience activities. Beyond reporting on the construction and implementation progress of the programs and projects, the Company has developed an evaluation process on performance of the resilience measures in the CCRP based on the goals and anticipated benefits of the measures. Future phases of work may refine performance metrics to better account for uncertainties, such as uncertainty in the overall rate and magnitude of climate change.

1. Introduction and Background

Central Hudson Gas & Electric Corporation (Central Hudson) has long been committed to serving its customers safely and reliably in the delivery of energy throughout New York State's Mid-Hudson River Valley. However, extreme weather and climate change are increasingly impacting the state's economy, environment, and people. For example, on August 4, 2020, approximately 115,000 customers (36% of Central Hudson's total customers) were without service due to Tropical Storm Isaias.[1] Extreme weather events such as Tropical Storm Isaias, July 2023 flooding in the Hudson Valley, and global climate extremes like the warm summer experienced in 2023 are expected to worsen in the future. To respond to climate hazards and encourage climate resilience, the New York State (NYS) Legislature enacted NY Public Service Law§66(29) Effective 3/22/2022, and in response to the law, the Public Service Commission (PSC) initiated a proceeding[2] (the "Order") that requires combination gas and electric utilities in the state to conduct Climate Change Vulnerability Studies (CCVS) and develop Climate Change Resilience Plans (CCRP).

Per the Order, the objective of this CCRP is to develop a multi-pronged resilience strategy with investments in the five, ten, and twenty-year timeframes that address climate vulnerabilities identified by the CCVS (see Appendix A for a summary of key requirements). A multi-pronged resilience strategy is one that spans all facets of the Company's electrical service, including planning, design, operations, and emergency response. Additionally, the Order calls for the CCRP to incorporate equity into the resilience strategy to inform climate-driven investments.

This report, Central Hudson's CCRP, discusses the most suitable, cost-effective, and equitable infrastructure investments to strengthen the system and combat the impacts of extreme weather and climate change. This report builds on Central Hudson's CCVS, which examined the impact of higher temperatures, extreme precipitation and flooding, wind, and extreme weather across the service territory. This CCRP outlines a variety of storm hardening and physical resiliency measures as well as operational resiliency measures to mitigate the impacts of climate change on Central Hudson's assets. Implementation of the resilience measures in the CCRP will ensure that Central Hudson continues to provide safe and reliable electrical service to its customers.

1.1. SUMMARY OF THE CLIMATE CHANGE VULNERABILITY STUDY RESULTS

The purpose of Central Hudson's 2023 CCVS was to assess how climate change impacts Central Hudson's electric system and to inform the development of this resilience plan. The CCVS focused on assessing vulnerability for priority climate hazards chosen through consultations with Central Hudson Subject Matter Experts (SMEs) and a review of historic hazards that have impacted Central Hudson's customers.

[1] Central Hudson Gas & Electric Storm Scorecard, 11 Sep. 2020. "Tropical Storm Isaias."

[2] Case 22-E-0222

The CCVS identified the vulnerability of assets to five climate hazards: extreme heat, extreme cold, flooding, extreme precipitation, and wind. Central Hudson analyzed the vulnerability of distribution, transmission, and substation assets to these hazards by looking at exposure data and metrics of sensitivity and consequence. In the CCVS, Central Hudson identified the following priority vulnerabilities (see Table 1 for full summary of vulnerability ratings):

- **Substation assets are most vulnerable to extreme heat and flooding.**
  - Substation transformers are vulnerable to extreme heat.
  - Circuit breakers, including those within switchgear, are vulnerable to heat as well as flooding.
- **Distribution assets are most vulnerable to wind and flooding.**
  - Poles and conductors are vulnerable to the effects of wind on nearby vegetation.
  - Poles are also vulnerable to flooding.
- **Transmission assets are most vulnerable to extreme wind, extreme heat, and precipitation.**
  - Overhead conductors are vulnerable to extreme wind, extreme heat, and precipitation.
  - Line structures are also vulnerable to the effects of wind on nearby vegetation.

Overall, wind, heat, and flooding are the greatest concerns for Central Hudson's assets.

Table 1 - Vulnerability scores for all asset types and hazards. Orange indicates high vulnerability, yellow indicates moderate, green indicates low, and gray indicates not applicable.

Asset Types	Extreme Heat	Extreme Cold & Ice	Flooding	Extreme Precipitation	Extreme Wind
Transmission					
Line structures (poles/towers)	Gray	Yellow	Yellow	Yellow	Orange
Conductors (overhead)	Orange	Yellow	Yellow	Orange	Orange
Conductors (underground)	Yellow	Gray	Yellow	Yellow	Gray
Switching devices	Gray	Green	Green	Green	Green
Distribution					
Structures (overhead)	Gray	Yellow	Orange	Orange	Orange
Conductors (underground)	Yellow	Gray	Orange	Orange	Gray
Conductors (overhead)	Yellow	Yellow	Green	Green	Orange
Transformers (overhead)	Green	Green	Green	Green	Green
Transformers (padmount)	Green	Green	Yellow	Yellow	Green
Regulators (pole mounted)	Yellow	Green	Green	Green	Yellow
Capacitors (pole mounted)	Green	Green	Green	Green	Green
Switching devices	Green	Yellow	Green	Green	Yellow
Surge arrestors	Green	Green	Gray	Green	Green
Reclosers	Green	Gray	Green	Green	Yellow
Manholes	Green	Green	Yellow	Yellow	Gray
Substations					
Substation transformers/ voltage regulators	Orange	Green	Yellow	Yellow	Yellow
Circuit breakers	Orange	Green	Orange	Orange	Yellow
Instrument transformers	Yellow	Gray	Green	Green	Green
Substation reactors	Orange	Green	Yellow	Yellow	Yellow
Controllers	Yellow	Green	Green	Green	Green
Switching devices	Yellow	Yellow	Yellow	Yellow	Yellow
Surge arrestors	Green	Green	Gray	Yellow	Green

2. Engagement of the Climate Resilience Working Group

Central Hudson formed a Climate Resilience Working Group (CRWG) with a variety of stakeholders and community representatives and is committed to addressing the concerns expressed by the CRWG through future resilience investments and continued engagement. The CRWG includes state, regional, and local planning and emergency response officials, municipal leaders, first responders, and customer and environmental advocates (see Appendix B for a full list). This resilience plan incorporates the comments and addresses concerns identified through this engagement, including those related to equity and environmental justice.

Two meetings with a broad stakeholder audience were held before the Working Group was officially formed. A summary of these Stakeholder and CRWG meetings is outlined below.

- Stakeholder Session 1 (September 21, 2022): Initial meeting to learn about the legislation and invite stakeholders to share their own priorities and resilience activities to date. Following this meeting, an electronic survey was sent out to participants to learn about their concerns, efforts, and best points of contact.
- Stakeholder Session 2 (February 15, 2023): Stakeholder session to review community climate priorities and vulnerabilities, discuss available climate data, and establish a working group to provide input to the Study and Plan.
- CRWG Meeting 1 (April 20, 2023): CRWG meeting to review the role of the Working Group, discuss the Vulnerability Study process, discuss potential future climate scenarios, and discuss equity and justice considerations.
- CRWG Meeting 2 (July 19, 2023): CRWG meeting to review the draft Climate Change Vulnerability Study results and allow for questions, comments, and other input from the Working Group.
- CRWG Meeting 3 (October 5, 2023): CRWG meeting to recap the final Vulnerability Study results and present preliminary results from the Resilience Plan.
- CRWG Meeting 4 (November 2, 2023): CRWG meeting to review the draft CCRP, previously provided, and allow for questions, comments, and other input.

These meetings have yielded valuable stakeholder feedback that helped shape and refine the CCVS and CCRP. For example, as a result of this feedback, Central Hudson clarified the scope of each report, clarified terminology, provided additional detail on climate data and resilience projects/programs, improved readability of tables and figures, added a summary of the Company's electric assets, added information about the consultant used in developing Central Hudson's CCVS and CCRP, and made many minor editorial changes.

Central Hudson is committed to working with a diverse range of stakeholders, including environmental justice communities. Ensuring that community and consumer needs are consistently met in the face of climate change will require ongoing collaboration, monitoring, and adjustment of resilience investment plans. Central Hudson will continue to meet with the CRWG at least twice per year following the filing of this Resilience Plan to keep stakeholders apprised of any updates and milestones and to incorporate ongoing feedback into the implementation of the CCRP.

3. Consideration of Equity

Extreme weather and climate often create disproportionate impacts across the residents of NYS[3,4]. Specifically, these impacts can be felt more strongly in disadvantaged communities (DACs)[5] that have regional differences in sociodemographic characteristics, health, environmental burdens, and climate change risks[6]. Consequently, the NYS Climate Leadership and Community Protection Act ("Climate Act") of 2019 directs the entire state government (including the PSC) to consider equity in climate risk planning and analysis. The Order calls for utilities, including Central Hudson, to consider equity in the CCVS and CCRP.

One dimension of equity in climate resilience planning is a strong process for community participation. Central Hudson convened the CRWG to provide a transparent process that allowed for feedback to incorporate community concerns and promote alignment with community plans and needs. Other dimensions of equity include recognition of contextual factors that shape vulnerability and distribution of benefits and impacts, all of which were incorporated in Central Hudson's analysis for this CCRP.

The Climate Act established a Climate Justice Working Group (CJWG) tasked with developing criteria to identify DACs based on socioeconomic metrics (e.g., energy burden and poverty rate), as well as a process by which the CJWG might gather public input. The CJWG members include representatives from environmental justice communities, rural and urban communities, the State Departments of Environmental Conservation, Health, Labor, and New York State Energy Research and Development Authority (NYSERDA).

After a thorough feedback and revision process, the CJWG approved the final set of 45 criteria on March 27, 2023. These metrics include potential pollution exposures, income, race, and ethnicity (for a comprehensive list, please see: *Technical Documentation on Draft Disadvantaged Communities Criteria*[7]). Using this framework, the CJWG identified 35% (1,736 census tracts) of New York as DACs (see Figure 1), based on "…geographic, public health, environmental hazard, and socioeconomic criteria, which shall include but are not limited to:

[3] Rosenzweig, C., W. Solecki, A. DeGaetano, M. O'Grady, S. Hassol, P. Grabhorn (Eds.). 2011. Responding to Climate Change in New York State: The ClimAID Integrated Assessment for Effective Climate Change Adaptation. Technical Report. New York State Energy Research and Development Authority (NYSERDA), Albany, New York. www.nyserda.ny.gov

[4] Dupigny-Giroux, L.A., E.L. Mecray, M.D. Lemcke-Stampone, G.A. Hodgkins, E.E. Lentz, K.E. Mills, E.D. Lane, R. Miller, D.Y. Hollinger, W.D. Solecki, G.A. Wellenius, P.E. Sheffield, A.B. MacDonald, and C. Caldwell, 2018: Northeast. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 669–742. doi: 10.7930/NCA4.2018.CH18

[5] NY State defines DACs as communities facing increased burdens, vulnerabilities, and stressors from climate change and who are often overlooked in climate policy initiatives. DACs are identified on the basis of 45 indicators, including climate-related burdens and risks and health vulnerabilities (New York State (2022). Draft Disadvantaged Communities Criteria).

[6] EPA. 2021. Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. U.S. Environmental Protection Agency, EPA 430-R-21-003.

[7] The Technical Documentation on the Draft Disadvantaged Communities Criteria can be found on the New York's Climate Leadership & Community Protection Act website, https://climate.ny.gov/resources/disadvantaged-communities-criteria/.

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."

In identifying and selecting resilience measures through a Multi Criteria Decision Analysis (MCDA), **community resilience and community impacts were prioritized as criteria.** Central Hudson considered whether a measure had the ability to bolster community resilience—not just infrastructural resilience—and whether or not a project benefited customers on Life Support Equipment (LSE) who are typically more vulnerable to the impacts of outages. Central Hudson also incorporated analysis of DACs, as defined by NYS, in the definition of benefits and prioritization of resilience measures. Specifically, the Community Resilience factor in Central Hudson's multi-criteria decision analysis (MCDA) includes the extent to which a project benefits DAC customers (see Section 4.3.3 Multi-Criteria Decision Analysisbelow).

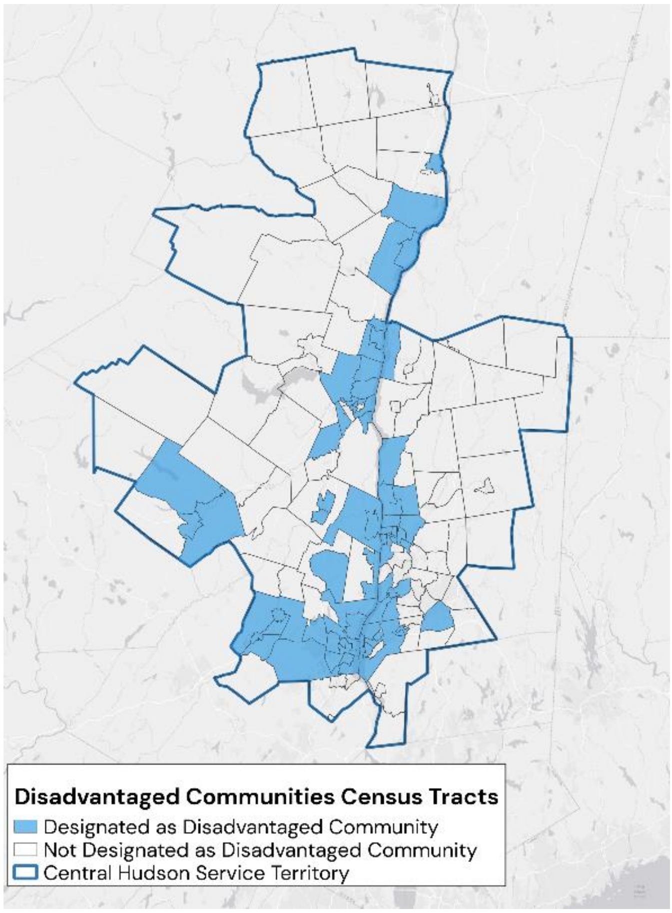


Figure 1 – CJWG-designated DACs in Central Hudson service territory.

4. Multi-Pronged Resilience Strategy and Approach

4.1 RESILIENCE JOURNEY

This CCRP continues Central Hudson's commitment to resiliency. Central Hudson maintains a comprehensive Capital Investment Plan and Operations and Maintenance (O&M) Plan for the electric transmission, substation, and distribution systems. Within the Capital Investment Plan, programs are developed to address aging infrastructure, maintain compliance, and address reliability and operating issues. Examples of these programs include the Secondary Network Upgrade Program, the 5kV Aerial Cable Replacement Program, the Overhead Secondary Replacement Program, the 4800V Conversion Program, the Copper Wire Replacement Program, the Pole Replacement Program, the Underground Residential Distribution Replacement Program, and a general Operating/Infrastructure program to simultaneously address condition-based infrastructure issues while creating stronger distribution ties.

Central Hudson began implementing its Smart Grid strategy in 2015, which includes implementing detailed electric models in the ESRI Geographic Information System (GIS) and a Distribution Management System (DMS). Intelligent Electronic Devices (IEDs) are being installed to provide data to the DMS to implement automatic Fault Location, Isolation, and Service Restoration (FLISR). This Smart Grid strategy uses innovative technology to improve system reliability, safety, and efficiency.

Vegetation management is an integral part of improving resilience. Tree contacts with utility infrastructure cause more power outages than all other outage causes combined. Trees in Central Hudson's service territory are frequently impacted by invasive insects such as the Emerald Ash Borer, causing trees to decay, fall, and damage assets. Central Hudson maintains a Routine Trimming Program as well as a Hazard Tree Removal Program on distribution lines with a history of poor reliability.

In May of 2019, Central Hudson filed a Storm Investigation Implementation Plan with the Public Service Commission, Case 19-E-0109. The plan included an investigation of historical outage information and distribution circuitry to identify potential investments to increase the reliability of critical facilities. Based on the investigation, Central Hudson developed a Storm Hardening Plan, which proposed $42.85 million toward vegetation management and $100 million of capital investment over an 8-year period. The Storm Hardening Plan included tree trimming practices, tree and vine removals, circuit redesigns and replacements, implementation of FLISR, and installation of remote-controlled switches/reclosers. Portions of this plan were integrated into the Company's subsequent rate plan.

In July of 2023, the Company published its comprehensive Five-Year Electric Capital Plan for the 2024–2028 period. The plan included future investments in the Company's electric system necessary to maintain safe and reliable service. Electric system projects and programs address system expansion/enhancement, study-based load growth, infrastructure/planned replacement, new business/customer additions, compliance, daily operations/repairs, and unplanned replacements, but the majority of projects are focused on infrastructure replacements. Central Hudson utilizes an asset management process to coordinate infrastructure improvements, including field inspections, condition monitoring, periodic testing, and in-depth analysis of assets. The Five-Year Electric Capital Plan includes a storm hardening program that is focused on rebuilding mainline portions of distribution circuits that have experienced lower levels of reliability performance. This CCRP builds on the efforts outlined in the Five-Year Electric Capital Plan and expands the focus to include both short- and long-term impacts of climate change. The expenditures identified for the projects and programs proposed in this CCRP are for incremental work to address vulnerabilities related to climate change and do not overlap with expenditures and projects included in the Five-Year Electric Capital Plan.

4.2 RESILIENCE FRAMEWORK

Due to the complex nature of climate-related risks, no single measure is sufficient to address all vulnerabilities. A multi-pronged resilience strategy across all facets of Central Hudson's electrical service, including physical infrastructure and operational practices, allows for strategic planning and implementation at every level of the Company's organization.

The resilience framework shown below includes four key objectives, each pertaining to a different phase of the life cycle of outage-inducing climatic events. These objectives shaped the creation of priority vulnerabilities noted in the CCVS, as well as the additional resilience measures listed in this CCRP. Selection of measures was geared toward accomplishing at least one of the following objectives:

1. Withstand – **Strengthen** assets and operations to **resist** the adverse impacts of a climate hazard event.
2. Absorb – Increase the system's ability to **anticipate** when a climate hazard event may occur and **absorb** its effects.
3. Recover – Bolster the system's ability to quickly **respond** and **recover** in the aftermath of a climate hazard event.
4. Adapt – **Adapt** the system to address a continuously changing climate threat landscape and perpetually improve resilience.

As per the Order, Central Hudson will update the CCRP on at least a five-year cycle going forward. These updates will help address gradual changes in climate (e.g., increasing temperatures) and in the frequency and intensity of high-impact low-likelihood (HILL) events (e.g., ice storms followed by cold snaps). Considering both short-term and long-term system stressors helps ensure the resilience measures in this CCRP broadly cover impacts. For example, gradual temperature change can affect consumer demand. Substations may need to be situated farther away from a floodplain or even elevated to avoid being damaged in an intense flooding event or storm. Central Hudson is taking action to ensure decisions are climate-informed and consider resilience. This comprehensive approach to resilience will enable all projects and programs— not just the ones designed specifically for resilience improvement— to incorporate climate risks in their design and implementation.

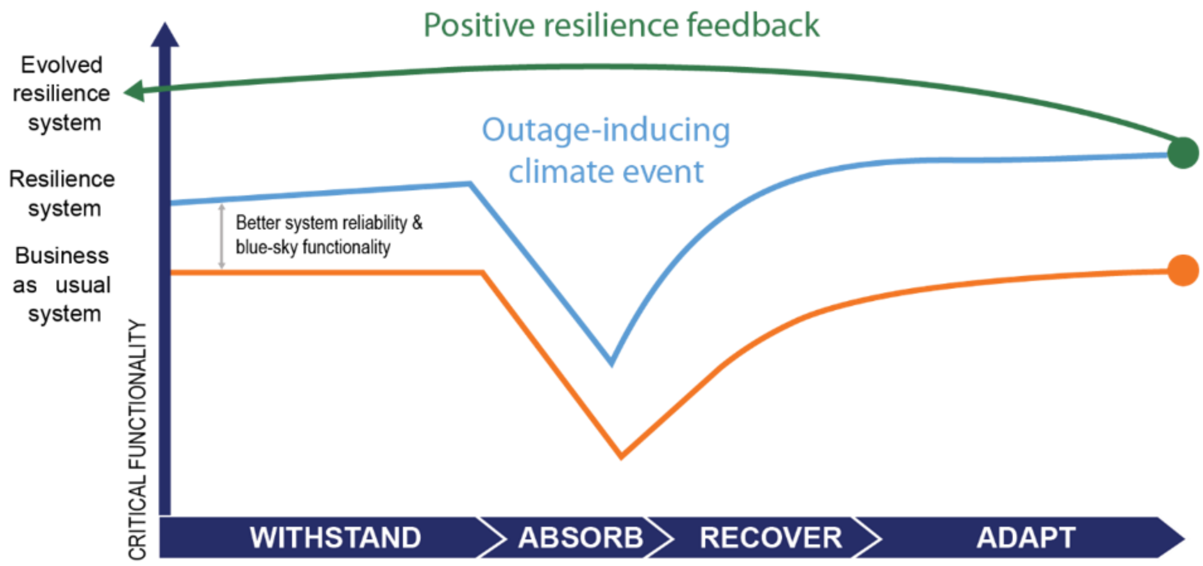


Figure 2 - Resilience Framework

4.3 RESILIENCE MEASURE PRIORITIZATION

Prioritization of resilience measures is a multi-stage process that involves several key steps, such as identification of preliminary resilience measures, priority asset screening and refining of resilience measures, assessment of measures using multi-criteria decision analysis, and ranking of measures. Figure 3 provides a depiction of prioritization framework steps, including inputs, processes, and outputs. Subsequent sections elaborate on these steps.

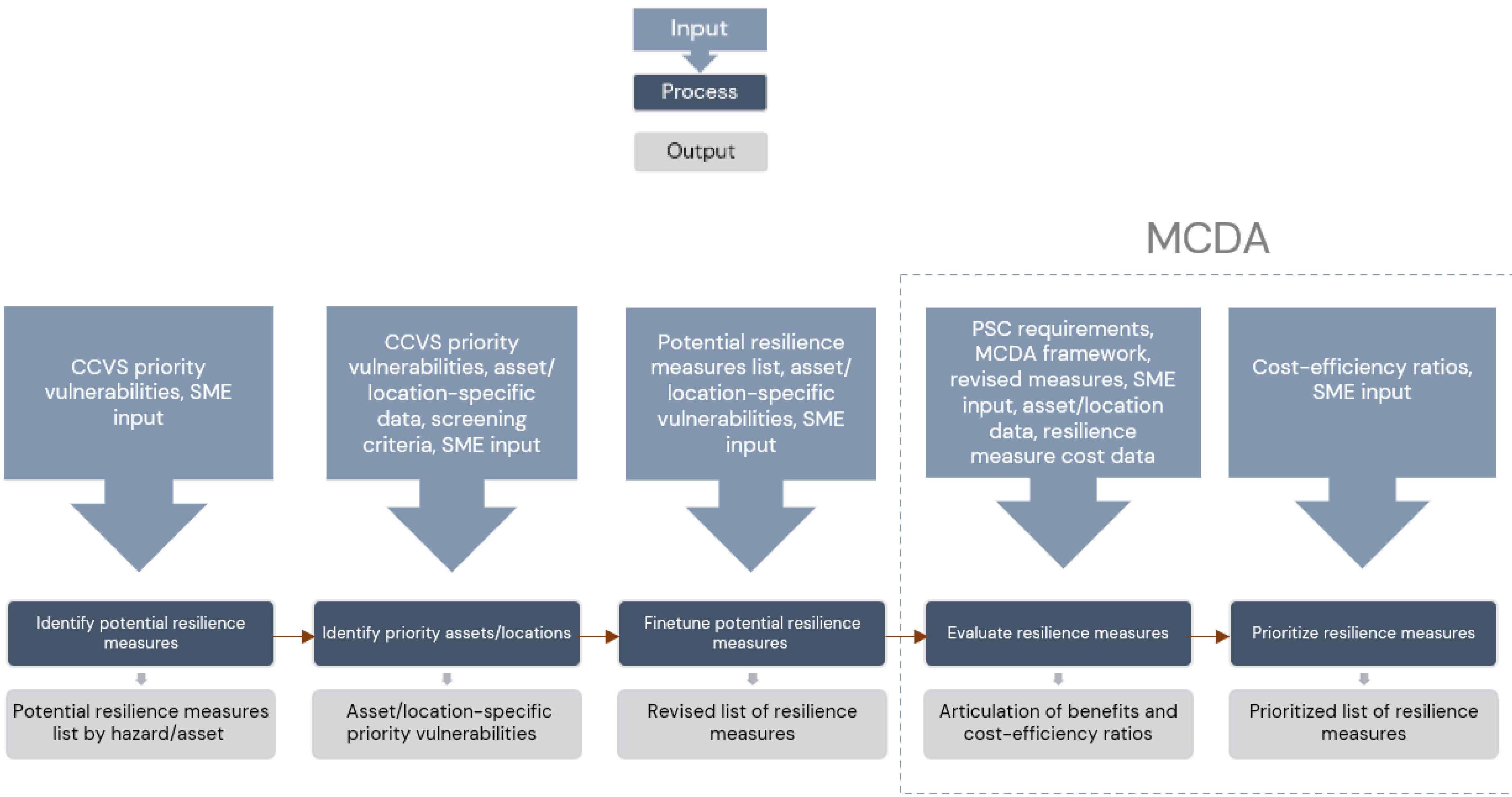


Figure 3 – Resilience Measures Prioritization Process Overview

4.3.1 Identification of Measures

In the early stages of the resilience planning process, a workshop was convened with Central Hudson Subject Matter Experts (SMEs) to broadly gather potential resilience measures. Proposed measures were organized according to the framework described in Figure 4 and focused on specifically addressing priority vulnerabilities in relation to transmission, substation, and distribution assets. The workshop participants—including broad representation from the Engineering and Operations groups—discussed suitability and completeness of each measure relative to the identified priority vulnerabilities and agreed on a preliminary set of measures that would be refined later in the process, following the asset screening described in Section 4.3.2 Identification of Priority Assets/Locations. This initial list of resilience solutions included both asset- and process-focused measures and provided multiple alternatives for a single asset–hazard combination.

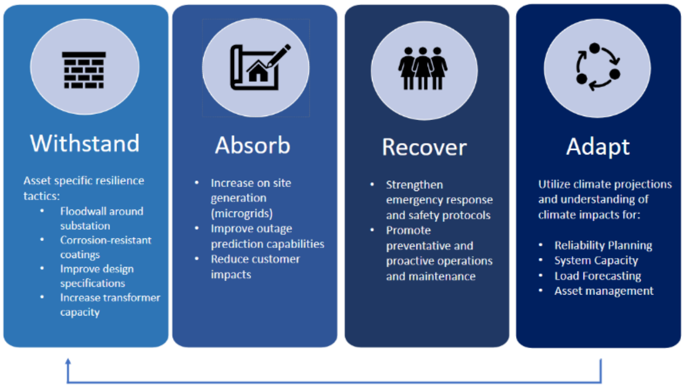


Figure 4 - Resilience Measures Examples.

4.3.2 Identification of Priority Assets/Locations

All assets identified as priority vulnerabilities were further screened to determine specific locations or assets that should be prioritized for resilience measures. The screening criteria considered the following asset characteristics: health, criticality, storm performance, whether the asset served load directly, and the criticality of the load served. Based on SME responses, assets were then classified as "priority" or "not a priority." The screening criteria are described below, with further technical details provided in Appendix C.

Asset Health

To account for variability in data and system characteristics, Central Hudson determined specific asset health metrics for each asset category based on the availability of asset data. For example, in assessing the health of distribution assets at the circuit level, Central Hudson considered the average age of all distribution poles on a given circuit relative to their typical useful life, and classified the 30% of circuits with the oldest average pole age relative to typical useful life as being in poor health. While the Company's existing replacement strategies are predominately condition-based versus time-based, as equipment reaches the end of its useful life, the condition assessment is more likely to identify issues that warrant replacement. To minimize costs, Central Hudson determined that consideration should be given to assets that are nearing the end of their useful lives and that don't already have plans for replacement. Similarly, when examining substation assets, Central Hudson considered the average health scores for all transformers in each substation, and the worst 30% of substations received priority for the purposes of this assessment. Transmission asset health for a particular transmission line was determined as an average of two measures: average age of conductor spans on a given line relative to their typical useful life and average age of transmission structures on a given line relative to their typical useful lives. Central Hudson took structure material (wood vs. steel) and structure type (pole vs. tower) into account for this analysis, as their useful lives vary. Once again, transmission lines for which average structures and conductor spans scored amongst the oldest 30% were classified as being in poor health.

Asset Criticality

For transmission lines and transmission substations, an asset was identified as “critical” if its loss would result in a high degree of system vulnerability or decreased stability. Central Hudson identified assets associated with the bulk power system (345kV) or associated with Central Hudson’s NW Loop to meet these criteria. Single transformer distribution substations were also classified as critical assets due to the potential for a single-contingency failure to result in potentially long-duration customer outages. Distribution circuits with a radial feeder design serving more than 1,000 customers and without any automatic load transfer schemes were also classified as critical.

Storm Performance

Asset performance during storms and severe weather events was analyzed using storm performance criteria. For distribution and substation assets, storm performance was assessed using reliability data from the past five years. Assets scoring in the lowest 30% for reliability performance during storms were classified as worst performing. Similarly, for transmission assets, transmission line trip-out events were analyzed from the past five years, and the bottom 30% were identified as the worst performing lines during storms.

Load Serving Capabilities

Finally, the two criteria that considered asset load serving capabilities (i.e., whether it directly served load or served critical customers/facilities and essential services during emergencies) offered “yes” and “no” options. A “yes” response correlated with priority asset status, while a “no” response suggested the asset was likely a non-priority asset.

Next, each asset was assigned a priority classification using the following logic: an asset was labeled as a priority if it was simultaneously in poor health and deemed critical, in addition to receiving two other affirmative responses. For example, an asset would be classified as a priority asset if it was deemed to be in poor health, critical, worst performing during storms, and serving critical load. The resulting list of priority assets was reviewed for accuracy and completeness to ensure that any assets with known performance issues that were not selected as priority, but that would benefit from resilience measures, were included in the final list of priority assets. This review also identified assets that did not need to be labeled priority, even if deemed to be in poor health, such as assets were slated for retirement.

Priority asset selection was an important step because not only did it reduce the number of asset–resilience measure pairings that would progress to the MCDA stage, but also it enabled further refinement of resilience measures based on location-specific characteristics. Please see Appendix D for a full list of assets identified as “priority assets” for resilience based on these criteria.

4.3.3 Multi-Criteria Decision Analysis

Multi-criteria decision analysis (MCDA) allows for the consideration of multiple objectives and evaluation criteria, both qualitative and quantitative, making it an ideal process for providing a comprehensive evaluation of potential resilience measures in the face of a high degree of climate uncertainty.

Central Hudson's MCDA process, as shown in Figure 5, involved selecting decision criteria and weights, scoring each measure against the criteria, and determining benefits. Next, efficiency of each measure was assessed by relating its benefits to its costs and calculating the cost efficiency ratio. The key outcome of the MCDA exercise was a cost efficiency ratio-based rank order of resilience measures to support Central Hudson's prioritization of mitigation measures.

Factor and Criteria Selection and Weighting

The initial list of MCDA factors and criteria, designed to evaluate proposed resilience measures in relation to requirements set out in the PSC order, was **derived from an extensive literature review, other utility resilience plans, and direct industry experience** with the goal of including a diverse list of factors that would ensure the prioritization of resilience measures that were impactful and holistically improved resilience for Central Hudson and its customers throughout the service territory. This initial list was later reviewed and refined by Central Hudson SMEs during a workshop, where feedback was provided on specific factors and criteria to be included in the final MCDA framework as well as relative importance of the criteria in terms of weights. Based on consensus, electrical service, resilience, and economic impact factors were considered the most critical and subsequently incorporated into the final MCDA framework.

The resulting factors, criteria, and weights are aligned with the PSC Order requirements as well as Central Hudson's commitment to serve customers in a safe, reliable, and affordable manner. Table 2 outlines the MCDA factors, criteria, and relative weighting used to evaluate and ultimately prioritize resilience measures. Further detail on these criteria is located in Appendix E.

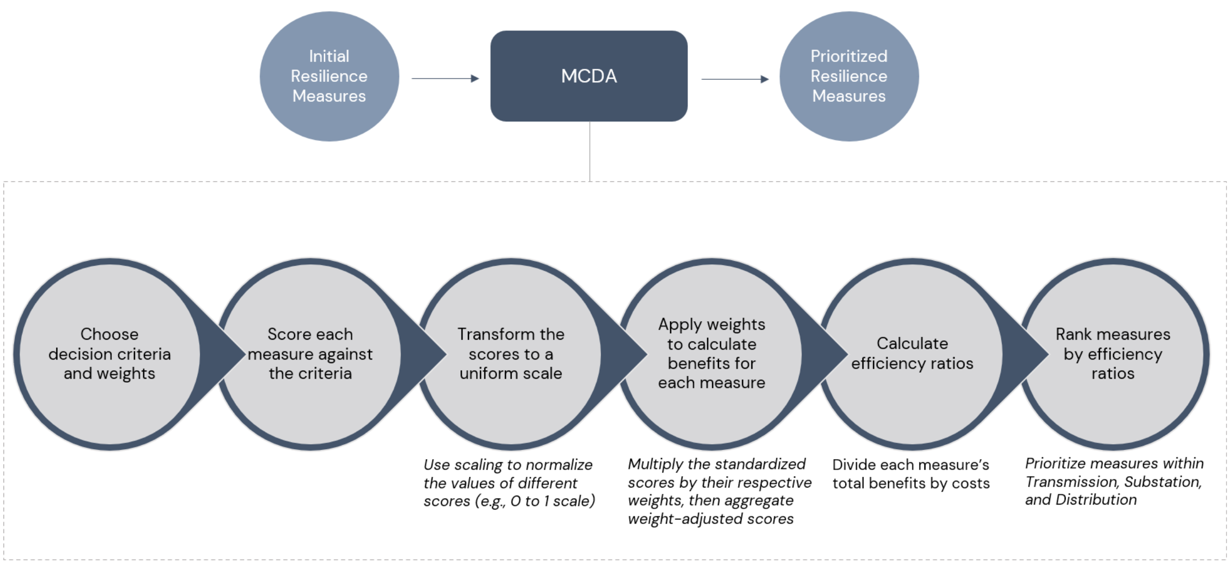


Figure 5 - Multi-criteria Decision Analysis (MCDA) key steps and components.

Table 2 – Factors and criteria for evaluating resilience measures.

Factors	Criteria Weight	Criteria
Electrical Service (30%)	33 ⅓ %	The measure's potential to reduce the number of customers affected by outages during events associated with climate hazards**
	33 ⅓ %	The effectiveness of the measure in reducing extended outage duration*
	33 ⅓ %	The effectiveness of the measure in reducing frequency of extended outages*
System Resilience (30%)	15%	Resilience measure's ability to address the "absorb" dimension of resilience*
	15%	Resilience measure's ability to address the "withstand" dimension of resilience*
	15%	Resilience measure's ability to address the "recover" dimension of resilience*
	15%	Resilience measure's ability to address the "adapt" dimension of resilience*
	40%	Resilience measure's ability to address more than one type of vulnerability (asset-hazard combination) *
Economic (20%)	50%	Resilience measure's anticipated impact on reducing restoration costs associated with extreme weather events*
	50%	Resilience measure's anticipated impact on reducing utility O&M costs*
Community Resilience (20%)	25%	Extent that project is expected to reduce impacts to customers needing life support equipment (LSE)**
	25%	Extent that the project provides community-wide benefits beyond Central Hudson infrastructure**
	50%	Whether project provides benefits to Disadvantaged Communities (DAC) customers**

*Evaluated based on qualitative data
**Evaluated based on quantitative data

Scoring Process

Each proposed resilience measure for a given asset–hazard combination was evaluated at the specific asset level and scored against MCDA factors and criteria described in Table 2.

The initial set of scores were recorded as raw scores. These raw scores were derived from two main sources: qualitative assessments by SMEs and quantitative data, such as number of Life Support Equipment (LSE) customers in a project area. To make the scores comparable across different criteria and data sources, all raw scores were then normalized to fit within a standardized 0–10 range. This was done by subtracting the minimum possible score for a given criterion from the raw score for the same criterion and then dividing the result by the difference between the maximum and minimum values of these raw scores, and finally multiplying the result by ten. The formula used to normalize the raw scores is shown below:

$$\text{Normalized score} = ((\text{raw score} - \text{min})/(\text{max} - \text{min})) * 10$$

To reflect the varying importance of different criteria and factors, the normalized scores were then adjusted using assigned weights. The final benefits score for each resilience measure was calculated as a sum of all its weighted scores.

The scoring was performed by consensus of SMEs within small focus groups by area (distribution, substation, and transmission) to bring a diversity of perspectives and to ensure each criterion was assessed by experts with deep knowledge in that specific area.

Cost Efficiency

The project team used the cost efficiency ratio to create a preliminary ranking of the asset-based resilience measures across distribution, substation, and transmission asset categories. The ratio was calculated by dividing each resilience measure’s total benefits score by its estimated total cost. The cost-efficiency metric served as a useful benchmark to evaluate the relative value of various resilience measures and guide prioritization of investments. Cost-efficiency scores and rankings were evaluated separately for each system (i.e., distribution, substation, and transmission) to make more accurate and context-specific comparisons. In cases where mitigation options were directly comparable for a given project area, the measure with the most cost-efficient (highest number) score was selected.

Final Resilience Measures

The final selection and prioritization of resilience measures was made based on the cost-efficiency scores and additional considerations that were not fully captured by the priority asset screening and MCDA, such as topography, circuit configuration, and alignment with other planned work in a given project area. Where there were multiple comparable options for mitigation measures to address the same asset/hazard combination, the cost-efficiency scores were used to eliminate the least cost-effective options. For example, Central Hudson identified three potential mitigation options for addressing a two-mile long section of the “HG” Transmission Line that is prone to contacts with vegetation during high wind conditions, conditions which are only expected to worsen with increasing frequency and intensity of storm events due to climate change:

- Rebuilding this portion of line to run underground instead of overhead ("Undergrounding")
- Increasing the transmission corridor width and performing edge reclamation (i.e., clearing vegetation out to the edges of the expanded corridor)
- Removal of hazard trees within existing corridor (i.e., trees that are outside of the routine trimming clearance zone but are at high risk of falling into conductors due to being dead, diseased, infested by insects, deformed, shallow-rooted, or otherwise structurally unsound)

After collecting costs and developing benefit scores for each measure using the process described above, Central Hudson identified the third option as being the most cost-efficient and thus was ultimately selected as the measure to be proposed, as shown in the example in Figure 6.

In some cases, multiple mitigation measures are proposed in this CCRP to address the same asset/hazard combination to account for different topographies and circuit configurations.
In these cases, the MCDA process informed the prioritization of these measures but did not seek to eliminate the options with lower cost efficiencies as those may be the only ones feasible for a given topography or configuration.

Asset ID	Hazard	Asset Class	Measure	Total Benefits	Estimated Cost	Cost-Efficiency Ratio	Rank
HG	Wind	Overhead conductors & Line Structures (Poles and Towers)	Increase transmission corridor widths	4.40	$150,000	0.0000293	2
HG	Wind	Overhead conductors & Line Structures (Poles and Towers)	Undergrounding	3.45	$20,000,000	0.0000002	3
HG	Wind	Overhead conductors & Line Structures (Poles and Towers)	Hazard Tree Removals in existing corridor	4.65	$90,000	0.0000517	1

Figure 6 - Hazard Tree Removals selected as preferred measure for resilience to wind due to greatest cost efficiency.

For example, three separate programs are proposed to address the effects of wind on vegetation affecting overhead distribution infrastructure:

- The Targeted “Ground-to-sky” Trimming Program
- Lateral Line Rebuilds Using Composite Poles Program
- Strategic Undergrounding Program

The Targeted “Ground-to-sky” Trimming program and the Strategic Undergrounding Program would both focus on three-phase circuit mainlines in project areas with high customer counts, but undergrounding has a worse cost-efficiency ratio and thus would only be chosen for specific circuit miles for which “ground-to-sky” trimming would be impractical or infeasible, such as for an overhead line that runs along the base of a hill with high tree density where no amount of trimming would prevent trees from falling into the lines. The Lateral Line Rebuilds Using Composite Poles Program would focus on primarily single-phase lines in rural areas with lower customer counts, but that tend to draw disproportionately high resources during major storm events due to lack of available ties for switching and/or off-road sections requiring special equipment. Individual project and program descriptions and business case justifications are detailed in the data sheets in Appendix F.

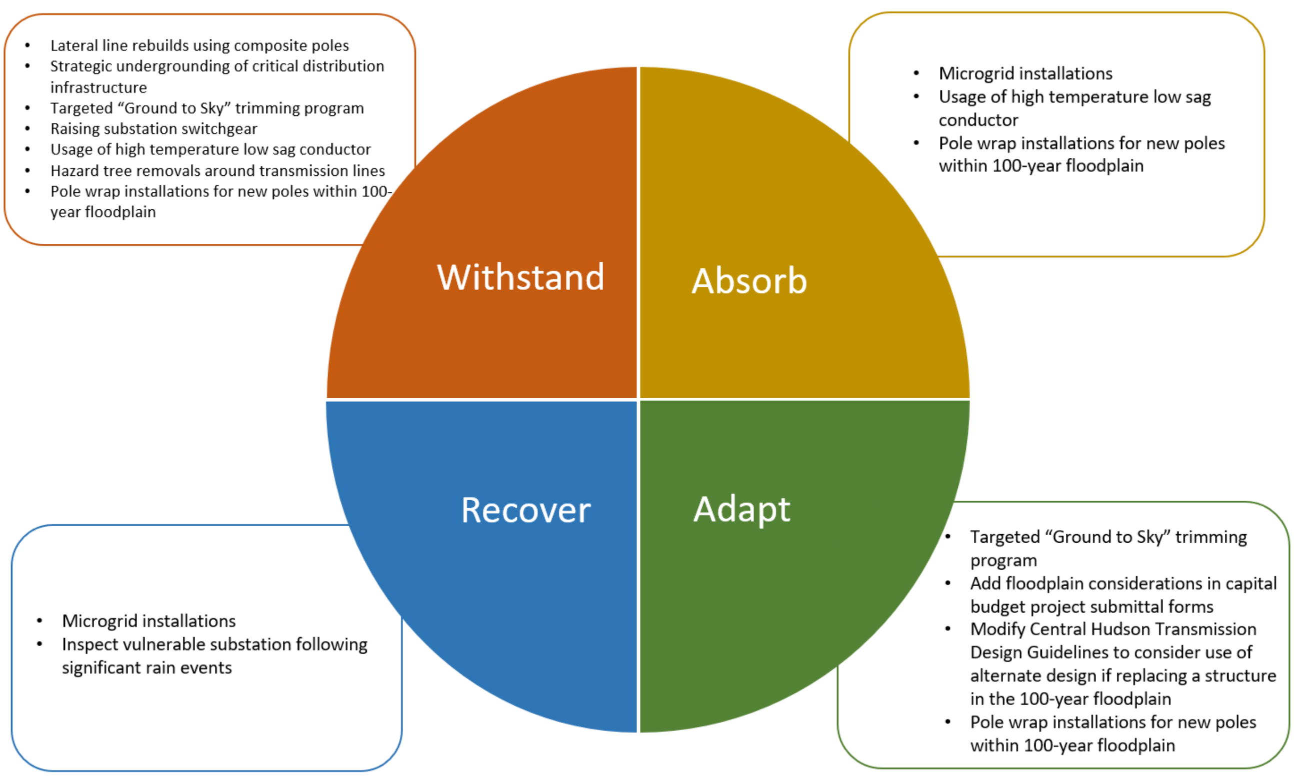


Figure 7 - Selected resilience measures within the resilience framework.

5. Investment Plan

Central Hudson has developed asset-focused programs and projects and process-focused resilience measures to protect the electric system against the identified risks of climate change over the next five, ten, and twenty years. More information on each program and project is provided in Table 3, including hazards addressed, timeline, and approximate costs. Five-year, ten-year, and twenty-year timelines refer to in-service dates of 2025–2029, 2030–2034, and 2035–2044, respectively. Project-specific information for the projects and programs within the five-year timeline, including more detailed project descriptions, is provided in project and program data sheets in Appendix F.

Table 3 - Asset-focused Resilience Programs and Projects

Classification	Type	Asset-focused Resilience Programs/Projects	Asset	Hazard	5-Year Cost (2025-2029)	10-Year Cost (2030-2034)**	20-Year Cost (2035-2044)**
Transmission	Project	HG Line - Use of HTLS Conductor on 16 miles of rebuild*	Overhead Conductors	Extreme Heat	$605,000	–	–
Transmission	Project	SR Line - Hazard tree removals between structure #112824 and structure #112845	Structures and Overhead Conductors	Extreme Wind	$30,000	–	–
Transmission	Project	HG Line - Hazard tree removals between structure #27501 and structure #27539	Structures and Overhead Conductors	Extreme Wind	$90,000	–	–
Substation	Project	Converse Street - Raise switchgear*	Switchgear-style Circuit Breakers	Extreme Precipitation and Flooding	$1,000,000	–	–
Substation	Project	Forgebrook - Raise switchgear	Switchgear-style Circuit Breakers	Extreme Precipitation and Flooding	–	$4,000,000	–
Substation	Project	Hurley Avenue - Raise switchgear	Switchgear-style Circuit Breakers	Extreme Precipitation and Flooding	–	$4,000,000	–
Distribution	Project	2387 Circuit - Microgrid - Lanesville	Poles and Overhead Conductors	Extreme Wind	–	–	$4,550,000
Distribution	Project	3078 Circuit - Microgrid - Cragsmoor	Poles and Overhead Conductors	Extreme Wind	–	$4,550,000	–
Distribution	Project	3078 Circuit - Microgrid - Spring Glen	Poles and Overhead Conductors	Extreme Wind	–	$4,550,000	–
Distribution	Project	7081 Circuit - Microgrid - Millerton	Poles and Overhead Conductors	Extreme Wind	–	–	$5,800,000

Classification	Type	Asset-focused Resilience Programs/Projects	Asset	Hazard	5-Year Cost (2025-2029)	10-Year Cost (2030-2034)**	20-Year Cost (2035-2044)**
Distribution	Program	Strategic Undergrounding Program	Poles and Overhead Conductors	Extreme Wind	$10,000,000	$15,000,000	$40,000,000
Distribution	Program	Targeted "Ground-to-sky" Trimming Program	Poles and Overhead Conductors	Extreme Wind	$5,250,000	$6,125,000	$14,000,000
Distribution	Program	Lateral Line Rebuilds Using Composite Poles Program	Poles and Overhead Conductors	Extreme Wind	$11,250,000	$12,187,500	$26,250,000
				TOTALS:	**$28,225,000**	**$50,412,500**	**$90,600,000**

*Work in this project area is already in Central Hudson's Five-year Electric Capital Plan; funding request is for **incremental** work due to climate change, which will be tracked separately.
**Project/program costs for the ten-year and twenty-year timelines are very high-level estimates presented in 2023 dollars.

By investing in these asset-related resilience programs and projects, Central Hudson will be able to better protect the system's infrastructure and maintain reliable service to customers. The following describe the benefits of implementing these proposed programs and projects:

- Transmission:
  - Usage of high temperature low sag (HTLS) conductor:
    - Mitigate conductor sagging into vegetation during periods of sustained high temperatures
  - Hazard tree removals:
    - Mitigate against outages caused by vegetation felled by high wind
- Substation:
  - Raise substation switchgear projects:
    - Decrease probability of customer outages due to flooding events
    - Improved restoration time and minimized restoration cost
    - Improve workers' ability to access switchgear during and in recovery phase of flood events
- Distribution:
  - Microgrid Projects:
    - Ability to operate independently (i.e., ability to continue powering community centers during 'macro grid' outage events)
    - Increased system reliability by helping to improve management of electricity demand
  - Strategic Undergrounding Program:
    - Enhance system reliability by minimizing outages caused by wind on vegetation
    - Potential reduced long-term maintenance costs
  - Lateral Line Rebuilds Using Composite Poles Program:
    - Reduced maintenance requirements
    - Less frequent pole failures (higher resistance to climate hazards) can minimize customer outages and corresponding storm restoration costs
    - Reduced time required to install can improve restoration times
  - Targeted "Ground-to-sky" Trimming Program:
    - Can reduce future clear costs and minimize cost of restoration and impact during extreme climate events
    - Reduce customer outages caused by falling tree limbs or debris

Table 4 - Process-focused Resilience Measures

Classification	Type	Asset-focused Resilience Programs/Projects	Asset	Hazard	Estimated Annual Cost (beginning 2025)
Distribution	Process Change	Pole wrap installations for new poles within floodplains	Poles	Extreme Precipitation and Flooding	$77,550
Distribution/ Substation	Process Change	Add floodplain considerations in capital budget project submittal forms	Distribution poles; substation switchgear-style circuit breakers	Extreme Precipitation and Flooding	No request
Substation	Process Change	Inspect vulnerable substations following significant rain/flooding events	Switchgear-stye circuit breakers	Extreme Precipitation and Flooding	No request
Transmission	Process Change	Modify Central Hudson Transmission Design Guidelines to consider use of alternate structure design if replacing a structure in the 100-year floodplain	Structures	Extreme Precipitation and Flooding	No request

By investing in the process-related resilience measures in Table 4 above, Central Hudson will be able to better protect the system's infrastructure and maintain reliable service to customers. The following describe the benefits of implementing these proposed measures:

- By using pole wraps when replacing a pole in the 100-year floodplain, Central Hudson is protecting poles from water damage and ground line rot, which will result in these poles being more resilient to wind and vegetation impacts. This reduces the frequency of customer outages and increases the lifespan of these poles, which could also lead to reduced O&M costs.
- Adding floodplain considerations for new construction will ensure new assets are equipped with measures to eliminate flood impacts or ensure they are not exposed to flooding. This reduces the number of damaged assets due to flooding, frequency of customer outages, and may avoid repair costs associated with flood damage.
- By inspecting vulnerable substations following significant rain events, Central Hudson can immediately address any potential damage and reduce restoration time and costs associated with outages.
- Modifying Central Hudson Transmission Design Guidelines to consider the 100-year floodplain will minimize flood-related damage and disruptions by ensuring new transmission line structures are equipped with measures to lessen or eliminate flood impacts. In addition, the duration and frequency of customer outages may be reduced as well as potential associated restoration costs.

As calculated from Table 3 and Table 4 above, the total cost for implementation of the first five years of the plan (2025–2029) is $28,612,750. This translates to an average annual increase of 0.14% in the delivery portion of the customer bill (averaged across all service classes), or an average annual total bill increase of just 0.06%, over that period. Table 5 provides estimated incremental revenue requirements as well as delivery and total bill impacts for the first five years of the plan.

Table 5 – Incremental revenue requirements and bill impacts for first five years

	2025	2026	2027	2028	2029
Incremental Revenue Requirement ($000)	$1,097	$486	$485	$479	$469
Total % Bill Increase	0.10%	0.05%	0.05%	0.05%	0.04%
Delivery % Bill Increase	0.25%	0.11%	0.11%	0.11%	0.11%

The overall timeframe of the asset-focused measures is shown in Table 6. The total cost for implementation of the first five years of the plan also includes one process-focused measure, pole wrap installations for new poles within floodplains, that includes an annual cost of $77,550.

Table 6 – Timeframe for Asset-focused Projects and Programs

Project or Program Name	Implemented Years 1-5	Implemented Years 6-10	Implemented Years 11-20
Distribution Programs			
Lateral line rebuilds using composite poles (37 priority circuits)	●	●	●
Strategic undergrounding of critical distribution infrastructure program (37 priority circuits)	●	●	●
Targeted "Ground to Sky" trimming program (37 priority circuits)	●	●	●
Distribution Projects			
Microgrid Installation – Circuit 3078 Cragsmoor		●	
Microgrid Installation – Circuit 3078 Spring Glen		●	
Microgrid Installation – Circuit 2387 Lanesville			●
Microgrid Installation – Circuit 7081 Millerton			●
Substation Projects			
Raise Substation Switchgear – Converse St	●		
Raise Substation Switchgear – Forgebrook		●	

Project or Program Name	Implemented Years 1-5	Implemented Years 6-10	Implemented Years 11-20
Raise Substation Switchgear – Hurley Ave		●	
Transmission Projects			
Usage of high temperature low sag (HTLS) conductor on 16 miles of rebuild	●		
Hazard Tree Removals – SR Line	●		
Hazard Tree Removals – HG Line	●		

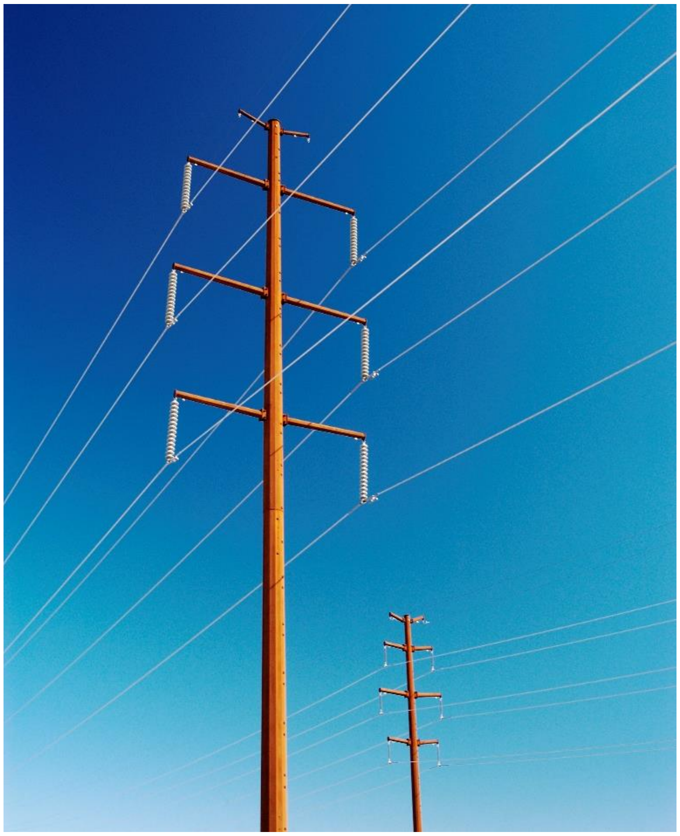
6. Governance

The implementation of this Resilience Plan will be overseen by Central Hudson's Electric Engineering and Operations group, with no major changes planned to the group's structure at this time. While the costs of resilience work specific to the CCRP will be tracked separately from the Company's business-as-usual work, the projects, programs, and procedural changes proposed in this Plan will be constructed and managed as part of Central Hudson's broader capital and maintenance programs.

In accordance with New York Public Service Law §66(29) and PSC Case 22-E-0222, beginning December first of the year after the second full year of implementation of this Resilience Plan and biennially thereafter, Central Hudson will file with the Public Service Commission a report on the status of its activities to comply with the CCRP. This report shall include, but is not limited to, identification of all storm protection and resiliency activities completed or planned for completion, the actual costs and rate impacts associated with completed activities as compared to the estimated costs and rate impacts for those activities, the estimated costs and rate impacts associated with activities planned for completion, and any updates to the governance, planning, and operational activities undertaken by Central Hudson in furtherance of the Plan. This report will also detail performance results of measures that have been implemented as described in the Investment Plan section.

At least every five years following the Public Service Commission's approval of the CCRP, Central Hudson will file an updated Plan that includes the same elements as are contained herein.

In addition to continued coordination with its CRWG in the implementation of this CCRP and future resilience plans, Central Hudson will continue to engage with the Joint Utilities of New York and with industry organizations such as the Electric Power Research Institute to keep abreast of best practices as well as new methodologies, tools, and availability of data in the resilience sector.



7. Performance Measures

The primary objective of the PSC Order is to reduce the impacts of climate change on customers by having utilities incorporate climate change into planning, design, operations, and emergency response. Central Hudson will work toward incorporating performance measures into the biennial reports on the status of activities to comply with these resilience plans. Central Hudson intends to measure performance of the resilience measures in this CCRP based on the goals and anticipated benefits of the measures.

Performance measures are based on pre- and post-event data to help link performance issues to extreme weather and climate. A number of external factors not caused by extreme weather and climate can affect performance, such as population change, land use and land cover change, and systemic barriers to equity. Additionally, the Priority Asset Screening (see Section 4.3.2 Identification of Priority Assets/Locations) helps isolate the benefits of resilience measures to issues surrounding extreme weather and climate by screening for assets not already slated for replacement but otherwise in poor condition, assets serving load for critical customers/facilities, assets providing power to essential services during emergencies, and assets with a history of poor performance during storms. More information on performance measures can be found in Table 7.

Several uncertainties related to extreme weather and climate are important to acknowledge, as these uncertainties can affect the ability to distinguish pre- and post-event or pre- and post-impact measurement. While the frequency and/or magnitude of extreme weather events is expected to increase, it is impossible to determine exactly whether, where, and when those events will occur more than 48–72 hours in advance. Also, there are large uncertainties in the overall rate and magnitude of climate change over the life cycle of large-scale utility infrastructure (~20–80 years). In future phases of work, Central Hudson may refine performance measures to account for these uncertainties.

Table 7 - Performance metrics by resilience measure

System	Resilience Measure	Anticipated Benefit	Performance Measure
	Microgrid installation projects	• Ability to operate independently (i.e., ability to **continue powering local communities** during 'macro grid' outage events) • **Increase system reliability** by helping to improve management of electricity demand	Number of successful microgrid operations and total number of customers/customer-hours saved.
	Strategic undergrounding of critical distribution infrastructure program	• **Reduce exposure** to weather and climate hazards • **Enhance system reliability** by minimizing outages caused by physical weather impacts (i.e., wind, falling tree limbs…) • **Reduce maintenance costs** over long term	Tree-related outage frequency performance for aggregated circuits completed compared to a baseline 3-year historical average for circuits with at least 3 years of post-implementation data. If improvements are not indicated, reporting should include a narrative of why this may be the case.
Distribution	Lateral line rebuilds using composite poles program	• **Reduce maintenance needs** due to longer pole lifespan • **Reduce pole failure rates** by creating higher resistance to climate hazards, minimizing customer outages • Reduce time required to install poles which can **improve restoration times**	Outage frequency and duration performance for aggregated circuits completed compared to baseline 3-year historical averages for circuits with at least 3 years of post-implementation data. If improvements are not indicated, reporting should include a narrative of why this may be the case.
	Targeted "ground-to-sky" trimming program	• **Minimize cost of restoration** and impact during extreme climate events • **Reduce customer outages** caused by falling tree limbs or debris	Tree-related outage frequency performance for aggregated circuits completed compared to a baseline 3-year historical average for circuits with at least 3 years of post-implementation data. If improvements are not indicated, reporting should include a narrative of why this may be the case.

System	Resilience Measure	Anticipated Benefit	Performance Measure
Substation	Raise substation switchgear	• **Decrease probability of customer outages** due to flooding events • **Improve restoration time** and minimize restoration costs • **Improve** workers' ability to **access** switchgear during and in recovery phase of flood events	Number of customer outages caused by substation flooding at substations where flood mitigation work has been completed.
Transmission	Usage of high temperature low sag (HTLS) conductor on 16 miles of rebuild	• **Mitigate conductor sagging into vegetation** during periods of sustained high temperatures	Number of trip-outs due to heat causing wires to sag into vegetation or distribution underbuild on transmission line for which HTLS conductor was used.
	Hazard tree removals in existing corridor	• **Mitigate against outages caused by vegetation** felled by high wind	Number of transmission trip-outs due to trees in the identified sections where mitigation work was performed.

8. Conclusion and Next Steps

The CCRP builds upon Central Hudson's ongoing efforts, further strengthening the resilience of infrastructure, operations, and local communities. The resilience measures identified in this report will help improve Central Hudson's customer experience by reducing the number of outages occurring due to climate-change driven events, promoting faster restoration times, and providing broader community benefits. Central Hudson took deliberate steps to factor equity and community resilience considerations into the prioritization of resilience measures, focusing not just on the needs of individual customers but also disadvantaged communities.

In addition to system and customer resilience benefits, affordability and rate stability were top of mind as Central Hudson evaluated and prioritized resilience measures. The total cost of implementing the initial five-year phase of the resilience plan translates to an average annual increase of 0.14% in the delivery portion of the customer bill (averaged across all service classes), or an average annual total bill increase of just 0.06%, over that period.

Development of this CCRP has meaningfully enhanced Central Hudson's capabilities to advance resilience. Both the CCVS and CCRP have contributed to a greater understanding of climate hazards, facilitated adoption of innovative analytical approaches and tools, and fostered alignment and collaboration across the organization as well as the continued focus on the communities Central Hudson serves.

Moving forward, implementation of the resilience projects and programs identified in this CCRP will be the primary focus of resilience work in future years; however, Central Hudson will continue to engage with stakeholders and industry organizations to keep abreast of best practices as well as new methodologies, tools, and data, including evolving climate projections. Tracking performance of implemented resilience measures will also inform future investments designed to minimize the impacts of climate change on Central Hudson's customers.

Appendix A: Matrix for Key PSL §66 Requirements

Table A-1 – Matrix for Key PSL §66 Requirements.

Public Service Law §66 Requirement or Public Service Commission 22-E-0222 Requirement	**Climate Change Resilience Plan (CCRP) Section**
How and to what extent the utility will mitigate the impacts of climate change on utility infrastructure, **reduce restoration costs and outage times** associated with extreme weather events, and enhance electric system reliability.	Anticipated reduction in restoration costs and outage times evaluated for each measure using the MCDA framework (Section 4.3.3 Multi-Criteria Decision Analysis); Appendix E: MCDA Final Framework)). Resilience measure descriptions are further elaborated in Appendix F: Project and Program Data Sheets).
How the utility will **incorporate climate change** into its planning, design, operations, and **emergency response**.	Section 4.2 (Resilience Journey)
Incorporate climate change into existing processes and practices, manage climate change risks, and build resilience.	Section 6. Governance)
An **estimate of the costs and benefits** of the improvements proposed in the Plan, especially regarding underground electric transmission and distribution lines.	Section 4.3.3 Multi-Criteria Decision Analysis); Appendix E: MCDA Final Framework)
An implementation **schedule**.	Section 5 (Investment Plan)
Performance benchmarks.	Section **Error! Not a valid result for table.**)
The **rate impact** from the first five years of investments.	Section 5 (Investment Plan)
Any **third-party coordination** opportunities.	Section 6. Governance). The Joint Utilities of New York and the CRWG.
Address the recommendations from the utility **climate resiliency working group (CRWG)** established through this law.	Section 2. Engagement of the Climate Resilience Working Group)

Appendix B: List of Climate Resilience Working Group (CRWG) Participating Organizations

The following organizations participated in the Climate Resilience Working Group, which reviewed Central Hudson's work and provided input on the creation of this resilience plan:

- City of Poughkeepsie
- City of Kingston
- City of Newburgh
- Columbia County
- Ulster County
- Dutchess County
- Albany County
- Sullivan County
- Putnam County
- Orange County
- Greene County
- Sustainable Hudson Valley
- Department of Public Service (DPS) Staff
- New York State Department of State Utility Intervention Unit
- Town of Olive
- New York State Energy Research and Development Authority (NYSERDA)
- Multiple Intervenors
- New York Geothermal Energy Organization (NY-GEO)
- Clearwater

Appendix C: Priority Asset Screening Tool

The following instructions for asset screening were provided to Central Hudson SMEs to help prioritize vulnerable assets.

Screening Instructions:

For Criterion 1, Asset Health, please calculate asset health scores (see below).

For Criteria 2, 3, and 4, evaluate each asset and select Yes, No, or NA (not applicable). Please evaluate assets only at the transmission line, circuit, or substation level. For each asset evaluated, please use the data screening instructions outlined below to make a Yes, No, or NA determination for each transmission line, circuit, or substation.

Screening Criteria	Criteria Description	Asset Screening Instructions
Criterion 1: Asset Health	The asset's health condition is characterized as poor	**Substations**: For every substation, compute a metric that is the average of the health indices for all transformers in the substation. For each individual substation, if this metric falls in the bottom **30%**, please answer "YES." If it does not, select "NO." **Transmission Lines:** For every transmission line, compute a metric that is an average of the following two terms: 1) the average age of all conductor spans divided by the Typical Useful Life (TUL), and 2) the average age of all transmission towers divided by the TUL of a transmission tower. If TUL data are specific to the material of the structure, use the relevant data set. For each transmission line, if the metric computed above falls in the bottom **30%**, please answer "YES." If it does not, select "NO." **Circuits:** For every distribution circuit, compute a metric that is the average age of all distribution poles divided by the Typical Useful Life (TUL) of a distribution pole. For each distribution circuit, if the metric computed above falls in the bottom **30%**, please answer "YES." If it does not, select "NO."
Criterion 2: Load Service	The asset is a load serving asset	**Distribution Circuits/Substations:** Please consult the Central Hudson records to check if distribution circuit or substation is load serving. If it is, please answer "YES." If it is not, select "NO." **Transmission Lines/Substations:** Please consult the Central Hudson records to check if a transmission line or substation is load serving. If it is, please answer "YES." If it is not, does the loss of this transmission asset result in the need for load shedding? If it does, please answer "YES." If it does not, select "NO."

Screening Criteria	Criteria Description	Asset Screening Instructions
Criterion 3: Critical Load	The asset serves load for critical customers/facilities or provides power to essential services during emergencies	**Transmission Lines, Substations, and Circuits:** Please consult critical facility data. If the substation, transmission line, or circuit serves ANY critical facilities/customers (Class 1, 2, or 3) or provides power to essential services during emergencies, please answer "YES." If it does not, select "NO."
Criterion 4: Storm Performance	The asset is among lowest performing during storms	**Substations and Circuits**: Please consult reliability data to examine whether the substation or circuit is among the bottom third for reliability performance during storm events over the past 5 years. If it is among the bottom third, please answer "YES." If it is not, answer "NO." **Transmission Lines**: Please consult the transmission line outage data to examine whether the transmission line is among the bottom **30%** for transmission line outages during PSC recordable storms over the past 5 years. If it is among the bottom third, please answer "YES." If it is not, answer "NO."
Criterion 5: Asset Criticality	The design/criticality of the asset is more likely to result in outages or present difficulties in restoring service	**Transmission Lines/Substations**: Answer "YES" if outage of the line or substation results in a high degree of system vulnerability or stability. **Circuits**: Please consult the design of the feeder. If the feeder is a radial design, please answer "YES" for circuits that feed more than 1,000 customers and do not have any automatic load transfer schemes installed. **Distribution Substations**: Please consult the design of the substation. If the substation is a single transformer substation, please answer "YES." If not, answer “NO.”

Appendix D: Priority Asset List

The following distribution circuits, substations and transmission lines were deemed to be "Priority Assets" for resilience based on the criteria outlined in Section 4.3.2 Identification of Priority Assets/Locations. Please note that not all Priority Assets have associated projects or programs. In those cases, a deeper analysis of the asset or component sub-assets revealed no vulnerability to climate hazards based on specific conditions or circumstances (typically elevation or loading) or that there were already plans in Central Hudson's Five-Year Electric Capital Plan to retire, replace, or otherwise modify the asset in question due to factors unrelated to climate.

Distribution Circuits:					
1091	2387	3091	5024	6092	8063
2003	2389	4012	5043	6095	8065
2041	3001	4043	6001	6096	
2071	3004	4052	6003	6097	
2081	3012	5001	6042	7056	
2094	3013	5003	6051	7081	
2385	3078	5023	6057	8014	

Substations:
Ancram
Clinton Avenue
Converse Street
East Park
Forgebrook
Greenfield Road
Hurley Avenue
Milan
Modena
Neversink
Pulvers Corners
Smithfield
South Wall Street
Tioronda
Vinegar Hill

Transmission Lines:
FT
SR
HG

Appendix E: MCDA Final Framework

Table E-1 – Criteria and scoring methodology for evaluating resilience measures.

Factors	% Weight	Criteria	Metric	Scoring Scale Description	Evaluation Methodology
Electrical Service (30%)	33⅓%	The measure's potential to achieve the greatest reduction in number of customers affected by outages during events associated with climate hazards	Number of customers in the project area	A quantitative score directly linked to the actual number of customers in the project area.	Number of customers in the project area. Project area size varies depending on the project (e.g., a distribution undergrounding project on the mainline serves more customers than work on a pole at the end of a feeder).
	33⅓%	The effectiveness of the measure in reducing extended outage duration	Impact on outage duration	A qualitative estimate of the measure's effectiveness in reducing extended outage duration. "0" – measure has no discernable effect on reducing extended outage duration; "1" – measure has minimal effect on reducing extended outage duration; "2" – measure has moderate effect on reducing extended outage duration; "3" – measure has substantial effect on reducing extended outage duration.	Subject Matter Experts (SMEs) evaluated proposed resilience measures in terms of their effectiveness in reducing duration of extended outages. When evaluating the resilience measure's effectiveness in reducing outage duration, SMEs considered whether and to what extent the measure enabled the following conditions: faster detection of outages, faster response and recovery, improved real-time situational awareness, and ability to self-monitor, self-heal, and adapt to changing conditions, redundancy and backup, etc.

	33⅓%	The effectiveness of the measure in reducing frequency of extended outages	Impact on outage frequency	A qualitative estimate of the measure's effectiveness in reducing frequency of extended outages. "0" – measure has no discernable effect on reducing frequency of extended outages; "1" – measure has minimal effect on reducing frequency of extended outages; "2" – measure has moderate effect on reducing frequency of extended outages; "3" – measure has substantial effect on reducing frequency of extended outages.	SMEs evaluated proposed resilience measures in terms of their effectiveness in reducing frequency of extended outages. When evaluating the resilience measure's effectiveness in reducing outage frequency, SMEs considered whether and to what extent the measure enabled the following conditions: early detection of potential issues **that enables preventative maintenance/action**, robust and adaptive system design and performance under diverse climate hazards, continuity of service despite asset failure, etc.
System Resilience (30%)	15%	Resilience measure's ability to address the "absorb" dimension of resilience	Resilience measure's "absorb" classification	A qualitative assessment of whether the measure is expected to address the "absorb" dimension of the resiliency framework, with "0" indicating "no" and "1" indicating "yes."	SMEs evaluated the ability for the measure to prevent damage to assets that would ultimately cause customer interruptions.
	15%	Resilience measure's ability to address the "withstand" dimension of resilience	Resilience measure's "withstand" classification	A qualitative assessment of whether the measure is expected to address the "withstand" dimension of the resiliency framework, with "0" indicating "no" and "1" indicating "yes."	SMEs evaluated the ability of the measure to support continued service to customers at a reduced level in the face of damage to the system.
	15%	Resilience measure's ability to address the "recover" dimension of resilience	Resilience measure's "recover" classification	A qualitative assessment of whether the measure is expected to address the "recover" dimension of the resiliency framework, with "0" indicating "no" and "1" indicating "yes."	SMEs evaluated the ability of the measure to support service restoration after damage to the system.

	15%	Resilience measure's ability to address the "adapt" dimension of resilience	Resilience measure's "adapt" classification	A qualitative assessment of whether the measure is expected to address the "adapt" dimension of the resiliency framework, with "0" indicating "no" and "1" indicating "yes."	SMEs evaluated the ability of the measure to support improvements in planning and operations in such a way as to further build resilience to climate change.
	40%	Resilience measure's ability to address more than one type of vulnerability (asset–hazard combination)	Number of vulnerabilities addressed	A qualitative assessment of the number of vulnerabilities addressed by the measure (asset–hazard combination).	SMEs evaluated the number of vulnerabilities addressed by the measure.
Economic (20%)	50%	Resilience measure's anticipated impact on reducing restoration costs associated with extreme weather events	Impact on restoration costs	A qualitative estimate of the resilience measure's impact on reducing restoration costs, with "0" indicating no discernable impact, "1" indicating minimal impact, "2" indicating moderate impact, and "3" indicating substantial impact.	SMEs evaluated proposed resilience measures in terms of their potential impact on reducing utility restoration costs associated with extreme weather events. When evaluating the resilience measure's effectiveness in reducing storm-related restoration costs, SMEs considered both capital and Operations and Maintenance (O&M) costs associated with restoration of service due to outages. This includes mobilization, staging, construction, and repair and replacement costs, among others.
	50%	Resilience measure's anticipated impact on reducing utility O&M costs	Impact on Operations and Maintenance (O&M) costs	A qualitative estimate of the resilience measure's impact on reducing utility O&M costs, with "0" indicating no discernable impact, "1" indicating minimal impact, "2" indicating moderate impact, and "3" indicating substantial impact.	SMEs evaluated proposed resilience measures in terms of their potential impact on reducing utility routine operation and maintenance costs. When evaluating the resilience measure's effectiveness in reducing O&M costs, SMEs considered all expenses associated with day-to-day operations and maintenance of assets. This includes routine inspections and testing, planned maintenance and repairs, energy/fuel costs, labor costs, etc. Does not include storm-related restoration O&M costs.

Community Resilience (20%)	25%	Extent that project is expected to reduce impacts to customers needing life support equipment (LSE)	Number of customers in the project area that utilize LSE	Number of customers that use LSE.	Used the number of LSE customers per distribution circuit associated with a specific asset.
	25%	Extent that the project provides community-wide benefits beyond Central Hudson infrastructure	Number of facilities in the project area that are classified as Level 1, Level 2, and Level 3 critical customers	Number of critical facilities.	Used the number of Level 1–3 critical facilities per distribution circuit associated with the specific asset.
	50%	Whether project provides benefits to Disadvantaged Communities (DAC) customers	(Y/N) Whether project serves power to DAC-Identified area	"0" indicating that the feeder is not in a DAC, "1" indicating that the feeder does cross through a DAC.	Used spatial data to determine whether feeders cross or do not cross through a DAC.

Appendix F: Project and Program Data Sheets

Project Name: SR Transmission Line – Hazard Tree Removals

Climate Vulnerability being addressed: Wind on Vegetation Affecting Structures/Conductor

Project Location: Woodstock, NY

Project Background and Justification: Central Hudson's 69kV SR Transmission Line runs from Saugerties Substation to Woodstock Substation, and serves as the radial feed to Woodstock Substation, providing electrical service to 8,480 customers in Woodstock and the surrounding areas. A 0.6-mile portion of this line, off-road between Laura Lane and Chestnut Hill Road and running along the base of a hill, has historically been susceptible to outages caused by uphill tall pine trees that fall from outside the trimming clearance zone. Between 2015 and 2022, there were five confirmed instances, four of which resulted in outages to Woodstock Substation. As the frequency and intensity of storm events increases due to climate change, the frequency of outages at this location is expected to increase proportionately.

Project Description/Scope of Work: Perform hazard tree removals for trees which could affect the SR Line between structure #112824 and structure #112845. While there is a hazard tree program for Central Hudson's distribution system, no such program exists on the transmission side.

Cost Estimate (Conceptual):

	Years 1-5
Capital:	–
O&M	$30,000

Basis for Estimate: 36 trees per mile @ $1,236/tree

<u>Project Benefits</u>

Electrical Service

☒ Customers affected by outages: <u>8,480</u>

☒ Anticipated reduction in outage duration

☒ Anticipated reduction in outage frequency

Economic Impact

☒ Anticipated reduction in storm restoration costs

☐ Anticipated reduction in O&M costs

System Resilience

☐ Absorb – Increase the system's ability to anticipate when a climate hazard may occur and absorb its effects

☒ Withstand – Strengthen assets to resist adverse impacts of a climate hazard event

☐ Recover – Bolster the system's ability to quickly respond and recover in the aftermath of a climate hazard event

☐ Adapt – Advance and adapt the system to address a continuously-changing climate threat landscape and perpetually improve resilience

Community Resilience

☐ Project area serves DAC Customers

☒ Project area serves Critical Customers

☒ Project area serves LSE Customers

<u>Alternatives</u>

Project Alternatives Considered:

Two alternatives were considered and scored as part of the MCDA process to mitigate this issue:

- Strategic Undergrounding
- Increasing Transmission Corridor Width and Clearing Additional Width

While either of the alternatives would have been more effective in addressing the issue, the costs to implement these alternatives were much higher compared to hazard tree removals within the existing corridor. Increasing transmission corridor widths would cost approximately $1.5 million and undergrounding of this section of line would cost approximately $10 million.

Decision Criteria for Alternate Selection:

The overall cost-efficiency score was orders of magnitude better for the hazard tree removal option compared to the other two options considered.

Project Name: HG Transmission Line – Hazard Tree Removals

Climate Vulnerability being addressed: Wind on Vegetation Affecting Structures/Conductor

Project Location: Wawarsing, NY

Project Background and Justification: Central Hudson's 69kV HG Transmission Line runs from Honk Falls Substation to Neversink Substation. A 2-mile portion of this line in the vicinity of Sholam Road in Wawarsing has historically been susceptible to outages caused by trees that fall from outside the trimming clearance zone. Between 2018 and 2022, there were five confirmed instances. As the frequency and intensity of storm events increases due to climate change, the frequency of outages at this location is expected to increase proportionately.

Project Description/Scope of Work: Perform hazard tree removals for trees which could affect the HG Line between structure #27501 and structure #27539. While there is a hazard tree program for Central Hudson's distribution system, no such program exists on the transmission side.

Cost Estimate (Conceptual):

	Years 1-5
Capital:	–
O&M	$90,000

Basis for Estimate: 36 trees per mile @ $1,236/tree

<u>Project Benefits</u>

Electrical Service

☐ Customers affected by outages: ____

☒ Anticipated reduction in outage duration

☒ Anticipated reduction in outage frequency

Economic Impact

☒ Anticipated reduction in storm restoration costs

☐ Anticipated reduction in O&M costs

System Resilience

☐ Absorb – Increase the system's ability to anticipate when a climate hazard may occur and absorb its effects

☒ Withstand – Strengthen assets to resist adverse impacts of a climate hazard event

☐ Recover – Bolster the system's ability to quickly respond and recover in the aftermath of a climate hazard event

☐ Adapt – Advance and adapt the system to address a continuously-changing climate threat landscape and perpetually improve resilience

Community Resilience

☐ Project area serves DAC Customers

☐ Project area serves Critical Customers

☐ Project area serves LSE Customers

Alternatives

Project Alternatives Considered:

Two alternatives were considered and scored as part of the MCDA process to mitigate this issue:

- Strategic Undergrounding
- Increasing Transmission Corridor Width and Clearing Additional Width

While either of the alternatives would have been more effective in addressing the issue, they were priced higher compared to hazard tree removals within the existing corridor. Increasing transmission corridor widths would cost approximately $150,000 and undergrounding of this section of line would cost approximately $20 million.

Decision Criteria for Alternate Selection:

The overall cost-efficiency score was best for the hazard tree removal option compared to the other two options considered.

Project Name: HG Transmission Line – Use of HTLS Conductor on 16 Miles of Rebuild

Climate Vulnerability being addressed: Extreme Heat

Project Location: Wawarsing, NY

Project Background and Justification: Central Hudson's 69kV HG Transmission Line runs for 16.25 miles from the Honk Falls Substation to the Neversink Substation. There have historically been thermal limitations with this line due to conductor sagging during high temperature periods, which presents a risk of contact with the distribution underbuild. This risk will only be exacerbated with projected temperature increases due to climate change as identified in Central Hudson's Climate Change Vulnerability Study.

Project Description/Scope of Work: A rebuild of this line is already scheduled within Central Hudson's 5-Year Capital Plan as a high percentage of the existing structures have conditions requiring replacement. This project represents the incremental cost associated with utilizing High Temperature, Low Sag (HTLS) conductor in place of conventional ACSR conductor for the rebuild. Use of HTLS conductor would help mitigate the potential effects of extreme heat on the line's electrical capacity and clearance.

Cost Estimate (Conceptual):

	Years 1-5
Capital:	$605,000
O&M	–

Basis for Estimate: $37,200 incremental cost/mile of using HTLS conductor over 16.25 miles

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<u>Project Benefits</u>

Electrical Service

☐ Customers affected by outages: _____

☒ Anticipated reduction in outage duration

☒ Anticipated reduction in outage frequency

Economic Impact

☐ Anticipated reduction in storm restoration costs

☐ Anticipated reduction in O&M costs

System Resilience

☒ Absorb – Increase the system's ability to anticipate when a climate hazard may occur and absorb its effects

☒ Withstand – Strengthen assets to resist adverse impacts of a climate hazard event

☐ Recover – Bolster the system's ability to quickly respond and recover in the aftermath of a climate hazard event

☐ Adapt – Advance and adapt the system to address a continuously-changing climate threat landscape and perpetually improve resilience

Community Resilience

☐ Project area serves DAC Customers

☐ Project area serves Critical Customers

☐ Project area serves LSE Customers

Alternatives

Project Alternatives Considered:

Various HTLS conductor designs will be considered against the use of conventional ACSR conductor as part of the final conductor selection for the line.

Decision Criteria for Alternate Selection:

The decision for the selection of the final conductor alternative will be based on a combination of factors including but not limited to cost, construction logistics, and operating and maintenance concerns.

Project Name: Converse Street Substation – Raise Switchgear

Climate Vulnerability being addressed: Extreme Precipitation and Flooding

Project Location: Kingston, NY

Project Background and Justification: Converse Street Substation feeds three distribution circuits in the City of Kingston, providing electric service to a total of 437 customers. This substation is located within the FEMA 100-year floodplain. Within the substation, there are switchgear-style circuit breakers at ground level that are susceptible to flooding.

Project Description/Scope of Work: This substation is already slated for a rebuild within the Company's five-year Capital Forecast. This project is for the incremental work associated with raising the switchgear approximately three feet from ground level to mitigate against flooding.

Cost Estimate (Conceptual):

	Years 1-5
Capital:	$1,000,000
O&M	–

Basis for Estimate: Previous flood mitigation work at another Central Hudson substation with job-specific adjustments

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Project Benefits

Electrical Service

☒ Customers affected by outages: 437

☒ Anticipated reduction in outage duration

☒ Anticipated reduction in outage frequency

Economic Impact

☒ Anticipated reduction in storm restoration costs

☐ Anticipated reduction in O&M costs

System Resilience

☐ Absorb – Increase the system's ability to anticipate when a climate hazard may occur and absorb its effects

☒ Withstand – Strengthen assets to resist adverse impacts of a climate hazard event

☐ Recover – Bolster the system's ability to quickly respond and recover in the aftermath of a climate hazard event

☐ Adapt – Advance and adapt the system to address a continuously-changing climate threat landscape and perpetually improve resilience

Community Resilience

☒ Project area serves DAC Customers

☒ Project area serves Critical Customers

☒ Project area serves LSE Customers

<u>Alternatives</u>

Project Alternatives Considered:

Floodwalls were considered around the perimeter of the substation.

Decision Criteria for Alternate Selection:

Further SME consideration of the substation drainage design yielded that floodwalls were not a viable solution.

Program Name: Distribution Targeted "Ground-to-sky" Trimming Program

Climate Vulnerability being addressed: Wind on Vegetation Affecting Poles/Conductor

Program Scope: 37 distribution circuits identified as Priority Assets for resilience (see Appendix D)

Program Background and Justification: This program aims to address distribution circuit miles in areas with historically poor reliability performance due to vegetation contact on poles and wires. As the frequency and intensity of storm events increases due to climate change, the frequency of outages due to trees in these areas is expected to increase proportionately.

Program Description/Scope of Work: Drawing from the list of 37 distribution circuits identified as Priority Assets for resilience, perform "ground-to-sky" trimming of overhead lines in project areas that will benefit 500 customers or greater, prioritized by historical reliability performance. Complete, on average, thirty miles of ground-to-sky trimming each year for the first five years of the program.

Cost Estimate (Conceptual):

	Years 1-5
Capital:	–
O&M	$5,250,000

Basis for Estimate: $35,000/mile with an average completion of 30 miles/year for each of the first five years

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<u>Program Benefits (Typical)</u>

Electrical Service

☒ Customers affected by outages: <u>Varied</u>

☒ Anticipated reduction in outage duration

☒ Anticipated reduction in outage frequency

Economic Impact

☒ Anticipated reduction in storm restoration costs

☐ Anticipated reduction in O&M costs

System Resilience

☐ Absorb – Increase the system's ability to anticipate when a climate hazard may occur and absorb its effects

☒ Withstand – Strengthen assets to resist adverse impacts of a climate hazard event

☐ Recover – Bolster the system's ability to quickly respond and recover in the aftermath of a climate hazard event

☒ Adapt – Advance and adapt the system to address a continuously-changing climate threat landscape and perpetually improve resilience

Community Resilience

☒ Project area serves DAC Customers

☒ Project area serves Critical Customers

☒ Project area serves LSE Customers

Alternatives

Project Alternatives Considered:

Strategic undergrounding should be considered as an alternative for a given project area.

Decision Criteria for Alternate Selection:

For project areas where ground-to-sky trimming is impractical or infeasible, strategic undergrounding should be considered as an alternate option.

Program Name: Distribution Strategic Undergrounding Program

Climate Vulnerability being addressed: Wind on Vegetation Affecting Poles/Conductor

Program Scope: 37 distribution circuits identified as Priority Assets for resilience (see Appendix D)

Program Background and Justification: This program aims to address distribution circuit miles in areas with historically poor reliability performance due to vegetation contact on poles and wires where other mitigation measures are impractical based on terrain or other considerations. For example, an overhead circuit that runs along the base of a hill with high tree density will continue to be susceptible to outages caused by trees regardless of the amount of trimming completed, and clearing of hillside trees can lead to soil instability and landslides. As the frequency and intensity of storm events increases due to climate change, the frequency of outages due to trees in these areas is expected to increase proportionately.

Program Description/Scope of Work: Drawing from the list of 37 distribution circuits identified as Priority Assets for resilience, perform strategic undergrounding of overhead lines in project areas that will benefit 300 customers or greater, prioritized by historical reliability performance. Complete, on average, one mile of strategic undergrounding each year for the first five years of the program.

Cost Estimate (Conceptual):

	Years 1-5
Capital:	$10,000,000
O&M	–

Basis for Estimate: $2,000,000/mile with an average completion of 1 mile/year for each of the first five years

---

<u>Program Benefits (Typical)</u>

Electrical Service

☒ Customers affected by outages: <u>Varied</u>

☒ Anticipated reduction in outage duration

☒ Anticipated reduction in outage frequency

Economic Impact

☒ Anticipated reduction in storm restoration costs

☒ Anticipated reduction in O&M costs

System Resilience

☐ Absorb – Increase the system's ability to anticipate when a climate hazard may occur and absorb its effects

☒ Withstand – Strengthen assets to resist adverse impacts of a climate hazard event

☐ Recover – Bolster the system's ability to quickly respond and recover in the aftermath of a climate hazard event

☐ Adapt – Advance and adapt the system to address a continuously-changing climate threat landscape and perpetually improve resilience

Community Resilience

☒ Project area serves DAC Customers

☒ Project area serves Critical Customers

☒ Project area serves LSE Customers

<u>Alternatives</u>

Program Alternatives Considered:

For a given project area, ground-to-sky trimming should be considered first as a means to mitigate poor reliability due to wind causing vegetation contacts with distribution poles/conductors as it has a higher average cost-efficiency score.

Decision Criteria for Alternate Selection:

Strategic undergrounding should be performed in project areas where ground-to-sky trimming is impractical or infeasible, or where vegetation issues persist despite ground-to-sky trimming having already been performed.

Program Name: Distribution Lateral Line Rebuilds Using Composite Poles Program

Climate Vulnerability being addressed: Wind on Vegetation Affecting Poles/Conductor

Program Scope: 37 distribution circuits identified as Priority Assets for resilience (see Appendix D)

Program Background and Justification: The vast majority of restoration efforts in a major storm event are focused on laterals in remote areas and/or the edges of the service territory. As the frequency and intensity of storm events increases due to climate change, the frequency of outages due to trees in these areas is expected to increase proportionately. Strategically hardening pockets that are prone to outages during major events and using construction such as tree wire or spacer cable and composite poles will make these areas more resilient.

Program Description/Scope of Work: Drawing from the list of 37 distribution circuits identified as Priority Assets for resilience, rebuild primary lateral lines to be more resilient to damage from tree contacts during high wind events. This will include utilizing 45 foot class 2 composite poles and corresponding hardware that increases the overall rated strength of the line. These areas will be reconductored with tree wire or spacer cable to further reduce exposure from tree contacts. The lateral lines being rebuilt are primarily single phase but may include two and three phase lines as well. Complete, on average, six miles of lateral line rebuilds each year for the first five years of the program.

Cost Estimate for Years 1-5 (Conceptual):

	Years 1-5
Capital:	$11,250,000
O&M	–

Basis for Estimate:

Total cost/mile approximately $375,000 with average completion of six miles/year for each of the first five years.

<u>Program Benefits (Typical)</u>

Electrical Service

☒ Customers affected by outages: Varied

☒ Anticipated reduction in outage duration

☒ Anticipated reduction in outage frequency

Economic Impact

☒ Anticipated reduction in storm restoration costs

☐ Anticipated reduction in O&M costs

System Resilience

☐ Absorb – Increase the system's ability to anticipate when a climate hazard may occur and absorb its effects

☒ Withstand – Strengthen assets to resist adverse impacts of a climate hazard event

☐ Recover – Bolster the system's ability to quickly respond and recover in the aftermath of a climate hazard event

☐ Adapt – Advance and adapt the system to address a continuously-changing climate threat landscape and perpetually improve resilience

Community Resilience

☒ Project area serves DAC Customers

☒ Project area serves Critical Customers

☒ Project area serves LSE Customers

<u>Alternatives</u>

Program Alternatives Considered:

Replace aging lateral line infrastructure in-kind.

Decision Criteria for Alternate Selection:

Due to a nationwide shortage of Class 2 poles, Central Hudson has reserved their installation for mainline construction. Lateral line rebuilds, which are typically Class 4 poles or smaller, are replaced with Class 4 poles. Central Hudson's practice is to rebuild all infrastructure utilizing grade B construction standards, which when combined with the longevity and resilience of composite poles, will result in a more resilient lateral line. Utilizing composite Class 2 poles will increase the overall rated strength of pole line to better-withstand damage from tree contacts.

Process Change Name: Distribution Pole Wrap Installations

Climate Vulnerabilities being addressed: Flooding/Extreme Precipitation/Wind on Vegetation Affecting Poles/Conductor

Process Change Scope: Distribution poles system-wide located within FEMA 100-year flood zones that are already slated for replacement

Process Change Background and Justification: Central Hudson's Climate Change Vulnerability Study indicated that approximately 4% of Central Hudson's installed distribution poles are located within the FEMA 100-year flood zone and are thus more vulnerable to accelerated ground-line decay compared to poles installed in drier areas. While Central Hudson's Inspection Program identifies most rotten poles prior to failure, poles located in the floodplain likely experience a loss of useful life, and are especially prone to failure during extreme weather conditions such as high winds.

Process Change Description/Scope of Work: Install a pole wrap (physical barrier system which forms an airtight and watertight seal around the base of the pole and is adhered prior to pole installation) on all new poles that are replaced within the 100-year floodplain.

Cost Estimate (Conceptual):

	Years 1-5
Capital:	$387,750
O&M	–

Basis for Estimate: $630 incremental cost/pole multiplied by approximately 123 poles/year replaced in 100-year flood zone over five years.

<u>Process Change Benefits (Typical)</u>

Electrical Service

☒ Customers affected by outages: <u>Varied</u>

☒ Anticipated reduction in outage duration

☒ Anticipated reduction in outage frequency

Economic Impact

☒ Anticipated reduction in storm restoration costs

☒ Anticipated reduction in O&M costs

System Resilience

☒ Absorb – Increase the system’s ability to anticipate when a climate hazard may occur and absorb its effects

☒ Withstand – Strengthen assets to resist adverse impacts of a climate hazard event

☐ Recover – Bolster the system’s ability to quickly respond and recover in the aftermath of a climate hazard event

☒ Adapt – Advance and adapt the system to address a continuously-changing climate threat landscape and perpetually improve resilience

Community Resilience

☒ Project area serves DAC Customers

☒ Project area serves Critical Customers

☒ Project area serves LSE Customers

<u>Alternatives</u>

Process Change Alternatives Considered:

Central Hudson considered a program to relocate pole lines entirely outside of flood zones rather than reinforcing in existing pole locations.

Decision Criteria for Alternate Selection:

Upon further investigation by Central Hudson SMEs, the pole relocation program was found to be impractical in all locations evaluated due to terrain and/or obligation to serve customers who happen to reside within flood zones.