

## JU Climate Change Vulnerability Studies

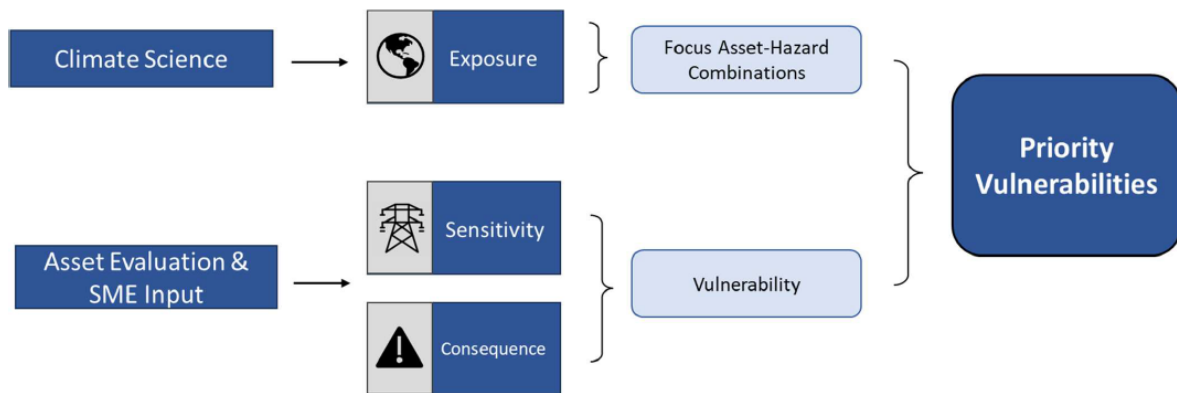
- Driven by legislation signed by Governor Hochul amending NYS Public Service Law Article IV, Section 66: “Each electric corporation subject to section twenty-five-a of this chapter shall prepare and submit a climate change vulnerability study to the commission within eighteen months of the effective date of this act. The commission shall provide such study to the governor and the legislature. The climate change vulnerability study shall evaluate the electric corporation's infrastructure, design specifications, and procedures to better understand the corporation's vulnerability to climate-driven risks, and shall include, but not be limited to, adaptation measures to address vulnerabilities and any other information deemed necessary by the commission.” The associated PSC Docket 22-E-0222; individual utilities’ vulnerability studies can be found within the docket at <https://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterSeq=67333&MNO=22-E-0222>. Electrical utilities subject to the legislation and order:
  - Central Hudson
  - Consolidated Edison
  - National Grid
  - NYSEG
  - Orange & Rockland
  - RG&E
- All utilities considered climate data developed by Columbia University under contract with NYSERDA. Data description extracted from National Grid CCVS:

NYSERDA partnered with Columbia University to develop climate projection datasets for the State of New York, which were also adopted by the Joint Utilities of New York for the CCVS and CCRP. These datasets use the new Coupled Model Intercomparison Project (CMIP) 6 Global Models downscaled at a set of weather stations across New York State and provide daily and, in some cases, hourly time series projections. These projections reflect updated climate science relative to older CMIP5 projections, and now comprise the climate projections of record for New York State. These projections use an ensemble of 16 GCMs and both SSP2-4.5 and SSP5-8.5, representing strongly mitigated and largely unabated future greenhouse gas emissions, respectively.

The Study leveraged these daily climate projection datasets to derive tailored calculations corresponding to asset sensitivities. For example, the Study identified key temperature thresholds for asset ratings and calculated the number of days exceeding those thresholds in the future. Projections were calculated at decadal time horizons from 2030s through 2080s. To account for interannual and interdecadal variability in the daily temperature datasets, the Study calculated variables as 30-year averages surrounding each time horizon of interest. For example, projections for the 2050s represent averages of daily data from 2041 to 2070. Projections are relative to a baseline, or base period, which comprises the dataset of historical observations from 1981 to 2010/28 at each weather station.

Utilities also considered additional data sources relevant to climate hazards in their service territories.

- To address the results and conclusions of the utilities' Studies, the Act requires each utility to file within 60 days of filing the Study (by November 21, 2023) a climate vulnerability and resiliency plan (Plan) to address the results/conclusions of the Study for the next ten- and twenty-year periods. Following public hearings, the Act requires the Commission, within eleven months after the Plans are filed, to either approve or modify the Plans.
- Utilities generally followed a similar process to identify priority vulnerabilities, based on consideration of exposure to a climate hazard, sensitivity of that asset or process to the climate hazard, and potential consequence due to the exposure. For example, National Grid included the below diagram in their study:



Below is a summary of priority vulnerabilities identified by each utility:

### Central Hudson

#### *Extreme Heat:*

##### Assets

- Overhead transmission conductors
- Substation transformers and voltage regulators
- Substation circuit breakers
- Substation reactors

##### Operations

- Load forecasting is based on historical data
- Asset management processes do not model the predicted impact of climate change on asset aging and failure rates
- Climate change can put pressure on already strained supply chains
- Long term temperature changes may decrease the capacity distribution equipment
- Recent heat waves exceed assumptions for distribution transformer ratings

- New York Transmission Owners Task Force on Tie-Line Ratings should consider long term temperature trends vis a vis tie line ratings
- Failure to consider climate change in reliability planning could result in system performance falling below target levels in the future
- More frequent and severe climate hazards will likely strain vegetation management

*Extreme Cold and Ice:*

Assets

- None identified

Operations

- Asset management processes do not model the predicted impact of climate change on asset aging and failure rates
- Climate change can put pressure on already strained supply chains
- Increased frequency and severity of extreme weather events strain emergency response capacity
- Disparate IT systems used for emergency response do not optimally support storm operations
- Failure to consider climate change in reliability planning could result in system performance falling below target levels in the future
- More frequent and severe climate hazards will likely strain vegetation management

*Flooding:*

Assets

- Overhead distribution structures
- Underground distribution conductors
- Substation circuit breakers

Operations

- Asset management processes do not model the predicted impact of climate change on asset aging and failure rates
- Climate change can put pressure on already strained supply chains
- Increased frequency and severity of extreme weather events strain emergency response capacity
- Disparate IT systems used for emergency response do not optimally support storm operations
- Failure to consider climate change in reliability planning could result in system performance falling below target levels in the future

*Extreme precipitation:*

Assets

- Overhead transmission conductors
- Overhead distribution structures
- Underground distribution conductors
- Substation circuit breakers

Operations

- Asset management processes do not model the predicted impact of climate change on asset aging and failure rates
- Climate change can put pressure on already strained supply chains

- Increased frequency and severity of extreme weather events strain emergency response capacity
- Disparate IT systems used for emergency response do not optimally support storm operations
- Failure to consider climate change in reliability planning could result in system performance falling below target levels in the future
- More frequent and severe climate hazards will likely strain vegetation management

*Extreme wind:*

Assets

- Transmission line structures (poles/towers)
- Overhead transmission conductors
- Overhead distribution structures
- Overhead distribution conductors

Operations

- Asset management processes do not model the predicted impact of climate change on asset aging and failure rates
- Climate change can put pressure on already strained supply chains
- Failure to consider climate change in reliability planning could result in system performance falling below target levels in the future

**Consolidated Edison**

*Temperature and TV*

Assets

- Transmission substations
- Area and unit substations
- Underground distribution

Operations

- In extreme high heat, delays to projects could occur and consequently lead to further reliability disruptions.
- Air quality events may become more frequent and severe
- Increased loads may require additional load relief investments
- Distribution equipment failures may rise with demand, particularly at the beginning of summer.
- Con ed may need to derate normal and emergency ratings to maintain assets' useful life.
- The size of the cooling equipment in Con Edison's facilities in New York City may require an increase of up to 40% by 2040
- A large increase in the number of emergency response activations could strain the system's capacity and resources.

*Flooding*

Assets

- Transmission substations
- Area and unit substations

### Operations

- Updating existing equipment to meet new flood standards may require investments
- A large increase in the number of emergency response activations could strain the system's capacity and resources.

### *Extreme Wind and Ice*

#### Assets

- Overhead distribution

#### Operations

- Storms and high wind events drive overhead distribution equipment failures
- High winds and ice storms could increase the risk of vegetation and windblown debris coming into contact with lines
- A large increase in the number of emergency response activations could strain the system's capacity and resources.

### **National Grid**

#### *Extreme Heat:*

#### Assets

- Overhead distribution transformers
- Pad-mounted distribution transformers
- Substation transformers
- Substation circuit breakers

#### Operations

- Safety challenges during emergency response
- Increased resource requirements for emergency response
- Longer restoration times due to increased frequency and severity of extreme events
- Disruption of BAU due to diversion of resources to emergency response
- Climate change can put pressure on already strained supply chains
- Recharging of future EV fleet during emergency response
- Response fatigue
- Strains on mutual assistance
- Increasing temperatures and humidity may impact worker productivity as more frequent rest periods are required, and higher humidity may impact workers' ability to perform live line work.
- Failure to consider climate change in reliability planning could result in system performance falling below target levels in the future
- Climate change adds uncertainty to long term load forecasting
- Failure to capture local variations in ambient temperature across the service territory
- Incomplete real-time visibility into substation transformer temperatures,
- Use of historical ambient temperatures to determine equipment ratings.

#### *Inland Flooding:*

#### Assets

- Substation transformers

- Substation circuit breakers
- Substation protection and control devices
- Substation instrument transformers

#### Operations

- Safety challenges during emergency response
- Increased resource requirements for emergency response
- Longer restoration times due to increased frequency and severity of extreme events
- Disruption of BAU due to diversion of resources to emergency response
- Climate change can put pressure on already strained supply chains
- Recharging of future EV fleet during emergency response
- Response fatigue
- Strains on mutual assistance
- Climate change is projected to impact vegetation in several ways, including an increase in the rate of tree growth, a decrease in overall tree strength, increased proliferation of invasive species, and changes to the geographic distribution of forests.
- Failure to consider climate change in reliability planning could result in system performance falling below target levels in the future

#### *High winds:*

##### Assets

- Transmission line structures (poles/towers)
- Overhead distribution line structures

##### Operations

- Safety challenges during emergency response
- Increased resource requirements for emergency response
- Longer restoration times due to increased frequency and severity of extreme events
- Disruption of BAU due to diversion of resources to emergency response
- Climate change can put pressure on already strained supply chains
- Recharging of future EV fleet during emergency response
- Response fatigue
- Strains on mutual assistance
- Climate change is projected to impact vegetation in several ways, including an increase in the rate of tree growth, a decrease in overall tree strength, increased proliferation of invasive species, and changes to the geographic distribution of forests.
- Projected increases in extreme wind conditions may reduce the number of days that bucket work may be performed
- Failure to consider climate change in reliability planning could result in system performance falling below target levels in the future

#### *Ice:*

##### Assets

- Overhead distribution structures

##### Operations

- Safety challenges during emergency response

- Increased resource requirements for emergency response
- Longer restoration times due to increased frequency and severity of extreme events
- Disruption of BAU due to diversion of resources to emergency response
- Climate change can put pressure on already strained supply chains
- Recharging of future EV fleet during emergency response
- Response fatigue
- Strains on mutual assistance
- Climate change is projected to impact vegetation in several ways, including an increase in the rate of tree growth, a decrease in overall tree strength, increased proliferation of invasive species, and changes to the geographic distribution of forests.
- Restoration times may increase due to hazards traveling in icy conditions
- Failure to consider climate change in reliability planning could result in system performance falling below target levels in the future

### *Heavy Precipitation*

#### Assets

- None identified

#### Operations

- Projected increases in heavy rain events is likely to increase the number of days where work is impacted due to rain or snow

### **NYSEG and RG&E**

#### *Extreme Heat:*

##### Assets

- Overhead distribution transformers
- Pad-mounted distribution transformers
- Substation transformers
- Substation regulators
- Substation reactors

##### Operations

- Potential for increasing severity and frequency of extreme events can impact emergency response effectiveness
- Climate change is projected to increase the number of storms, high heat days, and heat waves and could make adverse work conditions more frequent
- Climate change is anticipated to impact the effectiveness and necessity of vegetation management processes due to increases in frequency and intensity of storms, changes in vegetation growth seasons, introduction of new and invasive species, and reduction in tree strength
- Increased exposure to extreme winds, temperature, and precipitation can increase the failure rate of assets or shorten their lifespan

- Projected increases in ambient temperature may cause existing facility rating calculation methods to not align with future conditions
- Increasing frequency, severity, and duration of heat waves and other severe weather events caused by climate change has the potential to negatively impact reliability.
- Climate change projections show that temperature, humidity, and consequentially CTHI, are expected to increase throughout the century which would tend to drive a higher peak summer demand.

*Precipitation:*

Assets

- None identified

Operations

- Potential for increasing severity and frequency of extreme events can impact emergency response effectiveness
- Climate change is projected to increase the number of storms, high heat days, and heat waves and could make adverse work conditions more frequent
- Climate change is anticipated to impact the effectiveness and necessity of vegetation management processes due to increases in frequency and intensity of storms, changes in vegetation growth seasons, introduction of new and invasive species, and reduction in tree strength
- Increased exposure to extreme winds, temperature, and precipitation can increase the failure rate of assets or shorten their lifespan

*Flooding:*

Assets

- Pad-mounted distribution transformers
- Substation transformers
- Substation regulators
- Substation circuit breakers
- Substation protection and control devices
- Substation instrument transformers
- Substation control houses
- Substation reactors
- Substation structures

Operations

- Potential for increasing severity and frequency of extreme events can impact emergency response effectiveness
- Climate change is projected to increase the number of storms, high heat days, and heat waves and could make adverse work conditions more frequent

*Wind:*

Assets



- Transmission line structures (poles/towers)
- Distribution line structures

#### Operations

- Potential for increasing severity and frequency of extreme events can impact emergency response effectiveness
- Climate change is projected to increase the number of storms, high heat days, and heat waves and could make adverse work conditions more frequent
- Climate change is anticipated to impact the effectiveness and necessity of vegetation management processes due to increases in frequency and intensity of storms, changes in vegetation growth seasons, introduction of new and invasive species, and reduction in tree strength
- Increased exposure to extreme winds, temperature, and precipitation can increase the failure rate of assets or shorten their lifespan
- Increasing frequency, severity, and duration of heat waves and other severe weather events caused by climate change has the potential to negatively impact reliability.

#### *Wind and Ice:*

##### Assets

- Transmission line structures (poles/towers)
- Overhead transmission conductors
- Distribution line structures
- Overhead distribution conductor

##### Operations

- Potential for increasing severity and frequency of extreme events can impact emergency response effectiveness
- Climate change is projected to increase the number of storms, high heat days, and heat waves and could make adverse work conditions more frequent
- Climate change is anticipated to impact the effectiveness and necessity of vegetation management processes due to increases in frequency and intensity of storms, changes in vegetation growth seasons, introduction of new and invasive species, and reduction in tree strength
- Increased exposure to extreme winds, temperature, and precipitation can increase the failure rate of assets or shorten their lifespan
- Increasing frequency, severity, and duration of heat waves and other severe weather events caused by climate change has the potential to negatively impact reliability.

#### **Orange & Rockland**

##### *Temperature and TV*

##### Assets

- None identified

##### Operations

- Projected increases in the intensity and frequency of extreme precipitation events could lead to more frequent activation of emergency response protocols
- Greater need for invasive species management
- Drought could increase wildfire risk
- Increased exposure to hazards including heat events, flooding, and windstorms may exceed current standards for a variety of assets throughout O&R's electric system, causing potential shortening of asset lifespans, or in select cases, asset failure
- Failure to consider climate change conditions (TV/temperature) in reliability planning could result in an inaccurate picture of future reliability and resilience investment needs.
- Increased loads (due to increased TV) and decreased system capacity (due to increases in temperature) may require additional load relief investments
- To prevent adverse impacts to workers, O&R may need to implement a formal process that identifies a heat index threshold and requires workers to rest once the heat index is reached
- Potential to shorten equipment lifespan
- Potential need to de-rate equipment

### *Extreme Flooding*

#### Assets

- Substations

#### Operations

- Projected increases in the intensity and frequency of extreme precipitation events could lead to more frequent activation of emergency response protocols
- Greater need for invasive species management
- Increased exposure to hazards including heat events, flooding, and windstorms may exceed current standards for a variety of assets throughout O&R's electric system, causing potential shortening of asset lifespans, or in select cases, asset failure
- Potential to impact worker safety
- Assets in/near floodplains may require protection
- More frequent/intense storms may stress system spares

### *Extreme Wind and Ice*

#### Assets

- Overhead distribution

#### Operations

- Projected increases in the intensity and frequency of extreme precipitation events could lead to more frequent activation of emergency response protocols
- Greater need for invasive species management
- Increased exposure to hazards including heat events, flooding, and windstorms may exceed current standards for a variety of assets throughout O&R's electric system, causing potential shortening of asset lifespans, or in select cases, asset failure
- Increases in frequency and intensity of storms have the potential to impact reliability and may require adjusting planning practices
- Potential to impact worker safety

- More frequent/intense storms may stress system spares

### *Wind*

#### Operations

- Increased exposure to hazards including heat events, flooding, and windstorms may exceed current standards for a variety of assets throughout O&R's electric system, causing potential shortening of asset lifespans, or in select cases, asset failure

### *Major Winter Storms*

#### Operations

- Increased exposure to hazards including heat events, flooding, and windstorms may exceed current standards for a variety of assets throughout O&R's electric system, causing potential shortening of asset lifespans, or in select cases, asset failure