

Memorandum

To: O&R Climate Resilience Working Group
From: O&R Climate Risk and Resilience Team
Date: December 8, 2022
Re: Resilience Investment Update, Climate Hazard Assessment and Climate Variable Prioritization for Climate Change Vulnerability Study

Resilience Investments since Superstorm Sandy¹

Orange and Rockland Utilities, Inc. (O&R) has invested over \$1 billion dollars over the past ten years on capital electric reliability and maintenance projects. Since Superstorm Sandy, O&R has dedicated over \$140 million dollars specifically toward storm resilience projects² and plans to continue to make future investments that will be informed by Climate Change Resilience Plans, the first of which O&R will complete by November 2023. The resilience work that O&R has completed since Superstorm Sandy has reduced service restoration times by at least 30%. These projects included underground electric hardening, which has increased reliability for over 2,000 customers in Clarkstown, West Nyack, Monroe, and Middletown. Over the past ten years, O&R has dedicated \$53.2 million to electric system automation with the installation of more than 1,400 new remote operated devices to reduce customer impacts from storm outages. By employing tree-resistant cables on overhead lines, critical transmission line structures, such as the Jackie Jones Tower in Stony Point, are more resilient from storm damage and can operate at a higher capacity. O&R has implemented enhanced vegetation management practices to evaluate tree health along O&R lines from outside of the right-of-way as well as expanding tree-trimming clearances within the right-of-way to prevent to prevent damage caused by tree contact. Other storm resilience initiatives include installing customer smart meters and establishing emergency stand-by contractor agreements for technicians and truck fleets.

Climate Hazards and Impacts in O&R's Service Territory

Climate hazards that impact the O&R service area include extreme temperatures, precipitation, coastal and inland flooding, winds, tropical storms, and winter storms/Nor'easters. In preparing its first Climate Change Vulnerability Study, O&R is utilizing projections for climate hazards developed from the current Coupled Model Intercomparison Project – Phase 6 (CMIP6) climate model dataset provided by NYSERDA as part of the New York State Climate Impacts Assessment³.

Each of the following factors are relevant climate hazards to O&R's assets and operations:

- Extreme heat above certain thresholds can reduce the capacity and lifespan of assets such as transmission and distribution (T&D) overhead conductors, transformers, and T&D switching

¹ [O&R: \\$83M in More Electric System Undergrounding, Automation Since Sandy Results in a Stronger Power System, Fewer Outages and Faster Restoration Times \(oru.com\)](#)

² Reliability projects address current “blue sky” conditions (i.e., non-storm conditions) while resilience projects address future changes in climate and extreme weather events.

³ [New York State Climate Impacts Assessment – Understanding and Preparing for Our Changing Climate \(nysclimateimpacts.org\)](#)

devices. It is also relevant to core planning processes such as system planning and load forecasting.

- The heat index measures ambient temperature and relative humidity and can affect worker safety.
- Extreme cold as it relates to load forecasting and cold weather sensitive assets can result in operating restrictions, outages, and extreme cold weather procedures for emergency response.
- Heavy precipitation can result in inland flooding which can increase soil moisture and affect geotechnical conditions while coastal flooding can impact electrical assets along the Hudson River.
- Extreme temperature and humidity can generate high energy demand (both heating and cooling) while also reducing equipment operating performance.
- Wind impacts to overhead transmission and distribution lines and structures can result in down power lines and damage to towers causing outages.

Additional hazards that are complex and difficult-to-model are extreme events, which are highly variable year-to-year. Extreme events in the O&R service territory can include hurricanes and tropical storms, winter storms, Nor'easters, and drought. All these extreme weather events can result in compounding impacts to the electric grid.

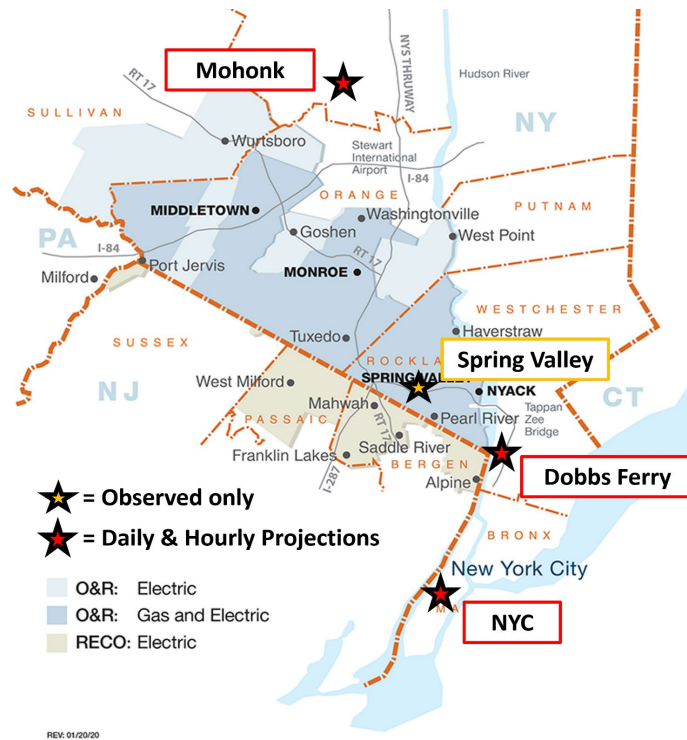
Weather Station Data & Prioritized Variables for Climate Vulnerability Study

To analyze O&R’s exposure to climate hazards, historical weather data is available from the following stations:

Station	Hazards	Climate Data Resolution
Mohonk	Temperature, precipitation, relative humidity	Daily, Hourly
Dobbs Ferry	Temperature, precipitation, relative humidity	Daily, Hourly
NYC	Temperature, precipitation, relative humidity	Daily, Hourly
Spring Valley*	Temperature, precipitation, humidity, wind	Daily, Hourly

*Spring Valley weather station data goes back at least 25 years and is currently used for peak electric load forecast.

The above weather stations are shown in relation to O&R’s service territory below.



The table below provides a list of prioritized climate variables to evaluate in support of O&R’s Climate Change Vulnerability Study and Resilience Plan. These variables were identified with the help of O&R SMEs and in consultation with peer utilities.

Hazard	Prioritized Variables	Purpose	Dataset
Extreme Heat	<ol style="list-style-type: none"> Days per year with maximum daily temperature above 95°F Days per year with maximum daily temperature above 104°F Days per year with average daily ambient temperature above 104°F Days per year with average daily ambient temperature above 86°F Days per year with average daily ambient temperature above 95°F Number of heat waves per year with 3 or more consecutive days over 90°F Highest annual maximum daily temperature Number of days per year with average daily temperature at or below 50°F Annual average daily minimum temperature Annual average daily maximum temperature Average summer daily maximum temperature Annual average daily mean temperature 	<ol style="list-style-type: none"> Potentially relevant to transmission overhead conductors and distribution overhead conductors wire ratings. Potentially relevant to the following major equipment: <ol style="list-style-type: none"> T&D conductors Substation distribution transformers (overhead and pad mount) “Substation terminal equipment” (e.g., switching devices, line traps, terminal equipment) Potentially relevant to transmission switching devices, circuit breakers. Potentially relevant to system planning. Potentially relevant to load forecasting. 	Columbia CMIP6 dataset

	13. Average summer daily mean temperature		
Average Temperature	1. Mean daily ambient summer temperature (6/1 – 8/31)	Potentially relevant to asset ratings	Columbia CMIP6 dataset
Heat Index	1. Days with heat index exceeding 91°F, 95°F, 103°F, 115°F	1. Potentially relevant for worker safety	Columbia CMIP6 dataset
Extreme Cold	1. Number of days with minimum daily temperatures below 32°F 2. Two consecutive days with daily average temperature ≤ 12°F each day 3. Annual coldest daily temperature	1. Potentially relevant to load forecasting and cold weather sensitive assets 2. Potentially relevant to extreme cold weather procedure for emergency response and possible electrical disruption	Columbia CMIP6 dataset
Heavy Precipitation	1. 1- and 5-day maximum precipitation 2. Days per year with >0.75 and >2 inches of precipitation 3. Annual average daily rainfall 4. Annual rainfall 5. Annual 95 th percentile daily rainfall 6. Annual 99 th percentile daily rainfall	Relevant to inland flooding	Columbia CMIP6 dataset
Return Period Precipitation	1. 25-year, 24-hour precipitation event	Relevant to oil containment	NYSERDA/Cornell CMIP5 Intensity-duration-frequency (IDF) curve dataset
Energy Demand	1. Cooling Degree Days 2. Heating Degree Days	Relevant to load demand	Columbia CMIP6 dataset
Temperature Variable (TV)	1. Days per summer with electric TV >85°F, >90°F 2. Annual maximum summer electric TV	Relevant to load demand	Columbia CMIP6 dataset
Coastal Flooding	1. Projected sea level rise ⁴ 2. Inundation extent and depth	Relevant to Hudson River assets	Columbia CMIP6 dataset for sea level rise and Columbia Hudson River flood datasets
Inland flooding	1. 100- and 500-year floodplain extent	Relevant to asset flooding	FEMA floodplain maps
Wind	1. Constraint on mean wind speed 2. Constraint on max wind gusts	Relevant to and overhead transmission and distribution lines and structures	Literature review and optional supplementary analysis of Spring Valley weather station observational dataset
Other extreme events	1. Hurricanes and tropical storms 2. Snow and ice 3. Lightning and thunderstorms 4. Drought	Relevant to multiple asset types	Literature review

⁴ Based on projections for the Battery tide gauge