Climate Change Vulnerability Study and Resilience Plan

CRWG Summer 2024

June 27, 2024

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Today's Discussion

- Meet the National Grid team
- Extreme Weather Events
- Public Service Commission (PSC) Requirements
- National Grid's Progress
- Details of the Company's Climate Strategies and Proposed Resilience Plan Investments
- Ensuring Equity and Addressing Disadvantaged Communities
- Refining Studies and Planning through Collaboration with EPRI
- Latest Developments and Next Steps
- Continue to Make Your Voice Heard

Meet the National Grid Team

Electric Team

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Stakeholder Lead

Customer and Community

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Director West

Kim Ireland

Director East

Alberto Bianchetti

Director Central

Extreme Weather Events

Thursday, January 11, 2024

- **190,000** impacted customers in central and western New York
- **Wintry mix of rain and snow, and winds in excess of 70 mph impacted the regions**.
- **Hurricane-force wind gusts of 78 mph were recorded at the Watertown International Airport.**
- The weather caused downed wires, trees, tree limbs, pole damage and other hazards.

Thursday, February 29, 2024

- **194,000** customers lost electric service
- Storm brought **wind gusts of more than 70 mph and caused extensive, widespread damage to the company's electric delivery system**."

Sunday, March 24, 2024

- **206,000** customers lost service as a result of the destructive spring storm that pounded Eastern NY.
- The storm brought a combination of sleet, freezing rain, and heavy wet snow that in its totality, *exceeded forecasted expectations*
- **20.5" of snow** fell across parts of **Saratoga County**.
- **Warren and Washington** Counties saw 18"-19" of snow.
- Upwards of 12" of snow impacted **Rensselaer, Montgomery, Herkimer, and Hamilton** Counties
- **Albany** receiving 8" of snow.
- **Ice accretions** reported near the Albany Airport **approached 0.5"** contributing to the conditions that ultimately caused significant damage to the electric system, creating customer outages.

Public Service Commission Requirements

Aims to bolster electric utility planning and resilience by incorporating climate change considerations.
(Maintains the high level of system reliability we have grown accustom to in the face of more severe weather due to climate change)

Vulnerability Study

- Evaluate infrastructure, design specifications, and procedures to identify vulnerabilities
- Identify priorities for adaptation measures that will feed into Resilience Plan
- Study to be performed with supporting climate data from NYSERDA and Columbia University

Resilience Plan

- Propose storm hardening measures for next 10 and 20 years
- Detail how climate change is reflected in planning, design, operations, & emergency response
- Address impacts on costs, outage times, potential for undergrounding lines, etc.
- Utility to establish “Climate Resilience Working Group” by 3/2023 to advise on Resilience Plan to include municipalities, customer advocacy groups, and energy/environmental advocates

Highlights

- Summarize findings on priority vulnerabilities for National Grid
- Discuss the resilience framework to achieve a multi-pronged strategy
- Discuss the business case justification framework and results
  - System Reliability, Criticality, Community Resilience
  - Consideration of Equity
- Review the resilience measures being proposed as part of the CCRP
- 5-, 10-, 20-yr investment plan

National Grid's initial Study and proposed Resilience Plan

Climate Change Vulnerability Study (CCVS) filed with the PSC in September 2023

- Assessed the vulnerability of electric infrastructure, design specifications, and planning and operational procedures to four key climate hazards:

 Heat,  Flooding,  Wind,  Ice

- Goal of Study was to incorporate climate change into planning, design, operations, and emergency response
- Relied on the best available climate science and considered input from a Climate Resilience Working Group

Climate Change Resilience Plan (CCRP) filed with the PSC in November 2023

- The Plan proposes incremental resilience investments over 5-, 10-, and 20-year time horizons.
- Multi-pronged resilience framework created to evaluate resilience measures based on four key objectives:
    1. **Strengthen** assets to withstand structural loads that may occur during extreme weather events.
    2. **Anticipate** climate hazards and absorb their impact when exposure cannot be avoided.
    3. **Respond** and recover service to normal levels in the aftermath of a climate hazard event.
    4. **Advance** resilience improvements and adapt to a continuously changing climate hazard landscape.

- **PSC Staff are reviewing proposed Plan; PSC is expected to approve or modify the Plan later this fall**
- **National Grid will update the Resilience Plan every 5 years**

Details of our Climate Change Resilience Strategies and Proposed Investments

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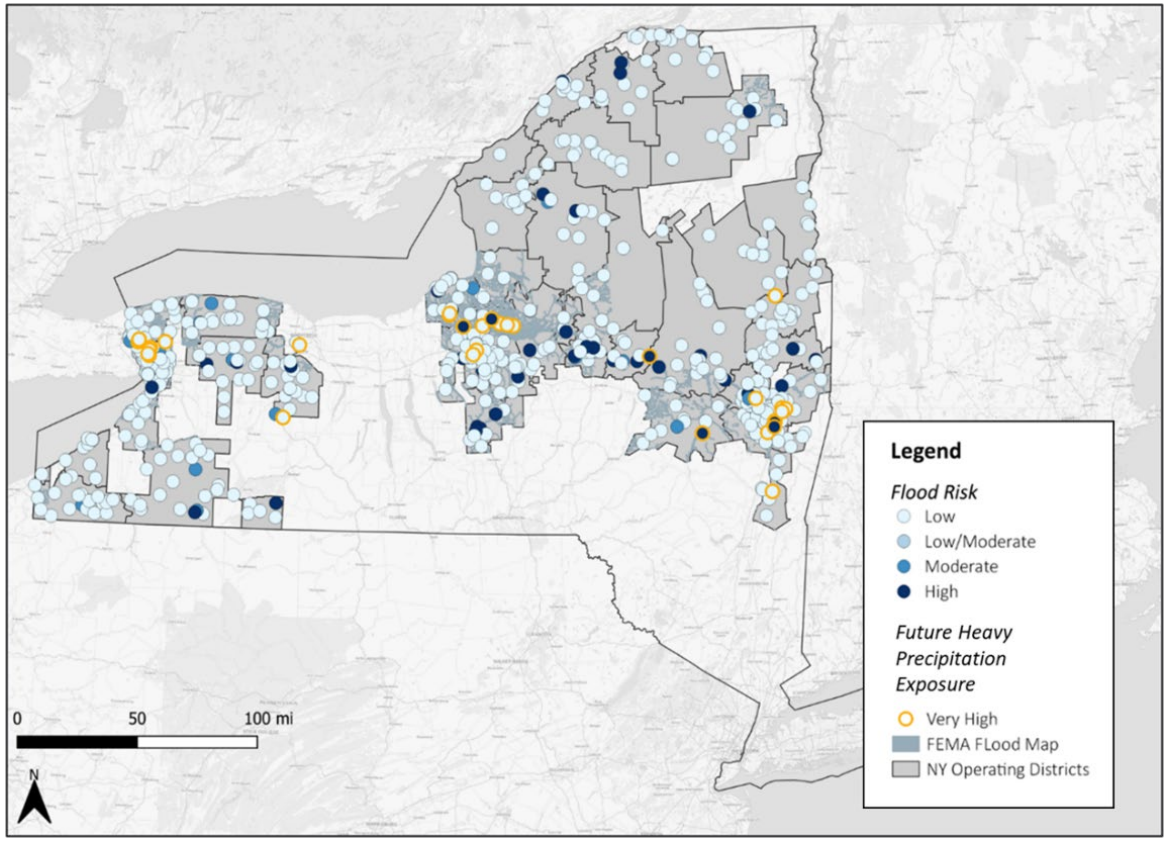
We developed an industry leading Climate Change Risk Tool (CCRT) to undertake systematic, geospatial assessment

The CCRT is a consistent, long-term assessment of physical climate change risks to our assets under 2deg C and 4deg C climate scenarios using the latest climate science developed in conjunction with business unit subject matter experts. It provides a consistent methodology to evaluate risk to meet increasing regulatory requirements and scrutiny.

The CCRT converts scientific climate data into a platform that provides visualization of the physical impacts to our installed asset base. It accounts for regional variations in climate science to aid in local decision-making.



Climate Change Risk Tool Hazards

Coastal Flooding

Freeze Thaw

Heatwaves

High Temperatures

High Winds

Lightning

Low Temperatures

River Flooding

Climate Hazard Parameters

Time periods

For the baseline (current) climate, the analysis uses the same time periods used in national climate assessments, 1981-2010 for UK and 1976-2005 for US. For the future, the analysis uses time periods for which climate projections are available in both UK and US datasets. These are: 2030s, 2040s, 2050s and 2070s.

Scenarios

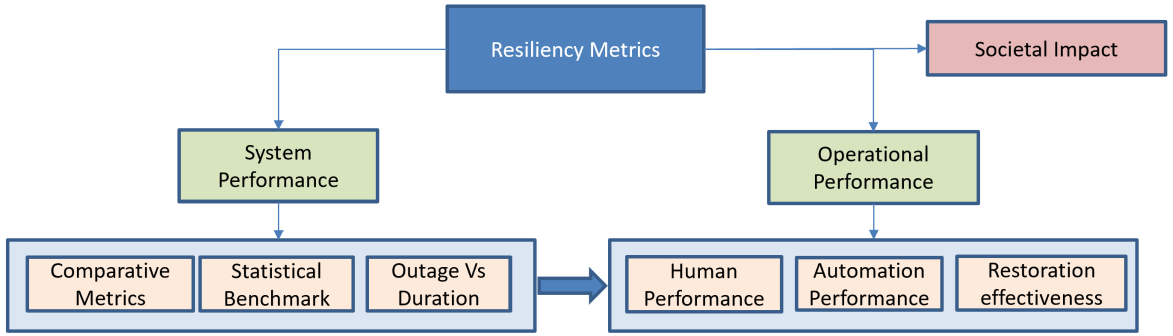
The two representative concentration pathways which have been used to best align with a 2° C and 4° C increase in global temperature are RCP4.5 and RCP8.5. RCPs (Representative Concentration Pathways) are greenhouse gas concentration trajectories adopted by the IPCC.

Resilience Metrics

- Performance Metric
  - Institute of Electrical and Electronics Engineers (IEEE)
    - Focus on both system and operational performance
    - Includes a success rate based on actual gray sky days (GSDs) experienced over a given period

$$Score = \left(1 - \frac{Number\ of\ outages\ in\ time\ period}{Number\ of\ GSD\ in\ time\ period}\right) * 100$$

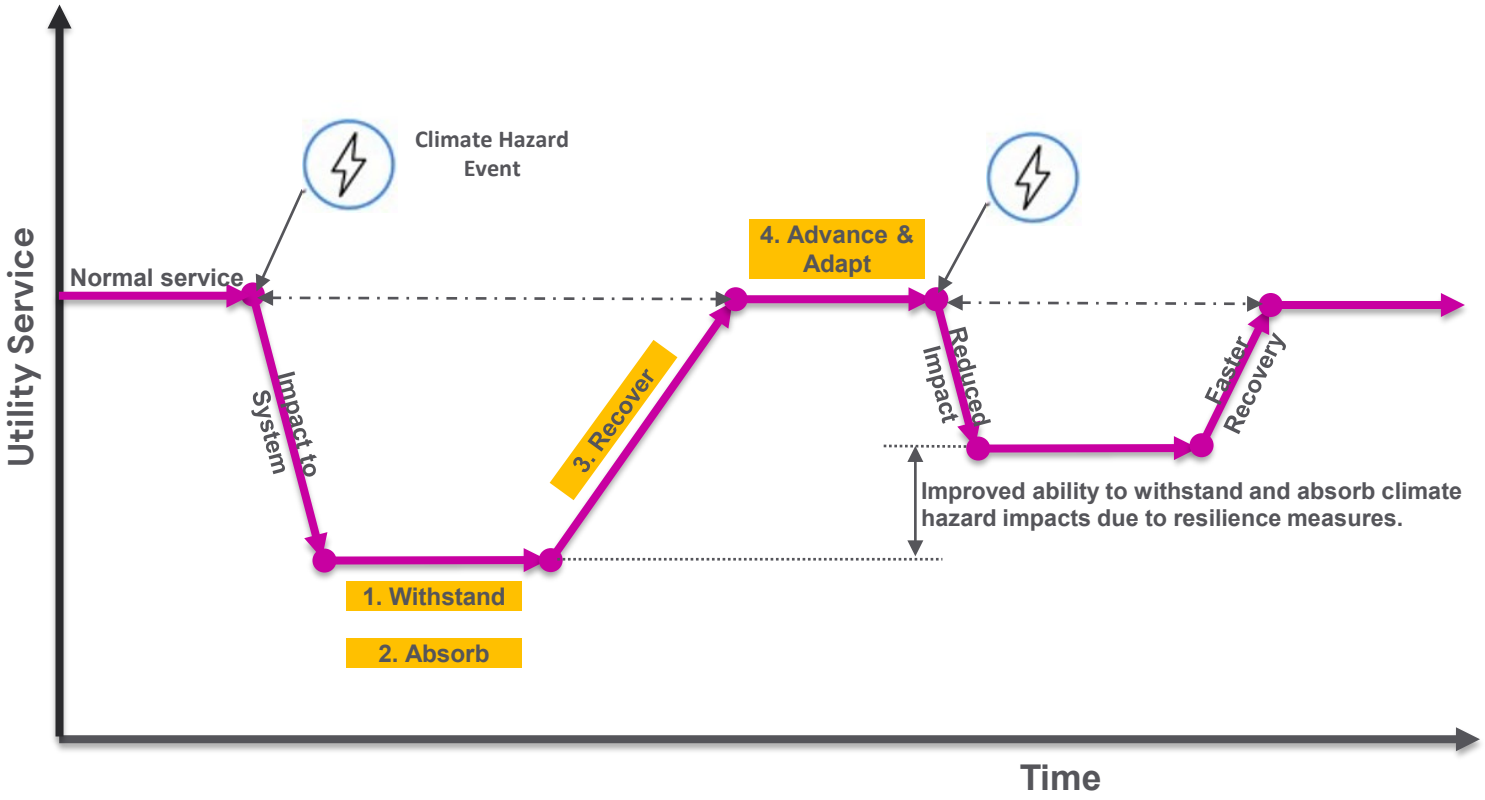
- Preparedness Metric
  - New York State Energy Research and Development Authority (NYSERDA)
    - Describes physical and operational attributes of a utility that are associated with climate resilience and provides a self-assessment framework for each utility to score each.



Attributes	
1.	% of total line miles of mainline or backbone feeders undergrounded
2.	% of system distribution poles with no identified deficiencies during most recent inspection
3.	% of system transmission poles and towers with no identified deficiencies during most recent inspection
4.	Average % loading of distribution feeders
5.	% of customers served by distribution feeders with ties to another substation
6.	% of customers served by feeders with distribution automation
7.	% of flood exposed substations with flood protection
8.	Demand response as a % of peak demand
9.	AMI penetration, %
10.	% of customers with on-site generation that can be islanded and operate independently from the grid
11.	Average health index of substation transformers
12.	Application of weather station data
13.	Spare equipment levels for pole structures (including ancillary equipment) and transformers (overhead and pad-mounted)
14.	Level of engagement with customers and stakeholders around resilience
15.	Level of maturity of an Emergency Response Program
16.	Capital investment in resilience

Resilience Framework

Pursue a multi-pronged resilience strategy with four dimensions: Withstand, Absorb, Recover, and Advance and Adapt.



1. Strengthen assets and operations to **withstand** the adverse impacts of a climate hazard event.

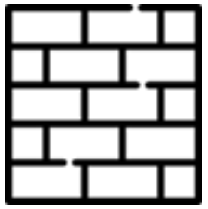
2. Increase the system's ability to **anticipate** when a climate hazard event may occur and **absorb** its effects.

3. Bolster the system's ability to quickly **respond and recover** in the aftermath of a climate hazard event.

4. Advance and adapt the system to address a continuously changing threat landscape and perpetually improve resilience.

Resilience Plan incorporates physical and operational measures

Strengthen & Withstand



Physical Measures

- Upgrades to overhead distribution and sub-transmission line designs
- Upgrades to overhead transmission line designs
- Targeted undergrounding of the most vulnerable portions of distribution lines
- Installation of substation flood walls

Advance & Adapt

Physical Measures

- Use upgraded design for new distribution and transmission substation transformers to withstand higher temperatures

Operational Measures

- Increase substation transformer temperature specifications
- Increase distribution structure standards
- Increase transmission structure standards

Respond & Recover

Physical Measures

- Purchase additional high strength spare transmission structures

Anticipate & Absorb

Operational Measures

- Add climate change scenarios to electric load forecasts

Proposed Resilience Investments

Project	Mitigated Climate Hazard	Description
1. Overhead Distribution and Sub-transmission Line Design Upgrades*	Wind Gusts and Ice	Update distribution line standards to move from type class 3 poles to class 1 for main lines and poles that carry heavy equipment (8,000 poles/year) and update sub-transmission line standards to use class 1 poles for single circuit structures, class H1 for double circuit structures, and class H2 for double circuit with distribution underbuilds (900 poles/year).
2. Overhead Transmission Line Design Upgrades*	Wind Gusts and Ice	Build T-Lines to withstand 120 MPH wind gusts in high wind areas (46 total) by using more steel and larger foundations. Projects include 44 – 115kV lines and 2 – 230KV lines (1,300 circuit miles covered).
3. Distribution and Sub-transmission Targeted Undergrounding	Wind Gusts and Ice	Targeted undergrounding of 1-2 miles per year of 3-phase main line in highest wind and icing areas.
4. Spare Transmission Line Structures	Wind Gusts and Ice	Purchase 10 T-Line spare structures per division designed for 120 MPH gusts to speed restoration.
5. Substation Flood Walls	Flooding	Install flood walls at 18 substations in high -risk areas (17,000 linear feet of flood walls total).
6. Distribution and Transmission Substation Transformer Specification Upgrades*	Extreme Heat	Update transformer spec from 32°C (90°F) to 35°C (95°F). There will be 35 distribution projects (81 transformers) and 24 transmission projects (37 transformers) with installs and replacements.

Ensuring Equity and Addressing Disadvantaged Communities

Leaving No Customer Behind

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Equity

Consideration of Equity to mitigate disproportionate burdens

Equity in sustainability incorporates procedures, the distribution of benefits and burdens, structural accountability, and generational impacts.

National Grid is addressing climate justice in a variety of ways, including:

- Providing affordable, clean energy options to all,
- Supporting the restoration of New York public parks by planting trees and other revitalization projects,
- Advocating for a New York environmental justice framework
- Educating the public on climate justice issues.

National Grid will maintain its commitment to equity in resilience projects, recognizing which proposed projects benefit disadvantaged communities in support of climate justice goals without unduly burdening any community.

Equitable access to information and participation through stakeholder engagement is paramount to National Grid's ability to successfully develop and execute our Climate Change Resiliency Plan.

Procedural equity

To ensure that stakeholders and communities impacted by energy projects and programs have the necessary information and opportunity to participate in and inform project development and implementation.

Distributional Equity

To ensure that the clean energy transition is implemented in a way that drives the more equitable realization of the benefits and burdens associated with the clean energy

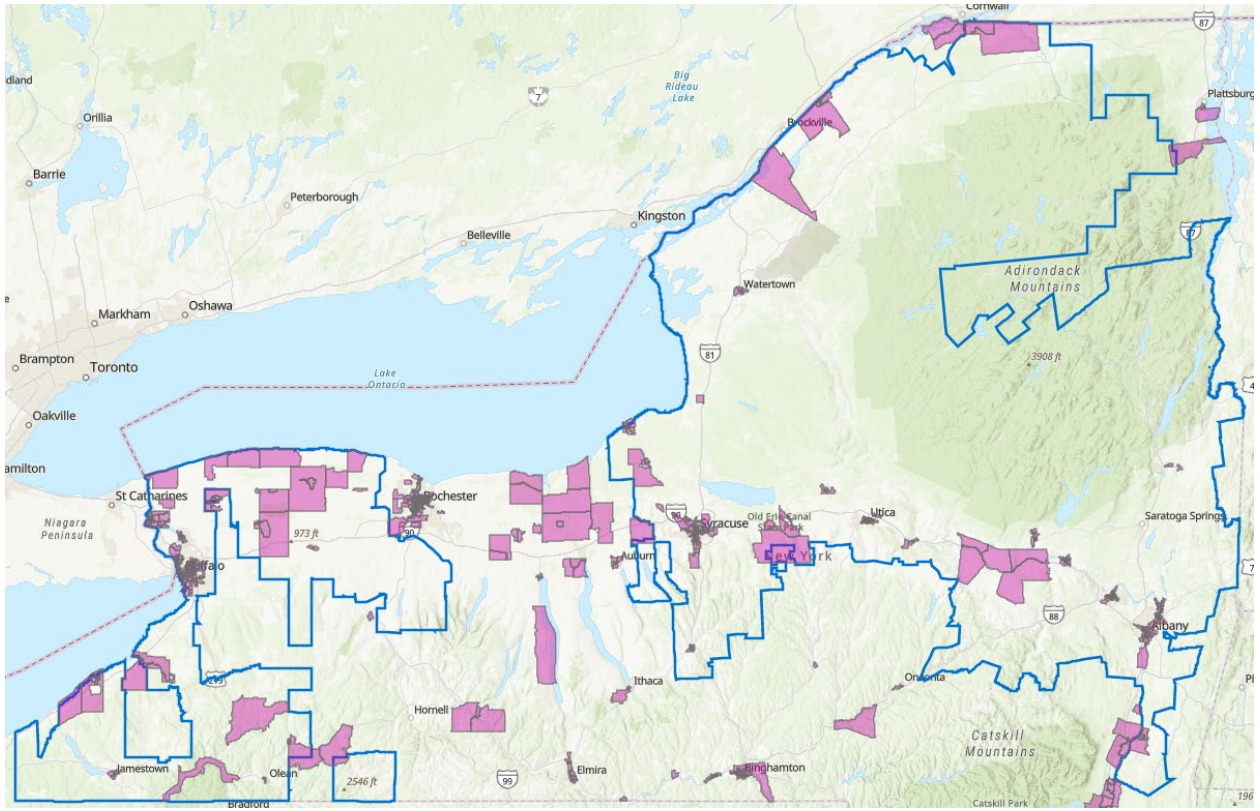
Considerations for Structural Equity

"Decisions are made with a recognition of historical, cultural, and institutional dynamics and structures that have routinely advantaged privileged groups in society and resulted in chronic, cumulative disadvantage for subordinated groups."

Considerations for Transgenerational Equity

"Consider generational impacts and don't result in unfair burdens on future generations"

Disadvantaged Communities are an important consideration



	NMPC ELECTRIC	NMPC GAS
# OF TOTAL CENSUS TRACTS	1,061	530
# OF DAC CENSUS TRACTS	313	165
% OF DAC CENSUS TRACTS	30%	31%
TOTAL POPULATION	3,695,288	1,910,730
DAC POPULATION	917,454	494,349
% DAC POPULATION	25%	26%

For more information on Disadvantaged Communities Criteria - New York's Climate Leadership & Community Protection Act (ny.gov)

Refining studies and planning through collaboration with EPRI

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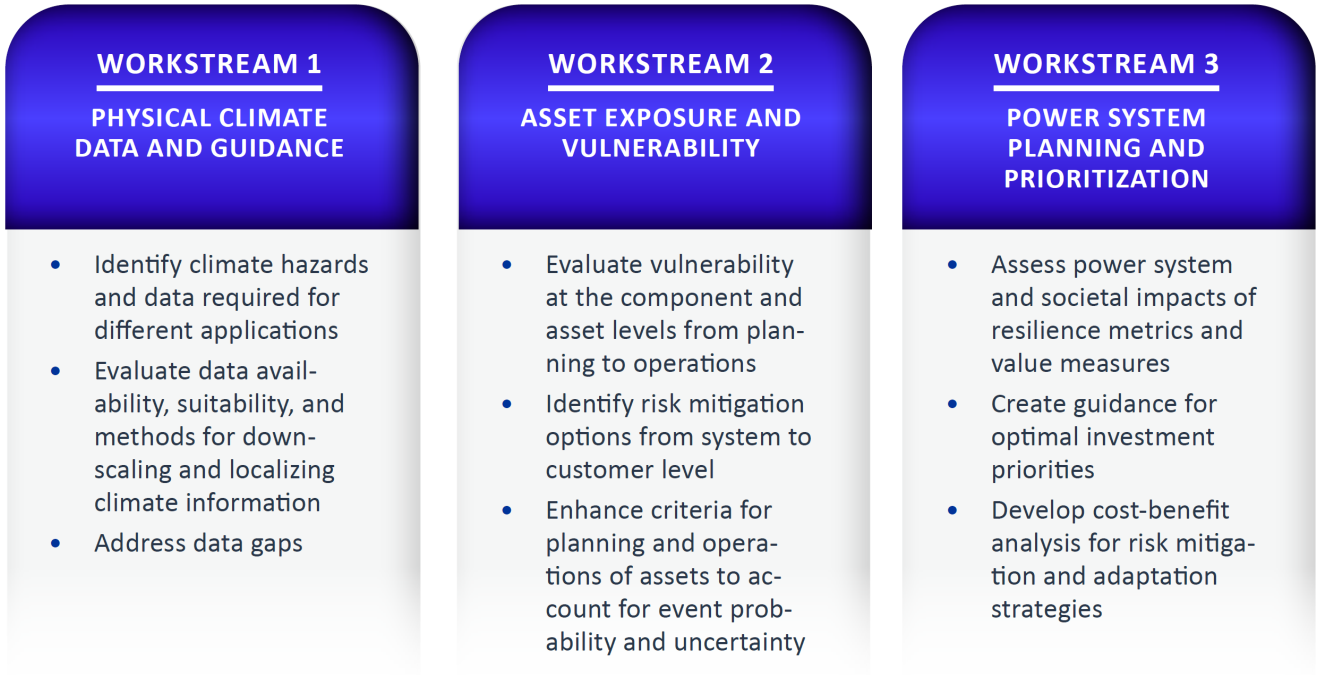
National Grid Engagement with EPRI* Climate READi

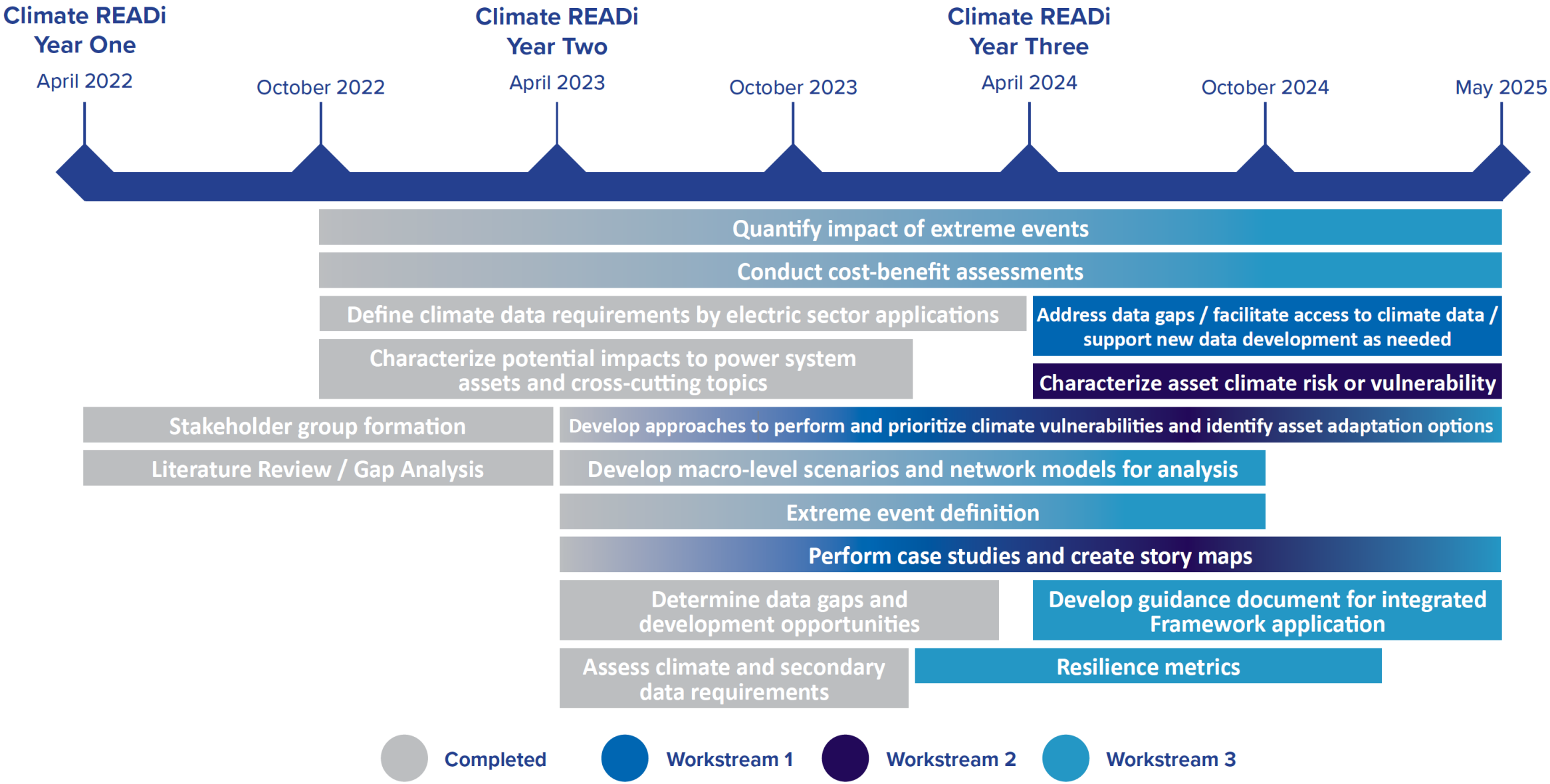


- WS3 Workshop, DC May 8-9
  - Lost Load Tolerance (LLT) for measuring resilience
  - Strategic Load Shifting – from feeder level to meter level w/ AMI
  - RiSc - Risk Screening Tool development
  - Health and Equity – developing metric for impact of higher temps
  - Risk/Impact of wildfires taking out multiple lines (N-K vs. N-1)

- Recent Publication & Deliverable Highlights:
  - Climate-Informed Planning and Adaptation for Power Sector Resilience
  - Types of Climate Data and Potential Applications within the Electric Power Sector
  - Unpacking Climatological and Power System Operating Extremes
  - Climate Vulnerability Considerations for the Power Sector: Transmission and Distribution Assets
  - Climate Data Inventory, Climate 101 Resource Page, & Climate Data Users Guide

*EPRI (Electric Power Research Institute) is a national organization that conducts research, development and demonstration projects

EPRI Climate READi Project Plan



Latest Developments and Next Steps

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Post Filing Engagement and PSC Regulatory Review

PSC Staff are thoroughly vetting our plan. We have been responding to Staff's questions and have conducted site visits of several CCRP project sites including:

Albany Steam Transmission Substation

Flood Wall Project,
Albany, NY

Riverside Distribution Substation

Flood Wall Project,
Albany, NY

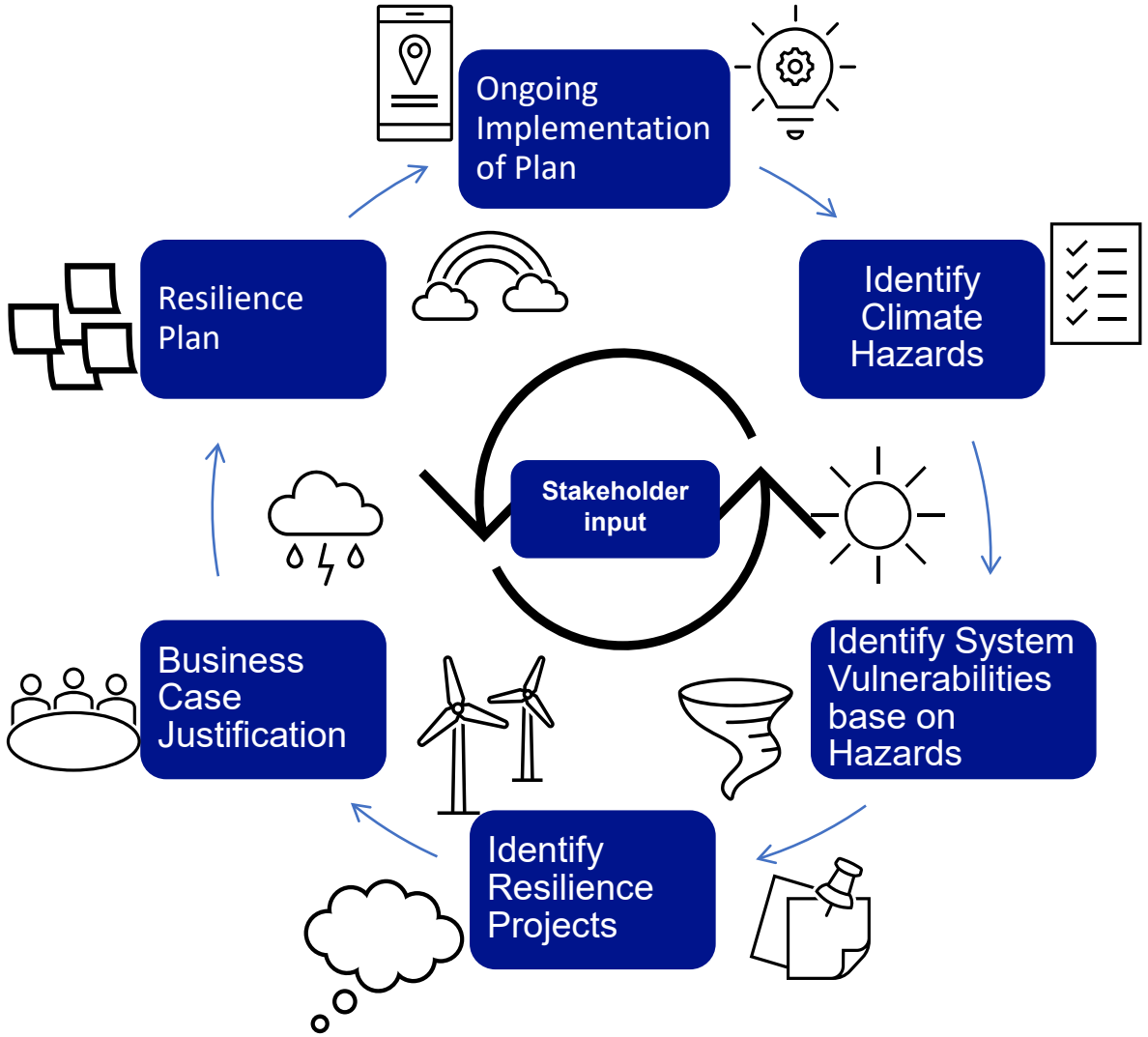
Targeted Undergrounding Example

Hemstreet 32852 Distribution Feeder,
Schagticoke, NY

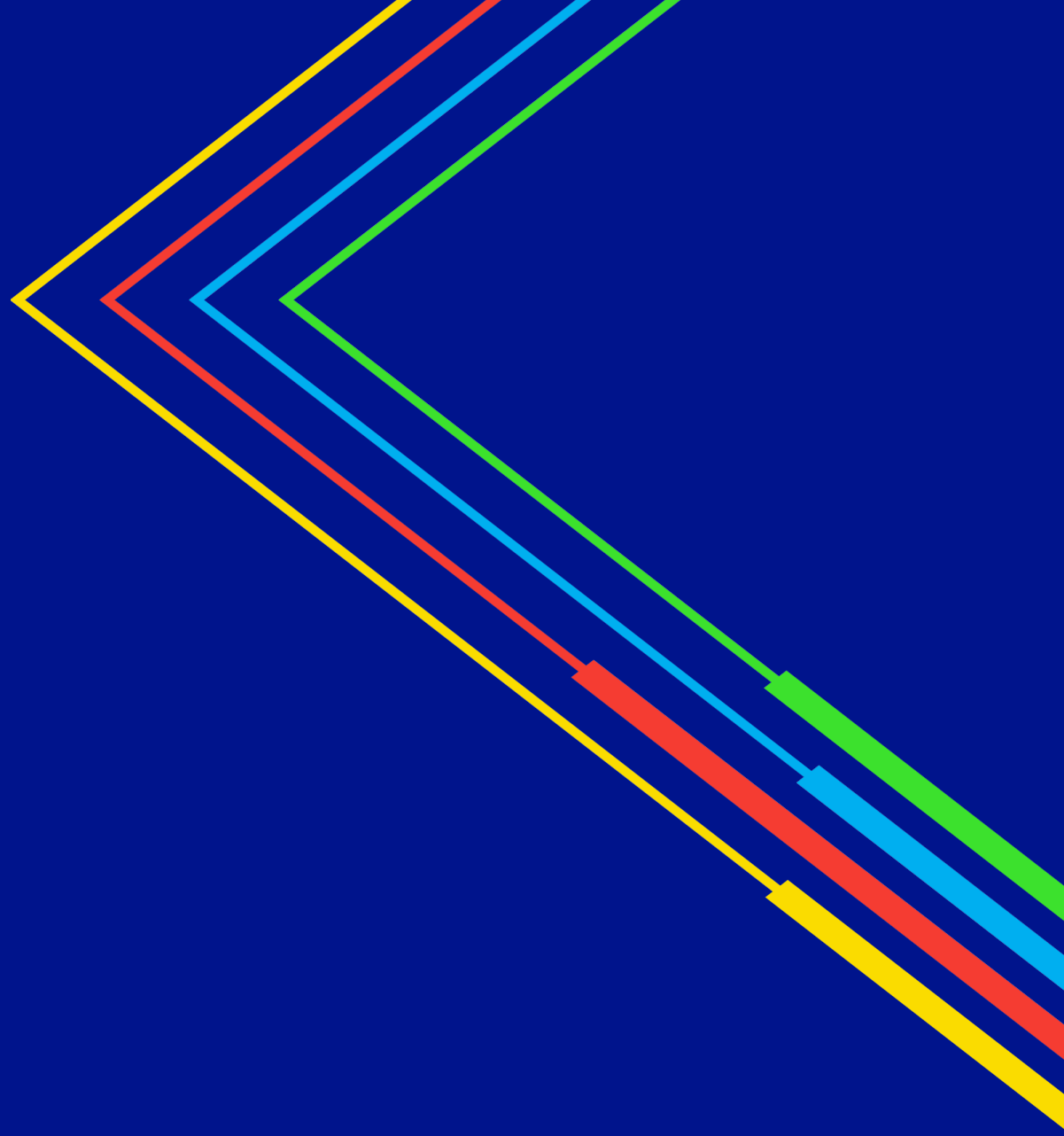
Continue to make your voice heard

Understanding local concerns and priorities is important to National Grid's planning

- Participate in National Grid's CRWG
  - Next meeting Fall 2024
- Visit our website for updates
  - https://www.nationalgridus.com/Our-Company/New-York-Climate-Resiliency-Plan
- File comments by visiting the PSC website:
  www.dps.ny.gov and selecting Case 22-E—0222
- Attend the PSC's upcoming Public Statement Hearings
  - August 6: Liverpool Public Library, Liverpool
  - August 7: Buffalo Central Library Auditorium, Buffalo
  - August 20: Hudson Valley Community College, Troy



Discussion and Questions?
Thank you!



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Appendix

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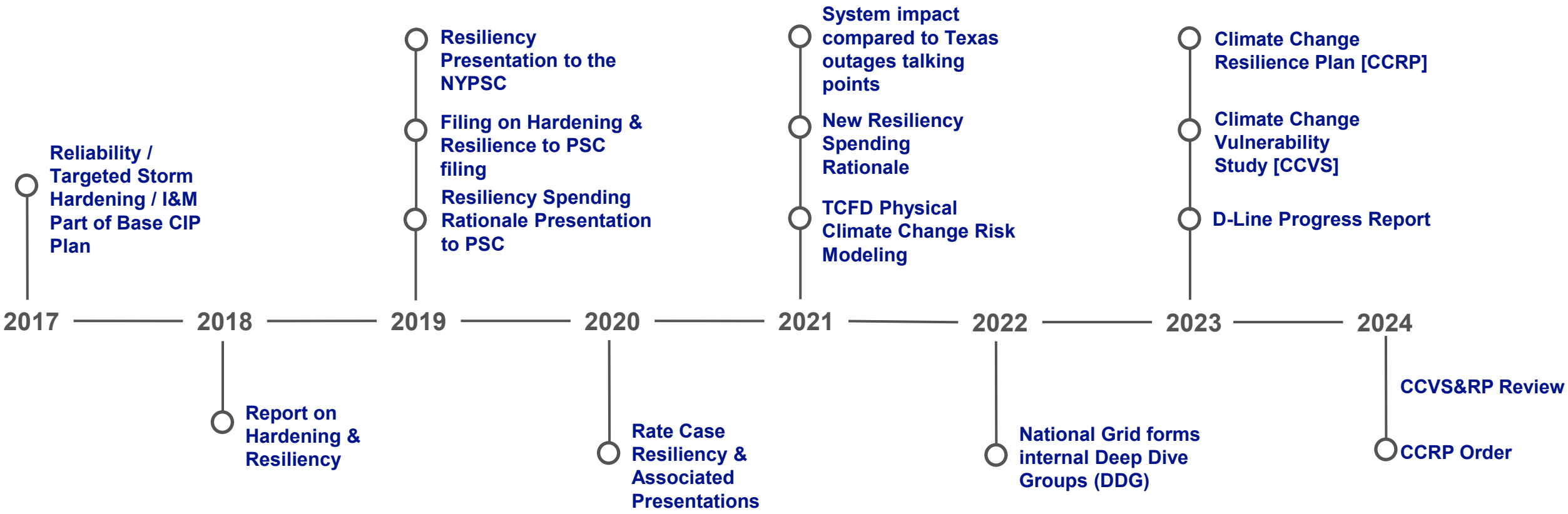
CCRP Resilience Journey



National Grid Customer and Community Team

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Bob Shevy	Rensselaer and Columbia Counties	(518) 410-1678
Scott Gresens	Albany, Saratoga and Washington Counties	(518) 466-8072
Tom Iwinski	Warren and Essex Counties	(518) 321-4229
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Richard Fox	Oneida, Herkimer	(315) 546-4011
Gerald Haenlin	Jefferson, Lewis	(315) 771-5128
Travis Glazier	Madison, St Lawrence, Franklin, Clinton	(315) 980-8825
Kate Benware	Cayuga, Cortland	(315) 409-9679

Stakeholder Input

Organization
Office of Environment, Onondaga County
AARP New York
AARP
Alliance for a Green Economy (AGREE)
Barclay Damon, LLP
Central NY Regional Planning & Development Board
ChargePoint, Inc.
Citizen Action of New York, Inc.
City of Albany
City of Glens Falls
City of Niagara Falls
City of Syracuse
Columbia County Planning Department
Columbia Economic Development Corporation
Direct Energy Services LLC
Division of Consumer Protection
Environmental Defense Fund
Erie County DHSES
Family Energy, Inc.
Franklin County Government
Greenlots
HOCCPP
Marathon Power LLC
Mission:data Coalition, Inc.
Natural Resources Defense Council
New York Geothermal Energy Org
New York Power Authority

Organization
New York State Department of Public Service (DPS)
New York State Office of General Services
Niagara County
NYGEO
NYSDOT
NYSERDA
Office of Environment, Onondaga County
Onondaga County DOT
Onondaga County
Oswego County
Other Intervenors
Pace Energy And Climate Center
People United for Sustainable Housing, Buffalo
DPS Staff
Public Utility Law Project of New York, Inc.
PULP
Schenectady County
Schenectady Fire Department
Sierra Club
St Lawrence County Emergency Services
Stop NY Fracked Gas Pipeline
Town of Amherst
Town of DeWitt
Utility Intervention Unit, Division of Consumer Protection,
Wyoming County Office of Emergency Services
Wyoming County Planning Department

We engaged with stakeholders on an individual and collective basis to provide them more agency in the process, to ensure we are gaining the necessary perspectives to inform our plans and decisions,.

We value the diverse input brought to the table on the efforts that impact communities. Throughout our stakeholder process we have built a shared understanding of our climate change vulnerabilities and our mitigation goals and developed a pathway for collaboration and communication, tailoring outreach through our CRWG, Community and Municipal leader updates, as well as part of our bi-annual storm preparation calls and individual conversations.

Our stakeholders include community leaders, policymakers, public officials, and non-governmental organizations, (consumer and environmental advocates,) among others, who are both impacted by and important contributors to our fair, and affordable clean energy goals.

We will continue to update stakeholders and provide opportunities for input through several pathways, including at least twice annual CRWG meetings, sharing our PSC approved plan with you, project specific updates on our website and through our typical stakeholder outreach.