National Grid
Stakeholder Climate Resilience Working Group (CRWG)

February 13th, 2023

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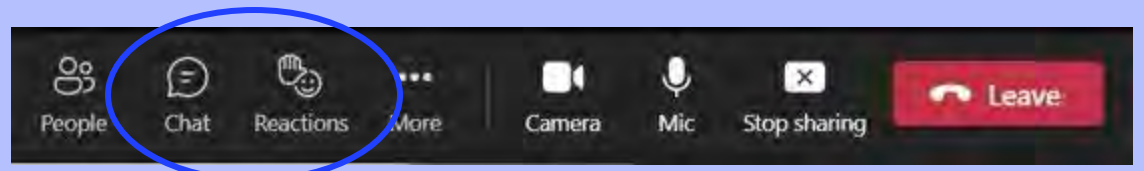
Today's Agenda

- Welcome and introductions
- Project context & role of CRWG participants
- Project approach
  - Project approach and components
  - Equity and justice considerations
  - Climate Science
- Working Group Participant Questions and Feedback
- Next steps

Welcome & Meeting Logistics

- Please use the ***raise hand function*** at any point during the presentation to ask a question or ***add it to the chat***.
- The meeting will be **recorded**.
- If you have technical difficulties or need assistance, please message Sneha Balakrishnan in Teams, or email her at Sneha.Balakrishnan@icf.com.

Example of Toolbar



Introductions: the National Grid team

Peter Haswell

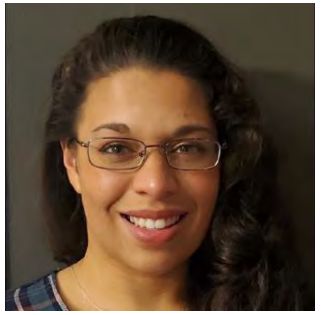
Project Manager

Katie Meyer

Technical Lead

Rachel Stowell

Stakeholder Lead



Project Context & Role of CRWG Participants

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National Grid Working Group Participants

Name	Title	Organization
Erin Pence	Deputy Director of Planning	Genesee County NY
Travis Glazier	Director	Office of Environment, Onondaga County
F. Michael Tucker		Columbia Economic Development Corporation
Jill Dunham		
David Massaro	Deputy Chief	Schenectady Fire Department
Philip Church	County Administrator	Oswego County
Kristin Campbell	Chief Planner	HOCCPP
Brian Meyers	Director of Fire and Emergency Management	Wyoming County Office of Emergency Services
James Bragg	Senior Planner	Wyoming County Planning Department
Martin Voss	Commissioner	Onondaga County DOT
Matthew Denner	Director	St Lawrence County Emergency Services
Charles Davidson	Sustainability Coordinator	Schenectady County
Chris Carrick	Energy Program Manager	Central NY Regional Planning & Development Board
Amber Stevens	Regional Emergency Manager	NYSDOT
Douglas Miller	Engineer	Town of DeWitt
Daniel Wears	Commissioner of Emergency Management	Onondaga County
Donna Kissane	County Manager	Franklin County Government
Jeff Flagg		City of Glens Falls
James Zymanek	Director of Emergency Services	Town of Amherst
Robert Restaino	Mayor	City of Niagara Falls
Jonathan Schultz	Director of Emergency Services	Niagara County
Corey Driscoll Dunham	Chief Operating Officer	City of Syracuse
Jason West	Director of Sustainability	City of Albany
Darien Pratchett	Emergency Services Coordinator	Erie County DHSES
Don Meltz	Senior Planner	Columbia County Planning Department
Yates, William	Director of Research	Public Utility Law Project of New York, Inc.
Wyman, Bob	Consultant	Individual
Wheelock, Laurie	Executive Director & Counsel	Public Utility Law Project of New York, Inc.
Trinsey, Amanda	Partner (Couch White, LLP)	Representing Multiple Intervenors
Stein, Elizabeth		Environmental Defense Fund
Spear, Christine		New York Power Authority
Schorr, Angela	Director, Regulatory Affairs NRG	Direct Energy Services LLC
Rigberg, Saul	Consultant	Representing AARP New York
Rantala, Stacey	Ass. Dir, Government & Regulatory Affairs	Family Energy, Inc.
Pravin, Avni	Deputy Policy Director	Alliance for a Green Economy (AGREE)
Pond, George	Partner	Barclay Damon, LLP
Podolny, Konstantin	Partner Read and Laniado, LLP	Rep: New York State Office of General Services
Panko, Danielle	Utility Analyst, Utility Intervention Unit	Division of Consumer Protection,
Nowak, Bill	Executive Director	NYGEO

Name	Title	Organization
Naum, Barry	Counsel Spilman Thomas & Battle, PLLC	Representing Walmart
Murray, Michael	President	Mission:data Coalition, Inc.
Murphy, Erin		Environmental Defense Fund
Miller, Kevin	Director of Public Policy	ChargePoint, Inc.
Meier, Rebecca		Stop NY Fracked Gas Pipeline
Maya, David		New York Power Authority
Markey, Nathan		New York Power Authority
Mager, Michael	Partner Couch White, LLP	Representing Multiple Intervenors
Maceko, Emma	Lead Regulatory Affairs Advisor	New York Power Authority
Luteran, Kevin	Program Manager	New York Power Authority
Levenson, Gary	Principal Attorney II	New York Power Authority
Luaks, Ronald	President R Lukas Consulting LLC	Representing Martathon Power LLC
Krame, Sarah	Associated Attorney	Sierra Club
Kasow, Jillian	Lead Counsel, Utility Intervention Unit	Division of Consumer Protection,
Hermann, Charles	Lead Project Engineer	New York Power Authority
Hart, Craig		Pace Energy And Climate Center
Haff, John	Assistant Director of Energy Planning & Procurement	New York State Office of General Services
Goodrich, Brandon	Staff Counsel	New York State Department of Public Service
Gocker, Clarke	Director of Policy and Strategy (PUSH)	People United for Sustainable Housing, Buffalo
Gilleo, Annie		Greenlots
Galbraith, Robert	Public Accountability Initiative	Individual
Collar, Gregg	Utility Analyst, Utility Intervention Unit	Utility Intervention Unit, Division of Consumer Protection,
Cohen, Bob		Citizen Action of New York, Inc.
Ciovacco, John	President Aztech Geothermal, LLC	Rep. New York Geothermal Energy Org
Casey, Christopher	Senior Attorney	Natural Resources Defense Council
Berman, Joshua	Staff Attorney	Sierra Club
Azulay, Jessica	Executive Director	Alliance for a Green Economy (AGREE)
Mack, Robert L		NYSERDA
Bello, Hafiz		NYSERDA
Brown, Anna		NYSERDA
Dave, Hetvi		NYSERDA
Sallese, Nicole		PSC Staff
Bardhi, Aferdita		PSC Staff
Frymire, Bridget		PSC Staff
Hogan, Erin		PULP
Morris, Jackson		Natural Resources Defense Council
DeCostanzo, Donna		Natural Resources Defense Council
Stelling, Joseph		AARP
Bill Ferris		AARP

Please provide your name, title, and affiliation in the chat

NY Public Service Order § 66(29) Effective 3/22/2022

Aims to bolster electric utility planning and resilience by incorporating future weather patterns

Climate Change Vulnerability Study

- **Due 9/2023**
- Evaluate infrastructure, design specifications, and procedures to identify vulnerabilities
- Include adaptation measures to address vulnerabilities; feeds into Resilience Plan
- Study to be performed with supporting climate data from NYSERDA and Columbia University

Climate Change Resilience plan

- **Due 11/2023**
- Propose storm hardening measures for next 10 and 20 years
- Detail how climate change reflected in planning, design, operations, & emergency response
- Address impacts on costs, outage times, potential for undergrounding lines, etc.
- Additional requirements the PSC may identify
- 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

PSC Reviewal & Approval

- Within 11 Months of Filing Resilience Plan
- Stakeholder engagement into utility plans is an important component

National Grid plans to engage the CRWG participants in Summer and Fall 2023 with initial findings of the Study and Plan and share updates in 2024 after they are filed.

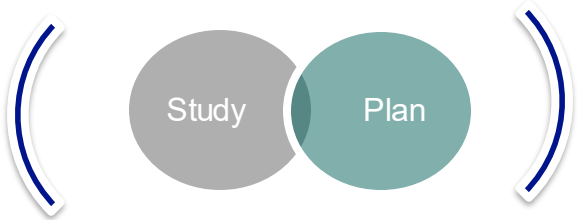
CRWG Role and Stakeholder Involvement Roadmap

"Each corporation shall establish a utility climate resilience working group … [which] shall advise and make recommendations to the corporation and the commission on the development and implementation of the corporation's climate resilience plan. The working group shall be comprised of representatives from the department, and municipal representatives, customer advocacy groups, and energy and environmental ad vocacy organizations. The working group shall meet at least twice annually."

Membership on the National Grid Climate Study and Resilience Plan Working Group is open to any stakeholder who would like to participate. National Grid has reached out to local, regional and state officials as well as interested parties who participated in the Company's most recent Niagara Mohawk Rate Case before the Public Service Commission (PSC).

National Grid's Work to Date and Next Steps:

Outreach, Engagement, & Initial Feedback



Study & Plan Development

Ongoing Engagement & Reporting

2022

August 2022: Conducted initial local community outreach to create awareness and seek input

January 2023: Engaged advocacy groups to identify priorities; reviewed survey input

2023

February 2023: Initiated Utility Climate Resilience Working Group (CRWG), holding first WG meeting

June 2023: WG meeting #2

What have we found in the study so far. Follow up from feedback.

October 2023: WG Meeting #3

Preview Resiliency plan

November 2023

File the Resilience plan

2024

Fall 2024 and beyond: Report to stakeholders on plan updates

Project Approach

- Equity and justice considerations
- Project approach and components
- Climate Science

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Equity and justice considerations

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National Grid Dedication Disadvantaged Communities and Energy Equity

National Grid will target to benefit disadvantaged communities and Energy Equity with our CCRP.

- National Grid takes equity into consideration in our asset planning and prioritization.
- We are dedicated to addressing the needs of vulnerable communities in our resilience plan.

Support an Equitable Energy Transition by:

- Drive Communication and Best Practices
- Comply With Regulatory and Legal Obligations
- Better Understand Our Most Vulnerable Customers
- Deliver Enhanced Value to Our Underserved Communities

Project Approach and Components

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Project Approach: Climate Change Vulnerability Study (CCVS)

Identify climate hazards for different asset types

- Identify hazards and relevant thresholds – high temperatures, wind, flooding, winter storms
- Conduct exposure analysis for hazard-asset combinations
- Use climate data sources, including Columbia/ NYSERDA data, MIT study, and National Grid's Climate Change Risk Tool

→

Risk-based prioritization of vulnerable assets & operations

- Evaluate assets & operations for climate sensitivities (using SME inputs and standards review)
- Identify potential impacts of exposure to prioritize vulnerable assets and operations, based on understanding of overall risk

→

Identify climate change planning scenario

- Identify climate change planning and design scenarios
- Consider climate science, risk-acceptance criteria, benchmarking, and stakeholder input

How have recent storms including Winter Storm Elliott impacted your community?

Are there any additional climate hazards you have identified in your communities?

Project Approach: Climate Change Resilience Plan (CCRP)

Identify resilience measures

- Develop portfolio of risk mitigation measures for priority assets & operations identified in CCVS
- Identify processes to incorporate climate change into design criteria, planning and operations
- Consider lessons learned from prior weather events such as the recent Buffalo storm (Elliott)

Prioritize resilience measures based on costs and benefits

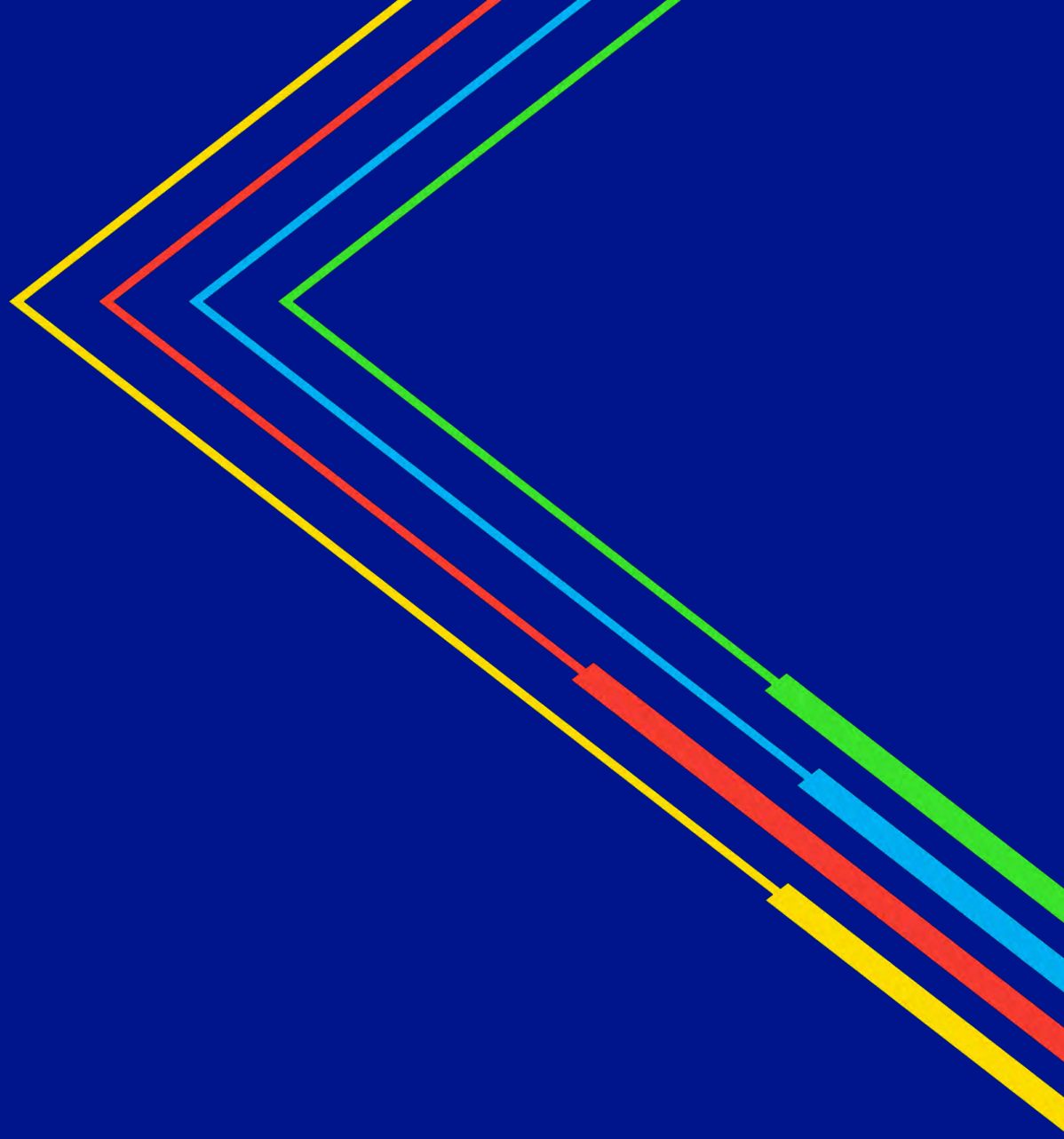
- Estimate costs and relative benefits to prioritize measures for implementation planning

Develop implementation plan

- Develop detailed implementation schedules for prioritized risk mitigation measures, focusing on timeframes, costs, performance benchmarks, and rate impact estimates

What is your biggest concern for us as when implement our resilience plan on the impact to the people you represent?

Climate Science



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Complementary Climate Science Datasets

Coupled Model Intercomparison Project Phase 6 (CMIP6) Global Climate Model projections developed for NYSERDA by Columbia

- Temperature
- Precipitation
- Humidity
- Sea level rise

Massachusetts Institute of Technology (MIT) dynamically downscaled projections

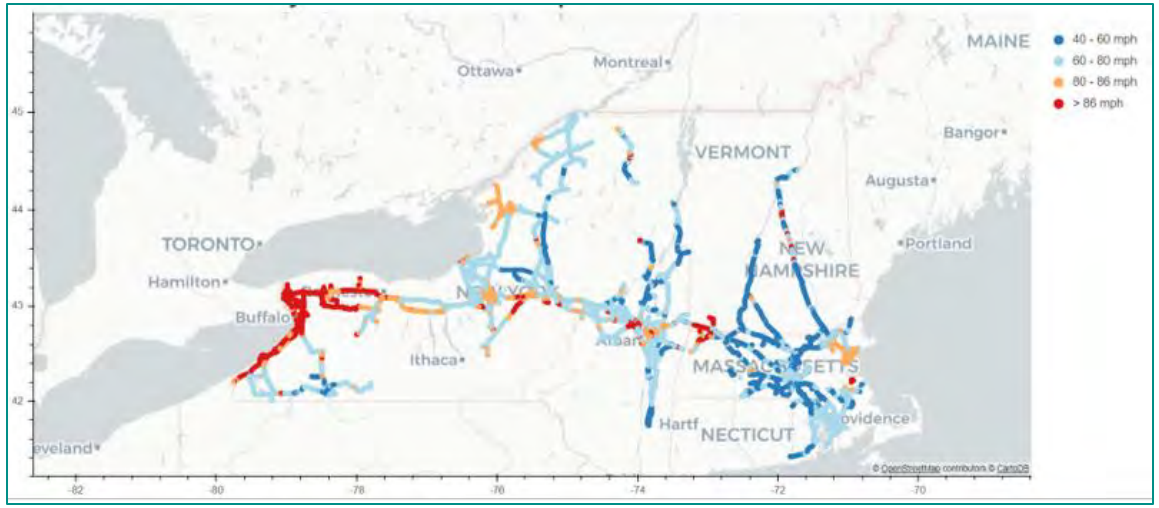
- Wind
- Winter precipitation and radial icing
- Others

National Grid's Climate Change Risk Tool (CCRT)

- Hazards including flooding, compound events and lightning

- National Grid leveraged this data science in our study.
- The Columbia data CMIP6 represents the latest Climate models (Which is our gold standard)
- This data will be supplemented with the MIT study and the CCRT risk tool.

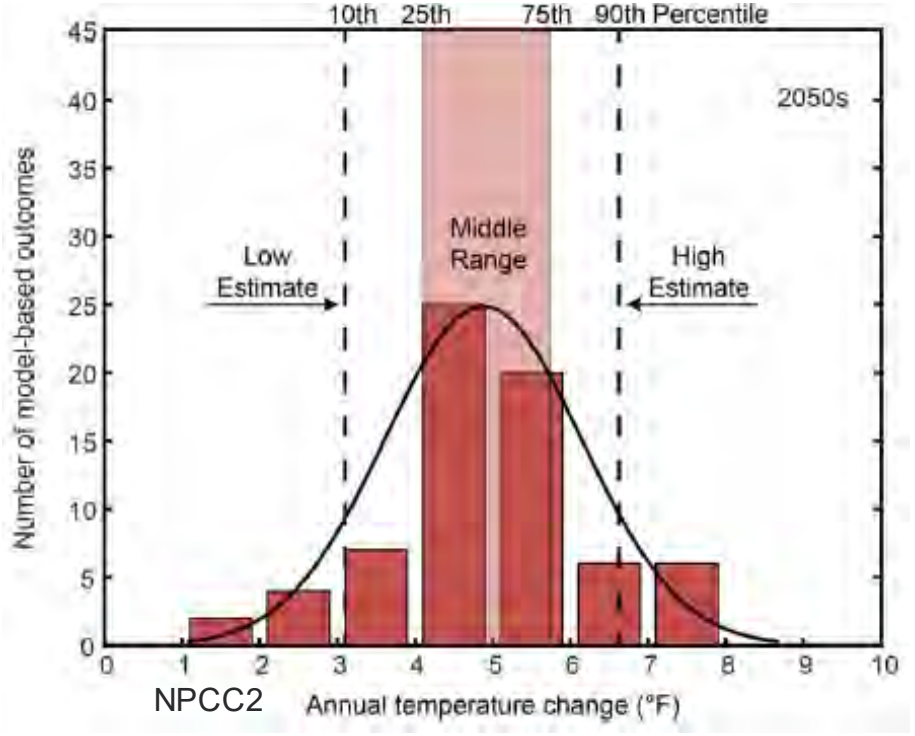
For example:

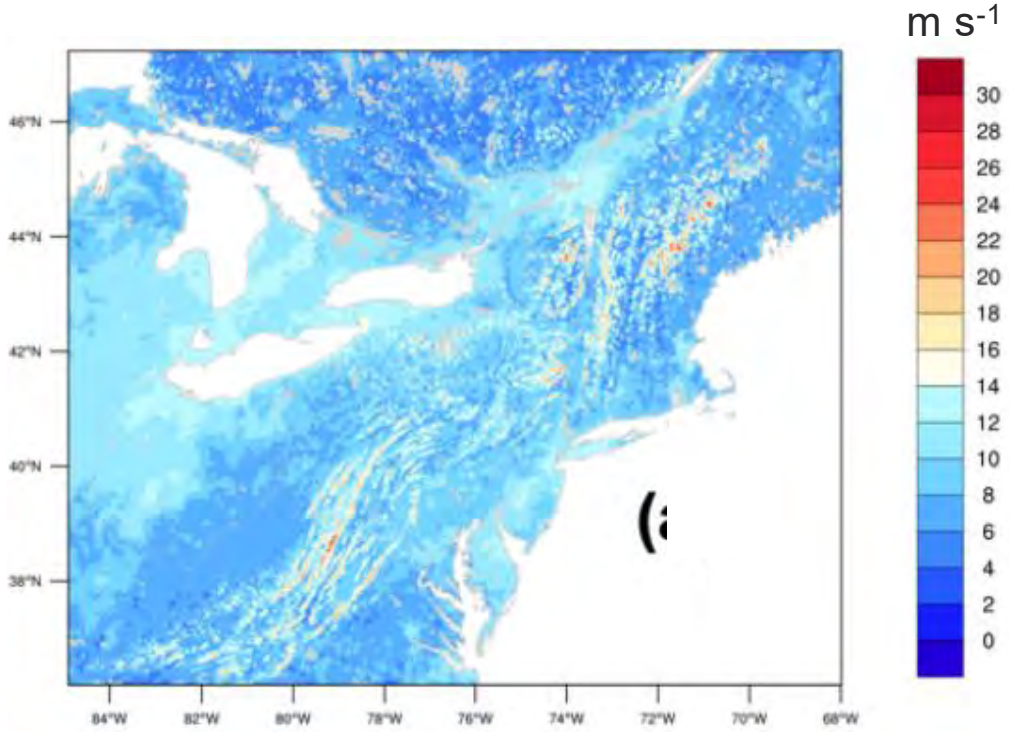


Geographical Distribution of 1-in-100 Wind Speeds by Transmission Line Asset (MIT data)

Climate Science Approach

- Tailor climate projection variables and analyses to National Grid's assets and system sensitivities
- Leverage best-available science to understand a range of potential climate risks and match to risk-based decision-making





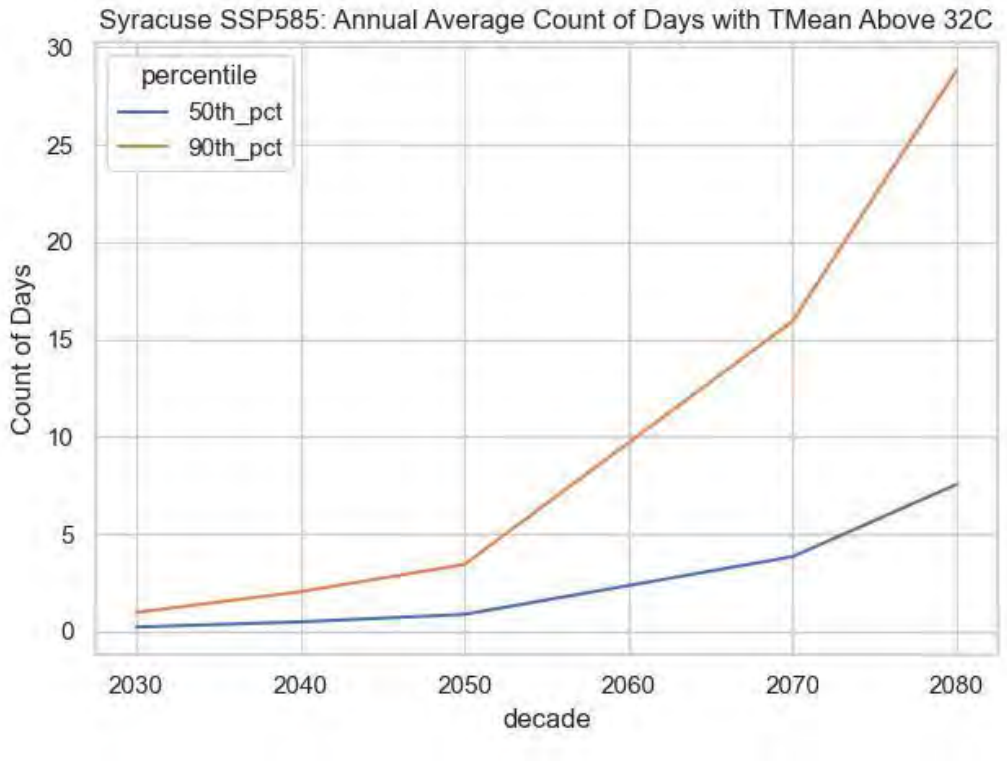
Extreme wind speeds (95th percentile of winds) between 2028-2041.

Transformer Analysis Maximum Mean temperature

Region	Station	Metric	Planning Scenario (Pathway)	Decade	50th pct	90th pct	max of tmax	mean of tmax
Central Lakes	Syracuse	tmean	ssp585	2050	0.866666667	3.433333333	46.32777778	29.48053546
Central Lakes	Syracuse	tmean	ssp585	2080	7.55	28.81666667	51.41111111	32.31260482
Central Lakes	Syracuse	tmax	ssp585	2050	0.333333333	2.5	46.32777778	29.48053546
Central Lakes	Syracuse	tmax	ssp585	2080	4.4	32.2	51.41111111	32.31260482
Central Lakes	Syracuse	tmean	ssp245	2050	0.466666667	1.666666667	45.28888889	28.59094442
Central Lakes	Syracuse	tmean	ssp245	2080	0.816666667	3.616666667	46.22222222	29.47380354
Central Lakes	Syracuse	tmax	ssp245	2050	0.1	0.8	45.28888889	28.59094442
Central Lakes	Syracuse	tmax	ssp245	2080	0.333333333	2.5	46.22222222	29.47380354
Great Lakes	Buffalo	tmean	ssp585	2050	0.5	2.983333333	44.71666667	28.74145015
Great Lakes	Buffalo	tmean	ssp585	2080	6.3	28.8	48.49444444	31.52390765
Great Lakes	Buffalo	tmax	ssp585	2050	0.066666667	0.7	44.71666667	28.74145015
Great Lakes	Buffalo	tmax	ssp585	2080	1.266666667	18.68333333	48.49444444	31.52390765
Great Lakes	Buffalo	tmean	ssp245	2050	0.05	1.133333333	43.62222222	27.86509132
Great Lakes	Buffalo	tmean	ssp245	2080	0.416666667	2.95	44.06111111	28.76679852
Great Lakes	Buffalo	tmax	ssp245	2050	0	0.333333333	43.62222222	27.86509132
Great Lakes	Buffalo	tmax	ssp245	2080	0.066666667	0.916666667	44.06111111	28.76679852
North Hudson Valley	Albany	tmean	ssp585	2050	0.383333333	3.316666667	43.89444444	29.62247726
North Hudson Valley	Albany	tmean	ssp585	2080	6.333333333	31.51666667	50.16666667	32.4897698
North Hudson Valley	Albany	tmax	ssp585	2050	0.15	1.866666667	43.89444444	29.62247726
North Hudson Valley	Albany	tmax	ssp585	2080	4.633333333	25.7	50.16666667	32.4897698
North Hudson Valley	Albany	tmean	ssp245	2050	0.133333333	1.516666667	43.86666667	28.72622892
North Hudson Valley	Albany	tmean	ssp245	2080	0.333333333	3.066666667	44.79444444	29.61754957
North Hudson Valley	Albany	tmax	ssp245	2050	0.083333333	0.7	43.86666667	28.72622892
North Hudson Valley	Albany	tmax	ssp245	2080	0.15	2.483333333	44.79444444	29.61754957

Chart: How many days do we get above the temperature threshold for our Transformer ratings.
This comes from the Columbia Study

- How do we design our Transformers to climate variable temperatures....
- Will we need to update our transformer specifications or derate transformers based on future temperature projections?
- Example of applying data science to identify a vulnerability

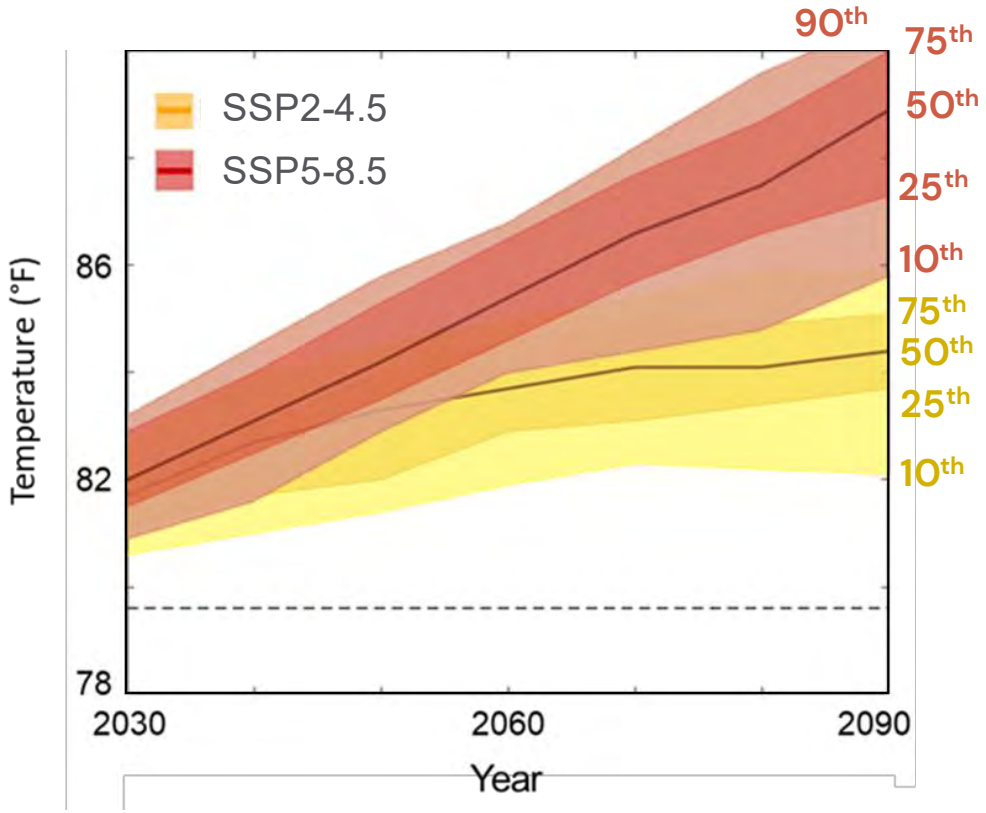


Climate Change Planning Scenario (Pathway) Considered for the CCVS and CCRP

- Climate change projections provide a range of plausible climate futures reflecting uncertainty around both future emissions trajectories and climate sensitivity.
- Climate Change Planning Scenarios (Pathway) provide standardized climate projections and assumed climate conditions in the service area to which the utility would plan in order to strengthen resilience to potential climate change risks.

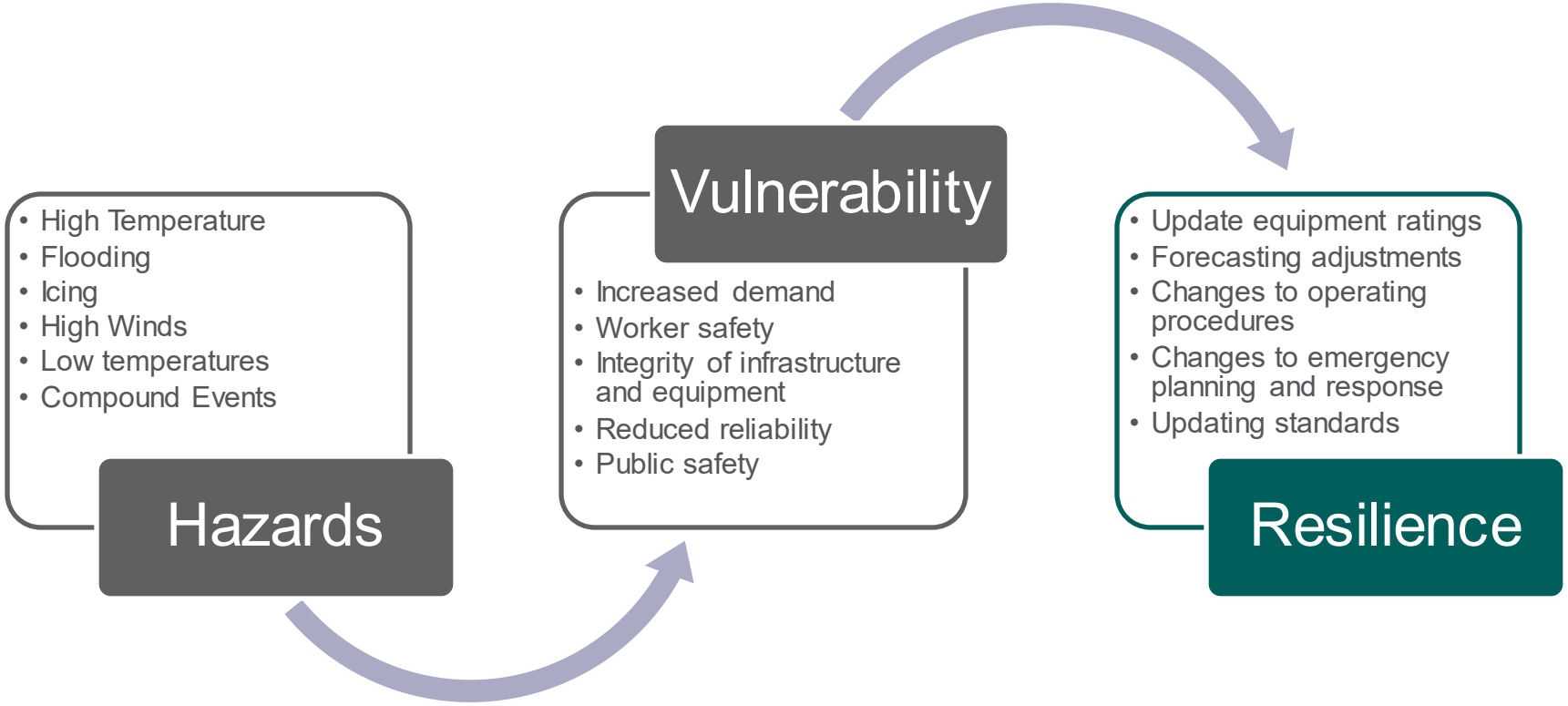
Potential selection criteria:

- **Climate science** (e.g., how bad might climate change be and what is the level of likelihood?)
- **Risk Aversion** (e.g., how risk-averse is National Grid in its current approach to capital investments related to service level?)
- **Benchmarking** (e.g., what other utilities are doing regarding their planning scenario selection?)
- **Climate policy**

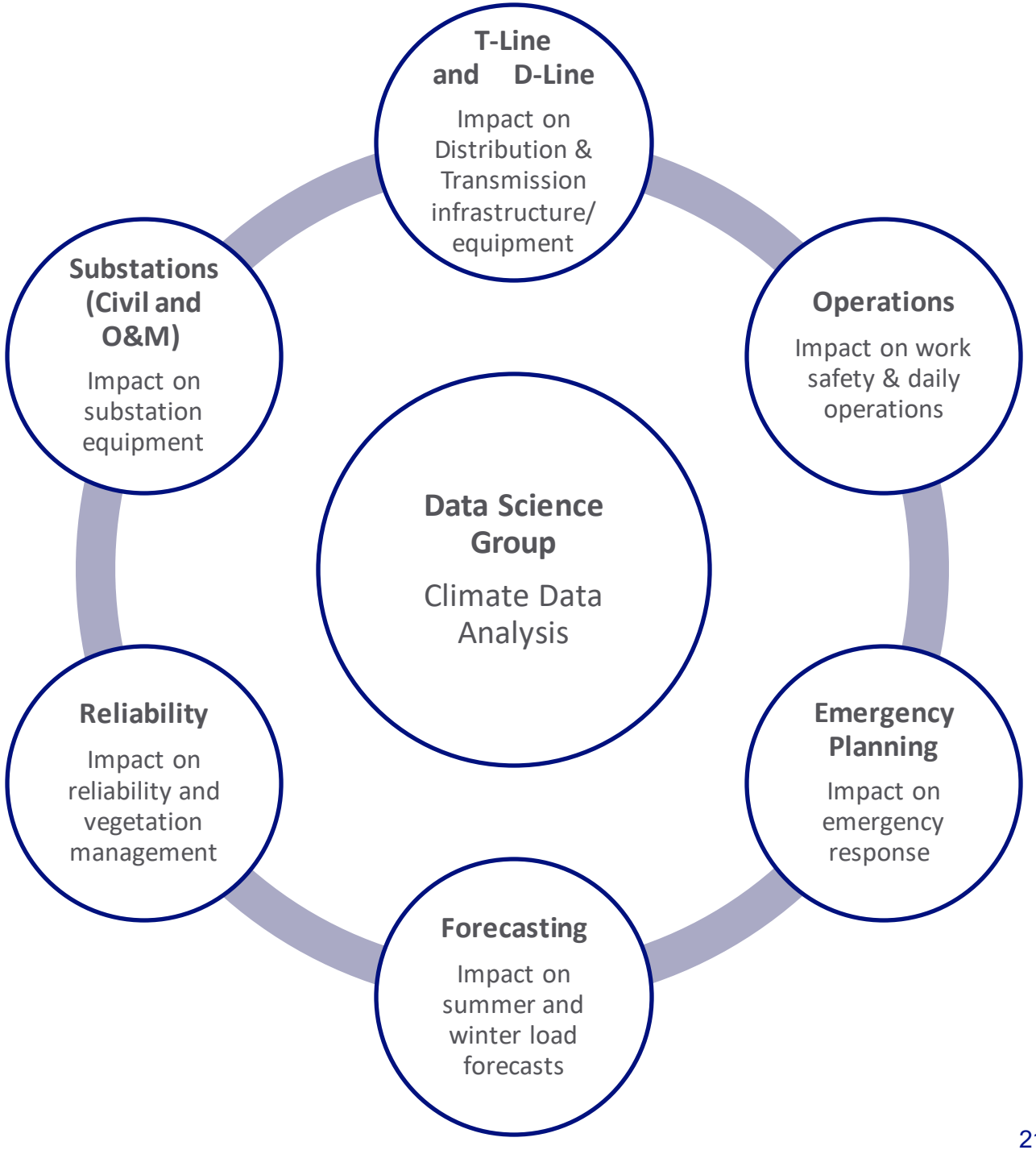


National Grid Expert "Deep Dive" Analyses

- Develop understanding of climate projections and climate change planning scenario
- Analyze climate data to understand potential exposure of different assets and operations to various climate hazards
- Define climate sensitivities of assets and operations—consider design/operating variables
- Identify potential impacts and their significance to prioritize vulnerable assets and operations
- Inform changes to asset management, standard practices and procedures to build resilience



Deep Dive Groups: All



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T-line = Transmision Lines

D-Line = Distribution lines

O&M = Operation and Maintenance

Deep Dive Groups: Examples

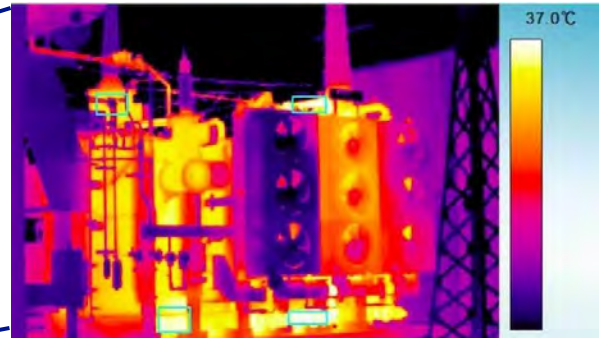
Substation: Civil

- Use the Climate Change Risk Tool (CCRT) to identify locations vulnerable to extreme precipitation
- Confirm a station is vulnerable with avialable elevation data
- Identify mitigation options for existing infrastructure and alter any current practices/standards for future stations

Graphic from Primera Engineering

Substation: O&M

- Use Columbia's CMIP6 temperature data to identify substation transformers' vulnerability
- Compare temperature projections to current standards to identify transformers that may be at risk in the near future
- Understand how ratings may need to change in the future



Graphic from Daelim Belefic

Transmission Lines

- Use wind and ice data from MIT to understand how projections compare to our current design guidelines and standards
- Identify existing lines and locations across our Transmission jurisdiction that may be vulnerable to high winds and/or icing that need to be addressed while designing future lines

Additional Stakeholder Discussion

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Question slide

- After our summer webinar, we received feedback on climate concerns. Now that we are "hopefully" finishing up our winter season, what additional climate concerns do you have?
- Any additional questions regarding the Climate Change Vulenrabilty Study and Resilience Plan?
- After Winter Storm Elliot, "a hundred year storm," have your thoughts on climate change, and how we prepare, been influenced and how?
- How and with who have your organizations collaborated with on your climate change concerns?

Next Steps

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Next Steps

Looking ahead, you will receive:

- An **update** following this meeting
- **Meeting invitations** for the second and third CRWG meetings

Appendix

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Analysis of Potential Hazards to Evaluate Vulnerabilities

Hazards	Weather Data	Data Sources	Asset Type/System Component	Vulnerabilities	Design/Operating Variable	Standard/Practice	Deep Dive SME Groups
Low Temp	Daily Min Temp	CCRT, Columbia, MIT	Winter Forecast	Forecasting heating load		Forecasting practices and procedures	Forecasting
Low Temp	Daily Min Temp	CCRT, Columbia, MIT	Breakers, etc.	Equipment vulnerable to extreme cold	- Standard equipment designed -40° C to +65° C		Sub (O&M + Civil), T-Lne
Low Temp	Daily Min Temp	CCRT, Columbia, MIT	Work Safety	"hands-off days"	- Below 0 deg F	Local 97 Contract - Inclement Weather	Operations
High Temp	Daily Max Temp	CCRT, Columbia, MIT	Conductors	conductor ratings	- Conductor ampacity - 100˚F ambient		T&D Line
High Temp	Daily Max Temp	CCRT, Columbia, MIT	Transformers, etc.	oil filled equipment	- Equip ratings based on 86° F or 32° F ambient		Sub (O&M), D-Line
High Temp	Daily Max Temp	CCRT, Columbia, MIT	Summer Forecast	weather normalization and load forecasting		Climate change into base load forecast	Sub (O&M)
High Temp	Daily Max Temp	CCRT, Columbia, MIT	Work Safety	Worker safety - work methods	When to stop work due to heat	Presently Supervisor's discretion	Operations
Precip	inches (daily)	Columbia, MIT	Work Safety	Increased hands-off days for field workers		Local 97 Union Contract	Operations
Humidity	% (hourly)	Columbia	Work Safety	Live line work above 85% humidity levels		No live line work above 85% humidity	Operations
Extreme Events	Qual Report	Columbia	Emergency Response	Need for more standby and holding crews		Emergency response prep	Emergency Planning

Analysis of Potential Hazards to Evaluate Vulnerabilities Cont.

Hazards	Weather Data	Data Sources	Asset Type/System Component	Vulnerabilities	Design/Operating Variable	Standard/Practice	Deep Dive SME Groups
Winter Precip	Qual Report	Columbia	D&T infrastructure	Heavy snow on trees, lines & sub equipment	Design structures and span lengths		T&D Line, Sub (Civil), Reliability & Veg
Winter Precip	Qual Report	Columbia	Emergency Response	Crews' accessibility to infrastructure		Snow removal required	Emergency Planning
Winter Precip	Qual Report	Columbia	Tx lines	Clearances to ground	Clearances standards with snow consideration		Transmission
Drought	Qual Report	Columbia	OH Equipment	Brush fires - fire risk for equipment & public	Emergency ratings for exposed equipment		Reliability and Veg Mgmt
Flooding	Qual Report	CCRT	Sub Equip & UG	Great Lakes high lake level	NESC flood plain standards	- 100 year + 2 feet	Sub (O&M & Civil)
Flooding	Qual Report	CCRT	Sub Equip	Substation equipment flooding	NESC flood plain standards	- 100 year + 2 feet	Sub (O&M & Civil)
Flooding	Qual Report	CCRT	URD and UG	T&D UG & URD	NESC flood plain standards	- 100 year + 2 feet	T&D Line
Heatwaves	Qual Report	CCRT, Columbia, MIT	Work Safety	Worker safety & productivity - work methods	Consider shifting work times to avoid peaks	Presently Supervisor's discretion	Operations
Heatwaves	Qual Report	CCRT, Columbia, MIT	Summer Forecast	Forecasting A/C load		Include climate change in baseline	Forecasting
High Winds	Wind Proj	CCRT, MIT	D&T Structures	Infrastructure construction standards	OH Standards & NESC		T & D Line
High Winds	Wind Proj	CCRT, MIT	Work Safety	Bucket truck safety	Bucket truck work stops above 40mph		Operations
High Winds	Wind Proj	CCRT, MIT	Reliability+Veg Mgmt	Evaluate tree trimming practices		Veg Mgmt and danger trees	Reliability and Veg Mgmt
Icing	Inches	MIT	D&T Structures	Risk of structure collapse	Design standard of 1.5" ice on equipment		T&D Line
Icing	Inches	MIT	Distribution Lines	Frozen branches falling on lines	Width of right of ways and tree trimming		D-Line