"Climate Change Vulnerabilities of and Adaptation Strategies for New York's Future Electric System"

Project Overview

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Extreme weather and climate resiliency affect the electric system via multiple pathways and at various scales

	Vulnerability	Driver	Risk
Supply and Distribution	Hydropower	precipitation, snowmelt, runoff	Reduced hydropower resource availability
	Thermoelectric units	air temp	Reduced thermal efficiency of power generation
	Power plants near water	sea level rise, precipitation	Flood risk in low-lying coastal and riverine areas
	Water-cooled units	water temp	Temp of intake and discharge water, cooling efficiency
	Wind and solar	wind speed & direction, clouds	Availability / predictability of renewable power
	T&D lines	air temp	Line efficiency, sagging lines
	Utility assets	extreme weather, storms	Power outages, infrastructure damage
Demand	Total consumption	air temp, extreme weather	Changes in HDDs / CDDs Changes in demand shapes and regional patterns
	Peak demand	air temp, humidity, extreme weather	Increase in summer peak load, power outages

Adapted from NYSERDA (2011)

What is the potential cost of these impacts?

What is the benefit of proactive adaptation planning?

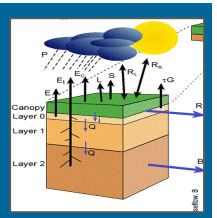
"Informing the resiliency of NY's *electric system of the future* for operations in the *climate of the future*"

- Objective: Assess NYS electricity system performance, vulnerabilities, and adaptation strategies under a future climate, including costs and benefits at the system-level
- New 2-year EPRI-NYSERDA project "Climate Change Vulnerabilities of and Adaptation Strategies for NY's Future Electric System"
- Develop new NY-focused REGEN to assess generation fleet given climate impact pathways (NYS ClimAID scenario inputs), environmental policies & socioeconomic trends
- Value: Help decisionmakers and planners design and operate system to be resilient to climate change and meet policy objectives at least cost

Project Approach: from climate drivers to NYS system impacts and costs

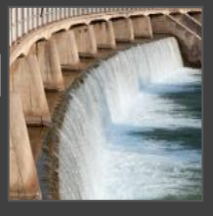
NYS ClimAID Climate Inputs and Hydrology

temperature, precipitation, availability



Electric Supply & Demand

impacts on resources, efficiency, loads

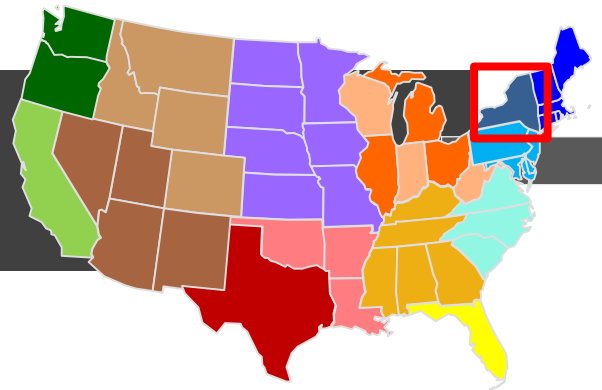


Resiliency Planning

decisions about generation capacity, ops, transmission, cooling technologies

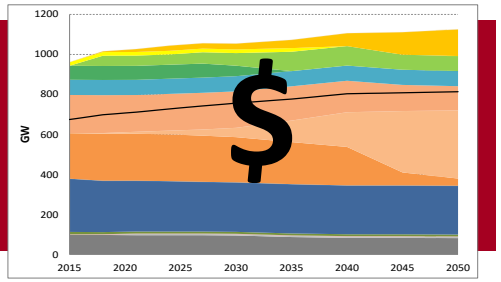
Electric System Analysis

EPRI US-REGEN capacity expansion and dispatch model



Costs and Benefits of Resilience Adaptation

system costs and EJ analysis



EPRI ELECTRIC POWER RESEARCH INSTITUTE

Project Team

Research Team

- Delavane Diaz, *EPRI*, Project Director
- Stephen Shaw, *SUNY-ESF*, climate/water lead
- David Young, *EPRI*, REGEN model lead
- John Bistline, *EPRI*
- Geoffrey Blanford, *EPRI*
- Mary Collins, *SUNY-ESF*
- David Hunter, *EPRI*
- Clarence Lyons, *EPRI*
- Nalini Rao, *EPRI*

- Kara Allen, *NYSERDA* project manager

Project Advisory Committee

- Dan Bader, *Columbia*
- Vatsal Bhatt
- Suzanne Hagell, *NY DEC*
- Radley Horton, *Columbia*
- Christa Kelleher, *Syracuse*
- Schuyler Matteson, *NYSERDA*
- John Reese, *Eastern Gen*
- Karl Schoeberl, *EEANY*
- Amanda Stevens, *NYSERDA*
- Michael Swider, *NYISO*

Project Outline

- Task 1: NYS stakeholder engagement
- Task 2: Compile New York climate data
  - Historical data and correlations
  - ClimAID projections of temperature and precipitation
- Task 3: Hydrological modeling of future water temperature & availability
- Task 4: Characterize NYS electric system in US-REGEN
  - Enhance NY representation with sub-state resolution
  - Develop and implement climate impact pathways on supply and demand side
- Task 5: Model reference scenario in enhanced US-REGEN (no climate impacts)
- Task 6: Model future electric system under climate change
- Task 7: Assess implications on vulnerable populations
- Task 8: Final report and dissemination of results

Modeling approach

Together…Shaping the Future of Electricity

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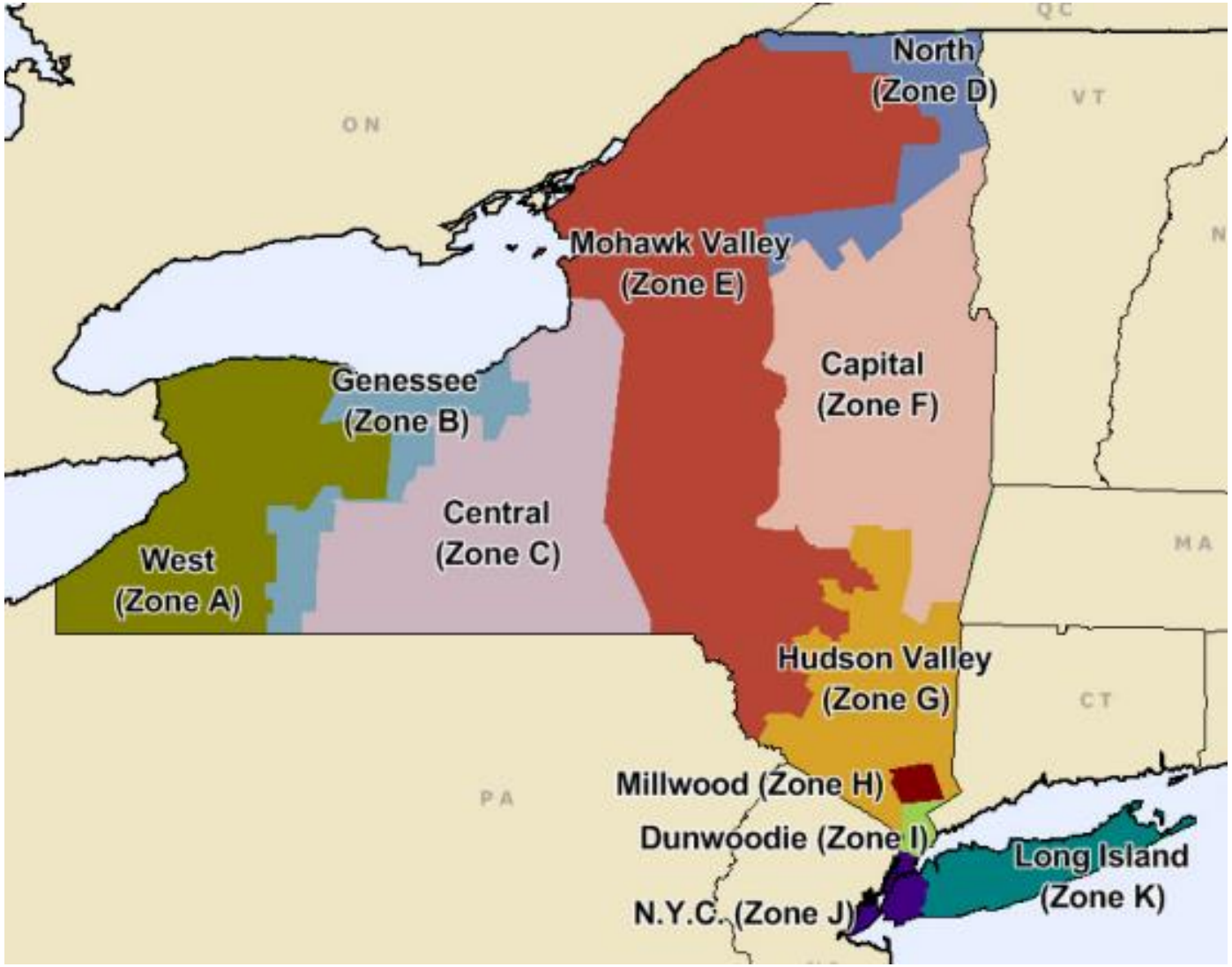
Back-Up Slides

Timeline

Task 1: Outreach and Engagement with NYS Stakeholders	Ongoing, May 2017
Task 2: Compile New York climate data	Apr-June 2017
Task 3: Hydrological modeling	May-Oct 2017
Task 4: Develop US-REGEN for NYS and impact pathways	July-Dec 2017
Task 5: Model reference scenario in US-REGEN	Dec-Jan 2018
Task 6: Model future electric system under climate change	Feb-June 2018
Task 7: Environmental Justice assessment	May-July 2018
Task 8: Final report and dissemination of results	Aug-Oct 2018

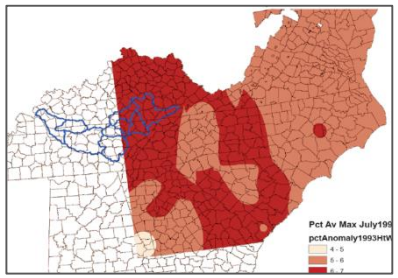
New York Transmission Zones



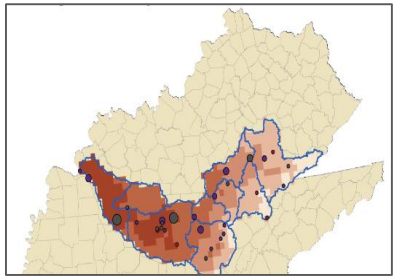
Source: Federal Energy Regulatory Commission

Impact pathways under development in US-REGEN

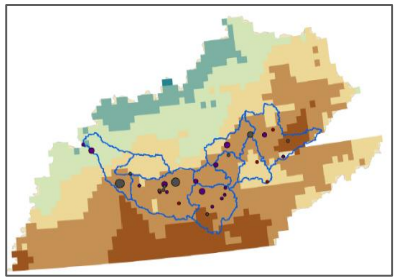
Illustrative Climate Drivers



Air Temperature



Stream Temperature



Water Availability

Changes in air temperature

Changes in water temperature

Changes in water availability (hydrology model)

Cooling technology choice

Increased cooling / decreased heating

Transmission impacts

Decreased thermal efficiency / increased cooling cost (EPRI SOAPP model)

Decreased availability of hydro generators

Other policy, resource, customer drivers

End-use technology choice

Add inter-region transmission capacity

Generation capacity addition and dispatch decisions

Illustrative climate drivers from Cumberland Basin study (ORNL 2016)