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Integrating Climate Resilience into Today's Energy Landscape: The New York Power Authority's Approach to Leveraging Predictive Models

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Outline

- NYPA background
- NYPA's climate projection study
- Implementing results
- Identified research gaps
- Lessons learned

New York Power Authority (NYPA) is the largest state public power utility in the US, and a New York State public-benefit corporation

25%
of the State's energy

80%+
hydropower generation

1/3
of the State's high voltage transmission lines

Founded by Franklin D. Roosevelt in 1931 - Power Authority Act.

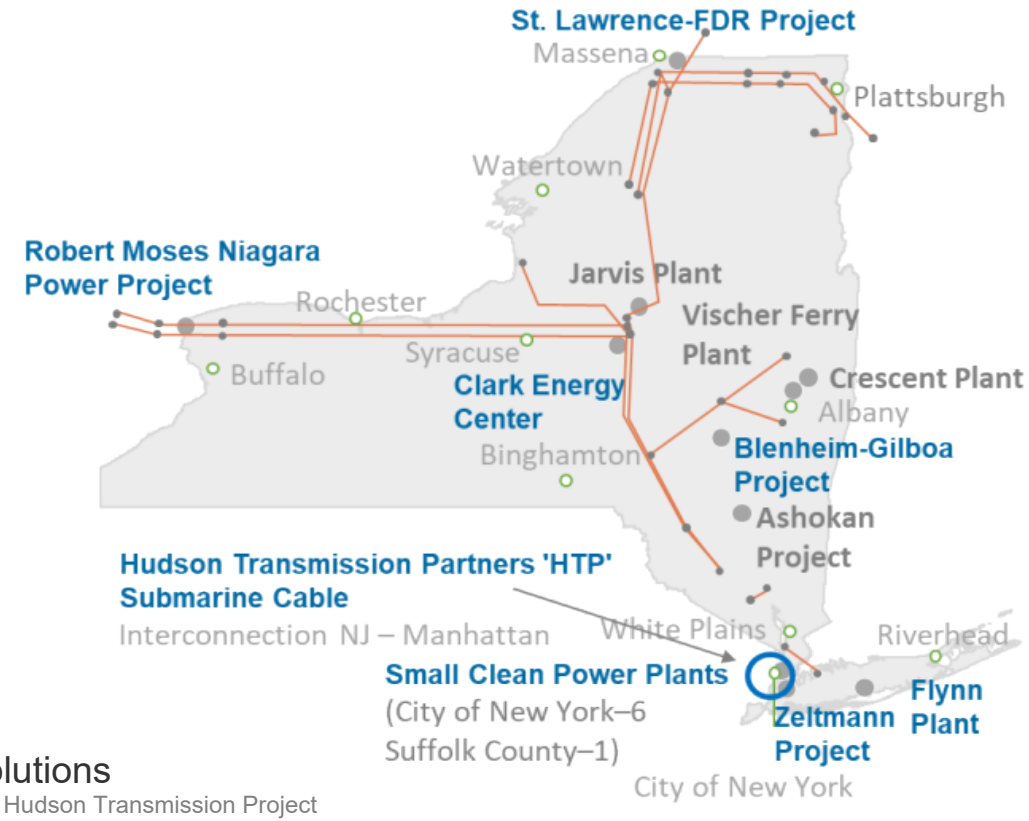
Generation

- 7.3 GW*
- 16 generating facilities
- 80% hydropower

Transmission

- 1454 circuit miles

- 2000+ employees
- 7-member board
- Revenue source
  - Power contracts
  - Generation
  - Customer Energy Solutions



* Inclusive of leased assets: Astoria Energy II, Hudson Transmission Project

Our customers include more than one thousand businesses, local and state government entities, municipal and rural cooperative electric systems, and non-profit organizations

Governmental

MTA

NYC Environmental Protection

CUNY The City University of New York

NYC Department of Education

New York City Housing Authority

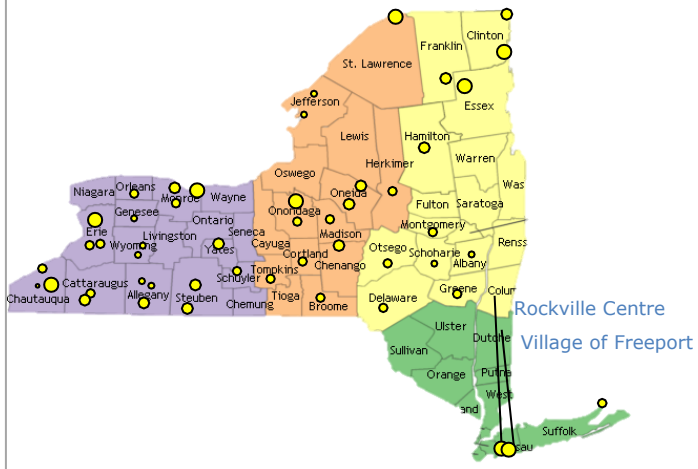
NYC Citywide Administrative Services

Westchester gov.com

The Corporation of the City of Yonkers

Municipalities and Cooperatives

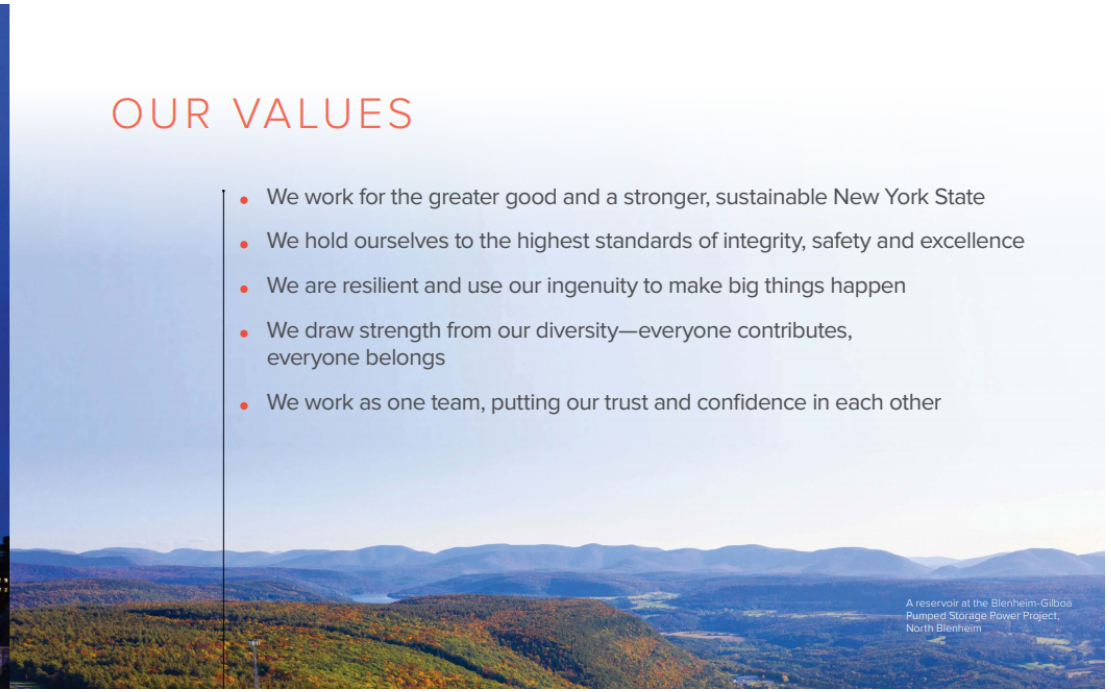
- 47 municipal
- 4 rural co-operatives



Businesses

- Commercial and industrial (C&I)
- Not-for-profit businesses
- Not-for-profit educational organizations

NYPA's strategic priorities center on an equitable clean energy transition for our customers and local communities



Strategic Priorities

- Preserve Hydropower
- Decarbonize NG Plants
- Lead Transmission
- Serve Customers and State
- Reimagine the Canals

Foundational Pillars

- Digitalization
- ESG
- DEI
- Resilience
- Resource Alignment

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Addressing climate change risk is key to meeting our commitments to our stakeholders, and for New York State's clean energy economy

NYPA commitments include:

- Energy reliability and affordability
- Carbon-free electricity by 2035
- Rapidly develop critical transmission projects

NYPA's climate risks include:

- Loss of generation capacity
- Increased generation and transmission disruptions
- Transmission line outages
- Price increases
- Customer and stakeholder electricity consumption and location changes

We worked with Argonne National Lab to apply climate impact models and infrastructure resilience analyses and assess climate risks and adaptation options

(1) Estimates of Local-Scale Climate Impacts for NYPA Service Area	(2) Infrastructure Risk & Resilience Analysis	(3) Adaptation Options Analysis
Projections based on Argonne's 12-km dynamically downscaled climate models for 2050 time period. **<u>Impacts include</u>:** • Inland flooding • Coastal flooding (sea-level rise, hurricanes storm surge) • Winter storms • Intense heat events • Precipitation impacts to canal systems and dam operations • Extreme temperatures and heat waves	**Climate impacts integrated into Argonne's EPfast electric transmission grid load-flow model to evaluate system-level impacts, disruptions, and cascading failures.** **<u>Outcomes include</u>:** • Identification of climate impacts • Climate sensitivity analysis • Risk-based vulnerability analysis	**Comprehensive summary of local scale climate risks for New York State, and location-specific climate risks overlaid to NYPA's infrastructure.** **<u>Outcomes include</u>:** • Final report and data • Information on using the data for additional analyses • NYPA-led implementation

The study included regular internal and external SME touchpoints, reviews, and stakeholder involvement, and we will continue to leverage internal knowledge

- Twelve-month project, June 2021 to July 2022
- Phased approach to modeling and analysis
- External partners provide critical review and validation (Columbia Center for Global Energy Policy, EPRI)
- Internal stakeholder input critical to success of project
  - Planners, hydrologists, and others participated in scoping to ensure alignment in climate model outcomes with NYPA climate risk concerns
  - Engineering, GIS, planning and operations are providing critical infrastructure data, including data to inform Argonne transmission grid modeling
  - Regional operations managers, facility operators, asset managers will help identify most consequential climate impacts to facilities, critical thresholds, and resilience actions taken

In conjunction with project start, training was provided to all employees on climate change and climate projections to increase climate literacy

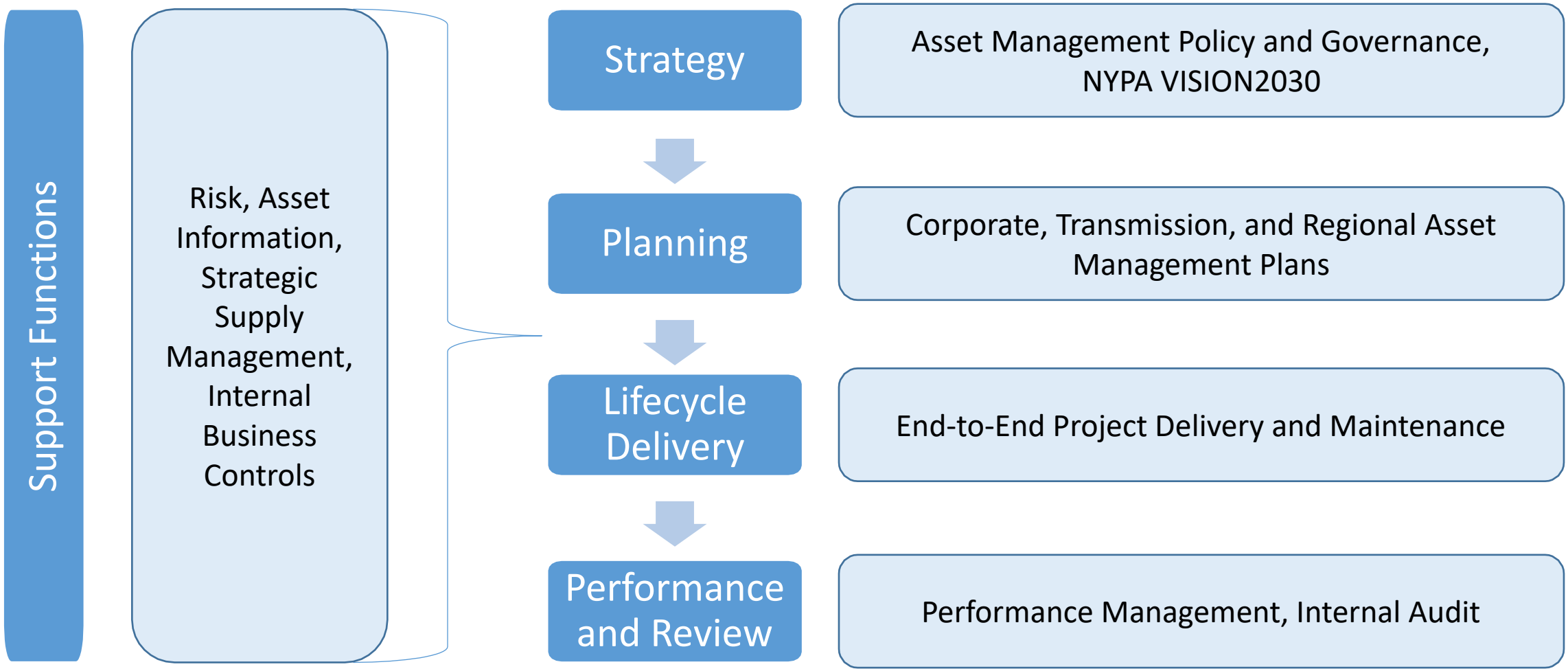
Five Science-based Units

Pre	1	2	3	4
COVID, Climate & Equity	***Basics of Earth Systems and Climate Science***	**Science of Recent Climate Change**	**Science of Climate Solutions**	**NYPA & Canals Climate Strategies**
Community impact of COVID-19, pollution, climate change, and racial and economic inequity	Present and past mechanisms for climate change: the greenhouse effect	Evidence of a changing climate and human causation	Systems approach with many puzzle pieces to mitigate GHG emissions and adapt to climate changes	NYPA & Canals Climate Policies & Commitments

NYPA is now developing a climate resilience implementation strategy

- The strategy will operationalize the results of the Argonne study
- We will apply climate resilience BMPs to operations by
  - Convening a working group of SMEs to support and provide input
  - Updating relevant policies and guidelines, including Asset Management Plans, Engineering design standards, H&S procedures
- NYPA's strategy will consider existing assets, future assets, and operations & processes
- Oversight and strategic guidance will be provided by Chief Risk and Resilience Officer
- We are also engaging with other utilities on climate resilience best practices as a co-founding member of EPRI's Climate READi

NYPA's asset management plans are one tool we're using for integrating climate projections, mitigation and adaptation into near- and long-term resilience



Considerable advancements are needed to synthesize disparate knowledge centers and enhance grid resilience

Lack of standardized understanding of climate threats and available resources

- What are the climate threats that NYS and utilities should prepare for?
  - Changes to mean weather conditions? Individual extreme events? Compound events?
- What climate data are available? Is spatiotemporal resolution sufficient?
- Increasing pressure from stakeholders and regulators to demonstrate climate resilience, without a clear definition or benchmark
- Regulatory requirements (e.g. engineering design codes, building/construction standards, flood maps) do not consider climate change

Uncertain future of policy and grid landscapes

- Grid resiliency assessments and load flow models must consider:
  - Grid expansion and upcoming Article VII projects
  - Renewable penetration and intermittency
  - Localized projections of energy efficiency and electrification
- State, regulatory, and stakeholder expectations and priorities may shift generation makeup

Knowledge silos and operational norms should be addressed as needed

- Standardization of asset management processes and procedures
- Projections of community electrification and energy efficiency projections
- Climate impacts to generation mix
  - Pertinent to hydroelectricity - Great Lakes water level
- Opportunities to use diverse portfolio of climate resilience strategies (e.g. nature based solutions; asset hardening)

We are just at the beginning of our implementation journey but have some lessons to share with others embarking on similar studies

- Know your organization's data types and limitations and what data inputs are required for the predictive models
- Make sure you have a plan in place to operationalize the data
- Collaborate with industry partners because there are a lot of great case studies and implementation strategies out there

- Understand the uncertainty and limitations of the forecasting models so that the most useful data is generated for your use cases (i.e., how much uncertainty can you tolerate?)

Image from Argonne National Laboratory

Questions?

Backup Slides

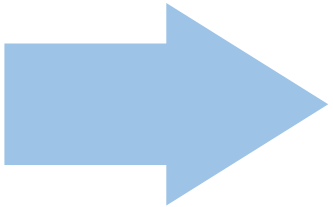
Implementation will include different planning horizons

- Implementation projects will increase climate resilience across NYPA
- Strategies include:
  - Existing assets: Infrastructure hardening, nature-based solutions
  - Future assets: Climate-smart, location-specific scoping, design, construction standards, and infrastructure siting (GIS)
  - Operations and processes: Real-time event mitigation (cyber), asset specific insurance, informing asset risk registers (ISO 55001)

Effectively translating the data into business decisions is key in order to ensure NYPA's climate resilience

Inputs

- Argonne results
- Industry best management practices
- Climate resilience case studies
- Industry collaborators
- VISION2030, CLCPA, and other NYPA and state priorities and mandates
- Climate READi



Physical Infrastructure

- G&T assets
- Renewables and energy storage
- Buildings and roads

Planning and Processes

- Licensing and permitting
- Risk integration
- Capital investments
- Asset planning, design, O&M
- Data management

Other

- Land and water
- Employee safety and well-being
- Demand-response

NYPA faces an increasing risk from climate impacts on assets and facilities, system operations, employees and external stakeholders

Climate Action Council:

- Adaptation and Resilience Initiatives

Strategic Priorities:

- Hydropower
- Transmission
- Serve and Decarbonize Customers and the State

Foundational Pillars:

- Resilience
- ESG
- Diversity, Equity & Inclusion
- Resource Alignment

Environmental:

- Climate Change
- Energy Reliability
- Environmental Stewardship

Social:

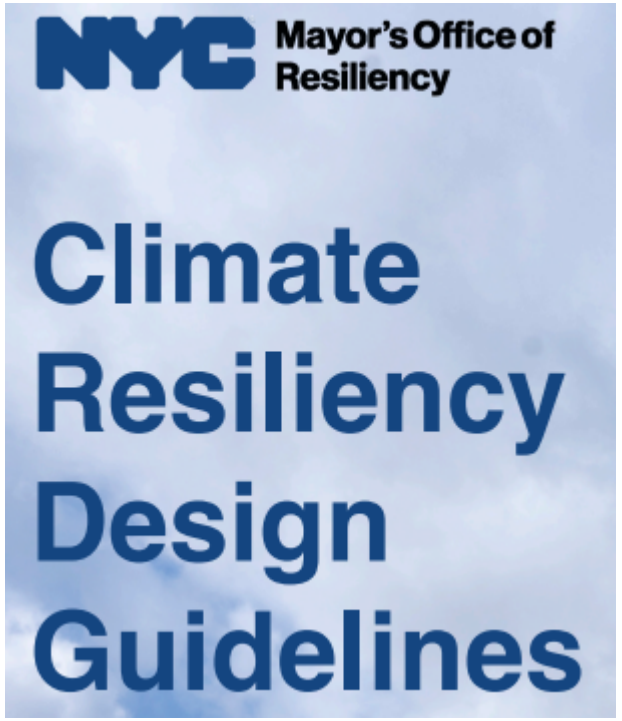
- Access & Affordability
- Diversity, Equity & Inclusion
- Community Engagement

Governance:

- Enterprise Risk & Resilience

Climate plans are becoming more relevant in stakeholder communities and provide benchmarking opportunities

- Federal agencies required to develop Climate Action Plans
  - Executive Order on Tackling the Climate Crisis at Home and Abroad (EO 14008, Jan 2021)
- Example climate plans being adopted by peers
  - Tennessee Valley Authority
    - Climate Action Adaptation and Resiliency Plan (Aug 2021)
  - ConEd
    - Climate Change Resilience and Adaptation: Summary of 2020 Activities (Jan 2021)

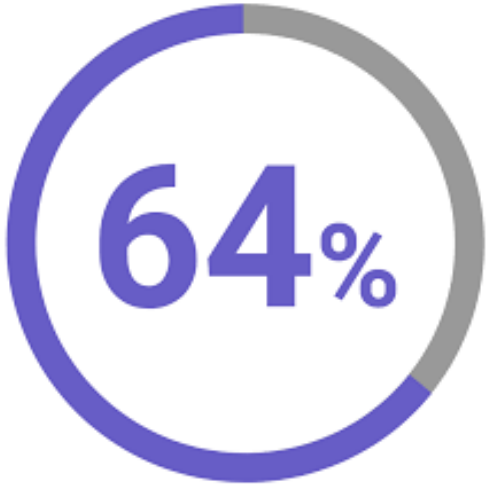


Post-unit 2 evaluation – Aug. 2021

indicated a significant improvement in climate literacy and positive program experience

climate change is caused by human activities, and agree it's a serious problem

climate change is not happening



learned a lot or quite a bit

Course material was definitely/somewhat interesting

Pre-course assessment survey – Nov. 2020

indicated a variety of levels of understanding and interest

climate change is caused by human activities, and agree it's a serious problem

climate change is not happening

don't know a lot about climate science

interested in climate issues