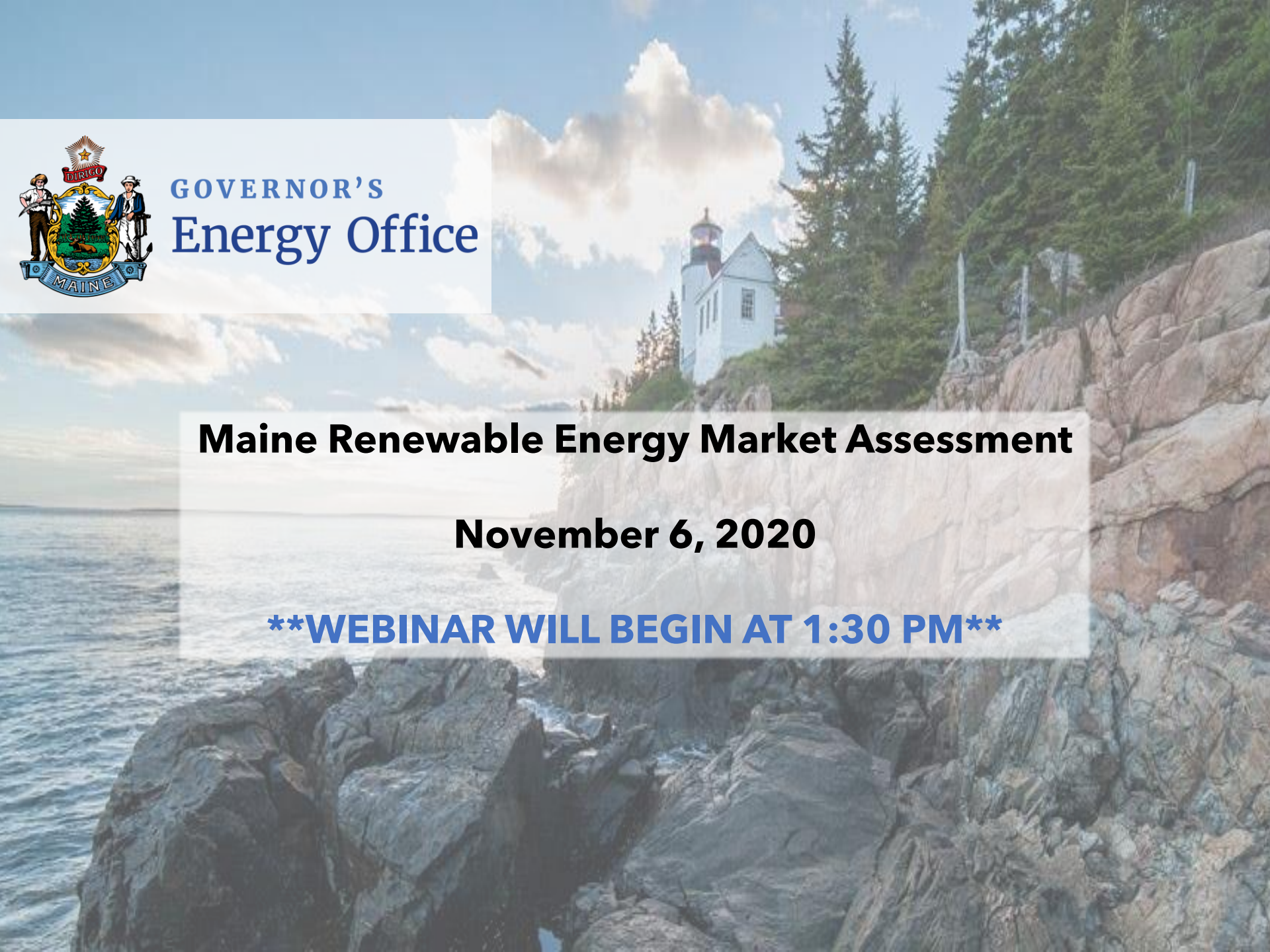


GOVERNOR'S
Energy Office

Maine Renewable Energy Market Assessment

November 6, 2020

****WEBINAR WILL BEGIN AT 1:30 PM****

GOVERNOR'S Energy Office

Dan Burgess, Director

GOVERNOR'S ENERGY OFFICE

Renewable Energy Market Assessment

RENEWABLE PORTFOLIO STANDARD LD 1494

Increased RPS of 80% by 2030

Goal of 100% renewable power by 2050

SOLAR & DISTRIBUTED GENERATION LD 1711

Incentivizes at least 375 MW of distributed generation

Encourages small scale and community solar projects

HEATING

Initiative to install 100,000 new heat pumps by 2025 with a focus on low-income residents

MAINE CLIMATE COUNCIL

Bold emissions reductions: Develop plan to meet state greenhouse gas emissions reduction targets

Mitigation: Strategies for all sectors of the economy, with a focus on Maine's transportation, electricity, and buildings sectors

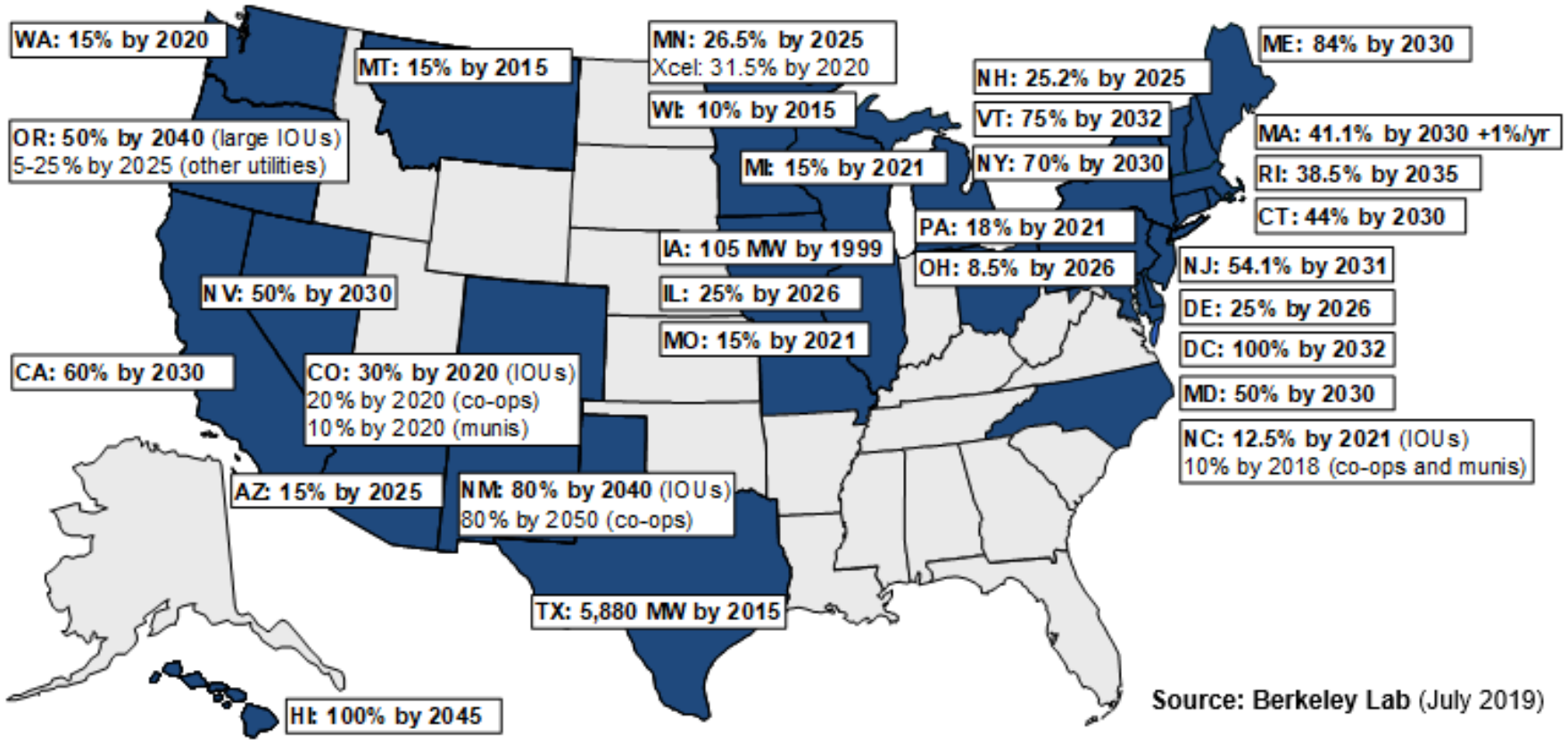
Resilience: Develop strategies that will make Maine people, industries, and communities resilient to the impacts of climate change

Clean Energy Economy: Plan to grow good paying jobs in the transition to a lower carbon economy

Transition: Ensure Maine's rural, low-income and elderly populations are not adversely impacted in the shift to a low-carbon economy, while also delivering benefits like lower heating bills

Equity: Encourage diversity, inclusion, and equity of all Maine people and communities

Renewable Portfolio Standards by State



Source: Berkeley Lab (July 2019)

LD 1494 - AN ACT TO REFORM MAINE'S RENEWABLE PORTFOLIO STANDARD

Enacted and Signed on June 26, 2019

INCREASED Maine's RPS to 80% by 2030, up from 40%, with a goal of 100% by 2050

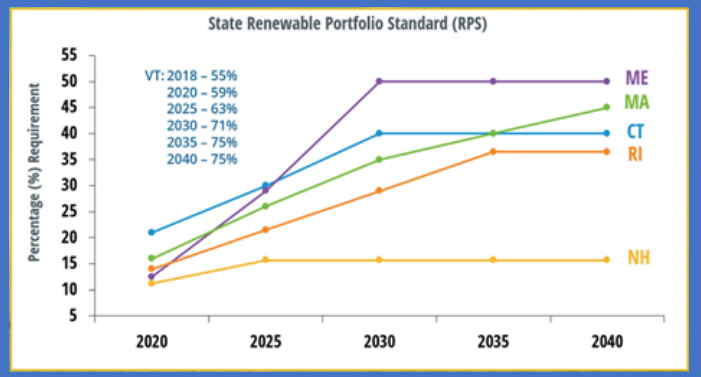
Required Maine PUC to **PROCURE 14%** of Maine load via long-term contracts; **70%** ratepayer benefits & **30%** economic benefit

TRANCHE 1 BID SELECTIONS resulted in commitment of:

- 546 MW of procured capacity in round 1
  - Technology: solar, wind, biomass, hydro
- 450+ full-time equivalent (FTE) jobs during construction
- Initial capital spending of $145+ million
- Additional spending of $3 million annually
- Tax payments averaging $4.7 million annually

TRANCHE 2: RFP by January 15, 2021

RENEWABLE PORTFOLIO STANDARD [RPS]



RENEWABLE ENERGY MARKET ASSESSMENT

LD 1494 - AN ACT TO REFORM MAINE'S RENEWABLE PORTFOLIO STANDARD

Enacted and Signed on June 26, 2019

The Governor's Energy Office and Governor's Office of Policy Innovation and the Future are required to conduct a 10-year renewable energy market assessment of 80% RPS by 2030.

This study will:

- Identify available technology, including emerging technologies;
- Estimated costs, benefits and capacity of technologies;
- Review time frames for permitting and project development;
- Analyze policy and regulatory options to best achieve RPS targets;
- Waste to energy, landfill gas and anaerobic digestion considerations;
- Focus on equity.

Consultants to assist with study are:

- Energy & Environmental Economics (E3)
- Applied Economics Clinic (AEC)

Energy+Environmental Economics

Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

Maine Renewable Energy Market Assessment

Sponsored by the State of Maine Governor's Energy Office

Nov 6, 2020

E3

Lakshmi Alagappan, Partner

Liz Mettetal, Managing Consultant

Saamrat Kasina, Senior Consultant

Charlie Duff, Consultant

Bill Wheatle, Consultant

AEC

Liz Stanton, Director

Bryndis Woods, Researcher

Agenda

- Using the ‘Chat’/’Raise Hand’ feature to ask questions in WebEx
- Introductions
- Study Objectives
- Scenario Design
- Modeling Approach and Assumptions
- Equity Considerations in Maine
- Q&A with Stakeholders
- Feedback and Next Steps

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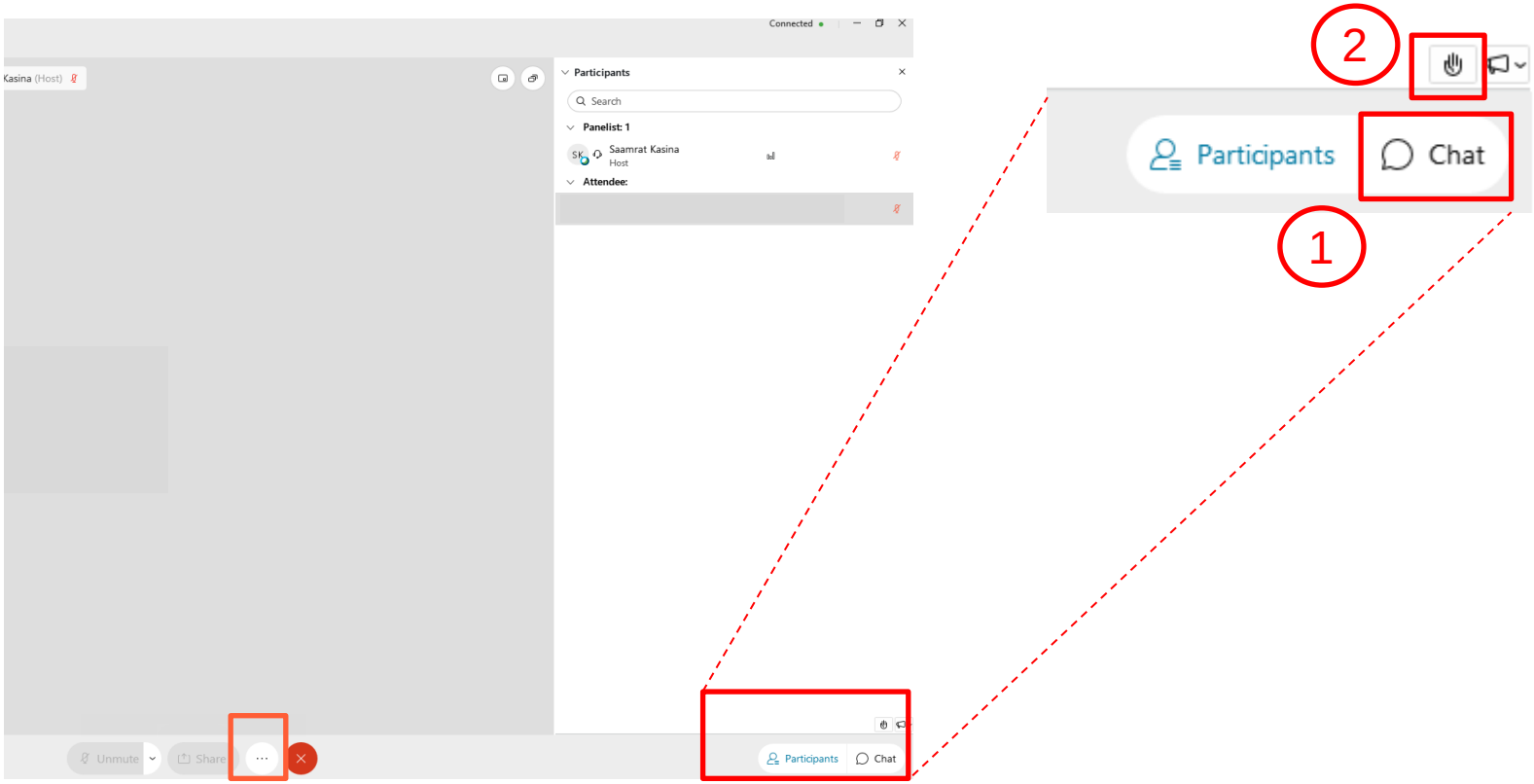
Using ‘Chat’ and ‘Raise Hand’ in WebEx to ask questions

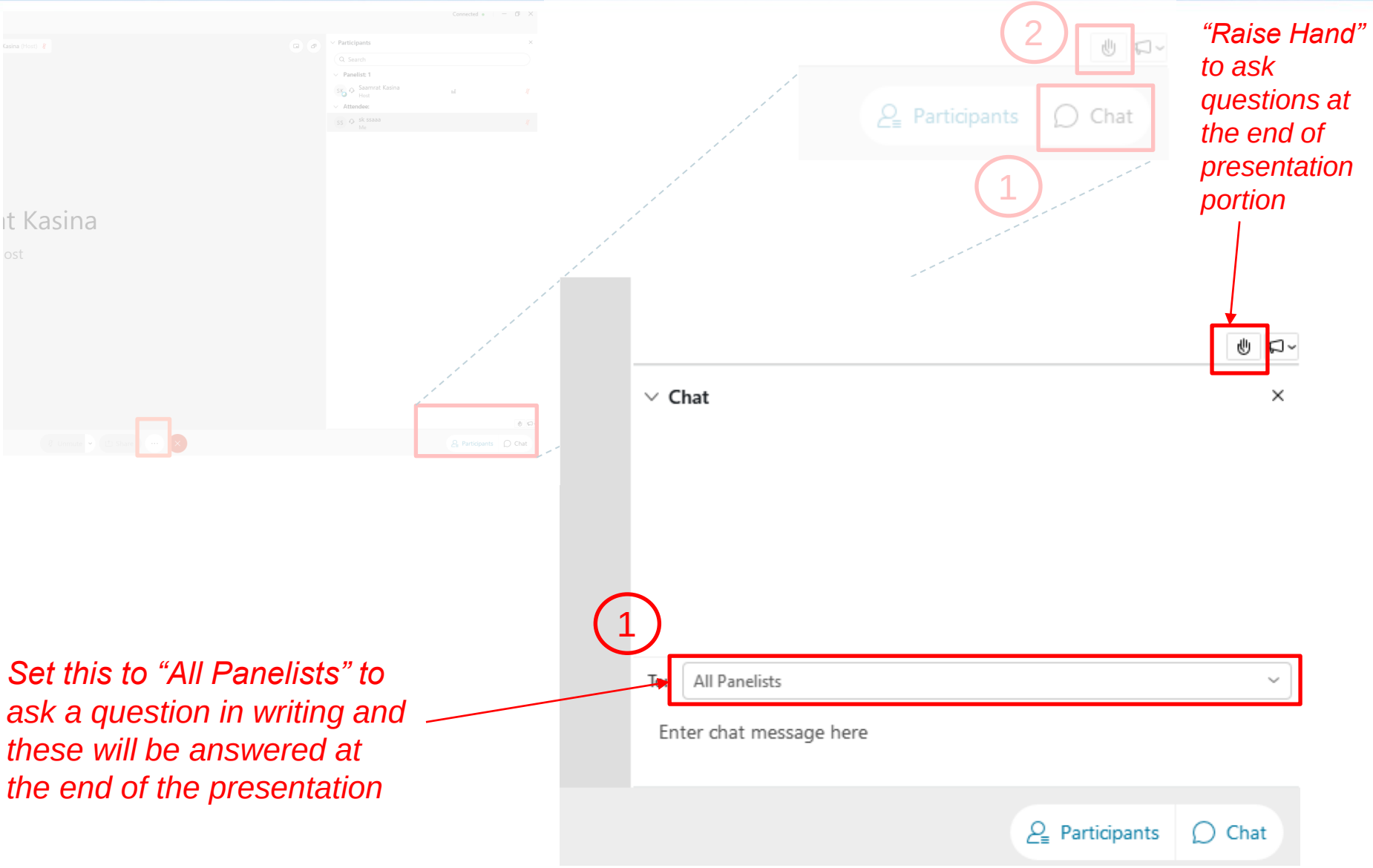
Two Ways to Ask Questions

+ Questions will be answered at the end of the presentation portion



+ Please use the ‘Chat’ feature or ‘Raise Hand’ to ask questions

Two Ways to Ask Questions



Set this to "All Panelists" to ask a question in writing and these will be answered at the end of the presentation

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Introductions

About E3

Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

- **Founded in 1989, E3 is a leading consultancy in the electric power sector – offices in Boston, New York, San Francisco, and Calgary**
- **E3 consults extensively for utilities, developers, government agencies, and environmental groups on clean energy issues**
- **Our experts provide critical thought leadership, publishing regularly in peer reviewed journals and leading industry publications**
- **We have conducted 100% Clean Energy Studies across the U.S., including:**
  - **US wide:** United Nations
  - **New York:** NYSERDA
  - **New England:** Calpine
  - **PJM:** Electric Power Supply Association
  - **Upper Midwest:** Xcel Energy
  - **California:** CPUC, CEC, SMUD, LADWP, The Nature Conservancy, Environmental Defense Fund
  - **Hawaii:** HECO
  - **Pacific Northwest:** numerous utilities

SUSTAINABLE DEVELOPMENT SOLUTIONS NETWORK
A GLOBAL INITIATIVE FOR THE UNITED NATIONS

IDDRI
SciencesPo.

About Applied Economics Clinic

- **The Applied Economics Clinic (AEC) is a non-profit consulting group offering low-cost expert services from seasoned professionals while providing on-the-job training to the next generation of technical experts.**
- **Founded by Elizabeth A. Stanton, PhD in 2017, AEC makes its expertise available to public service organizations working on topics related to the environment, consumer rights, the energy sector, and community equity.**
- **AEC has expertise in areas related to clean and just energy transitions, climate and energy policy impacts and community equity. Some examples of our work in these areas include:**
  - **Social Equity Analysis of Carbon Free Boston:** In 2019, AEC staff worked together with All Aces and the Institute for Sustainable Energy at Boston University to produce *Carbon Free Boston: Social Equity Report 2019* on behalf of the Boston Green Ribbon Commission. The report details how actions taken toward carbon neutrality will affect socially vulnerable populations and provides a roadmap to equitably engage the City's communities in climate action.
  - **Visualizations of Racial Inequity for Renew New England:** In 2020, AEC staff worked on behalf of the Renew New England coalition to produce multiple sets of data graphics to demonstrate racial/ethnic disparities across as many as 23 measures of wellbeing, like income, education or incarceration.

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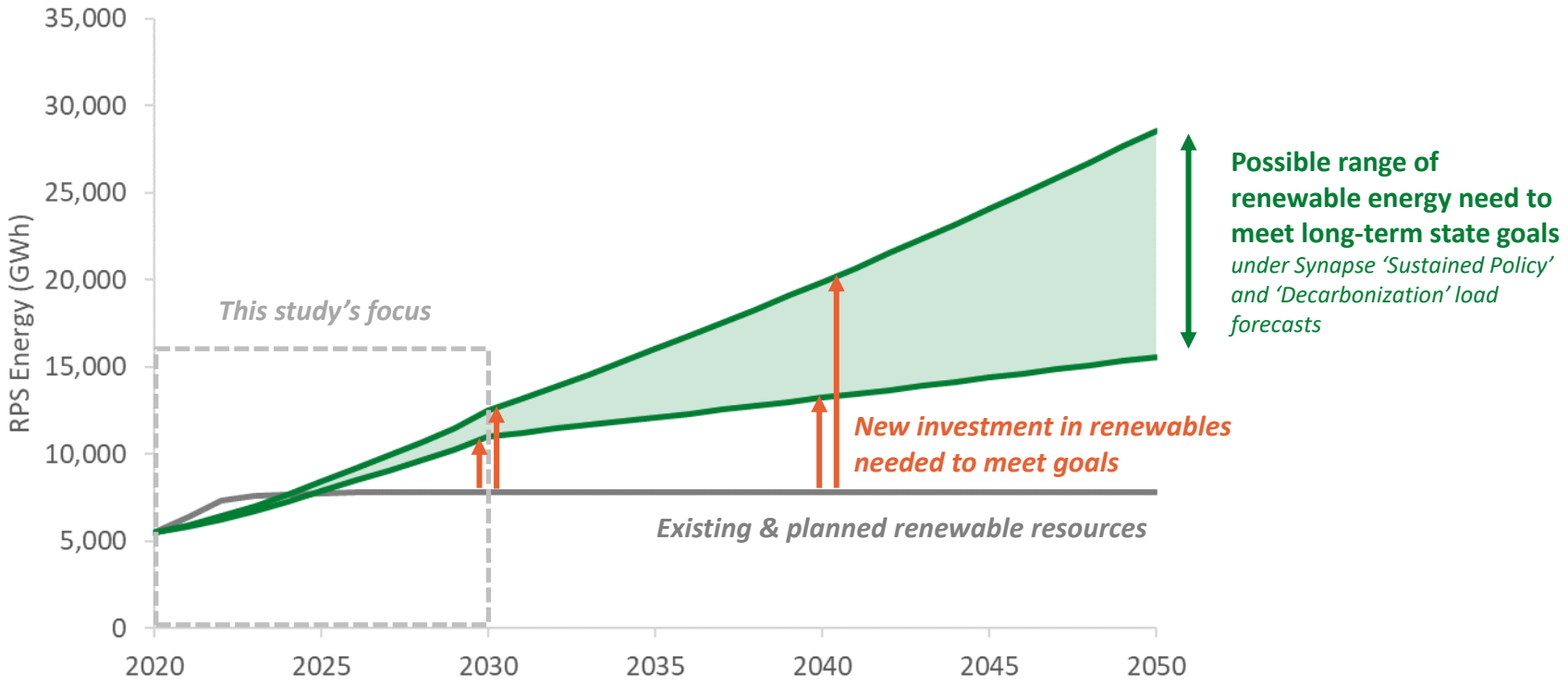
Study Objectives

Study Objectives

- **The primary purpose of this study is to provide plausible projections of how much renewable energy and infrastructure might be built in Maine over the next 10 years to meet the 80% by 2030 RPS goal, and assess the policy and regulatory mechanisms that may influence the timing and cost to rate payers of meeting the state's RPS**
  - What resources and transmission may be needed to meet Maine's increasing goals?
  - What are the cost and equity considerations associated with different portfolios?
- **To achieve this goal, E3 is creating a spreadsheet model that will utilize a scenario approach to develop multiple futures of renewable energy development**
  - Will consider several variables including resource economics, energy policy, commercial interest, and land use impacts
- **This presentation presents the scenario design approach and highlights some key inputs and assumptions for the modeling**

Maine's Pathways to Long-Term Policy Goals

- Maine's long-term RPS targets and decarbonization policies will require significant levels of investment in new renewable resources
- This study focuses on how the state can meet key interim milestones (80% RPS by 2030) within the next decade to build a foundation for long-term policy success



*May use a recently updated Synapse load forecast

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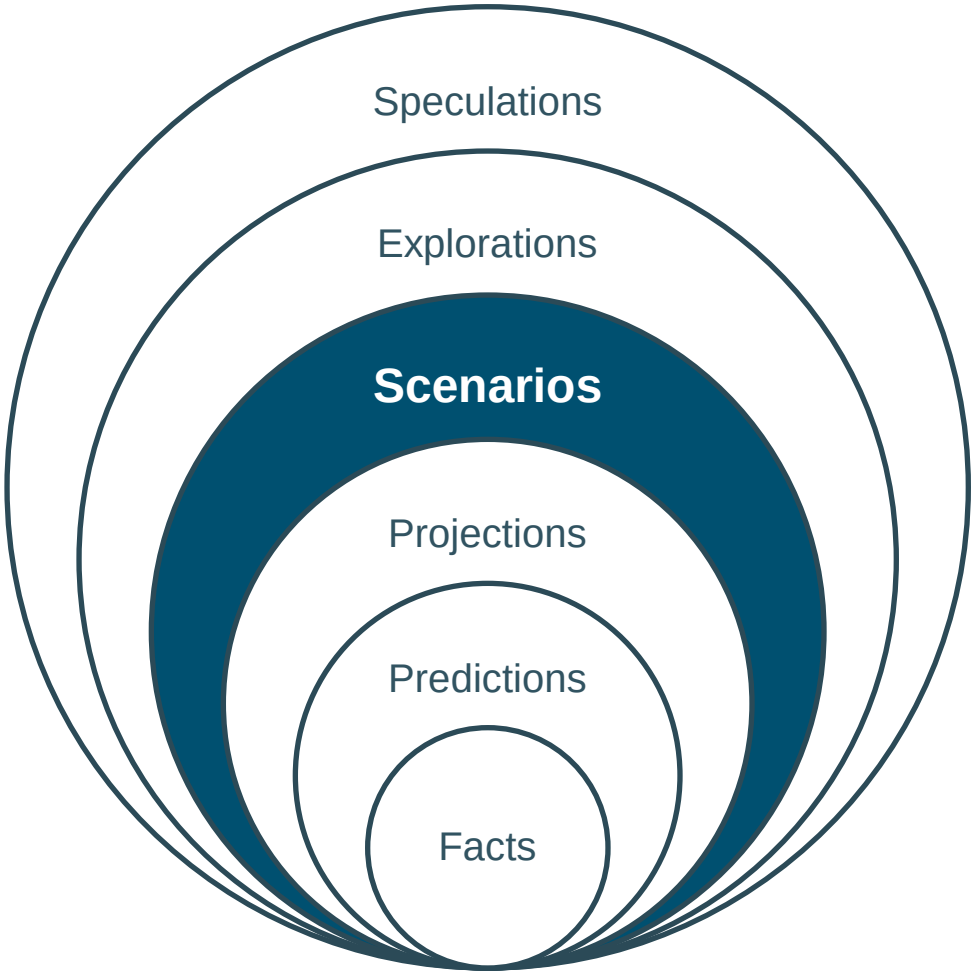
Scenario Design

Scenario Analysis Framework

- This study uses scenario analysis to identify and analyze plausible outcomes for renewable development within the state of Maine over the next 10 years

- Goal of scenario analysis is not to predict an outcome - but to highlight key drivers of and differences between scenarios to inform future decision making



Issues & Questions to Consider in Choosing Scenarios

- **Study will use scenario analysis to identify multiple portfolios that capture plausible outcomes for renewable development in Maine over the next 10 years**
- **Many factors could affect development patterns in the state, including:**
  - Commercial viability & scalability of resource technology options
  - Potential and development of energy generation resources such as wind, solar, hydro, biomass, waste-to-energy, and anaerobic digestion.
  - Limitations of existing transmission system and challenges of building new
  - Future load growth, including efficiency, demand response, electrification, and potential opt-outs
  - Increased deployment of distributed energy resources (DER)
  - Land use considerations
  - Increased/accelerated state policy targets
  - Focus on in-state vs. out-of-state procurement to meet Maine's needs
  - Procurement of resources in Maine to meet needs of other states
  - Consideration of other factors, including workforce development and equity

Q: Are there additional factors that should be considered for designing scenarios?

Overview of Scenario Design

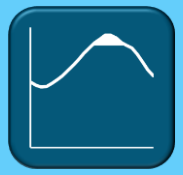
- **Planned scenarios are designed to examine how the costs and benefits change with different technology priorities and policy options emphasized**
  - Focus on resources within Maine and builds through 2030
  - Transmission and land use implications of each scenario will be important outcomes
- **Scenarios will be compared to a baseline reflecting current expectations of load growth in Maine and current trends for meeting the state's RPS goals**
- **Each scenario will have a "primary" focus, but will not be the only source of new renewables in that scenario (e.g., geographic and technology diversity in all)**

Potential Primary Focus Areas

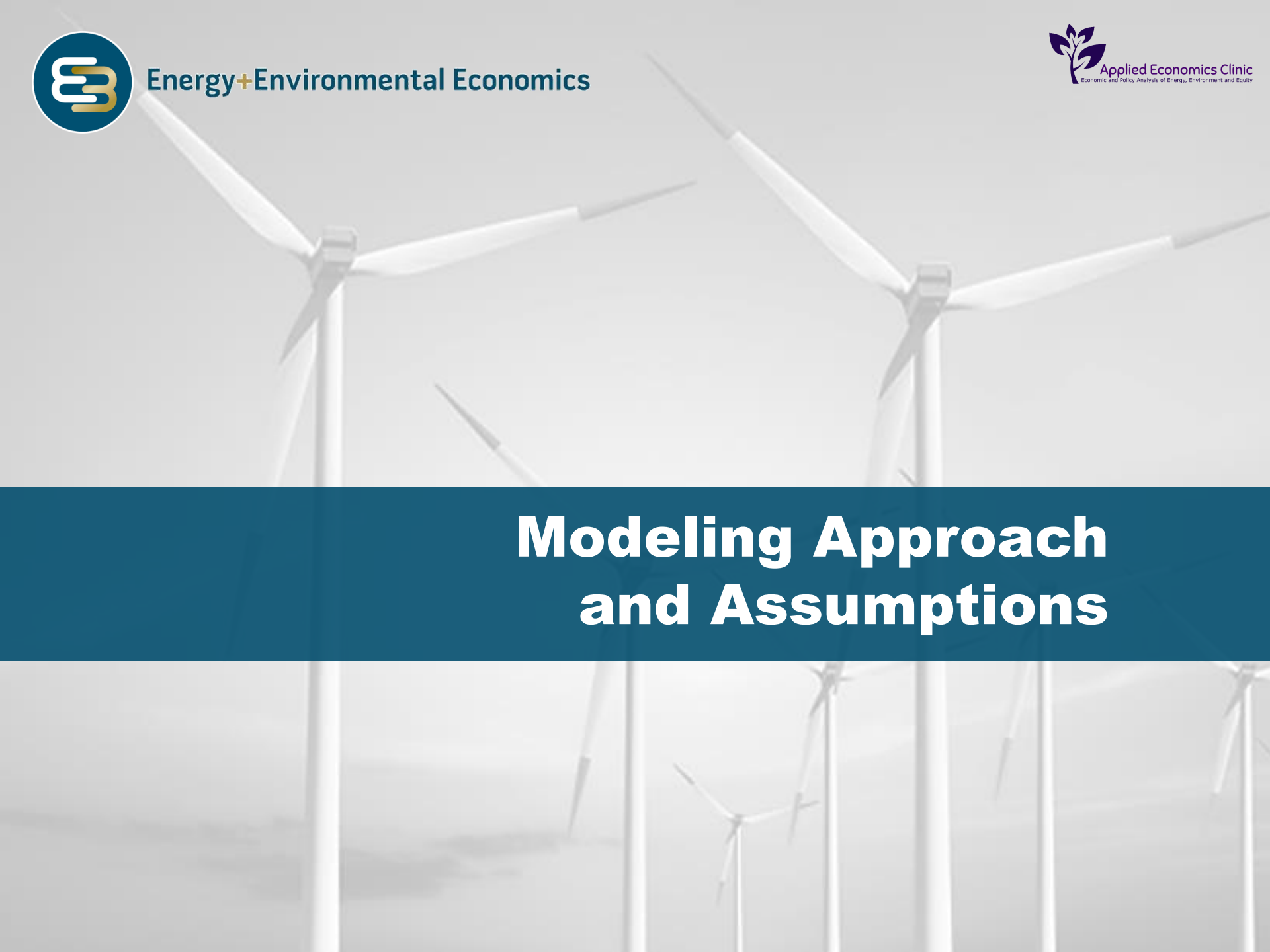
Offshore Wind

Distributed Energy Resources

Load Flexibility



"Balanced" Scenario



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Modeling Approach and Assumptions

Overview of E3 RPS Planning Tool

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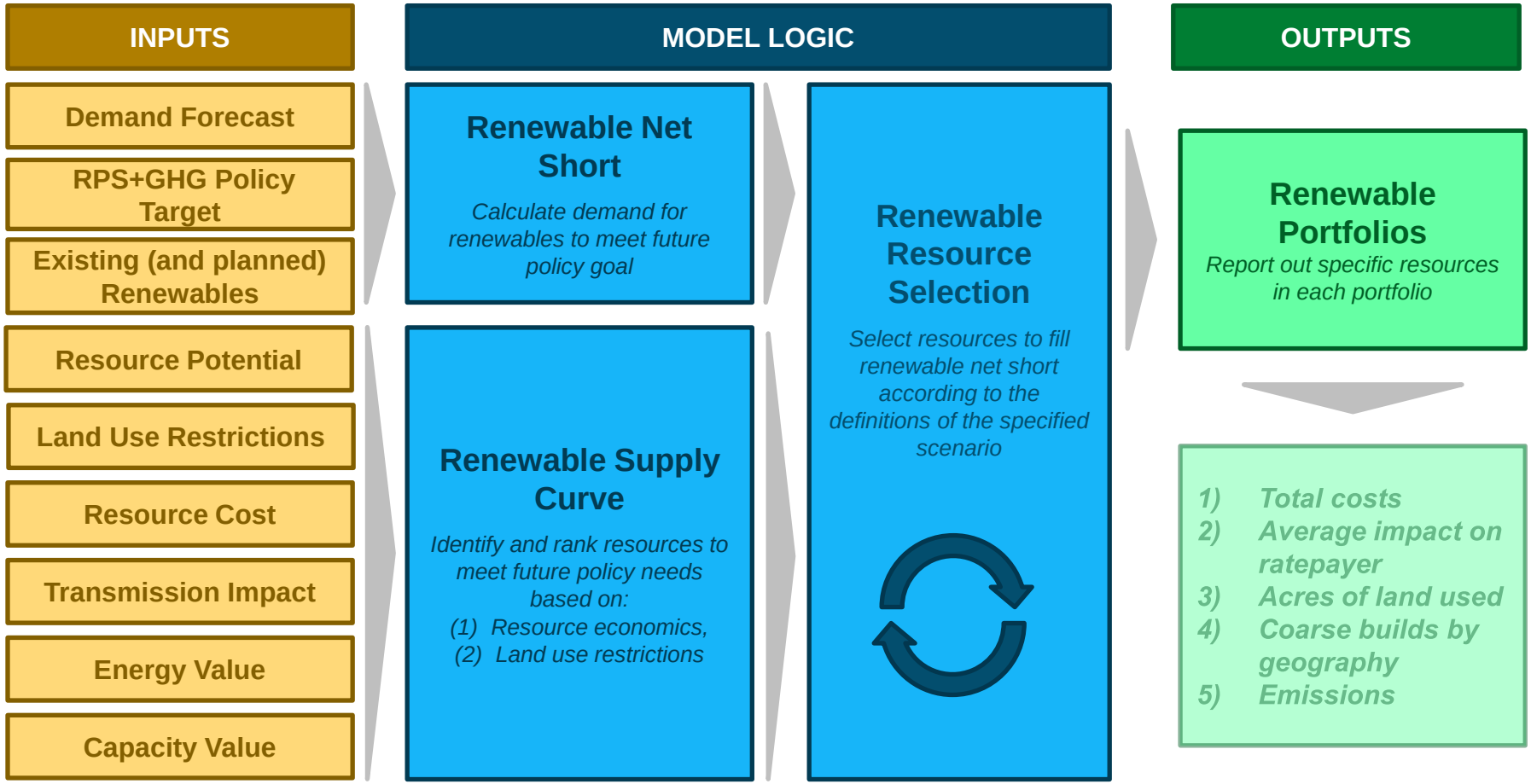
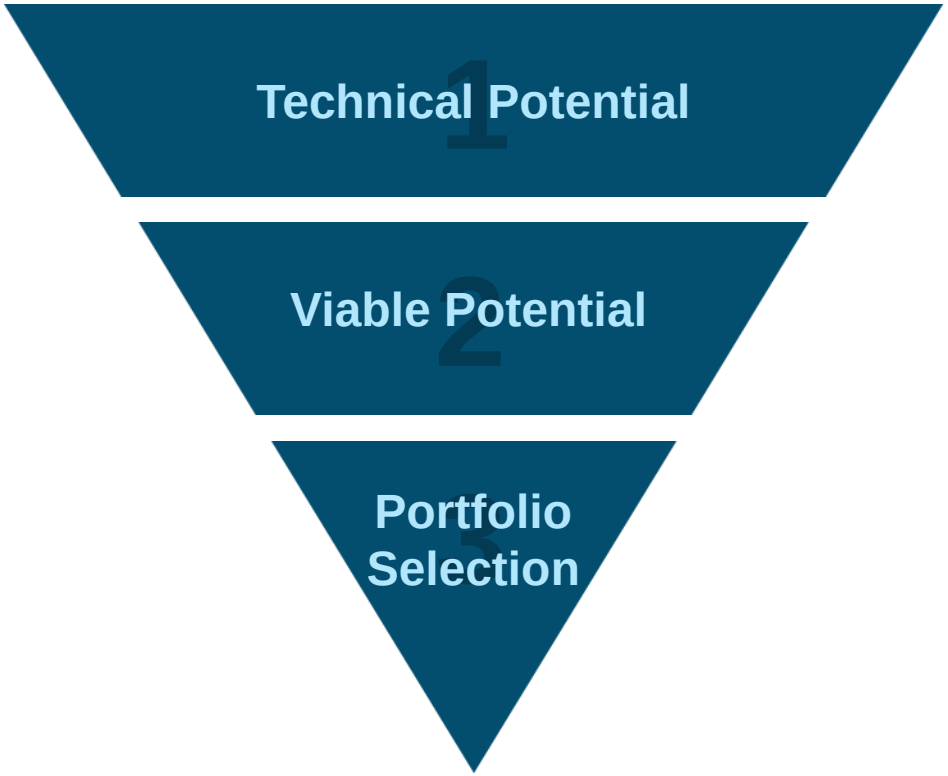
E3's RPS Planning Tool will generate RPS portfolios for Maine over the next decade under different sets of planning assumptions



Renewable Resource Potentials

- E3 will develop a renewable energy supply curve from NREL Regional Energy Deployment System (ReEDS) dataset – widely used in several planning studies
- Additional screens, such as land-use, will be added onto the ReEDS potentials to produce viable potentials – the maximum amount of each type of resource that can reasonably be developed by 2030
- The RPS Planning Tool will then develop plausible portfolios of resources to meet future state goals informed by an economic assessment of resource options

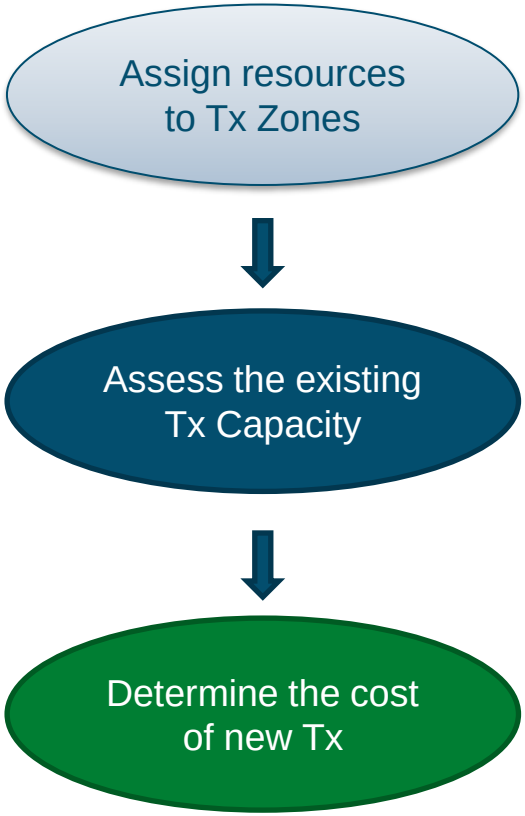
Developing Renewable Portfolios



Approach to Transmission

- **Joint planning of transmission and generation is complicated!**
- **To understand implications of renewable development on transmission needs, we ask three questions:**
  - Where are key transmission constraints within Maine (relative to potential renewable resources)?
  - How much new generation capacity can be developed within limits of existing system?
  - How much will new transmission investments increase transfer capability within and between zones?
- **Discussions with GEO and stakeholders will develop a zonal approach to transmission needs and costing in RPS model**

Transmission Development Analysis Process



Q: Which areas within Maine require new transmission infrastructure to facilitate renewable development?

Data Sources

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	Solar PV	Wind (Onshore)	Wind (Offshore)	Biomass, hydro
Potential • Technical potential (MW)	**NREL ReEDS Datasets** *7 TRGs, 134 zones*	*10 TRGs, 356 zones*	*15 TRGs, 70 zones*	***Climate Council-Synapse modeling, Discussions with stakeholders***
Technology Cost • Capital cost ($/kW) • Fixed O&M ($/kW-yr) • Interconnection cost ($/kW)	**NREL Annual Technologies Baseline** *Supplemented with regional cost adjustment factors and locational interconnection costs from NREL ReEDS datasets*			
Financing • Project capital structure • Tax credits	**E3 Pro Forma Financial Model** *Calculates cost-based power purchase agreement between third-party developer and credit-worthy utility*			
Hourly Profiles • Site-specific hourly capacity factors (%)	**NREL System Advisor Model (SAM)** *Hourly simulations based on NREL National Solar Radiation Database*	**NREL WIND Toolkit** *Hourly simulations based on mesoscale meteorological modeling*		
Loads • Annual loads • Electrification, EV projections	**Climate Council - Synapse Modeling** *Includes scenarios of heating, and EV projections*			
Transmission zones • Transmission constraints • Upgrade costs	**LD 1401 Stakeholder Study on Transmission, Discussions with stakeholders**			

Q: Are there additional data sources that should be considered?

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Equity Considerations in Maine

Maine Equity Context

- **One aspect of the Renewable Energy Market Assessment is to assess the equity considerations of meeting Maine's RPS**
  - The Applied Economics Clinic (AEC) has been contracted to assess how to best address the unique needs of Maine's underserved communities, such as low-and moderate-income households, as the state moves towards its renewable energy goals
- **Maine has several existing programs, policies and organizations that are working toward greater equity and justice in the energy sector, including but not limited to:**
  - **Maine Climate Council**: Performed an equity audit of Maine's Climate Action Plan
  - **Efficiency Maine**: Offers multiple low-income programs and produces annual reports on the performance and achievements of these programs
  - **Maine Office of the Public Advocate**: Represents the interests of Maine utility customers and advocates for rates and services that do not place undue burdens on vulnerable Mainers
  - **Maine Housing**: Offers a number of energy-related programs targeted for low to moderate income households, including assistance for heating and electricity costs, weatherization, heat pump installation, and education on reducing home energy needs

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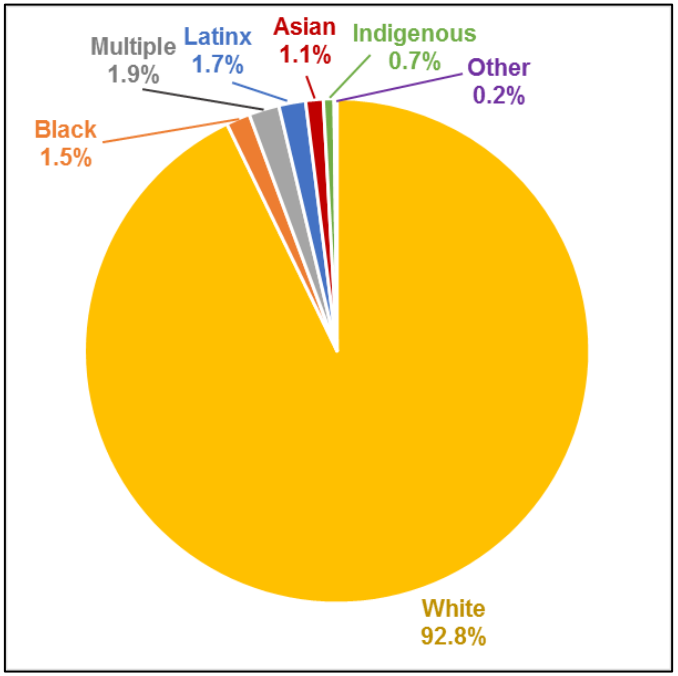
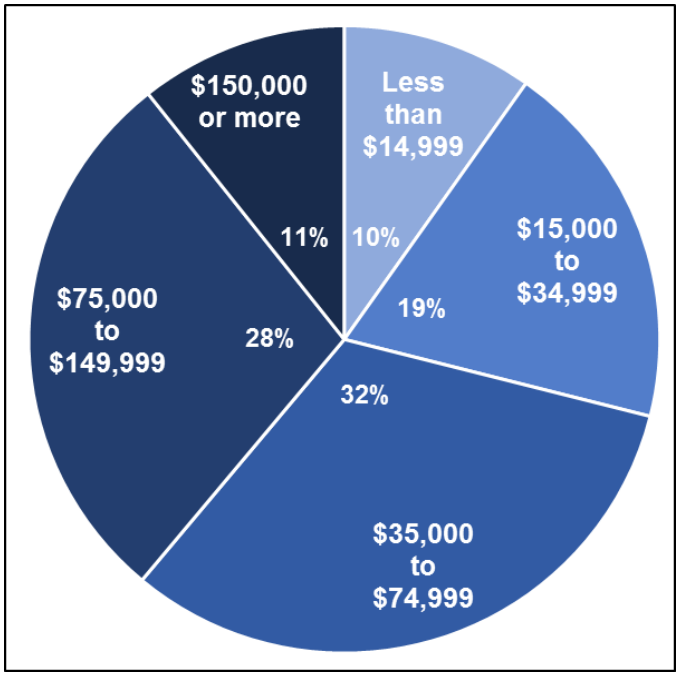
Maine's Population and Household Income

- Maine has a healthy middle class—larger than the national average
- Less than 10 percent of Maine's population is people of color
- Only 5 percent of Maine's population is Black, Latinx, Asian or Indigenous

2019 Maine population, by race/ethnicity and Maine households, by income





Data source: U.S. Census Bureau, 2019 American Community Survey 1-Year Estimates. "ACS Demographic and Housing Estimates" (Table DP05) and "Earnings in the Past 12 Months" (TableID: S2001).

Maine's Population Compared to U.S.

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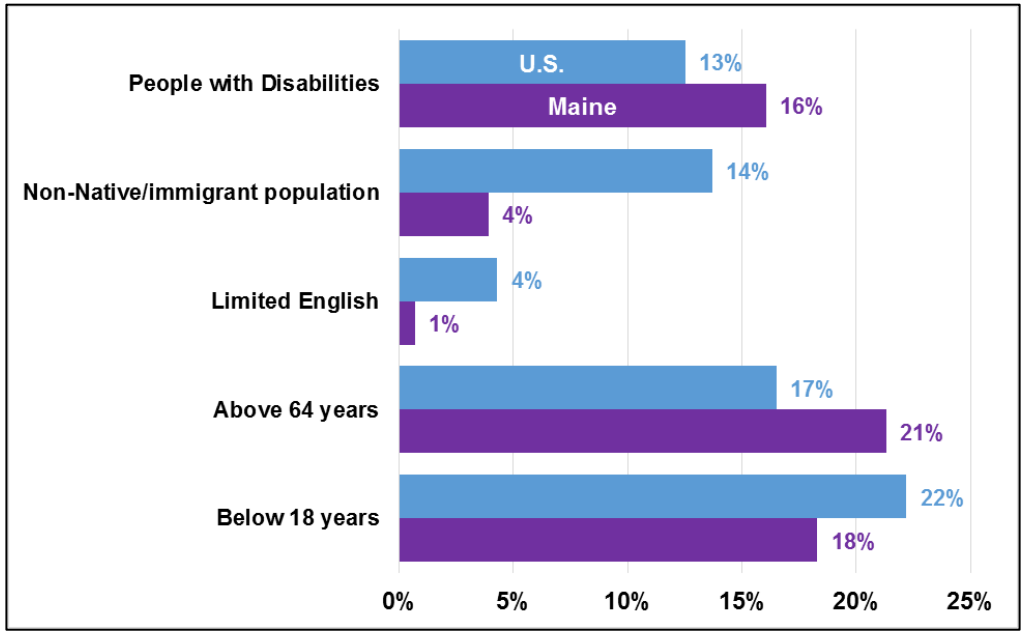
- **Compared to the U.S. (as a share of total population), Maine has:**
  - More people with disabilities,
  - Fewer immigrants,
  - Fewer limited English speakers,
  - More older people, and
  - Fewer younger people.

Share of 2019 Maine population: people with disabilities, immigrants, speak a non-English language, older than 64, and younger than 18



Data source: U.S. Census Bureau, 2019 American Community Survey 1-Year Estimates. "Limited English Households" (Table S1602), "Nativity and Citizenship Status in the United States" (Table B05001), "Disability Characteristics" (Table S1810), "Age and Sex" (Table S0101).

Vulnerable Populations in Maine

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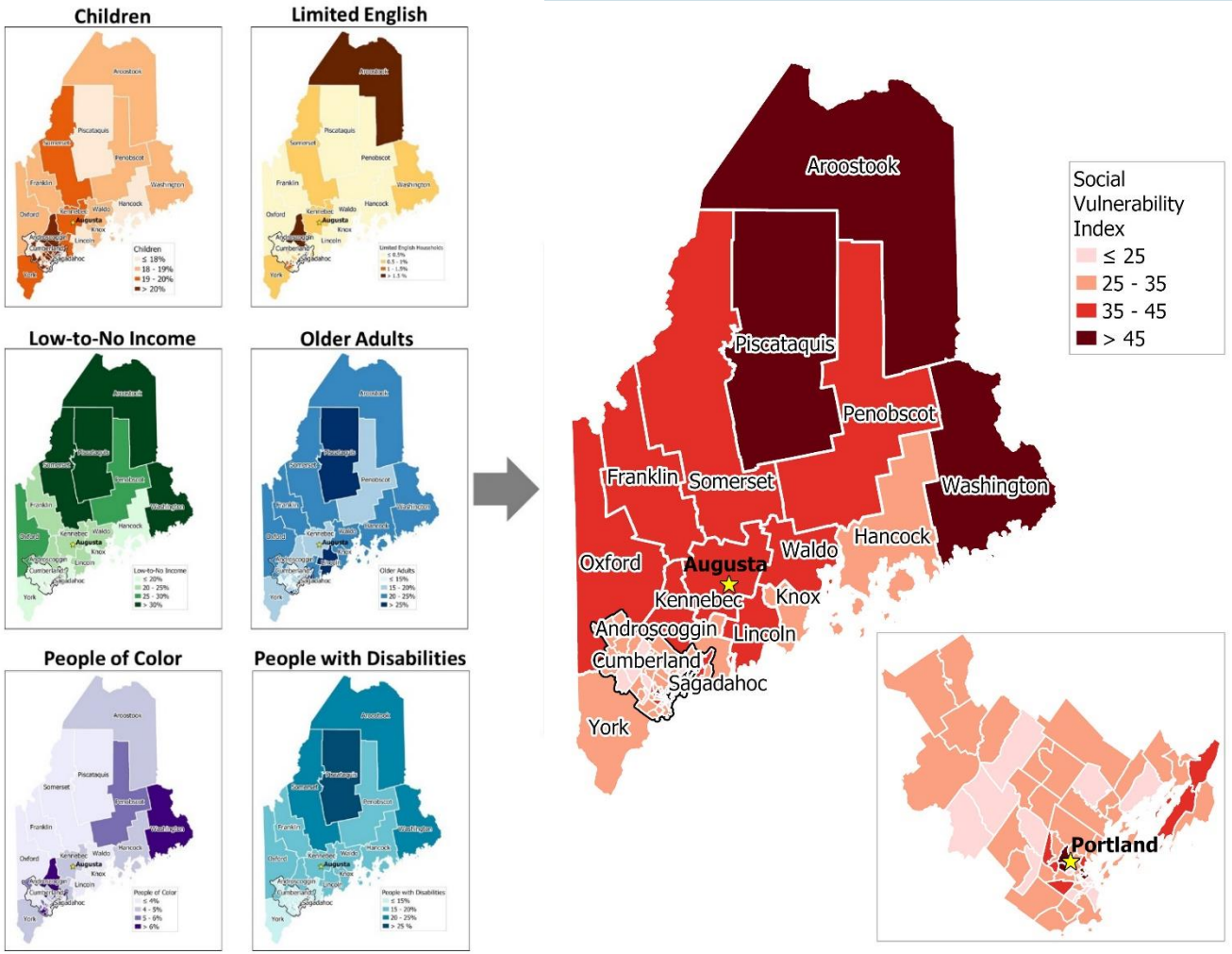
- The most socially vulnerable populations in Maine are concentrated in the north and northeastern parts of the state, and are characterized by low to no income, limited English, and people of color.
- There are large vulnerability disparities within Portland.
- Each component of the social vulnerability index is equally weighted and the index scale is unique to Maine.

Maine social vulnerability index

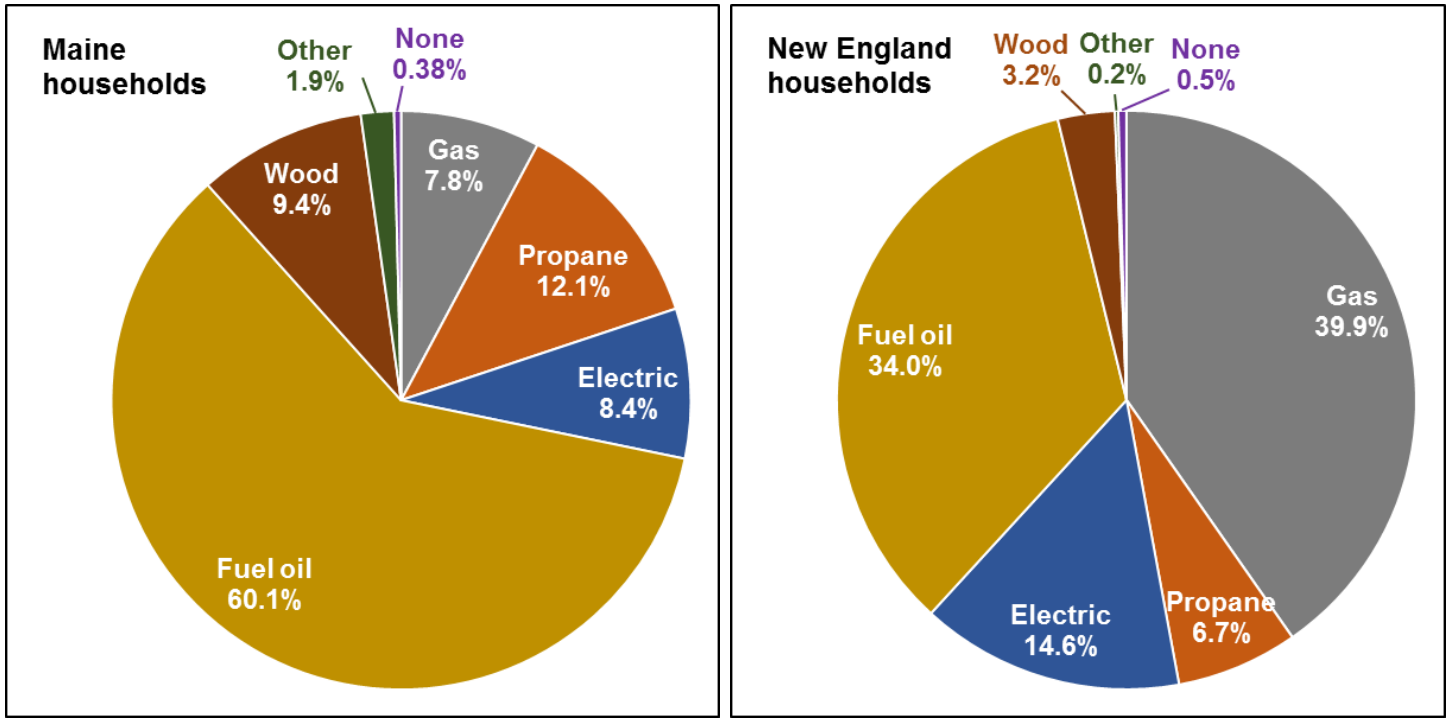


Source: AEC calculations using U.S. Census Bureau. 2019. American Community Survey 1-Year Estimates.

Heating Sources: Maine vs New England Households

- Maine is heavily dependent on fuel oil for heating: About twice as many Maine households use oil to heat their homes compared to all households in New England

Heating sources of Maine households and New England households

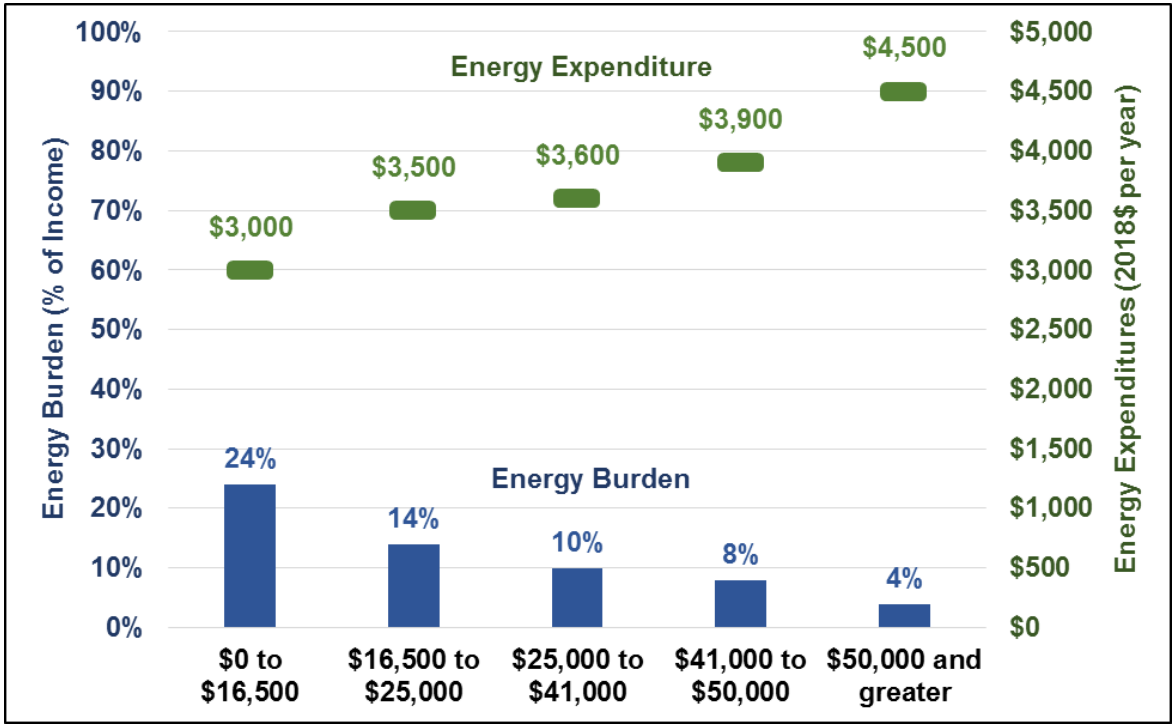


Data source: American Community Survey 1-Year Estimates Subject Tables. 2019. "House Heating Fuel". (Table B25040).

Maine Household Energy Burden

- Household energy burdens (the percentage of income spent on energy) are greatest for Maine's low to no income households and lightest for Maine's wealthiest households

Maine household's energy burden (% of income) and energy expenditure (2018$), by income



Data source: Allison, A. et al. 2019. Maine Low-Income Home Energy Burden Study. Prepared for Maine Office of the Public Advocate. Synapse.

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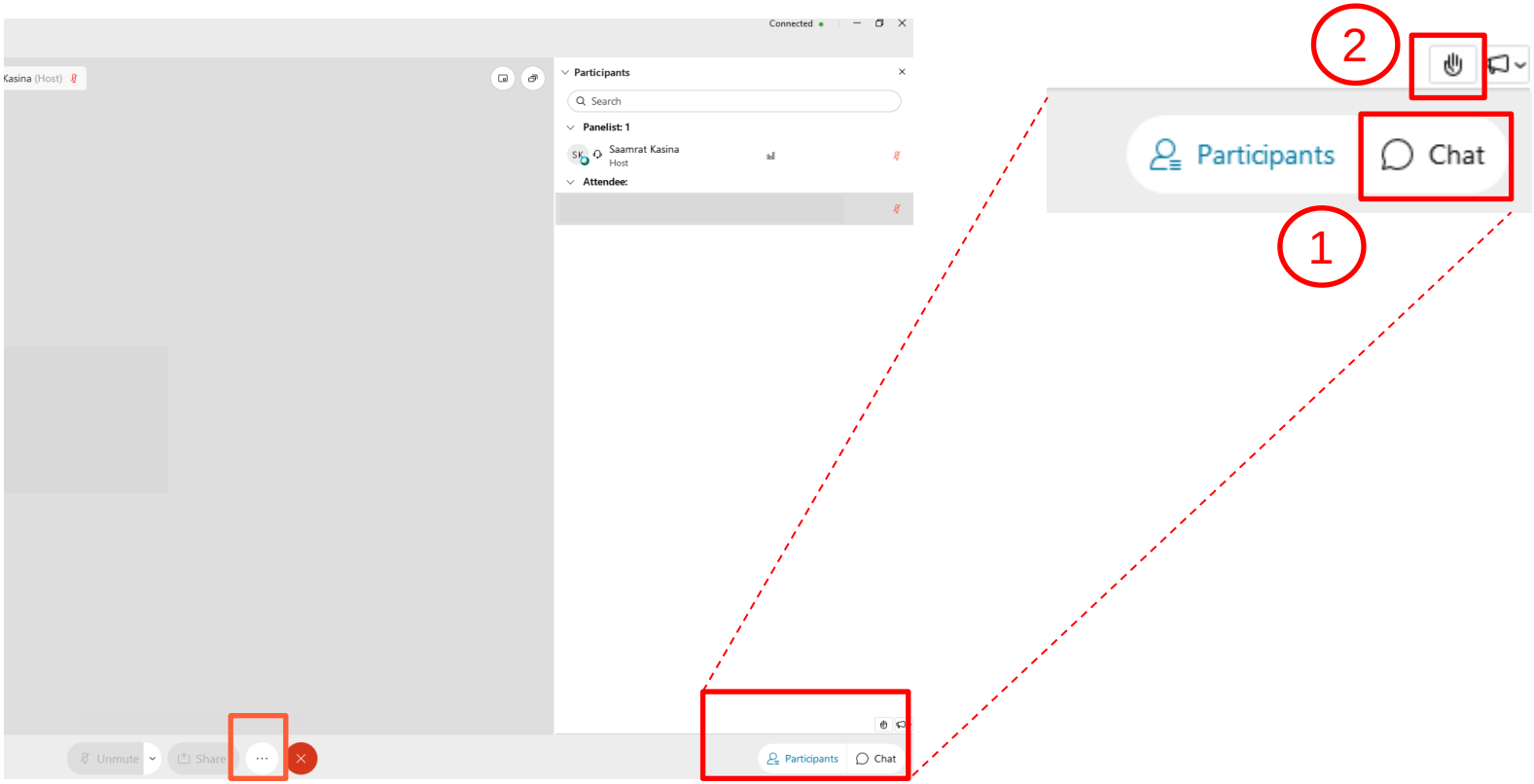
Study Q&A with Stakeholders

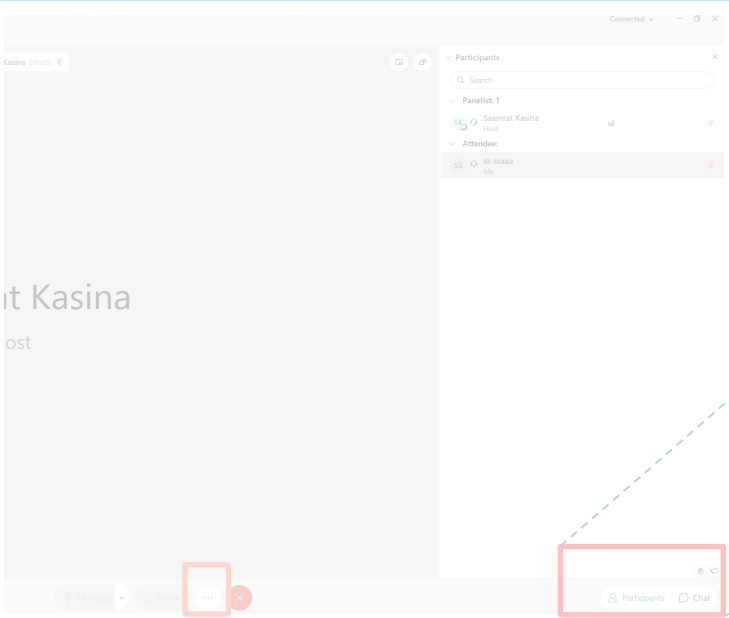
Two Ways to Ask Questions

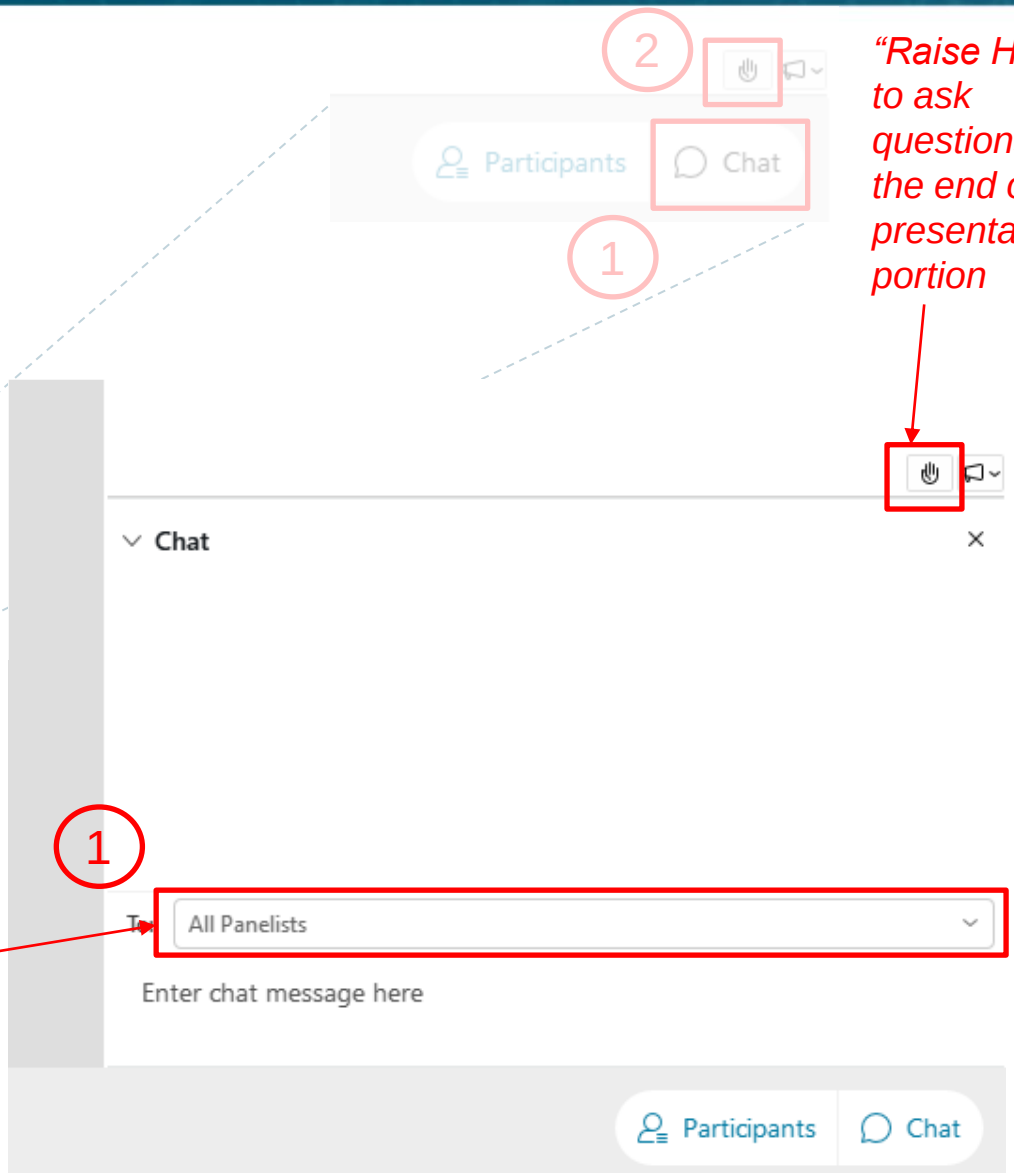
+ Questions will be answered at the end of the presentation portion



+ Please use the ‘Chat’ feature or ‘Raise Hand’ to ask questions

Two Ways to Ask Questions





Set this to "All Panelists" to ask a question in writing and these will be answered at the end of the presentation

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Feedback and Next Steps

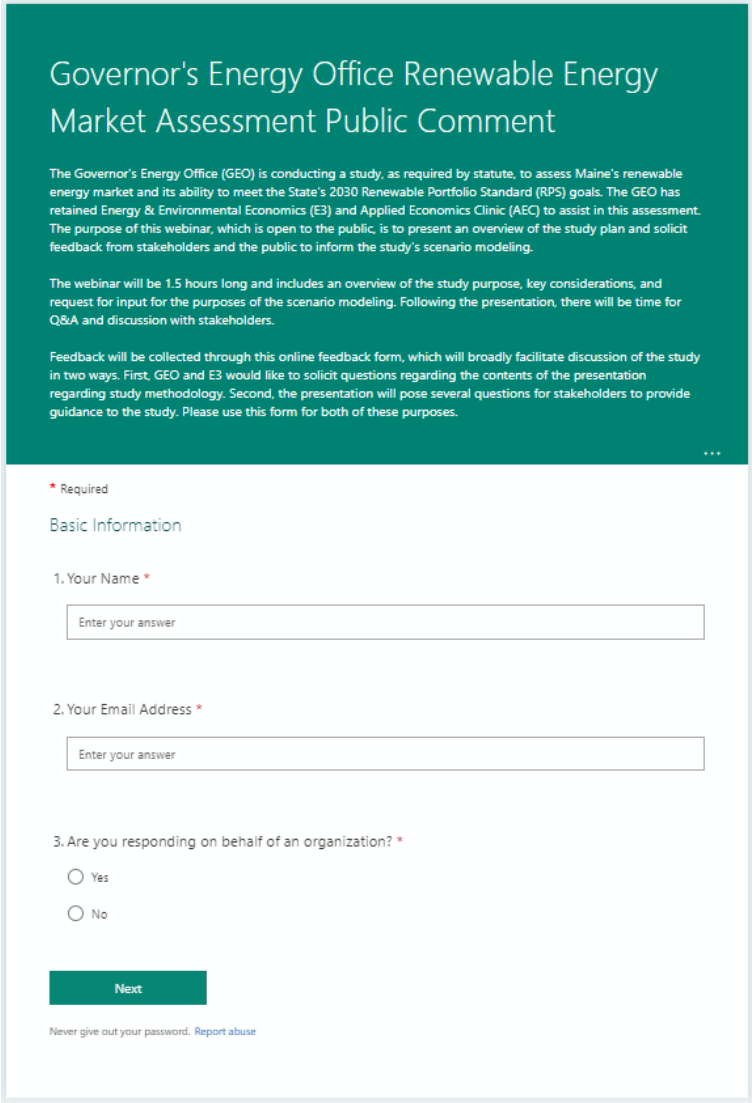
Feedback Questions

Topic	Question(s)
Policy	Are there specific policy options you would like to see considered in planning and procurement related to Maine's RPS?
Scenario Design	Do you have any feedback on the list of factors, or are there additional factors that should be considered for designing scenarios? Do you have feedback on any of the scenario focus areas or considerations specific to a particular scenario focus area?
Transmission	Which areas within Maine require new transmission infrastructure to facilitate renewable development?
Data Sources	Are there additional data sources that should be considered?
Equity	How can Maine pursue a greater share of renewable energy in a just and equitable manner? Do you have any equity or justice concerns related to the renewable scenarios presented today?
Other	Please provide any additional feedback not covered in the categories above.

Please submit your responses and feedback at: https://bit.ly/3oR3lCd

How to Submit Feedback

- **Link to submit feedback:**
  - https://bit.ly/3oR3lCd
  - Link also posted on the GEO RPS study page
- **What we are looking for:**
  - Specific responses to questions posed in this presentation
  - General feedback on study
- **Your feedback will be considered as scenarios are finalized and modeling begins**
- **If you would like to submit an attachment, please email Melissa.Winne@maine.gov**
- **We request that feedback is submitted by close of business 11/13/2020**



Governor's Energy Office Renewable Energy Market Assessment Public Comment

The Governor's Energy Office (GEO) is conducting a study, as required by statute, to assess Maine's renewable energy market and its ability to meet the State's 2030 Renewable Portfolio Standard (RPS) goals. The GEO has retained Energy & Environmental Economics (E3) and Applied Economics Clinic (AEC) to assist in this assessment. The purpose of this webinar, which is open to the public, is to present an overview of the study plan and solicit feedback from stakeholders and the public to inform the study's scenario modeling.

The webinar will be 1.5 hours long and includes an overview of the study purpose, key considerations, and request for input for the purposes of the scenario modeling. Following the presentation, there will be time for Q&A and discussion with stakeholders.

Feedback will be collected through this online feedback form, which will broadly facilitate discussion of the study in two ways. First, GEO and E3 would like to solicit questions regarding the contents of the presentation regarding study methodology. Second, the presentation will pose several questions for stakeholders to provide guidance to the study. Please use this form for both of these purposes.

* Required

Basic Information

1. Your Name *

Enter your answer

2. Your Email Address *

Enter your answer

3. Are you responding on behalf of an organization? *

Yes

No

Next

Never give out your password. Report abuse

Process and Schedule

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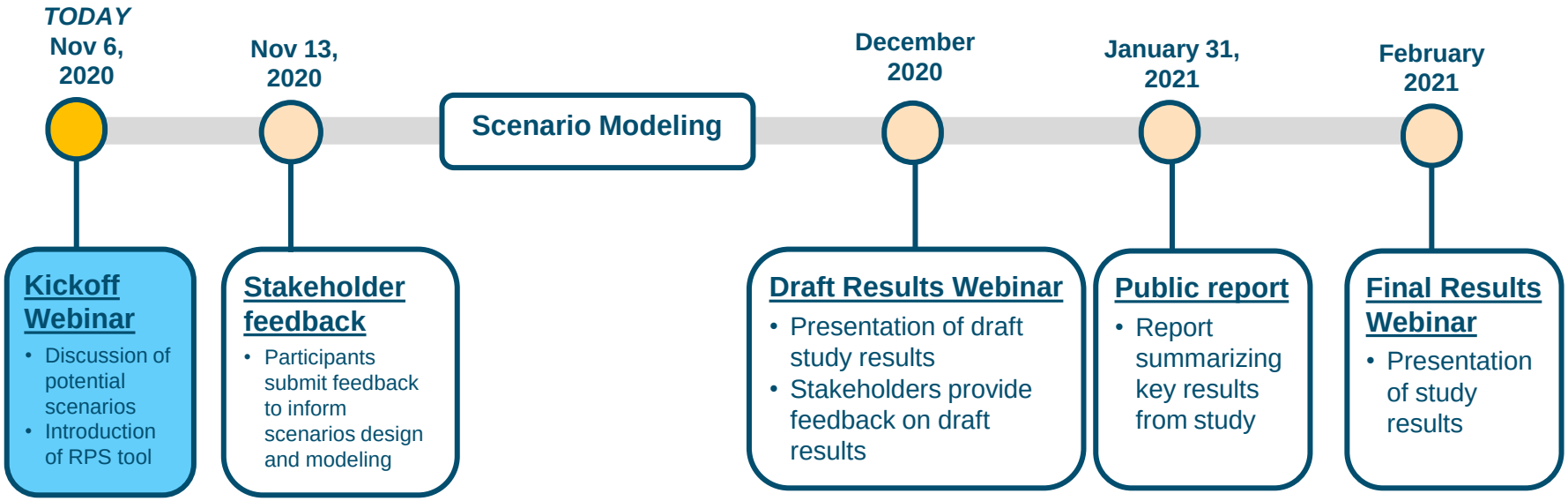
Stakeholders have an opportunity to submit input into the design and testing of potential scenarios. E3 will report out on the results of each scenario and their portfolio and cost differences from a baseline case.

1. **Stakeholders submit feedback on scenario design and modeling by Nov. 13, 2020**
2. **GEO, E3, and AEC conduct analysis through January 2021**
3. **GEO, E3, and AEC will present draft results in December 2020 and stakeholders to provide feedback on draft results**
4. **Report summarizing study findings will be released by January 31, 2021**
5. **GEO, E3, and AEC to present final results in February 2021**



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Thank You

Melissa Winne, Melissa.winne@maine.gov

Saamrat Kasina, saamrat@ethree.com

Bryndis Woods, bryndis.woods@aeclinic.org