GOVERNOR'S
Energy Office

Maine Renewable Energy Market Assessment

February 17, 2021

****WEBINAR WILL BEGIN AT 11:00 AM****


GOVERNOR'S
Energy Office
Dan Burgess, Director

GOVERNOR'S ENERGY OFFICE

Renewable Energy Goals Market Assessment

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

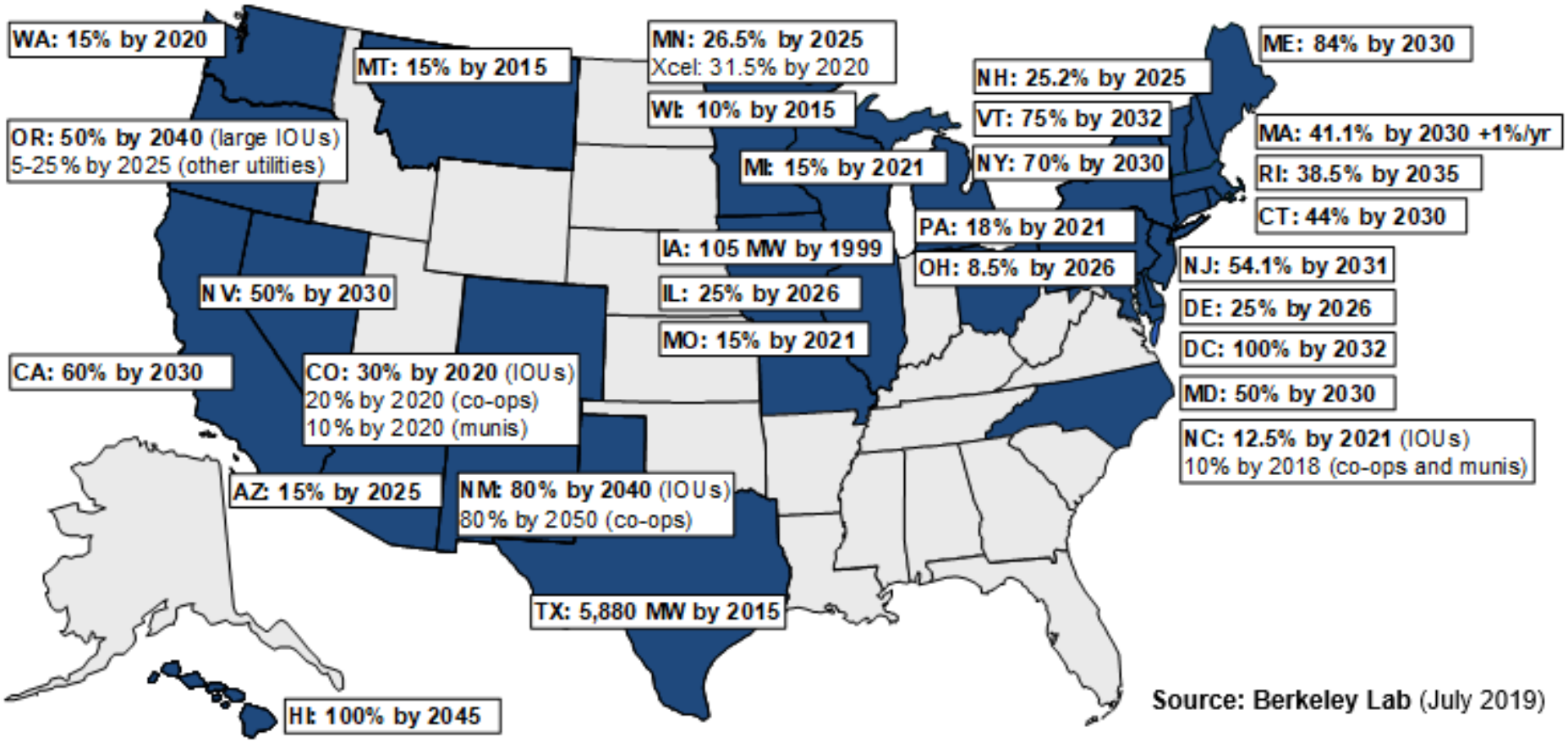
Resilience: Develop strategies that will make Maine people, industries, and communities resilient to the impacts of climate change

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 (17 renewable projects ~9.5% of State electric load)

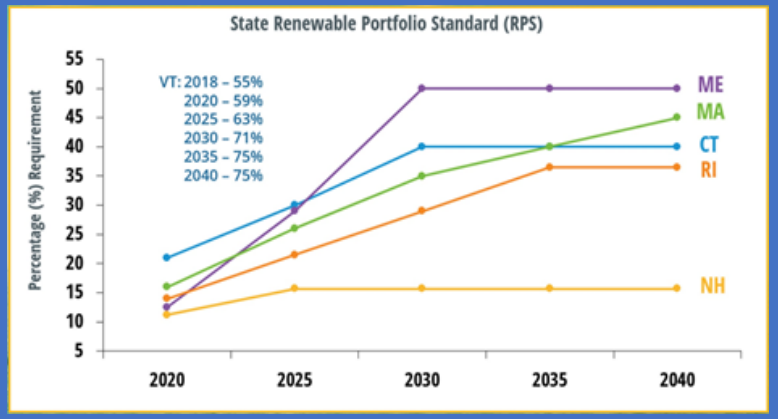
Resulted in commitment of:

- 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

- Issued January 15, 2021
- Roughly 4.5% of State electric load
- Bids due March 18, 2021

RENEWABLE PORTFOLIO STANDARD [RPS]



RENEWABLE ENERGY GOALS MARKET ASSESSMENT

LD 1494 – An Act To Reform Maine's Renewable Portfolio Standards (RPS)
Enacted and Signed on June 26, 2019

Legislation required the Governor's Energy Office and Governor's Office of Policy Innovation and the Future to **conduct a 10-year Renewable Energy Goals Market Assessment to inform how the state meets its clean energy requirements.**

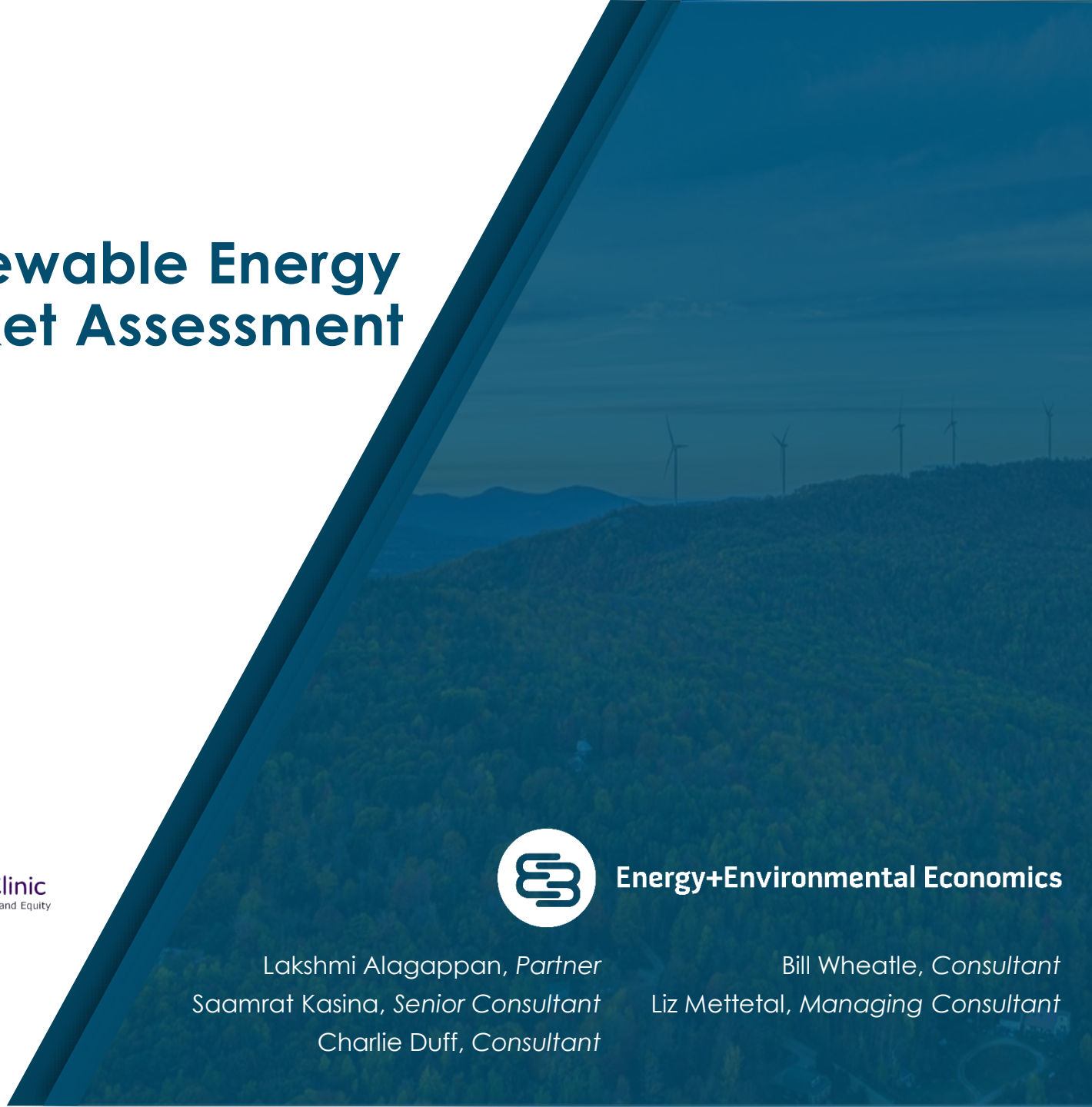
This study:

- Provides review and analysis of energy and REC need for 2030 RPS target;
- Identifies available technology and scenarios for meeting these targets;
- Analyzes policy and regulatory options to best achieve RPS targets.

GEO retained Energy & Environmental Economics (E3) and Applied Economics Clinic (AEC) to develop this assessment.

Maine Renewable Energy Goals Market Assessment

February 17, 2021



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Economic and Policy Analysis of Energy, Environment and Equity

Bryndis Woods, *Senior Researcher*
Liz Stanton, *Director*

Energy+Environmental Economics

Lakshmi Alagappan, *Partner*
Saamrat Kasina, *Senior Consultant*
Charlie Duff, *Consultant*
Bill Wheatle, *Consultant*
Liz Mettetal, *Managing Consultant*

Agenda

1	Logistics
	Using the 'Chat'/'Raise Hand' feature to ask questions in WebEx
	Introductions
2	Modeling Analysis
	Study Objectives
	Scenario Design, Modeling Approach, and Assumptions
	Scenario Results
3	Policy and Equity Considerations
	Equity Considerations
	Scenario Conclusions
	Policy Implications

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Using 'Chat' and 'Raise Hand' in WebEx to Ask Questions

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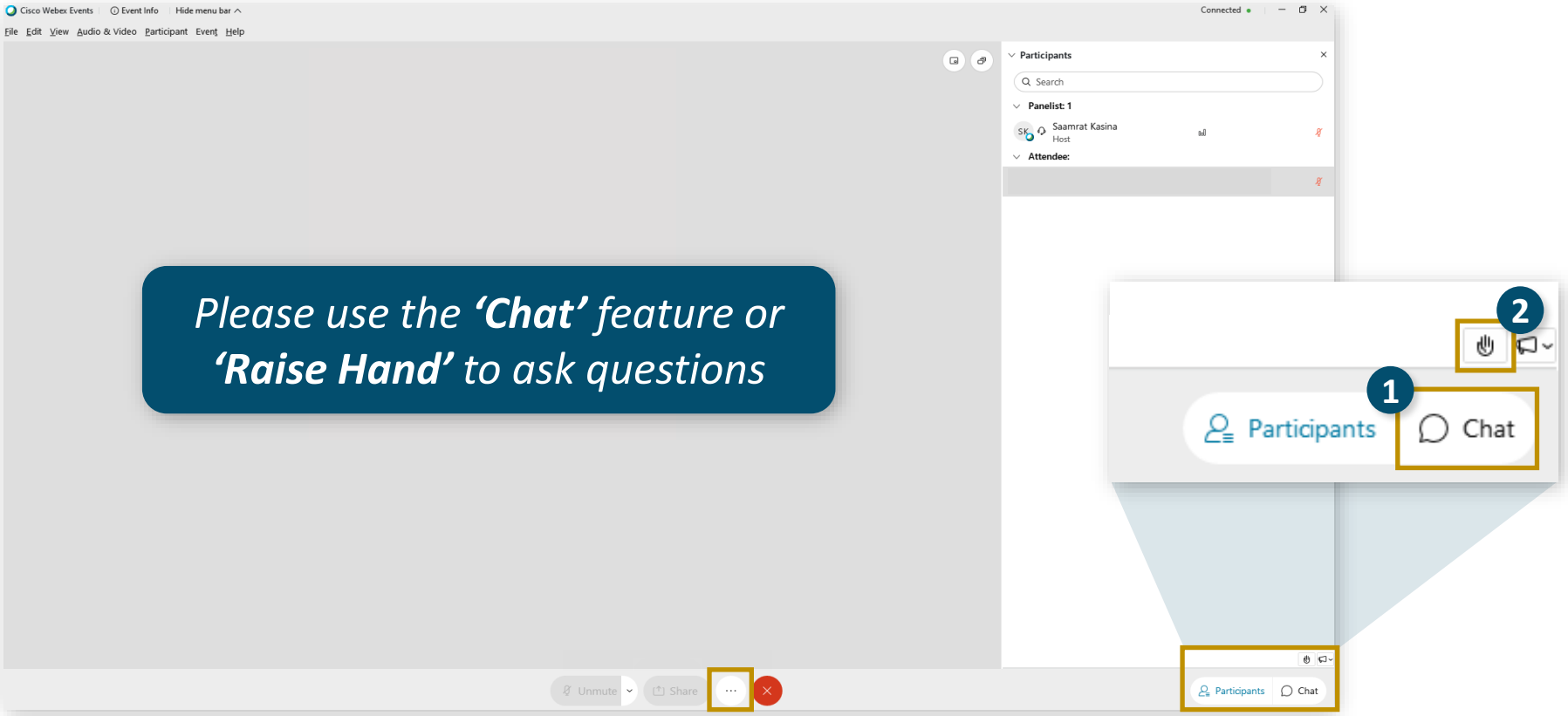
Two Ways to Ask Questions

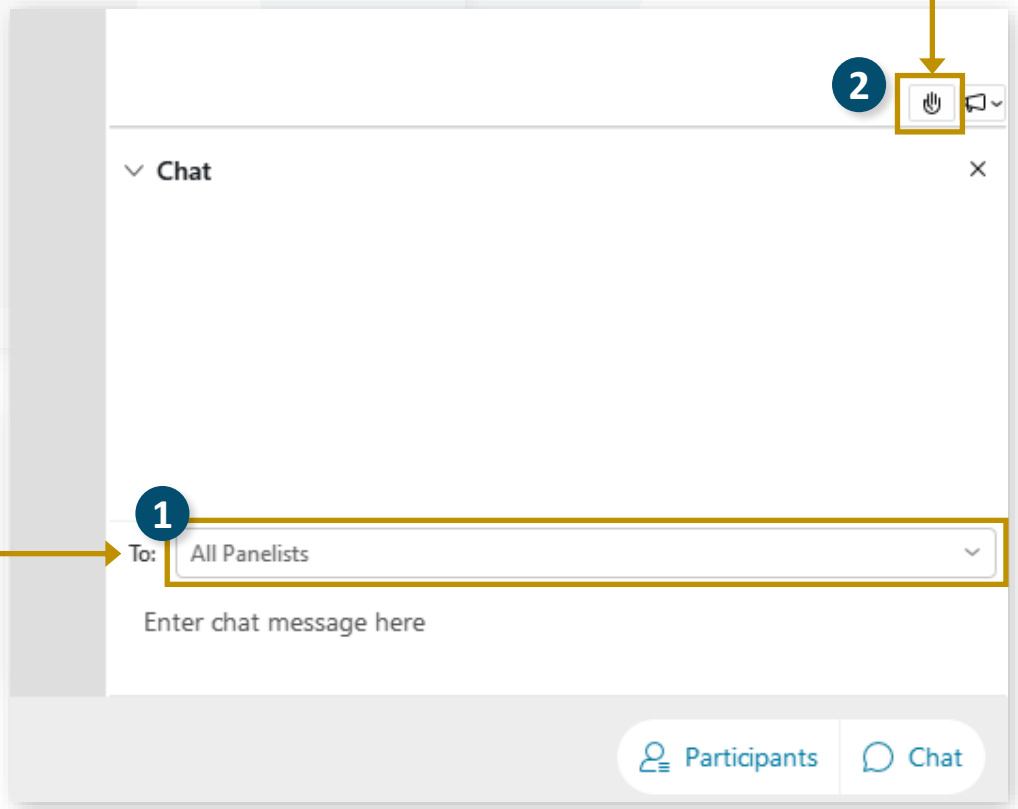
- Questions will be answered at the end of the presentation portion



Two Ways to Ask Questions

*Please use the **'Chat'** feature or **'Raise Hand'** to ask questions*

***"Raise Hand"** to ask questions at the end of presentation portion*



*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

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About E3

- 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

About Applied Economics Clinic

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- **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

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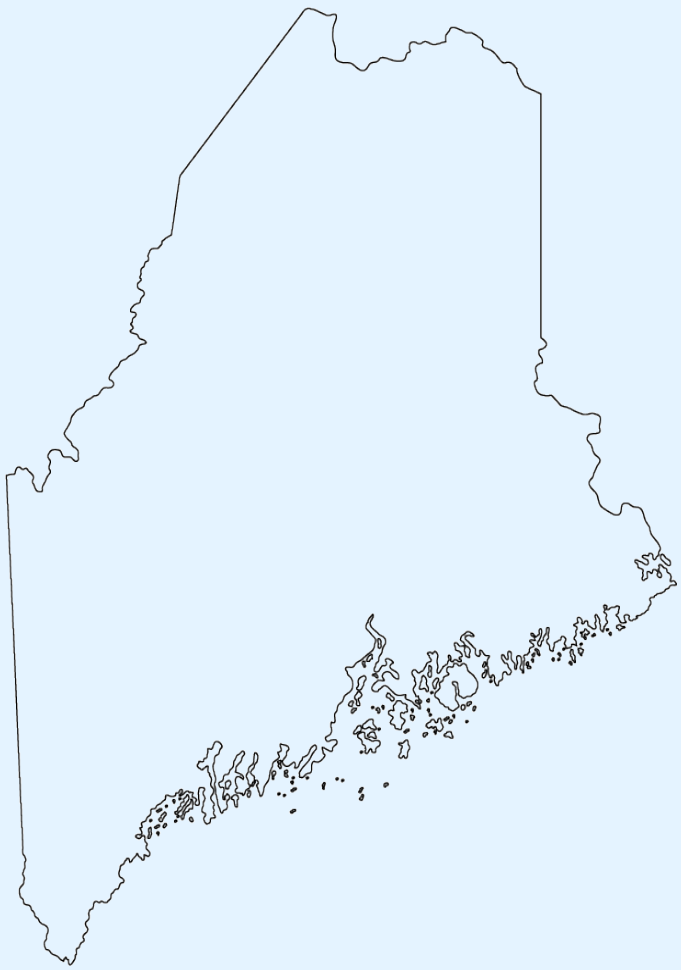
Study Objectives and Approach

- The primary purpose of this study was to provide:
  - Estimates of renewable energy needed to meet Maine's 80% by 2030 RPS requirement
  - Analysis of generation resources and transmission that could meet this requirement
  - The cost, equity, and policy considerations associated with different portfolios
  - Portfolios that set Maine on track to meet 100% renewable by 2050 goal
    - Illustrative results showing impacts through 2040 will be presented
- To achieve this goal, E3 created a spreadsheet model that utilizes a scenario approach to develop multiple futures of renewable energy development
  - Considers several variables including resource economics, energy policy, and land use impacts

Key Findings

- Maine has multiple pathways to meet its RPS goals
  - Maine is on track to meet its near-term RPS goals through 2026; new resources will need to be online to meet increasing goals thereafter
  - Transmission will be a key driver of renewable development
  - Storage paired with solar provides value to Maine's grid
- A technologically diverse portfolio helps lower risk
- Regional coordination on building transmission can help lower the costs of meeting Maine's RPS
- Energy equity benefits and challenges cut across four dimensions: resource diversity, customer-sited resources, geographic resource distribution, and cost.



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Scenario Design

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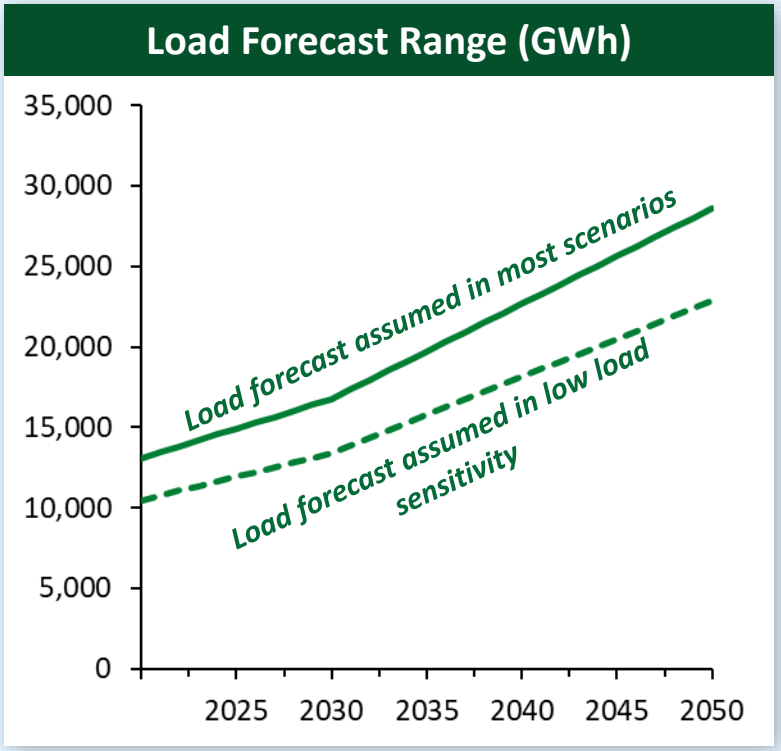
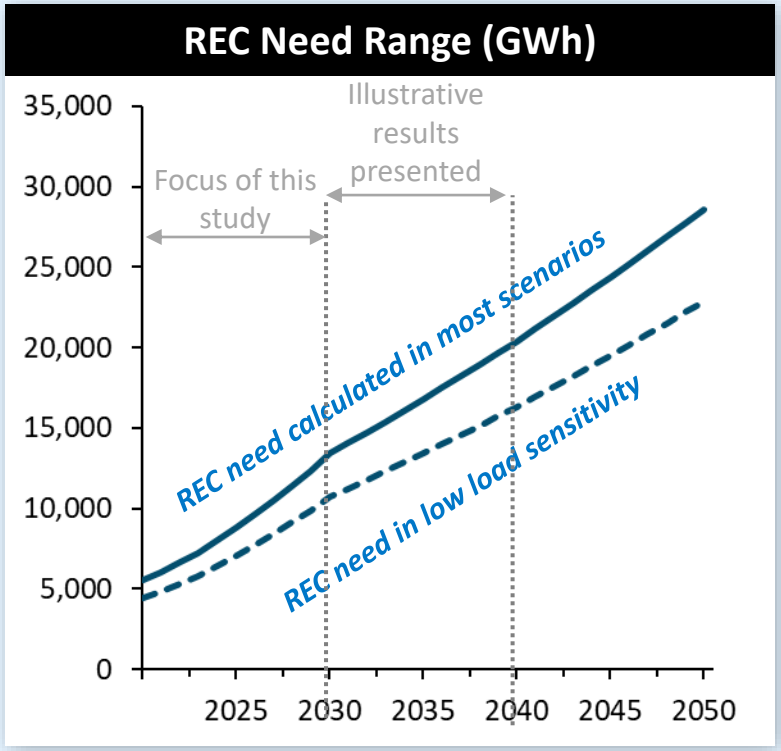
Impact of Load Forecast on Renewable Energy Requirement

- Load forecasts for Maine were derived from Climate Council/Synapse work (November 2020)
- Renewable Energy Credits (RECs) are used by load serving entities to comply with their RPS obligations



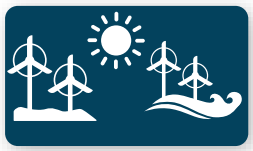


Scenario Descriptions

Scenario	Description
Base Case	Current trends through 2025 and then meets need with **least cost resources**. Includes additional land use screens
Unconstrained Land Use	Base Case, but **without additional land-use** restrictions
Offshore Wind	**Offshore wind focused** future which adds 1 GW of OSW by 2030
Existing Transmission Only	Recognizes the **difficulty of building onshore transmission** in the state
Regional Coordination	Coordination with other entities on **transmission cost-sharing**
Diverse Portfolio	Evaluating a **portfolio of diverse resources** along with cost-sharing of transmission







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Modeling Approach and Assumptions

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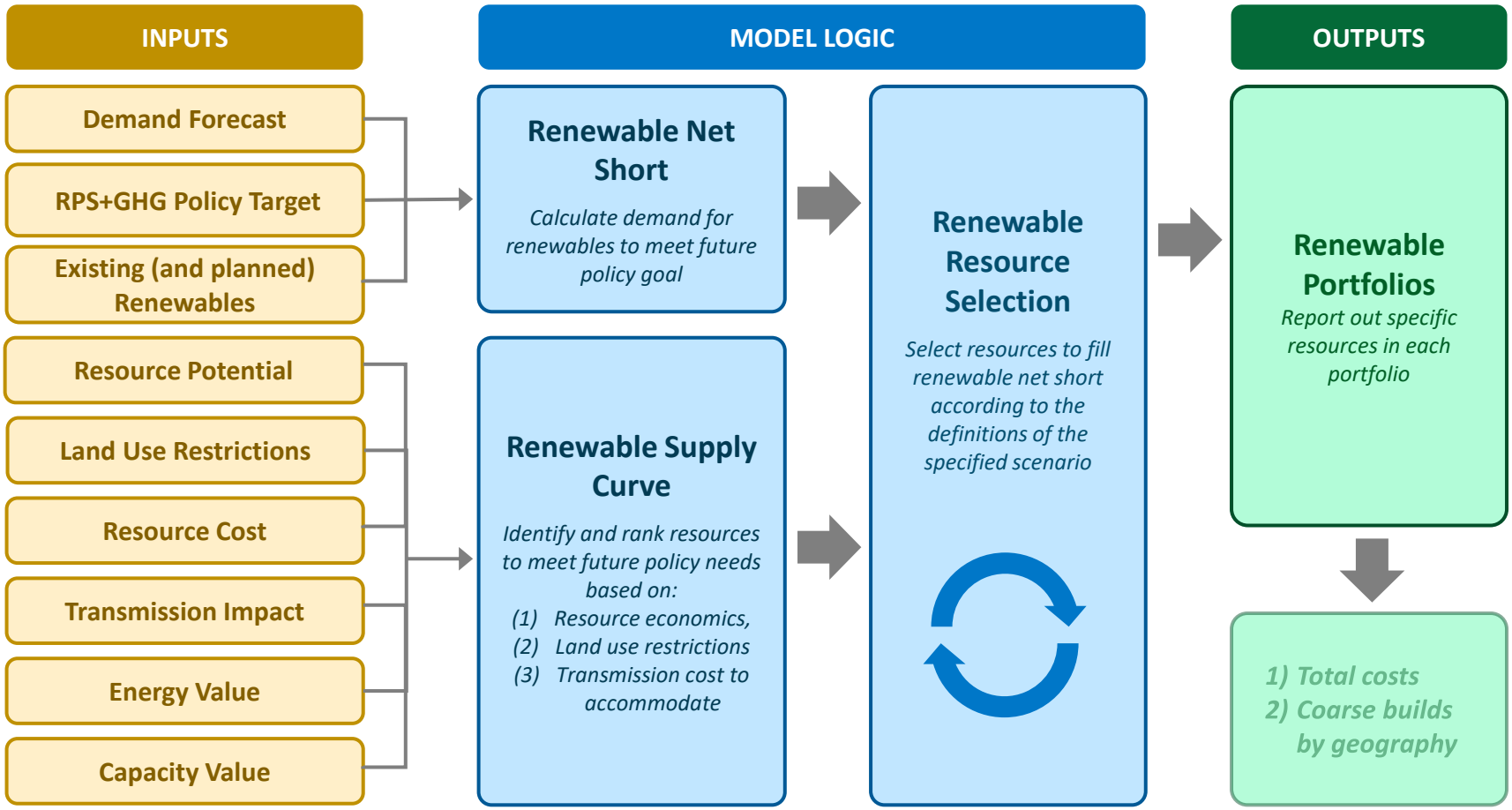
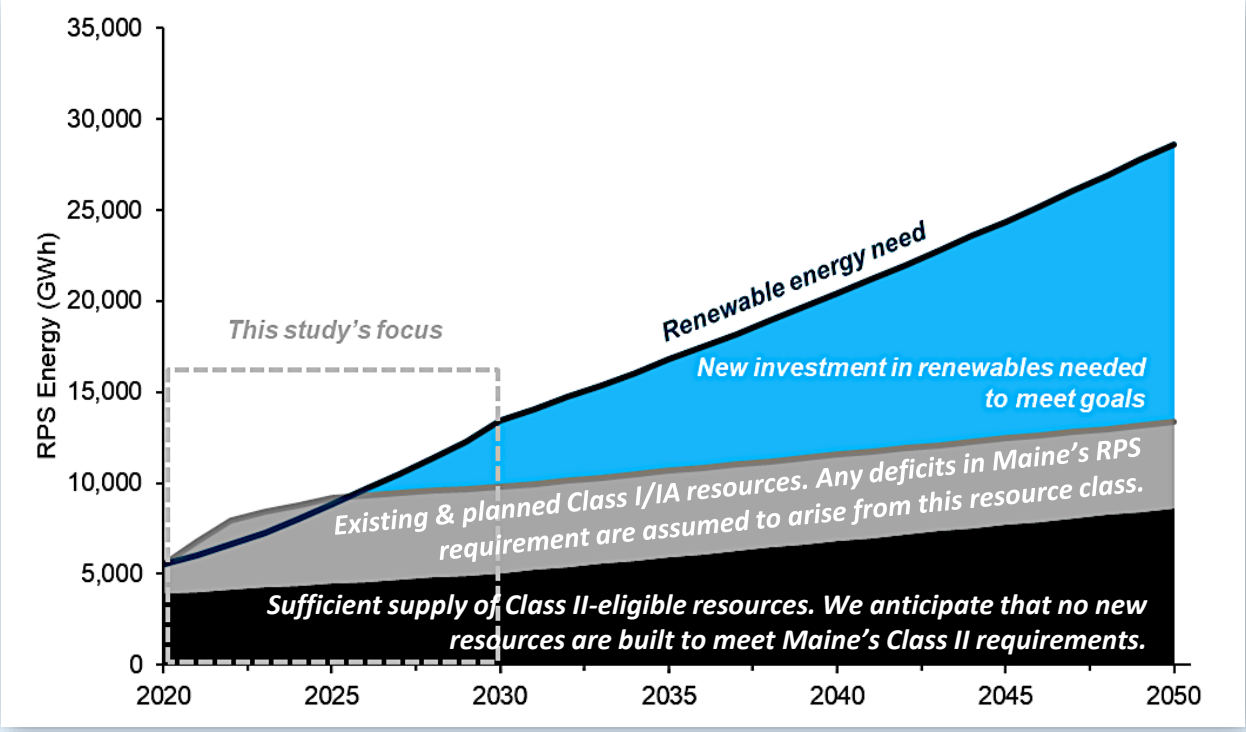
Overview of E3 RPS Planning Tool

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



Determining REC Need

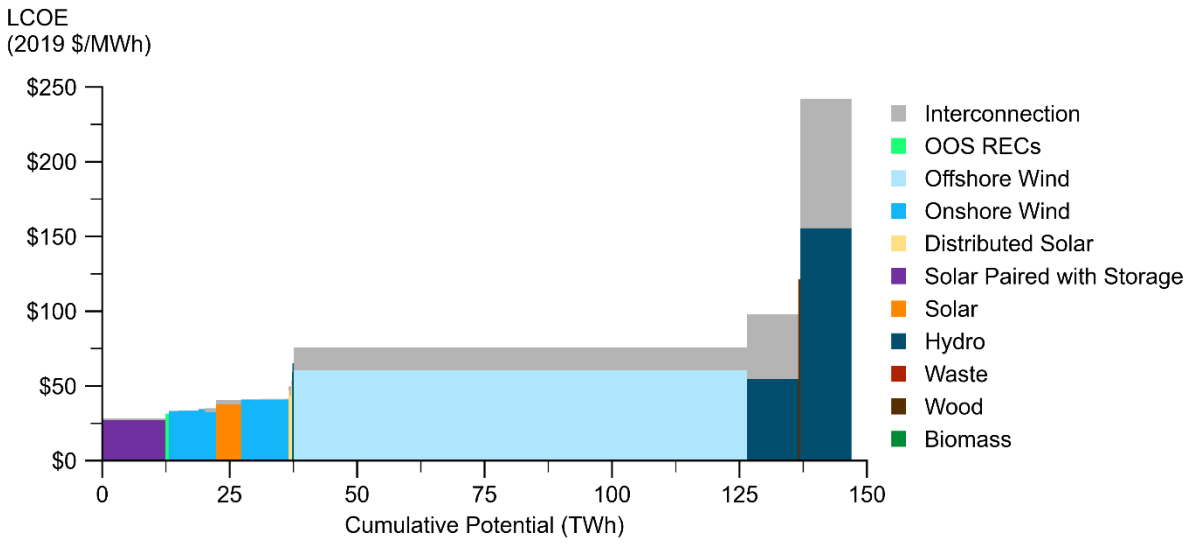
- Maine needs new resources online and generating RECs starting in 2026 to meet its RPS:
  - Renewable Net Short = Gross REC need minus Existing and Planned Renewables (Class I/IA and II resources)
  - Maine has sufficient Class I/IA and II RECs through 2025 to meet policy goals; Class I/IA deficit starts in 2026



Renewable Resource Potentials

- E3 developed renewable energy supply curves from NREL Regional Energy Deployment System (ReEDS) dataset which includes costs, characteristics, and potentials for onshore wind, solar plus storage, solar, offshore wind, hydro (<100 MW), waste, wood, and biomass
  - Technical potentials of utility-scale solar and onshore wind were reduced by land-use constraints
    - **Onshore wind:** Limited to 2% farmland and 2% forest* → results in 5199 MW of viable potential
    - **Utility-scale solar:** Limited to 4% farmland* → results in 7400 MW of viable potential
  - Costs include capital and interconnection costs
- Transmission costs, energy value, and capacity value may change the cost-competitiveness

2030 Statewide Renewable Supply Curve (not including zonal transmission upgrade costs)**

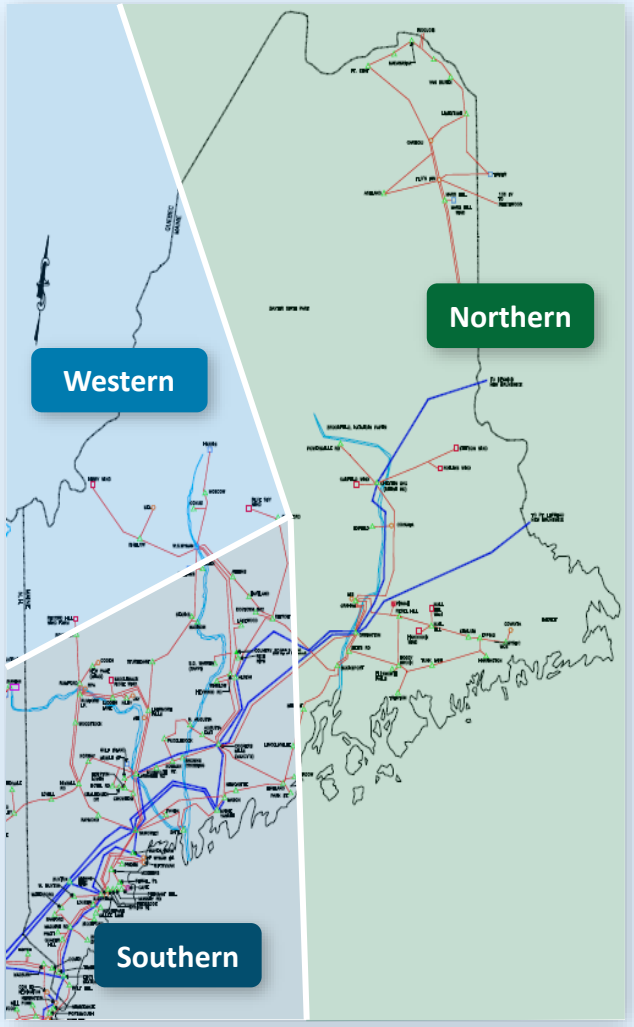


Indicative numbers to better understand land use restrictions' overall impact on development opportunities

***Based on resource zones, transmission costs are added to these resources*

Modeled Transmission Zones

- **Northern Zone**
  - Contains remote, high-quality wind resources that need new transmission to be deliverable to load centers
  - Although Northern Maine is not connected to rest of Maine, one Northern Maine zone was defined for purposes of this analysis
  - Key constraints: Northern Maine grid, Keene Road, and Orrington-South
- **Western Zone**
  - Contains relatively less remote high-quality wind resources that need new transmission to be deliverable to load centers
  - Key constraint: Wyman Road
- **Southern Zone**
  - Main population center responsible for majority of Maine's load; transmission is expensive to upgrade due to proximity to urban centers
  - Key constraints: Suroweic-South. Assumed to have 200 MW of headroom
- **Offshore wind and Distributed Generation**
  - Offshore wind: Assume offshore wind can interconnect to Southern zone and does not trigger onshore transmission upgrades
  - Distributed generation: Tiers of distributed generation are modeled, some requiring distribution and transmission upgrades



**Note: These transmission zones are not meant to represent actual physical / administrative zones in the Maine system*

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Scenario Results

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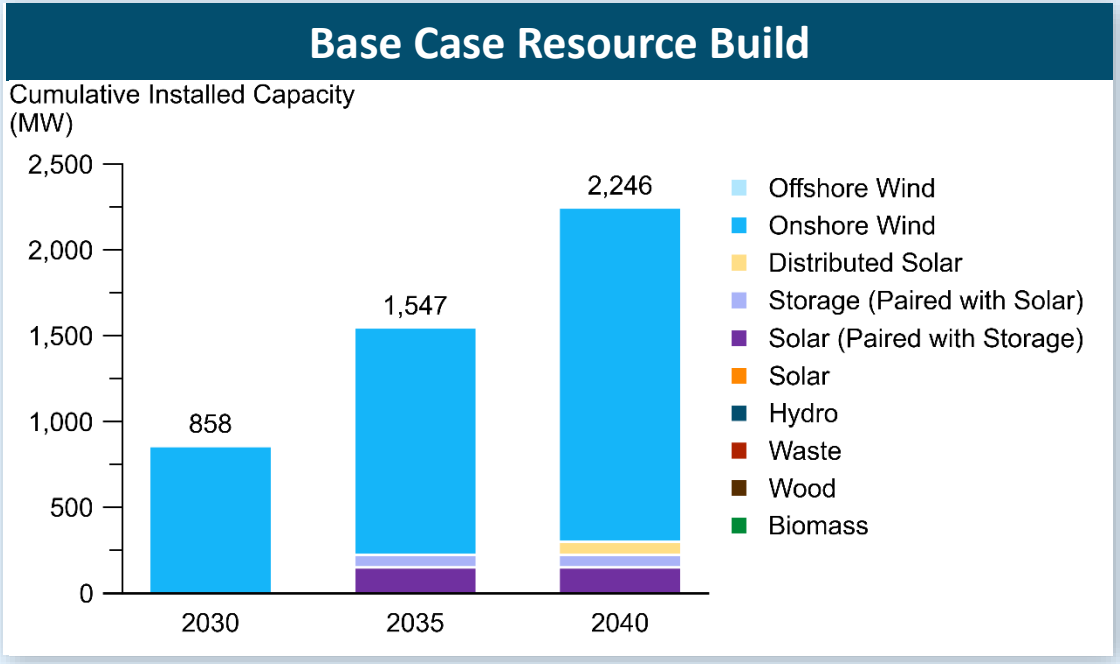
Results: Base Case

- Base case shows the least-cost portfolio of resources to meet RPS goals which follow current market and policy trends
- Onshore wind in the West and North is chosen by 2030 (some of this needs to be online by 2026) and requires new transmission upgrades
- PV+Storage and Distributed Generation are chosen post-2030



**Note: Although the focus of this study is through 2030, results are presented through 2040*

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Portfolio Comparisons

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Portfolio Comparison: 2030 Resources

- The scenarios highlight a diversity of approaches to allow Maine to meet its renewable energy requirements by 2030

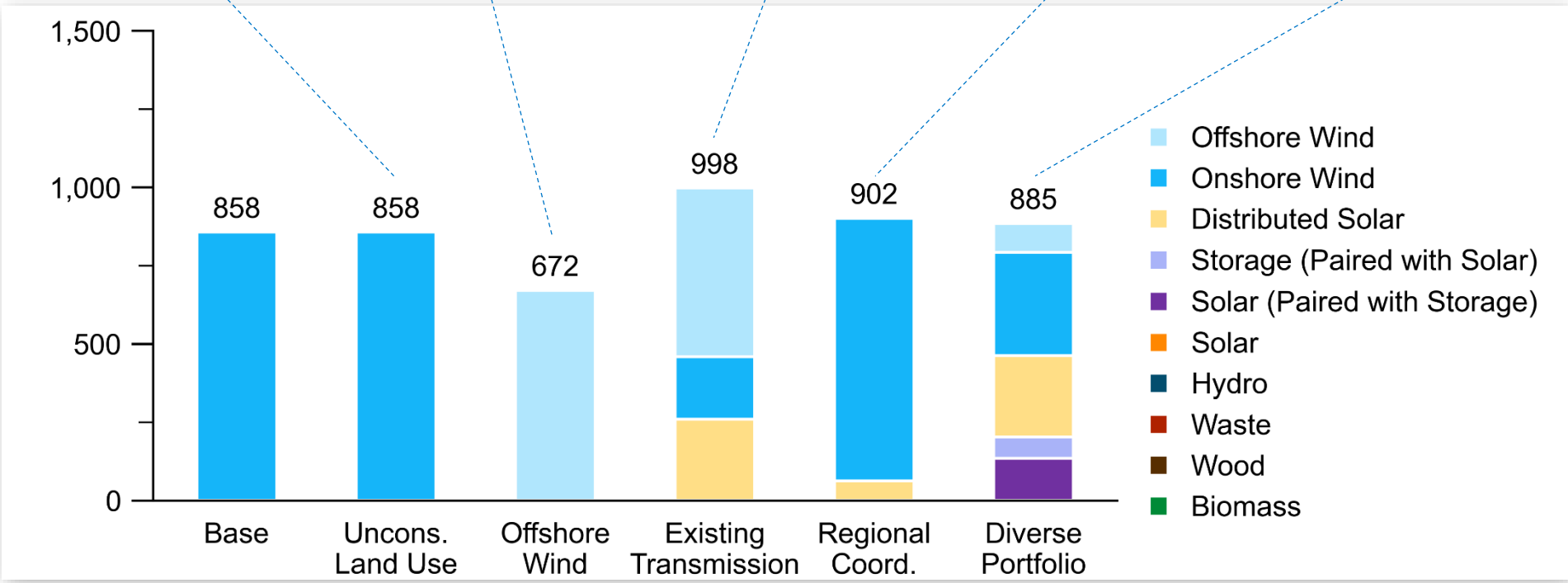
Transmission costs bind before land-use constraints

Offshore wind alone can be enough to meet 2030 RPS goals

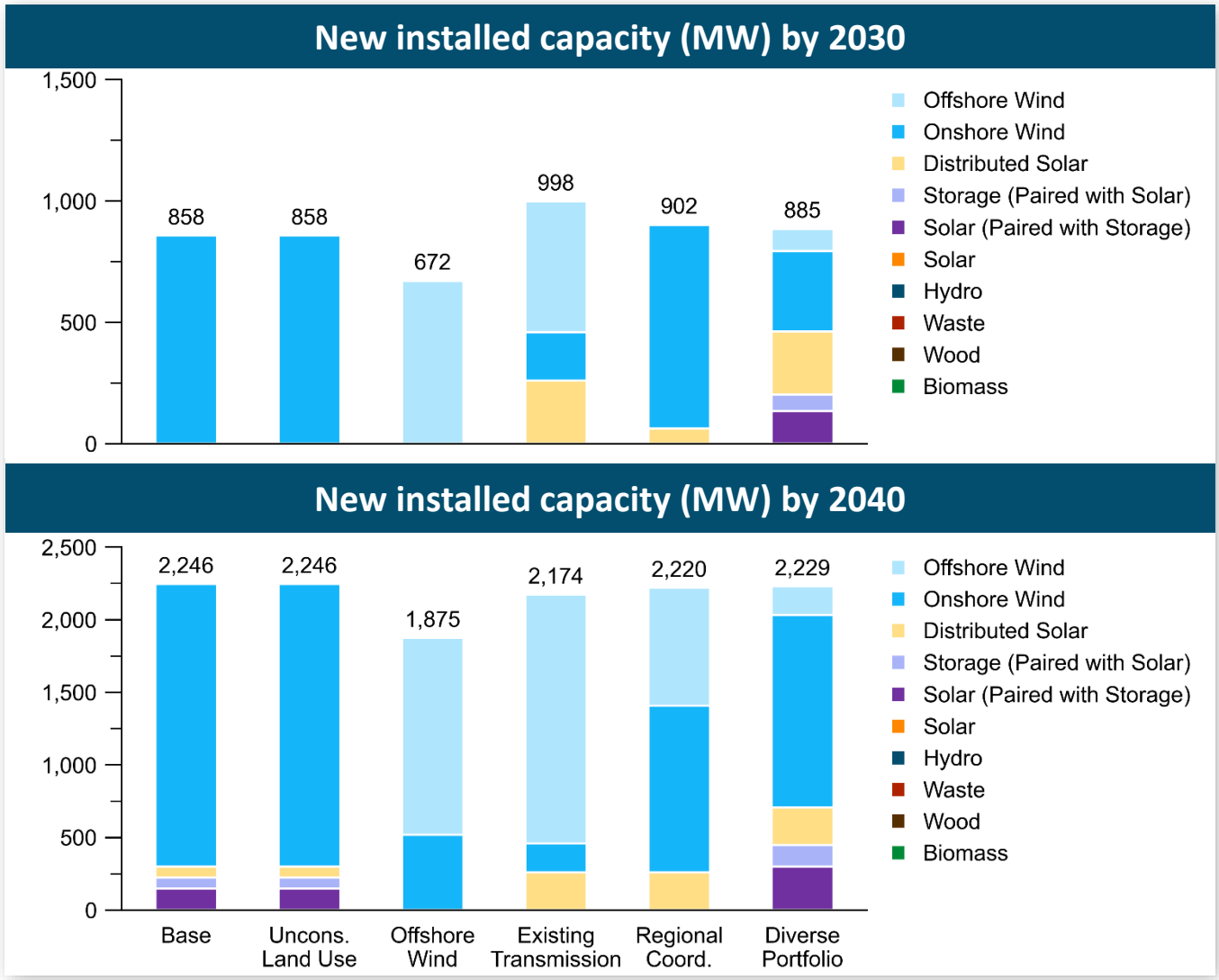
No new onshore transmission results in a combination of DG and Offshore wind

Cost-sharing of new transmission upgrades results in onshore wind and DG builds

Building a diverse set of resources could provide Maine with flexibility at a lower cost



Portfolio Comparison: Resources



Onshore wind shows up across scenarios and increases in capacity between 2030 and 2040

Significant transmission capacity is required to integrate large amounts of onshore renewables – both onshore wind and solar

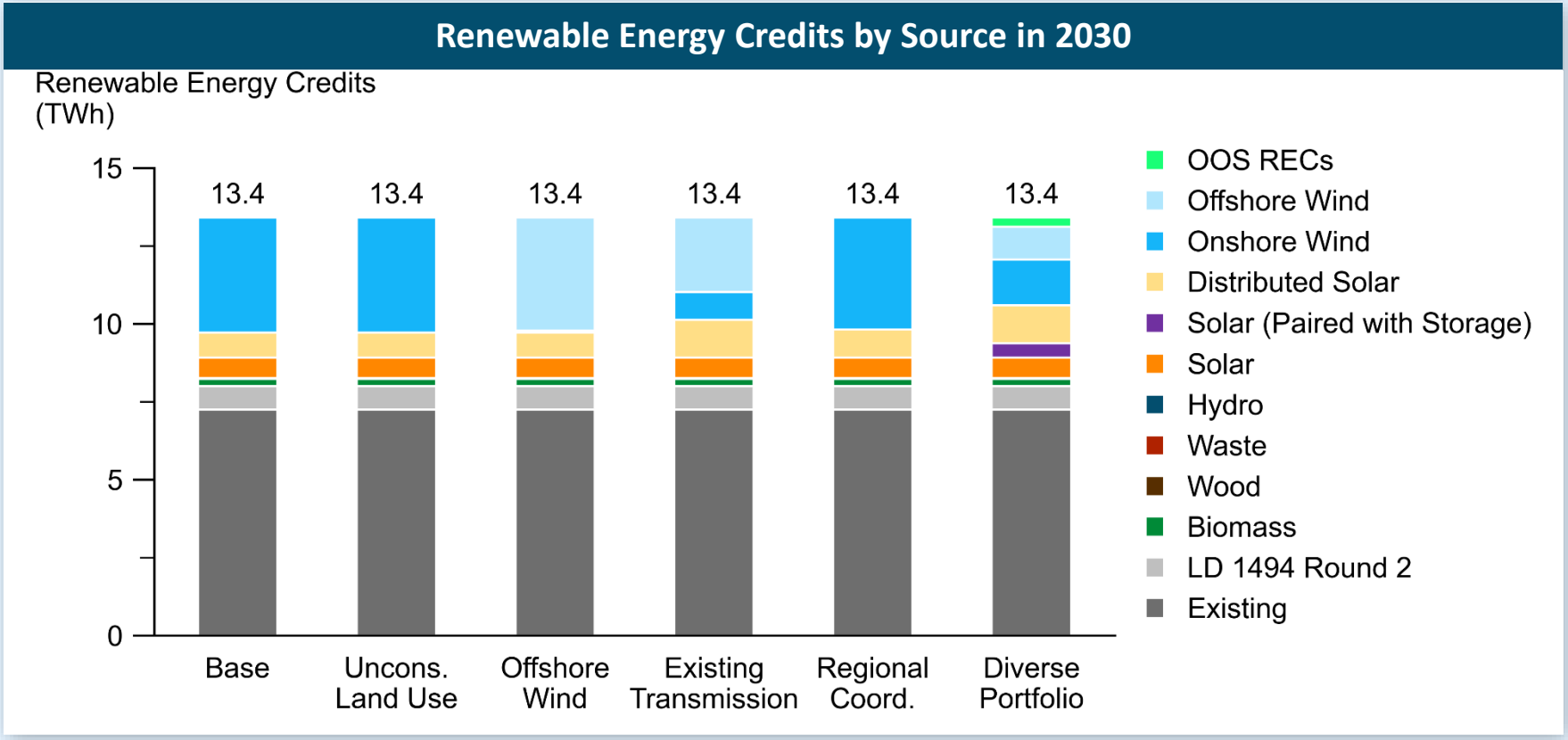
Offshore wind can provide value, especially post 2030 as its costs continue to decline

DG is chosen across multiple scenarios, especially if it does not trigger significant transmission upgrades

Solar exhibits strong synergies with storage

Portfolio Comparison: 2030 RECs

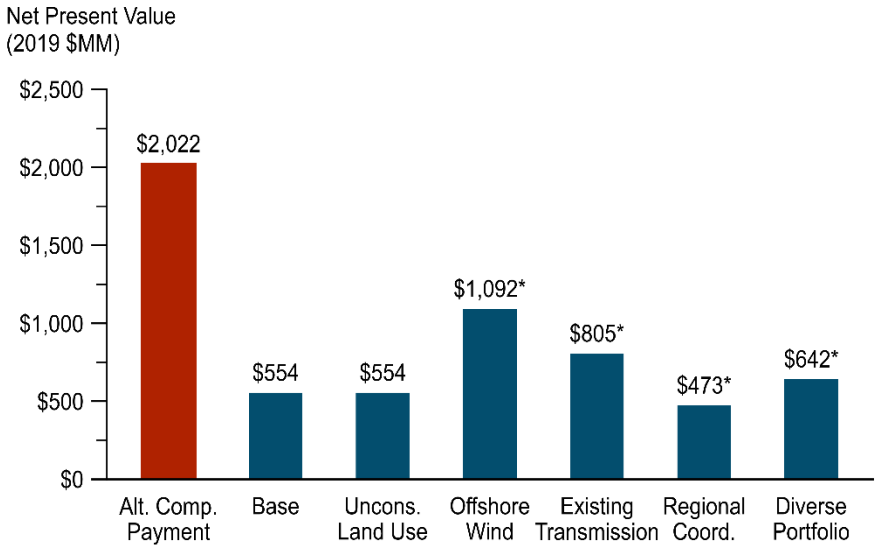
- Baseline RECs include all existing and planned Class I/IA/II RECs
- In most cases investigated, onshore wind provides most *new* RECs



Portfolio Comparison: Resource Costs

- **Costs include the renewable resource and transmission costs required to meet the RPS targets**
  - As a counterfactual, the cost to meet REC needs via the Alternative Compliance Payment (ACP) mechanism is shown
- **Scenario comparisons**
  - The Offshore Wind and Existing Transmission scenarios rely on offshore wind build*
  - The Regional Coordination scenario shows that sharing transmission costs with other New England States or Canadian provinces can reduce the overall cost to meeting Maine's RPS requirement
  - The Diverse Portfolio scenario takes advantage of available additional RECs from out of state, cost-sharing of new transmission, and deferral of onshore transmission build by building offshore wind and distributed generation

Net present value of costs to satisfy RPS



- **Note**: This is not a full cost-benefit analysis and does not calculate ratepayer impact. This slide only shows resource costs.

**These costs could be higher given transmission needed to connect more than 200 MW of offshore wind. More analysis is needed to understand the onshore transmission implications of offshore wind.*

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Energy Equity Considerations

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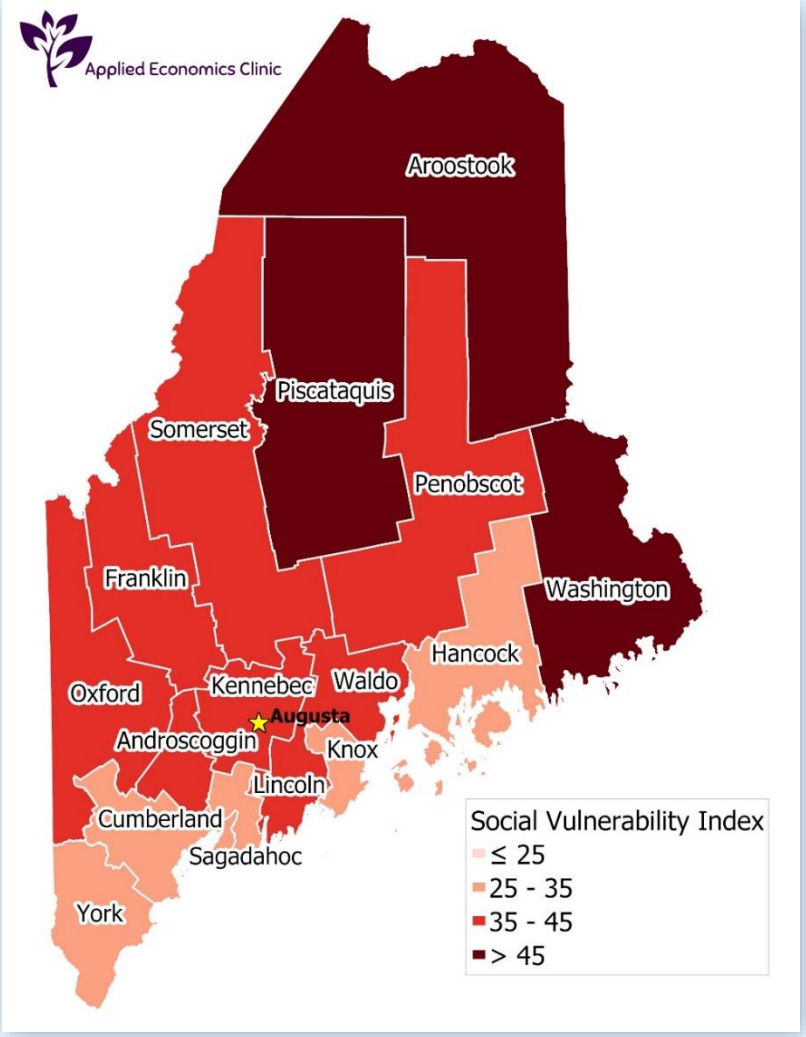
Equity Context - SVI

- The Social Vulnerability Index (SVI) for Maine provides an equity lens through which to interpret the analysis results
  - Vulnerable communities contain populations that are disproportionately burdened by existing inequities
- The SVI combines values from six categories of vulnerability, each expressed as a share of population: children (17 and younger), limited English-speaking households, older adults (65 and older), people of color, people with disabilities, and low-to-no income individuals
  - A higher SVI score (darker color) indicates a greater degree of social vulnerability
- Vulnerability is not evenly distributed across Maine
  - The three most socially vulnerable counties are in the Northern and Eastern parts of Maine
  - But there are also equally vulnerable areas (at a sub-county level) in less vulnerable counties



Equity Impacts by Scenario

- **Resource diversity**
  - Diverse Portfolio and High Regional Coordination scenarios build the broadest variety of renewable resources
- **Customer-sited resources**
  - All scenarios assume 500 MW of DG
  - In all but the Offshore Wind scenario, additional distributed generation was selected to be developed
- **Geographic resource distribution**
  - In four out of six scenarios (Base Case, Unconstrained Land Use, Regional Coordination, and Diverse Portfolio), new renewable resources are developed in all three regions of the state by 2035
- **Cost**
  - All scenarios show savings compared to RPS compliance through ACP payments
  - The greatest total cost savings relative to the ACP case are the Base Case and Regional Coordination Case, which both have significant amounts of new wind resources in the Western and Northern parts of the state and more regional coordination on building new transmission

Resource diversity

Different resources entail different benefits and challenges; pursuing a greater mix of resources affords more flexibility

Customer-Sited Resources

Customer siting builds household-level energy reliability and resiliency

Geographic Resource Distribution

Renewable resource development impacts local communities

Cost

Resource mix impacts electric bills

Equity Benefits and Challenges

- While this study did not conduct a comprehensive equity analysis, it highlights key equity benefits and challenges that may arise as Maine meets its RPS and climate goals

Benefits	Challenges
Reductions in emissions and corresponding improvements in air quality and human health that benefit frontline communities most	**Ensuring affordable electricity** that would not exacerbate existing energy burdens, particularly among low-income Maine households
Improved energy reliability and resiliency, a particular benefit for vulnerable communities who face increased risks from power outages	**Recognizing the equity implications of new transmission** that would improve grid interconnection in areas of the state with high social vulnerability
Reduced potential for dangerous events related to fossil fuel infrastructure, such as gas leaks, as renewable energy replaces fossil fuels	**Ensuring equitable distribution of distributed generation benefits** so vulnerable Mainers do not miss out
Clean energy employment and community investment that can be directed and targeted at Maine's vulnerable populations	**Minimizing impacts** on existing industries, stakeholders, communities and natural resources

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Key Findings & Policy Implications

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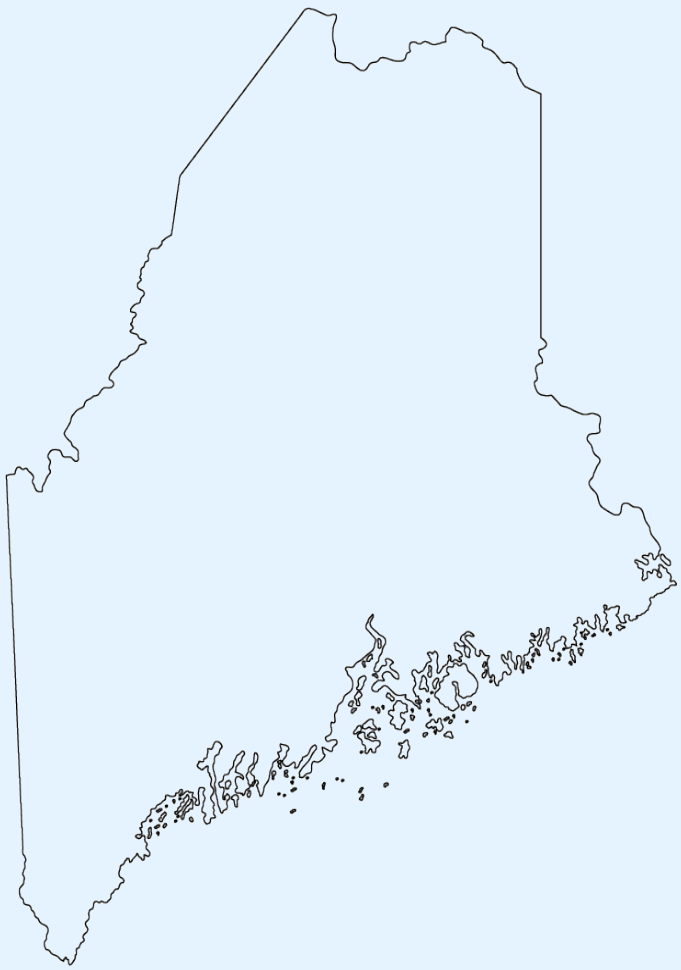
Key Findings

- Maine has multiple pathways to meet its RPS goals
  - Maine is on track to meet its near-term RPS goals through 2026; new resources will need to be online to meet increasing goals thereafter
  - Transmission will be a key driver of renewable development
  - Storage paired with solar provides value to Maine's grid
- A technologically diverse portfolio helps lower risk
- Regional coordination on building transmission can help lower the costs of meeting Maine's RPS
- Energy equity benefits and challenges cut across four dimensions: resource diversity, customer-sited resources, geographic resource distribution, and cost.



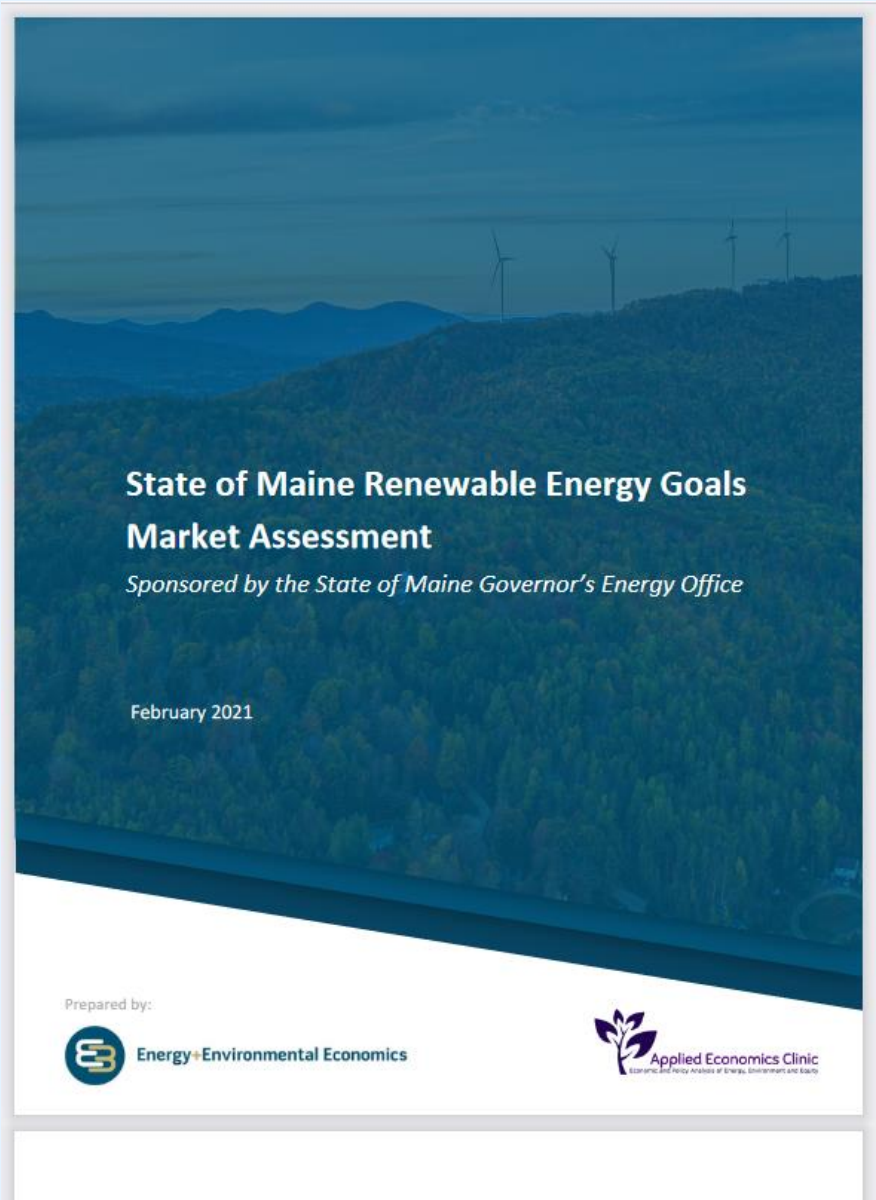
Policy Implications

- The analysis suggests that there are several policy pathways that could support timely and cost-effective renewable development to meet Maine's RPS goals
- **Planning and Resource Additions**: Ensuring clarity to developers and evaluating all value streams for projects would ensure the best value for Maine
- **Transmission**: Proactive transmission development will help develop in-state renewables
- **Regional Coordination**: Coordinating infrastructure development (e.g., transmission, offshore wind) across the region could lower costs of meeting Maine's RPS
- **Renewable Resources**: Specific technologies require additional analysis to fully understand their value in meeting Maine's RPS
  - Efforts to align incentives for DG with their value to the system (compensation could be based on location and timing of output) would ensure efficient DG development
  - Analysis is required to understand the onshore transmission impacts of significant offshore wind builds
  - Solar exhibits strong synergies with storage in Maine. More analysis is required to understand all the value streams storage can capture

You can find the full report here

- www.maine.gov/energy/
  - → Studies, Reports & Working Groups
    - → Current Studies & Working Groups
      - → Renewable Energy Market Assessment

- https://www.maine.gov/energy/sites/maine.gov.energy/files/inline-files/GEO_Renewable%20Energy%20Goals%20Market%20Assessment_Feb%202021.pdf



FEEDBACK

Stakeholders are invited to provide feedback to the Governor's Energy Office (GEO)

Of particular interest to the GEO is feedback on:

- Results and findings of the assessment; and/or
- Suggested next steps for most effectively meeting Maine's 2030 RPS and beyond.

Please send your written feedback via email to GEO Energy Policy Analyst, Melissa Winne, at: melissa.winne@maine.gov

Feedback is due by February 26 and may be shared publicly.

Please reach out to Melissa regarding any needs for alternative methods of providing feedback.

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Thank You

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