Maine Energy Storage Market Assessment

Sponsored by the State of Maine Governor's Energy Office

Stakeholder Session #2: Preliminary Modeling Results & Policy Discussion

February 14, 2022

Energy+Environmental Economics

ENERGY STORAGE & MAINE ENERGY AND CLIMATE POLICY

Maine Won't Wait: Maine's four-year climate action plan identified energy storage as an important factor in achieving emissions reduction goals, maximizing the value of renewable energy on the grid.

Targets: L.D. 528 signed into law June 2021, established state storage targets, directed an Energy Storage Market Assessment.

Assessment: This assessment of existing and emerging technologies, market factors, and a technical cost-benefit analysis is meant to inform policy makers to help develop a landscape ready to deploy storage to meet our 2030 goal of 400 MW and to most effectively capture the benefits of storage for the grid, society, and for ratepayers. *Assessment due to EUT Committee early March.*

Feedback: We're engaging stakeholders in this assessment to build key storage relationships in Maine, inform factors for analysis, and to most effectively share key takeaways from analysis with legislature.

Agenda

- **Using the ‘Chat’/’Raise Hand’ feature to ask questions in WebEx**
- **Introductions**
- **Project Schedule & Session #1 Recap/Feedback Summary**
- **Selected Benefit-Cost Analysis Results (Preliminary, Not Exhaustive)**
  - Wholesale Standalone Storage
  - Wholesale Storage + Solar
  - Customer-sited Commercial-scale Storage
- **Preliminary Policy Considerations**
- **Q&A with Stakeholders**
- **Feedback**

Feedback on study may be provided at: https://forms.office.com/r/ZDVLXHrquX

Energy+Environmental Economics

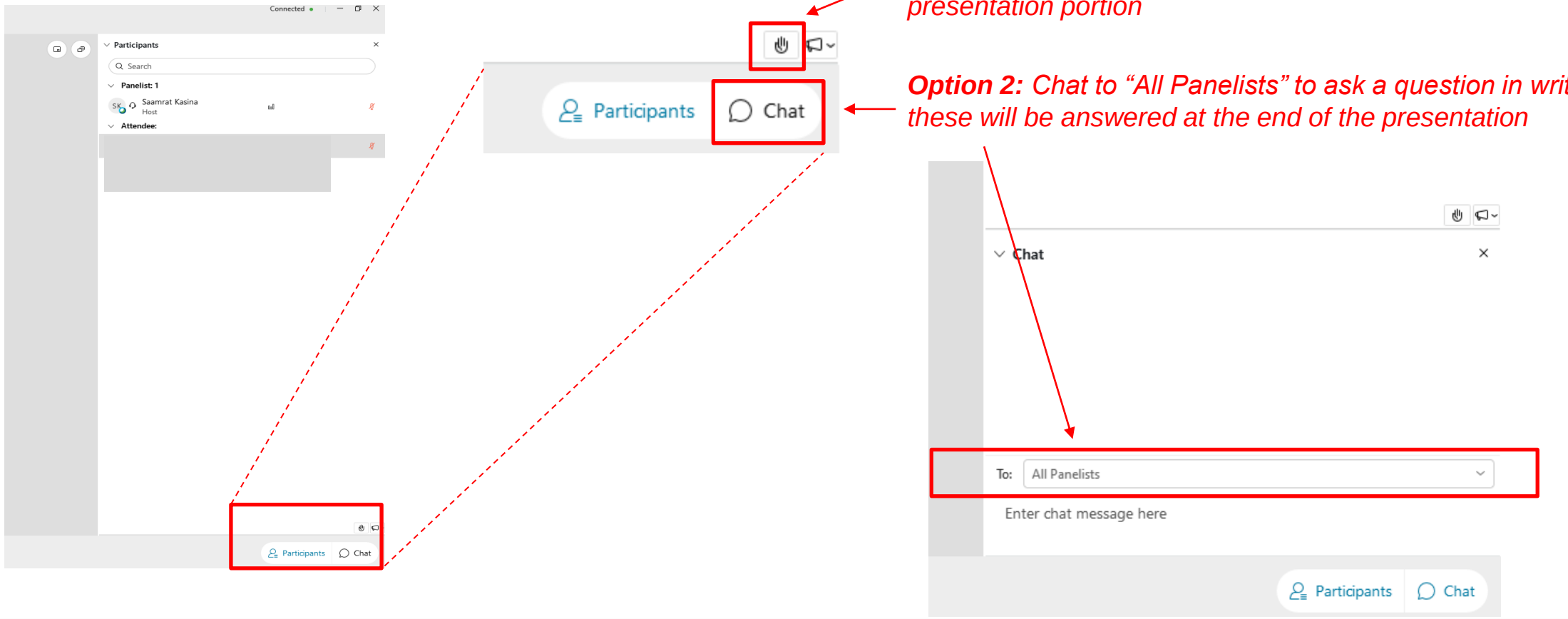
Using ‘Chat’ and ‘Raise Hand’ in WebEx to ask questions

Two Ways to Ask Questions

- Questions will be answered at the end of the presentation portion
- Please use the ‘Raise Hand’ or ‘Chat’ feature to ask questions

Option 1: *“Raise Hand” to ask questions at the end of presentation portion*

Option 2: *Chat to “All Panelists” to ask a question in writing and these will be answered at the end of the presentation*

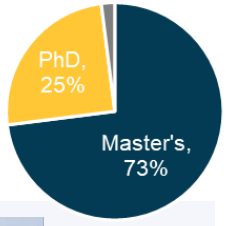


Energy+Environmental Economics

Introductions

About E3

90+ full-time consultants | 30 years of deep expertise | Engineering, Economics, Mathematics, Public Policy…




San Francisco

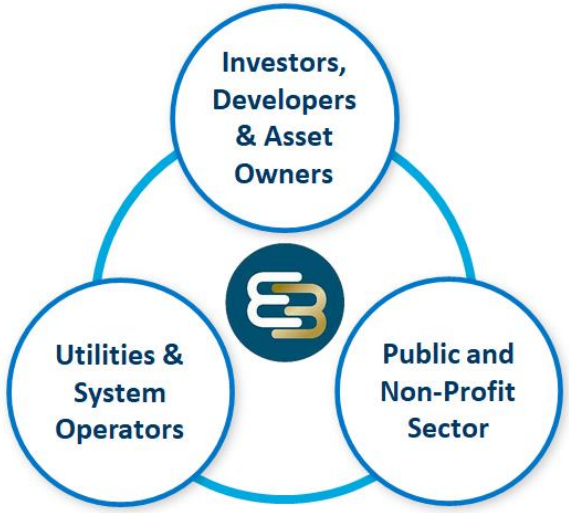

New York


Boston


Calgary

E3 Clients

300+ projects per year across our diverse client base



Recent Related Projects

- Maine Renewable Energy Goals Market Assessment (2021)
- Net Zero New England: Electric Reliability under Deep Decarbonization (2020)
- New York Energy Storage Roadmap – NYSERDA (2018)
- New York Peaker Repowering/Replacement Study – NYSERDA (2019)
- Minnesota Dept. of Commerce, Minnesota Energy Storage Cost-Benefit Analysis (2019)
- Energy Storage Market Analysis, Business Model Review, and Strategic Advice – Macquarie Capital (2016, 2018 – 2019)
- California Energy Commission, EPC-19-056, Assessing the Value of Long Duration Storage (2020-present)

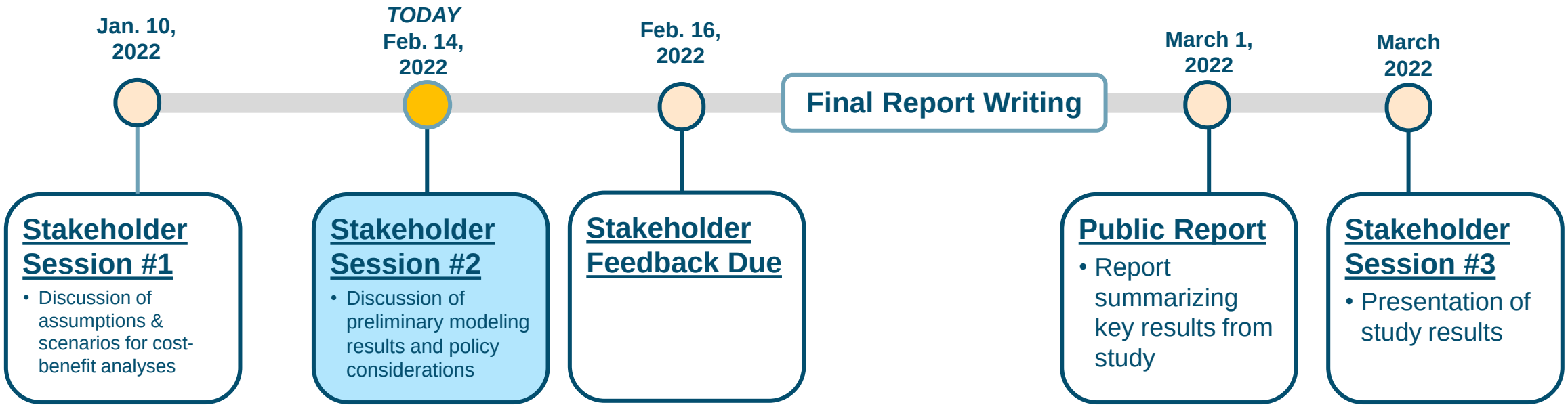
Energy+Environmental Economics

Project Schedule & Session #1 Recap

Project Schedule

Stakeholders have an opportunity to submit comments in advance of the report being published in early March 2022

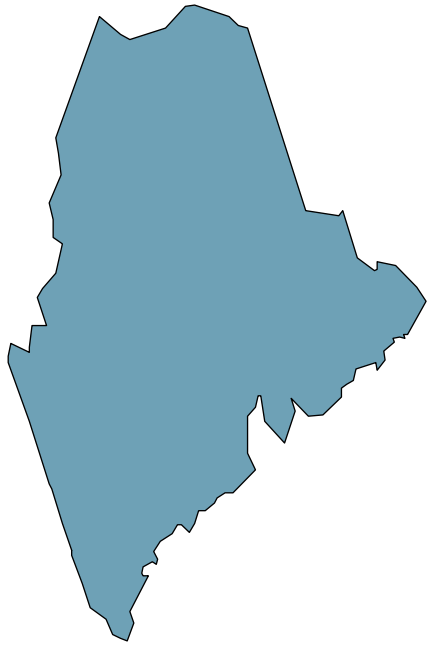
1. **Stakeholders submit feedback on preliminary results and policy considerations by Feb. 16, 2022**
2. **GEO and E3 conclude the report and analysis in the latter half of February 2022**
3. **Report summarizing study findings will be released in early March 2022**
4. **GEO and E3 to present results in March 2022**



Project Overview

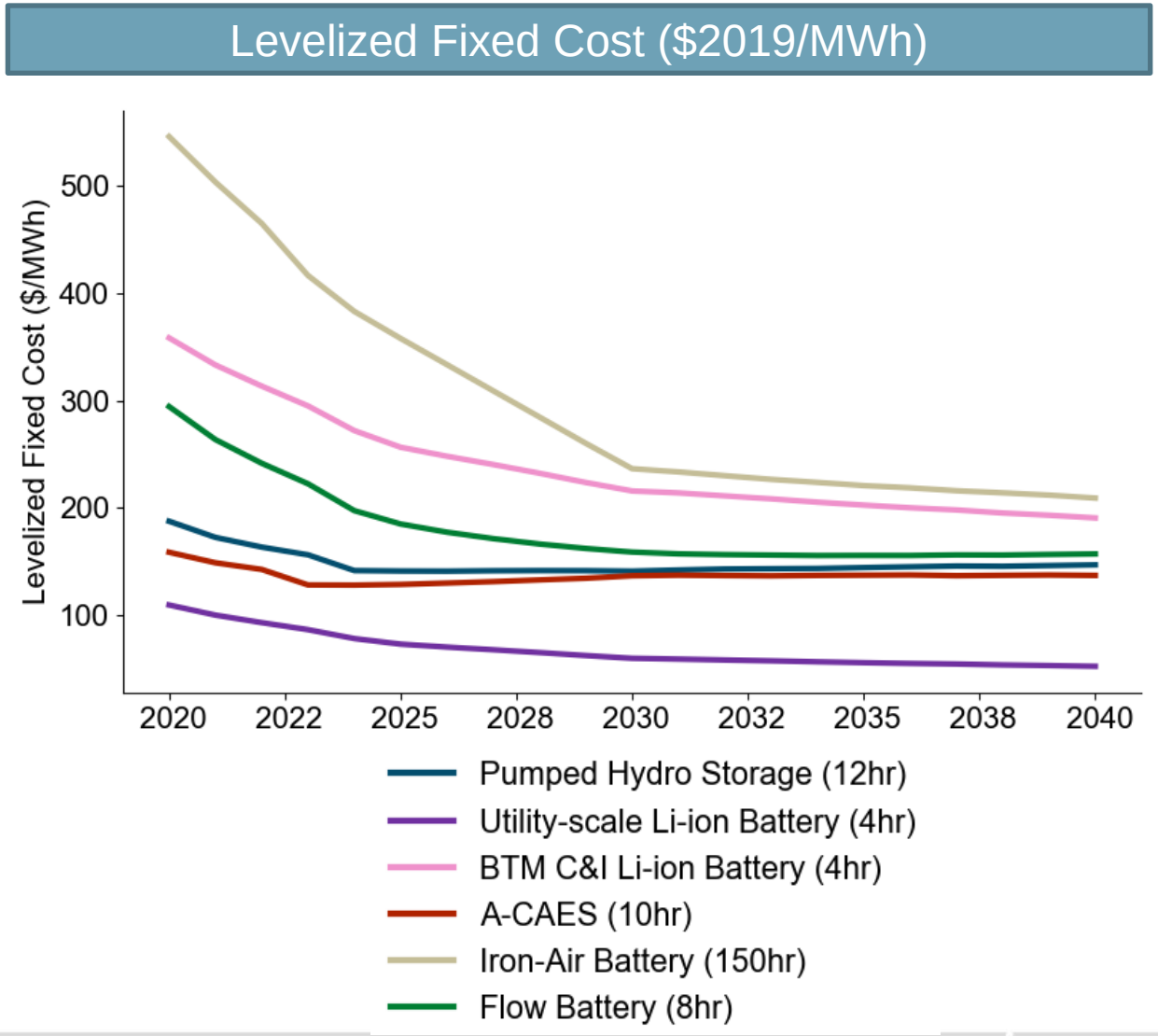
- **E3 is working with the Governor's Energy Office to assess the energy storage market in Maine**
  - Satisfies the requirements set forth in 2021 ***Act to Advance Energy Storage in Maine***, which also sets Maine storage targets
    - 300 MW by 2025
    - 400 MW by 2030

- **Study questions:**
  - **Technology Assessment:** Which storage **technologies and use cases** are likely to be valuable to Maine, today and in the future?
  - **Policy and Market Factors:** What **market and policy factors** may influence the speed and predictability of storage deployment in Maine?
  - **Cost-Benefit Analysis:** What are the costs and benefits of energy storage deployment over the next decade? What are the considerations for policy?
- **Study output will include public report with findings and policy recommendations**

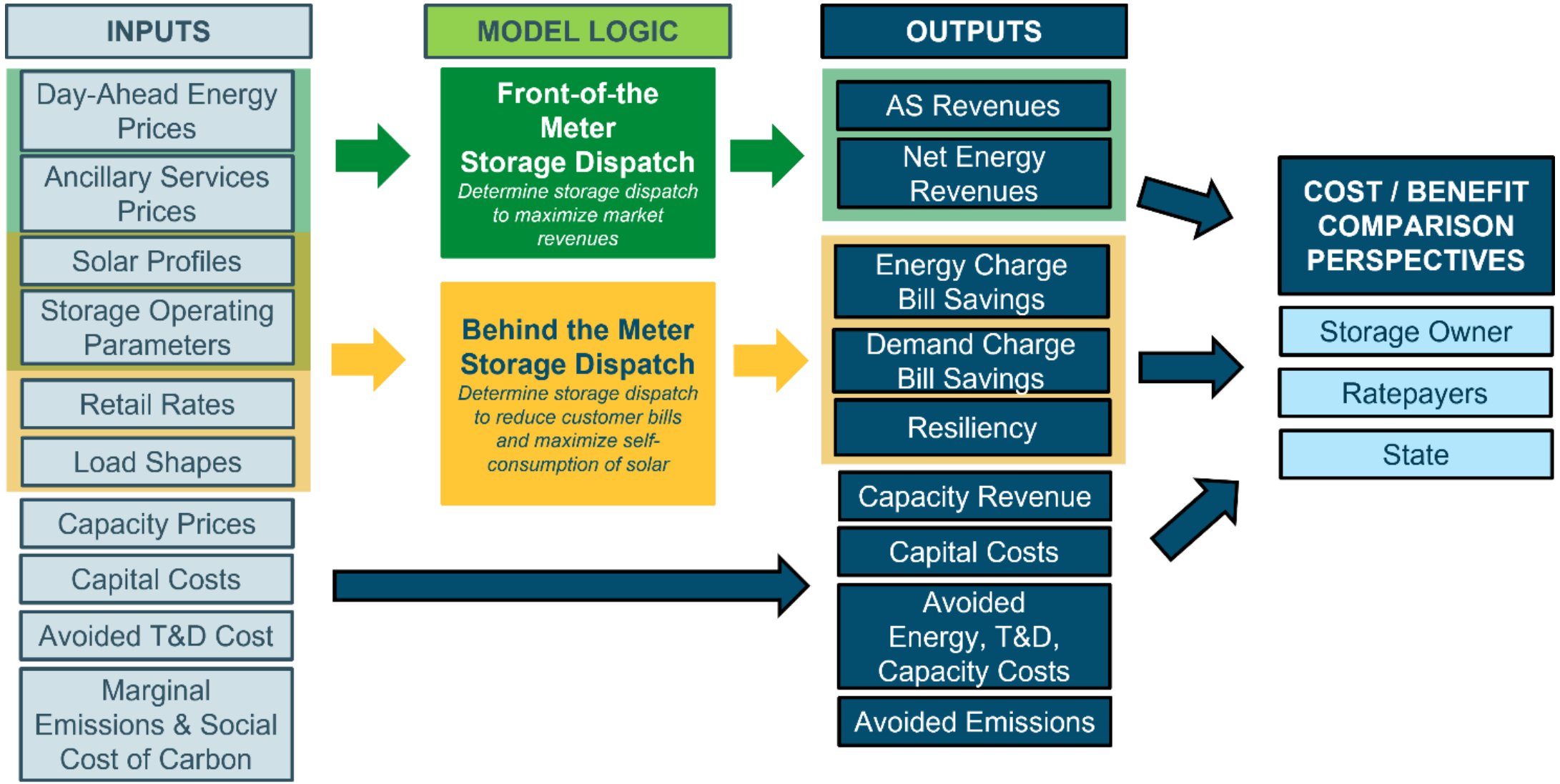


Cost-Benefit Analysis Leverages Storage Technology Assessment, with Focus on Near-Term Deployment

- **The cost-benefit spreadsheet model evaluates different use cases for Li-ion batteries, given the following factors analyzed in the storage technology assessment**
  - The ability to provide a range of high value services in the near term and long term
  - Maturity and commercial availability
  - Low capital cost or cost reduction potential
  - Able to be deployed in Maine within the study period (2022-2031)
- **Emerging and long-duration storage technologies are evaluated in the storage technology assessment and the report**



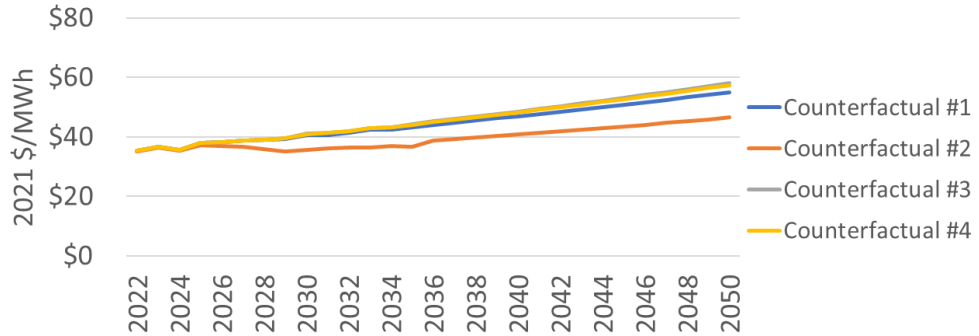
Modeling Methodology



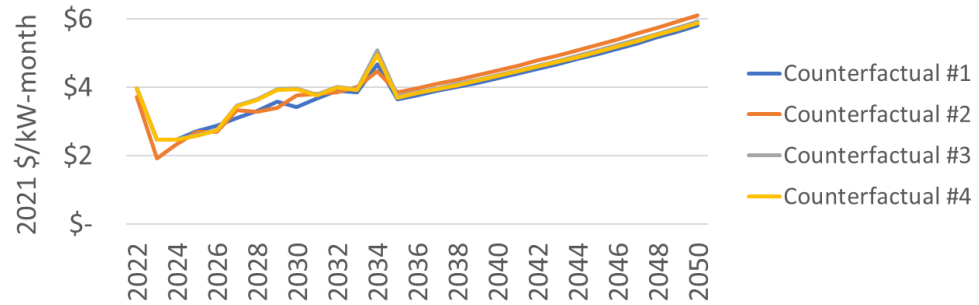
Key Data Sources

Key Data Items	Sources
Storage costs and operating characteristics	Lazard, NREL, E3's Pro Forma
Historical data	EIA, EPA, ISO-NE
Retail rates	Central Maine Power, Versant
Energy prices	AESC 2021 report, with adjustments based on E3's professional judgement
Capacity prices	
Marginal emission rates	
Emission costs	
T&D deferral	
Ancillary services prices	E3 estimate based on historical
Resiliency (SAIDI, SAIFI, VOLL)	EIA, DOE
Solar generation profiles	NREL
Customer loadshapes	Efficiency Maine Trust

AESC Energy Prices (Maine) – 2021 $/MWh



AESC Capacity Prices – 2021 $/MWh



Summary of Stakeholder Session #1 Comments

GEO and E3 received many constructive and helpful comments after the first session – thank you to all who provided feedback and/or data. Key points (not exhaustive):

+ **Technologies, Costs & Use Cases: General alignment on near-term focus on battery storage; received requests to review certain technologies, including long-duration storage and hydrogen, and use cases including C&I customer-sited storage:**
  - Action: Reviewing broader list of technologies, including LDES in report, and including customer-sited storage in modeling
+ **Modeling: A few participants asked about modeling additional value streams, e.g., emissions, resilience; some asked about modeling dynamic price effects of storage**
  - Action: Added avoided emissions costs and resiliency as value streams
  - Action: Agree price-taker framework is imperfect, but note adjustments made; AESC prices adjusted to reflect expectations of increased renewables, ELCCs for capacity markets, etc.
+ **Hurdles: Multiple participants noted storage costs, monetizing benefits, permitting and interconnection, transparency regarding where storage can bring highest value, coordination with utilities, rate design, etc.**
  - Action: Addressed through report assessment and the policy considerations

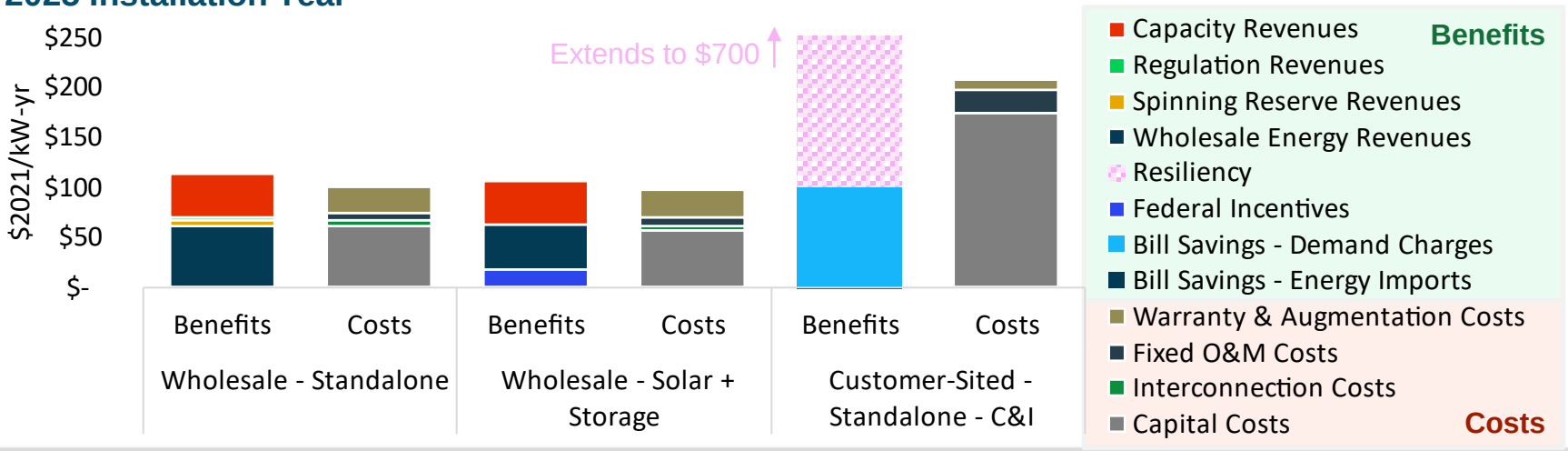
Energy+Environmental Economics

Preliminary Benefit-Cost Analysis Results

Key Takeaways

- Value stacking is important for storage cost-effectiveness
- Both wholesale and customer-sited storage provide diverse and important benefits for society
- Wholesale storage, both with and without solar, appears to be cost-effective from the owner perspective by the mid-2020s
- Customer-sited storage can provide high value benefits through bill savings and resiliency
- From the societal perspective, avoided T&D costs can provide a large benefit but realizing that can be project-specific and location-dependent

Owner Levelized Benefit-Cost Comparison Across Scenarios for 2025 Installation Year

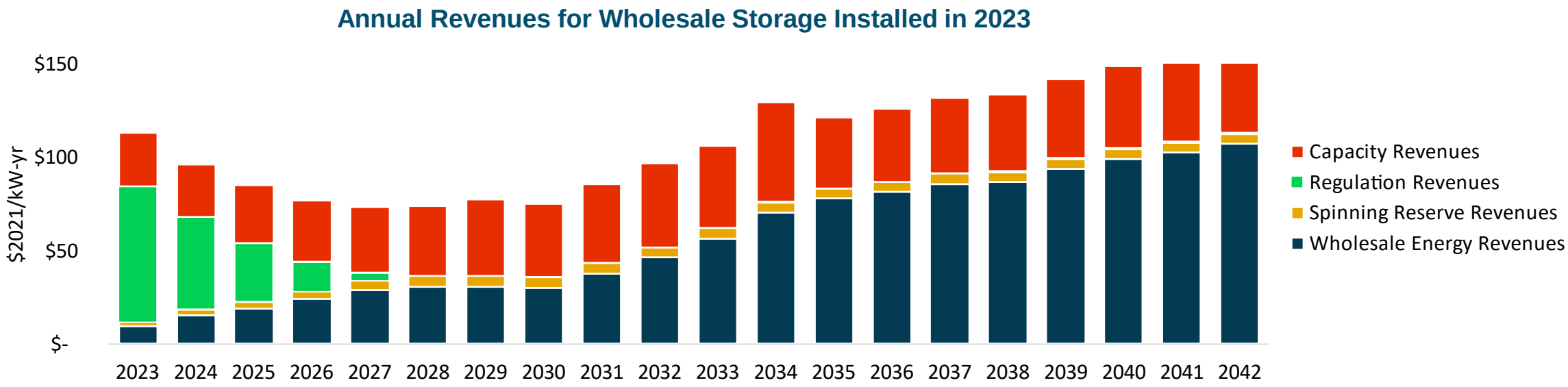


Energy+Environmental Economics

Preliminary BCA Results: Wholesale Standalone Storage

Revenues Evolve Over Time for Wholesale Standalone Storage

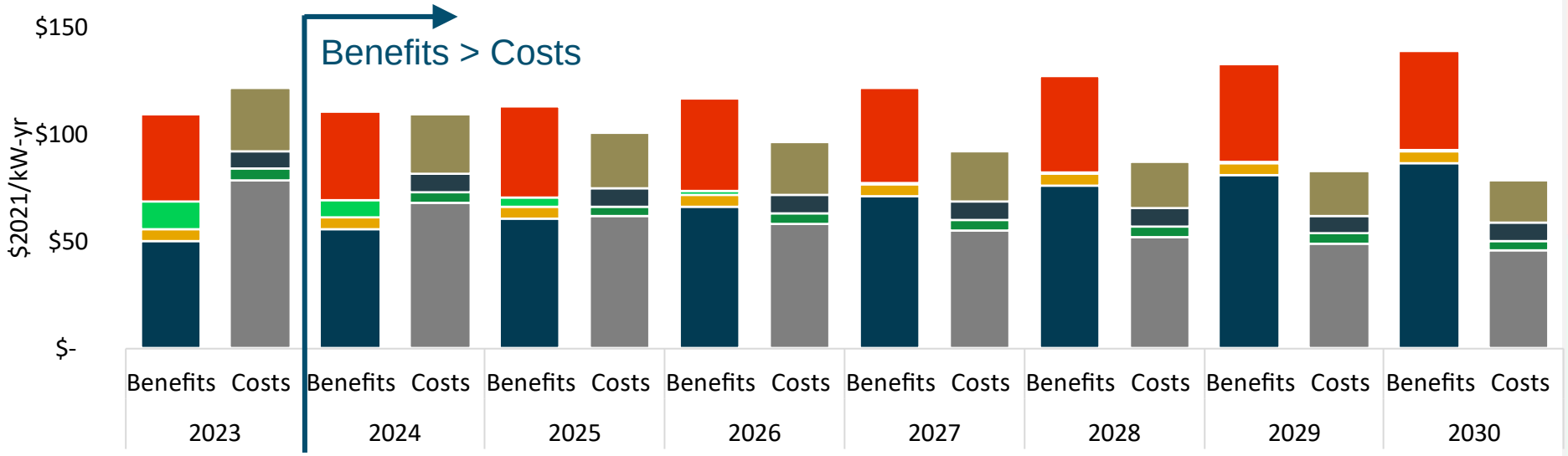
- Regulation provides an important revenue source in the near term, but may decline quickly as the market saturates
- Energy arbitrage revenues increase annually as ancillary services prices drop and daily price spreads widen as more renewables are brought online



Storage Installed by Mid-2020s Provides Net Positive Benefits From Owner Perspective

+ **Lifetime benefits are greater than costs for storage installed in 2024 and later**
  - Increased revenue is driven by better energy arbitrage opportunities in later years
  - Cost declines are driven by expectations for decreasing capital costs

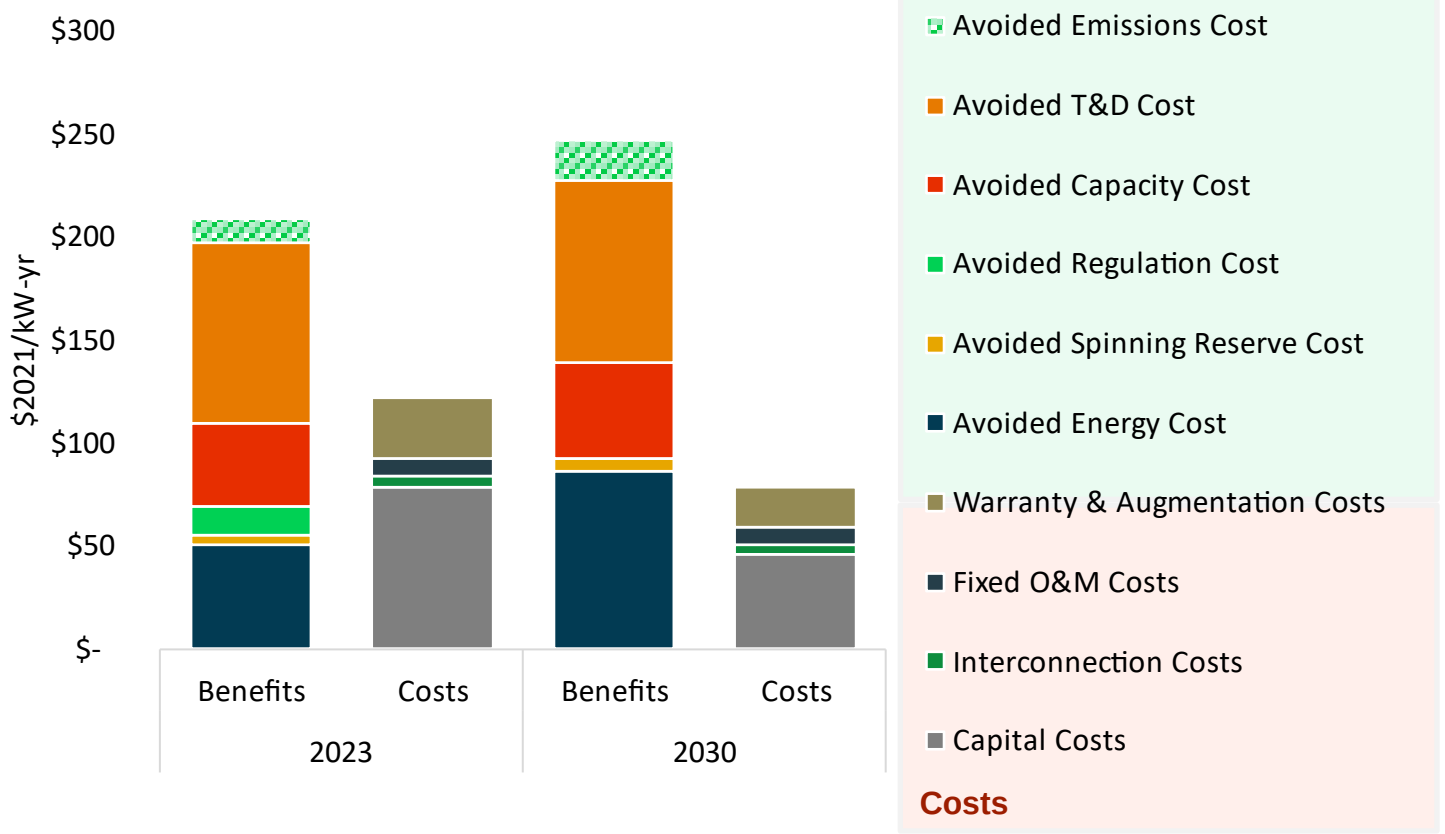
Owner Levelized Benefit-Cost Comparison for Wholesale Storage by Installation Year



Societal Cost Test: Wholesale Standalone Storage is Cost-effective, but Realizing All Benefits Can be Highly Location-Dependent

- **Considering the societal perspective, wholesale standalone storage has net benefits**
  - Benefit/cost ratios increase from 2023 to 2030 installations
- **Avoided T&D costs are a large driver of the total benefits but realizing them can depend on the specifics of that project and its location**
- **Avoided emissions costs are based on a social cost of carbon less the RGGI price, reflecting avoided risk of climate damages**

Societal Levelized Benefit-Cost Comparison for Wholesale Storage by Installation Year

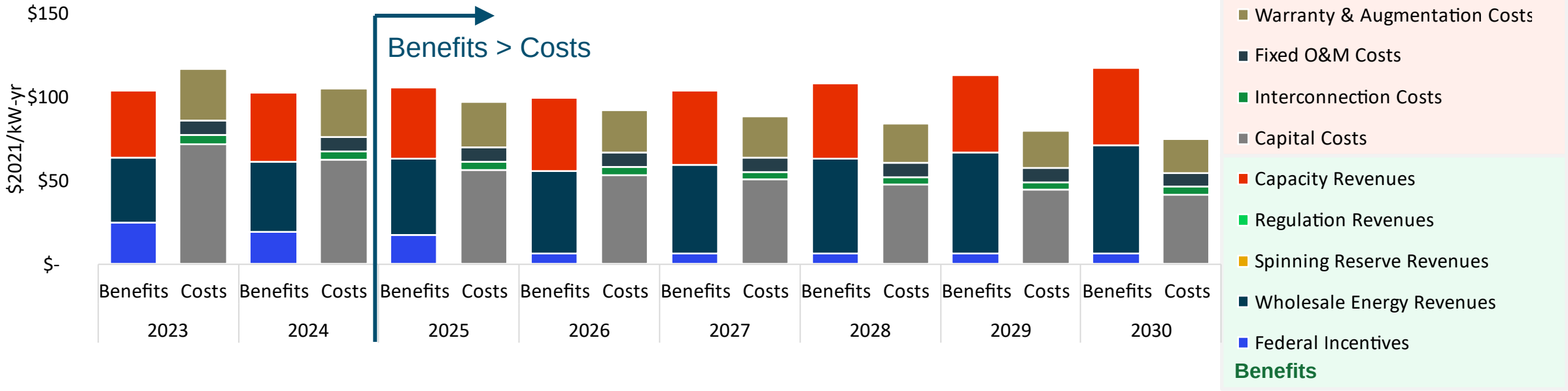


Energy+Environmental Economics

Preliminary BCA Results: Wholesale Storage + Solar

Wholesale Storage + Solar Installed by Mid-2020s Provides Net Positive Benefits From Owner Perspective

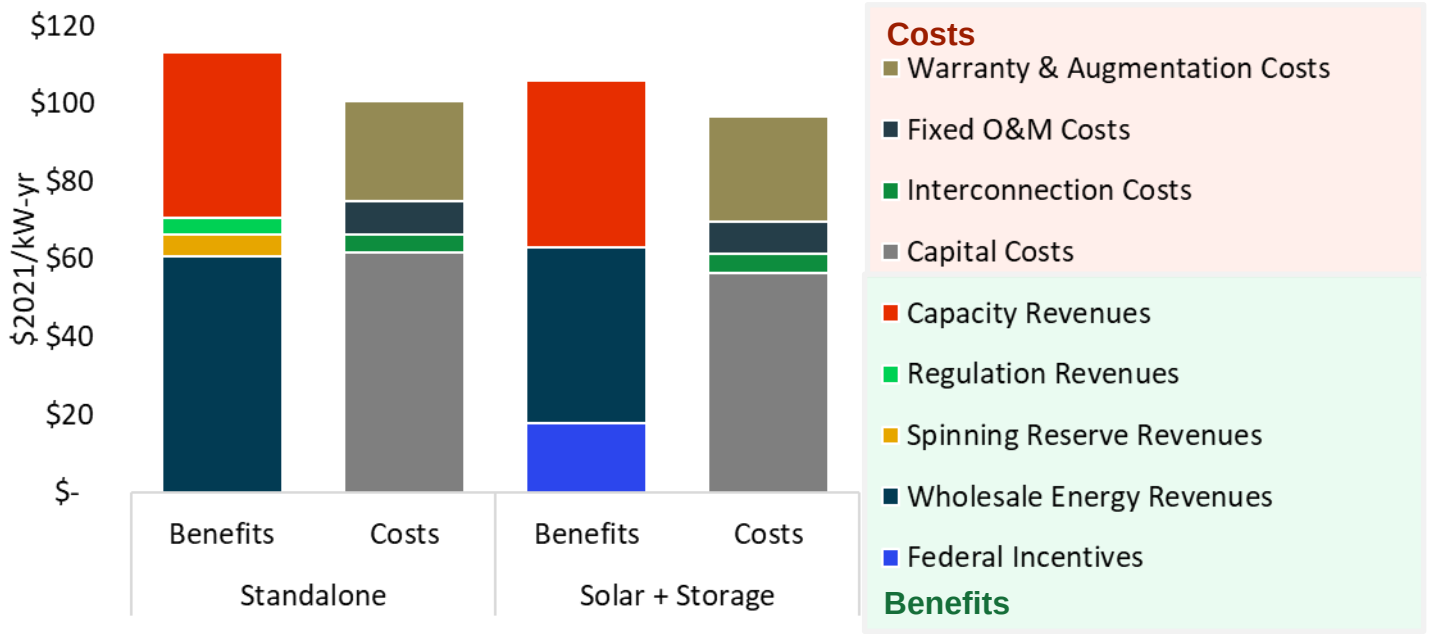
Owner Levelized Benefit-Cost Comparison for Wholesale Storage + Solar by Installation Year



+ **Like standalone storage, lifetime benefits are greater than costs in most years of installation**
  - Federal Incentives (ITC) make up a significant portion of total benefits, especially in earlier years
+ **Energy and capacity markets both provide significant revenue streams**
  - Storage is assumed to charge solely from solar to capture the ITC, impacting its dispatch and revenues
  - Storage paired with solar is assumed to not participate in AS markets, which can depend on storage configuration

Wholesale Storage + Solar has Similar Outlook on Balance to Standalone Storage

Owner Levelized Benefit-Cost Comparison for 2025 Installation Year



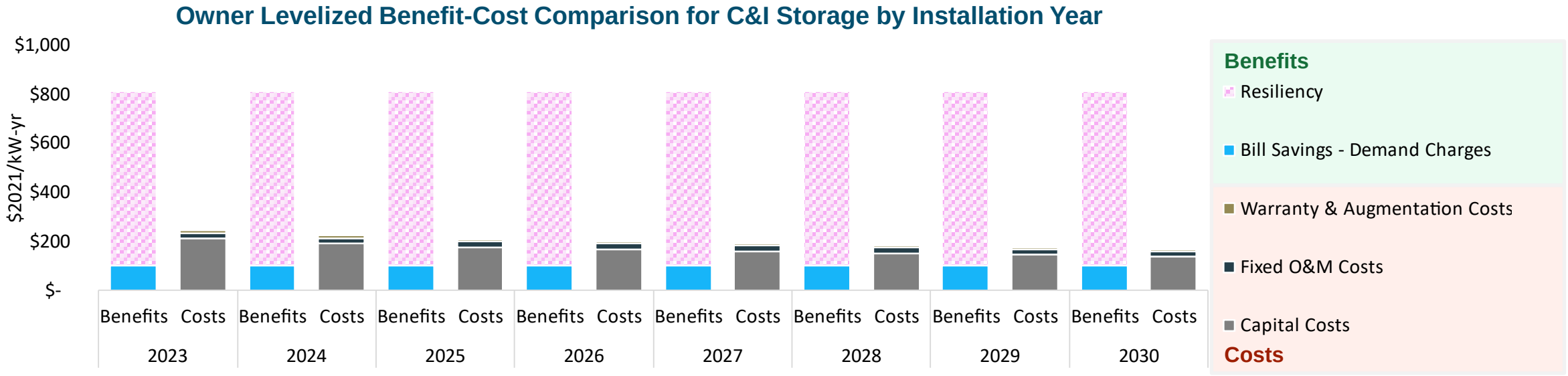
+ **Storage + solar shows similar cost-effectiveness to standalone storage in 2025 despite differences in specific costs and benefits**
  - Storage + solar qualifies for the federal ITC, but the solar charging requirement results in less flexibility and lower energy arbitrage revenues
  - Storage + solar is assumed to not participate in AS markets, further lowering revenue opportunities
  - Capital costs are lower for the storage portion of storage + solar systems due to construction cost savings*

* 2021 LBNL Study explores the energy price coupling penalty for storage + solar systems given geographic constraints – https://emp.lbl.gov/publications/are-coupled-renewable-battery-power

Energy+Environmental Economics

Preliminary BCA Results: Customer-sited C&I Storage

Cost-effectiveness of Customer-sited C&I Storage From the Owner Perspective Can Depend on Resiliency Benefits



+ **Storage has significant revenue from bill savings, but these revenues are still lower than costs, even by 2030.**

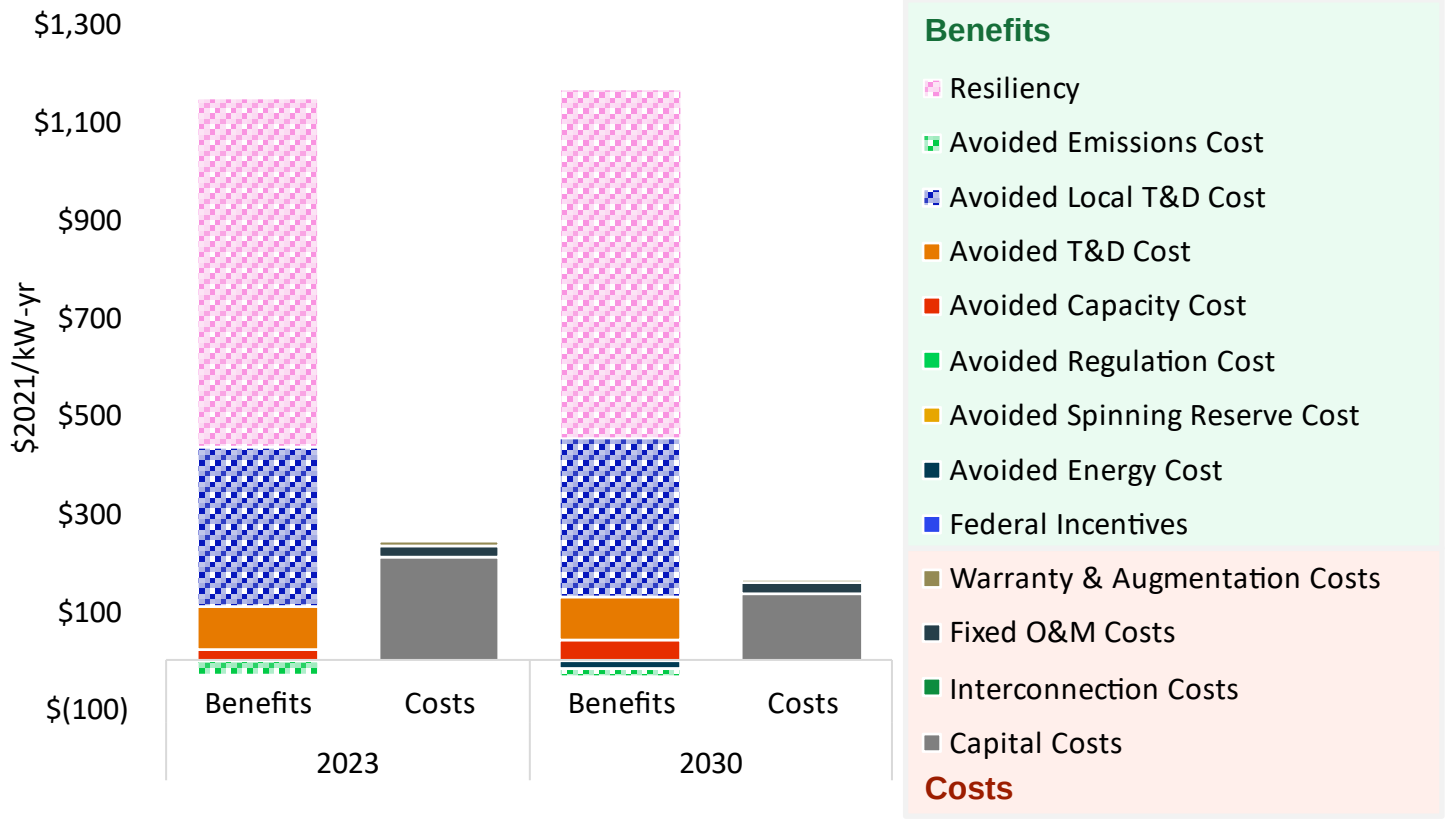
+ **Customer-sited C&I Storage is assumed to have additional resiliency benefits but quantifying them can be highly uncertain**
  - Resiliency is based on an assumed value of lost load along with historical outages in the region
  - The value of lost load attempts to capture the economic losses associated with power outages, but can vary significantly depending on customer type, outage duration, and location.

Note: The C&I Storage scenario uses Central Maine Power's LGS-S-TOU rate.

Societal Cost Test: Customer-sited C&I Storage is Cost-effective, but Benefits are Site-Specific

+ **Societal perspective demonstrates net benefits to Maine**
  - Resiliency benefits can vary, given function of value of lost load
  - Realizing avoided T&D costs for any specific project can depend on location
+ **Avoided emissions are negative**
  - TOU periods do not currently correlate well with marginal emissions rates
  - Using current TOU periods for 2030 modeling is a known limitation of this analysis

Societal Levelized Benefit-Cost Comparison for C&I Storage by Installation Year



Energy+Environmental Economics

Preliminary Policy Considerations

Preliminary Policy Considerations for Maine

- **Technology:** Support a technology neutral approach to policies aimed at growing a Maine energy storage market, with both near- and long-term development supported by a focus on innovation
- **Rate Design:** Continue pursuit of designs that allow for energy storage value to be maximized, and more closely align storage operation with outcomes supported by state policy goals
- **Programs:** Continue pursuit of options for development of incentive programs for energy storage, particularly customer-sited behind-the-meter storage, targeted to reduce peak demand and integrate renewable generation
- **Stakeholders:** Consider formation of an ongoing energy storage stakeholder group to share information and coordinate storage policy in Maine, as well as other New England states
- **Information:** Develop and make available resources for municipalities and tribes to support energy storage deployment given a rapidly developing industry
- **Planning:** Monitor guidance from federal agencies and national laboratories to support planning for energy storage decommissioning, recycling, and other end-of-life considerations
- **Policy Leadership:** Consider how energy storage can support Maine's *Lead By Example* efforts related to energy efficiency and renewables

Energy+Environmental Economics

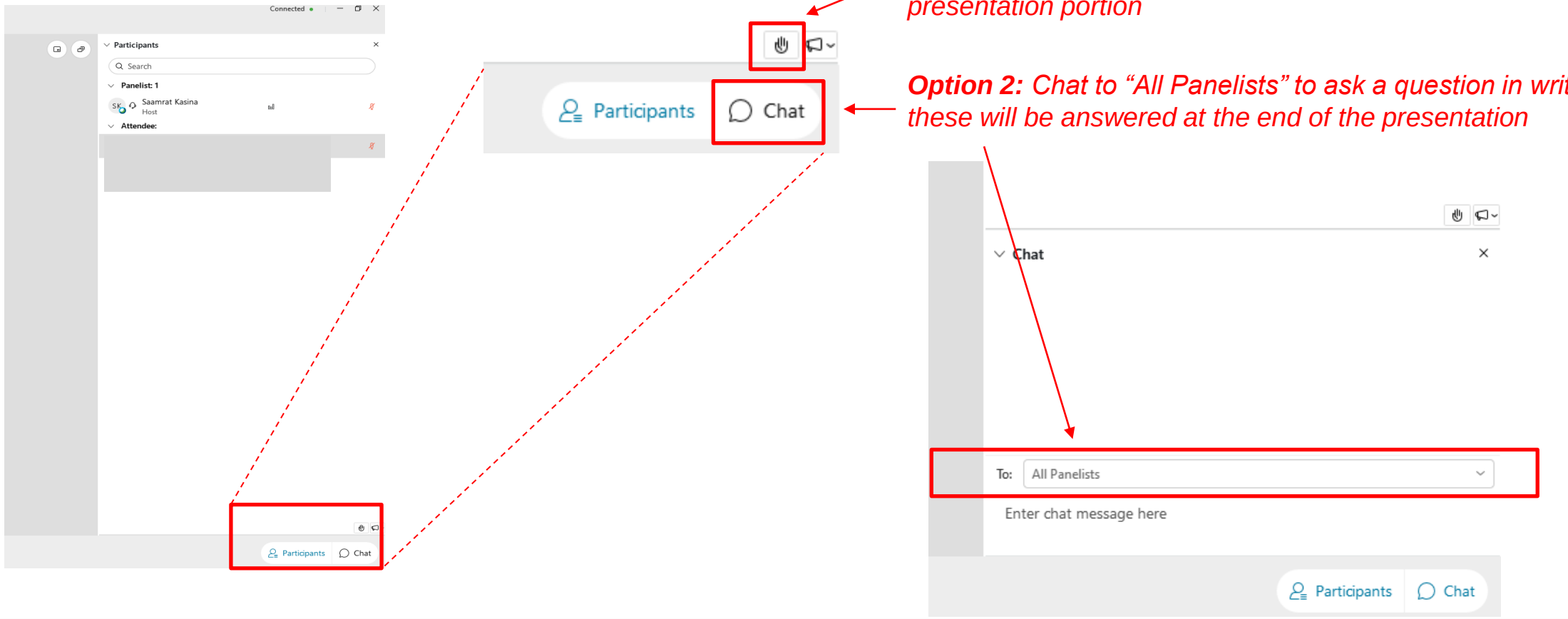
Q&A with Stakeholders

Two Ways to Ask Questions

- Questions will be answered at the end of the presentation portion
- Please use the ‘Raise Hand’ or ‘Chat’ feature to ask questions

Option 1: *“Raise Hand” to ask questions at the end of presentation portion*

Option 2: *Chat to “All Panelists” to ask a question in writing and these will be answered at the end of the presentation*



Energy+Environmental Economics

Feedback

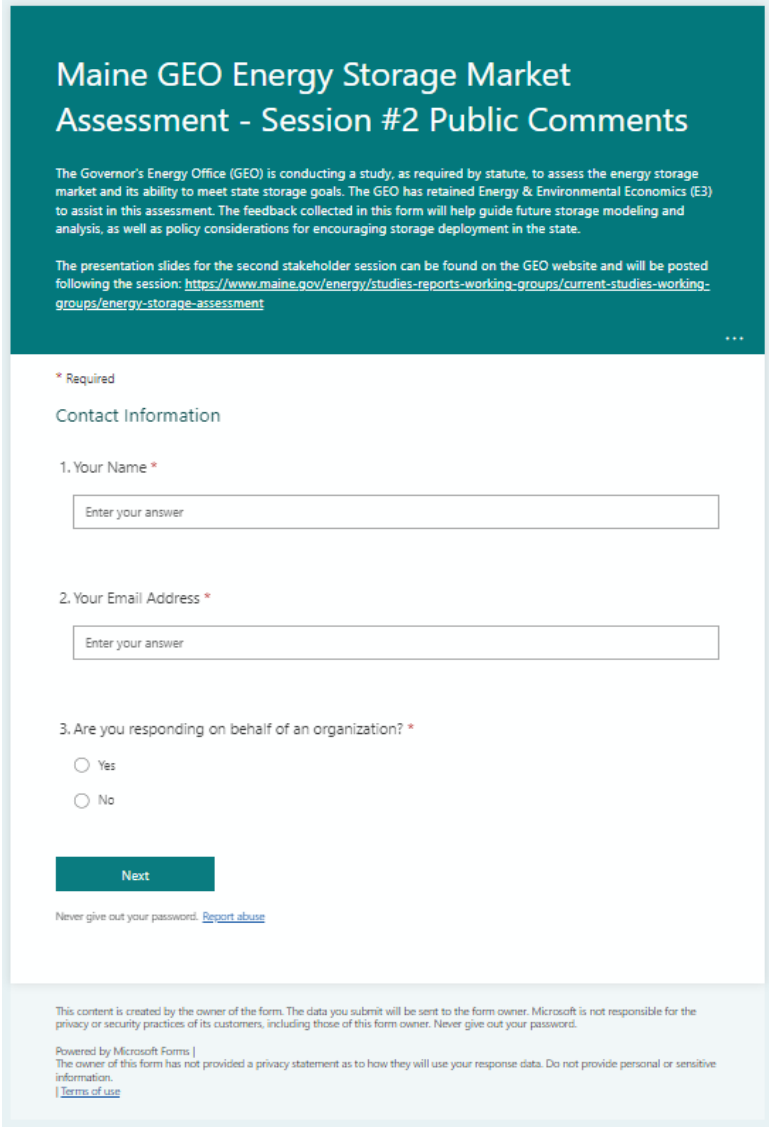
Feedback Questions

Topic	Question(s)
BCA Results	What considerations should be made for future cost-benefit analysis modeling? What uncertainties or modeling limitations should be highlighted?
Policy Considerations	What are areas for future study to support growth of storage industry in Maine? Are there any additional policy considerations that should be noted?

Please submit your responses and feedback at: https://forms.office.com/r/ZDVLXHrquX

How to Submit Feedback

- **Link to submit feedback:**
  - https://forms.office.com/r/ZDVLXHrquX
  - Link also posted on the GEO Energy Storage Market Assessment webpage
- **Your feedback will be considered as the report is finalized later this month**
- **If you would like to submit an attachment, please email Caroline.Colan@maine.gov**
- **We request that feedback is submitted by close of business 2/16/2022**



Maine GEO Energy Storage Market Assessment - Session #2 Public Comments

The Governor's Energy Office (GEO) is conducting a study, as required by statute, to assess the energy storage market and its ability to meet state storage goals. The GEO has retained Energy & Environmental Economics (E3) to assist in this assessment. The feedback collected in this form will help guide future storage modeling and analysis, as well as policy considerations for encouraging storage deployment in the state.

The presentation slides for the second stakeholder session can be found on the GEO website and will be posted following the session: https://www.maine.gov/energy/studies-reports-working-groups/current-studies-working-groups/energy-storage-assessment

* Required

Contact 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

This content is created by the owner of the form. The data you submit will be sent to the form owner. Microsoft is not responsible for the privacy or security practices of its customers, including those of this form owner. Never give out your password.

Powered by Microsoft Forms | The owner of this form has not provided a privacy statement as to how they will use your response data. Do not provide personal or sensitive information. | Terms of use

Energy+Environmental Economics

Thank You

Caroline Colan, Caroline.Colan@maine.gov

Tristan Wallace, Tristan.Wallace@ethree.com