2023 Draft Consolidated RES Model – for Review

November 2022

DEPARTMENT OF PUBLIC SERVICE

VERMONT
PUBLIC SERVICE DEPARTMENT

Topics Covered

- Overview of the Renewable Energy Standard (RES)
  - Tiers I, II, and III
- Modeling Exercise – 10-year projections of impact
  - Required Outputs/Outcomes
  - Model Inputs
  - Draft Results

Vermont Renewable Energy Standard

Vermont

- **Title:** Renewable Energy Standard.
- **Established:** 2005 (voluntary target); 2015 (standard).
- **Requirement:** 55% by 2017; 75% by 2032.
- **Applicable Sectors:** Investor-owned utility, municipal utilities, cooperative utilities, retail supplier.
- **Cost Cap:** Approximately 6%.
- **Details:** Distributed Generation: 10% by 2032. Energy Transformation: 12% by 2032 (includes weatherization, thermal energy efficiency, electric vehicles and heat pumps).
- **Enabling Statute, Code or Order:** Vt. Stat. Ann. tit. 30 §8001 et seq.; Standard: House Bill 40.

Source: https://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx and https://programs.dsireusa.org/system/program/detail/5786/renewable-energy-standard

Renewable Energy Credits (RECs)

- RECs are the tool used for accounting, tracking and assigning ownership of environmental attributes.
- One Megawatt-Hour (MWh) of renewable generation = one REC
- RECs are used throughout U.S. to track renewability
- Creates fungible commodity that can be traded; Renewable attributes can be separated from underlying generation
  - Attributes v RECs
- Creates uniform system for ensuring that there is no double counting
- Value of REC
  - Theory is that REC value should represent the difference between the revenues a resource receives from wholesale markets (e.g. energy, capacity, reserves, etc.) and the cost to build
  - Reality is that value is based on supply and demand
  - Different Tier/Class eligibility means different values

Vermont RES Tier 1 – Total Energy

- Eligibility – any renewable resource that can deliver into New England, regardless of when resource was constructed.
  - Includes resources from New York and Quebec
  - Has largely been met with hydroelectric resources from New England, New York, and Canada
- Required Amounts:
  - 55% of retail sales in 2017, increasing 4% every three years, until 75% in 2032
    - Tier II is included in Tier I
  - Current Requirements:
    - 2020-2022: 59%
  - Maintained at 75% thereafter
- Alternative Compliance Payment = $10.58/REC in 2020, increasing by Consumer Price Index (CPI) annually

Vermont RES Tier 2 – Distributed Generation

- Eligibility – renewable resources commissioned after June 30, 2015; connected to a distribution or sub transmission line in Vermont; nameplate capacity of less than 5 MW
  - Resources used to demonstrate compliance typically include net-metering, standard offer, utility PPAs
- Required Amounts: 1% of retail sales in 2017, increasing 0.6% every year, until 10% in 2032
  - Maintained at 10% thereafter
  - Current Requirements:
    - 2020: 2.8%
    - 2021: 3.4%
  - Carve out of Tier 1 requirements (not additional)
- Alternative Compliance Payment = $63.48/REC in 2020, increasing by Consumer Price Index (CPI) annually

Vermont RES Tier 3 – Energy Transformation

- Purpose: Support fossil fuel reductions for utility customers
- Eligibility: electrification (vehicles, heat pumps); sawmills; sugaring operations; weatherization; Tier 2 RECs
- Required Amounts: 2% of retail sales in 2017, increasing by 0.67 % each year until reaching 12% in 2032
  - Maintained at 12% thereafter
  - Later start date and lower overall requirement for small municipal utilities
- Alternative Compliance Payment = $ 63.48 /REC in 2020, increasing by CPI annually
- Costs vary considerably in terms of incentives paid to customers. Average cost was $51/ MWhe in 2020

RES Model Projections of Future Costs 2022-2031

- 30 V.S.A. 8005b(b)(2) requires the Public Service Department (PSD) to conduct an analysis of expected performance of the RES over a ten-year period utilizing a "Consolidated RES Model" to estimate the credible range of outcomes

- Outcomes:
  - Cost Estimates of RES under various scenarios
  - Rate pressure
  - Carbon emission reductions

- Key inputs:
  - Load forecast
  - REC prices (*Tiers I & II*)
  - Energy & Fossil Fuel Prices
  - Tier III technologies and impact on peak loads
  - Net-metering adoption rates

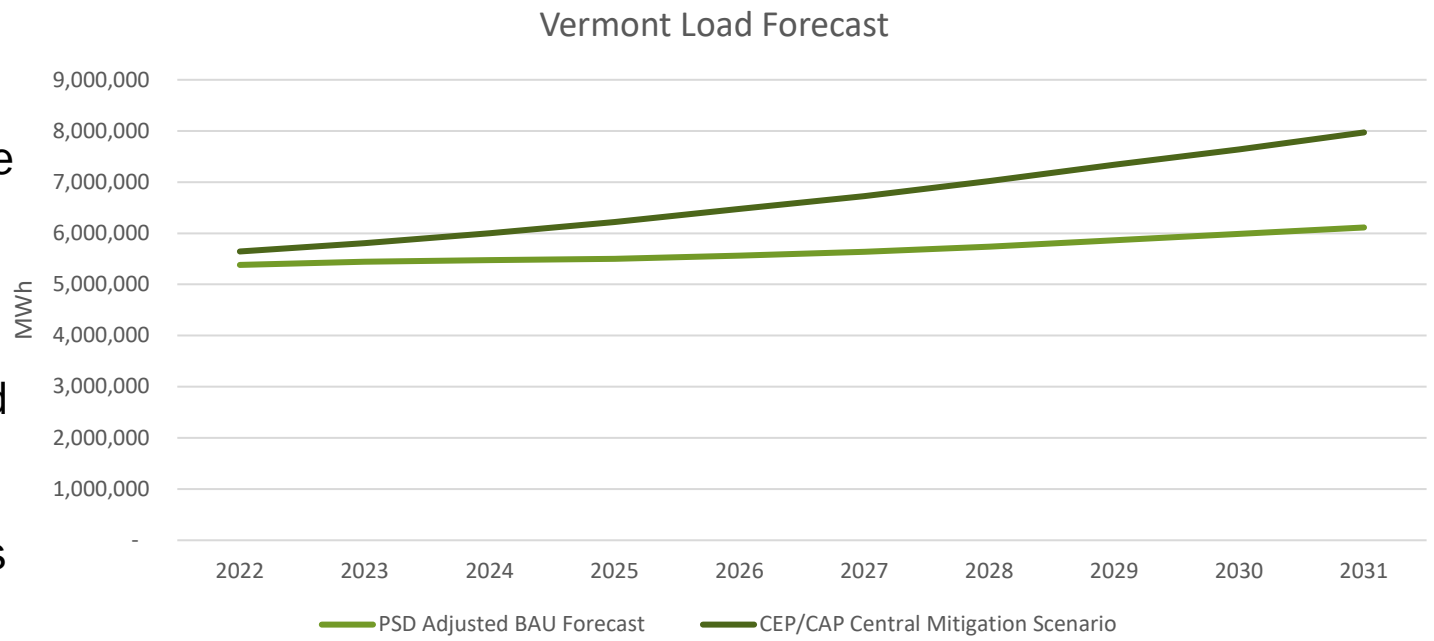
- Stakeholders are welcome to review the entire model to provide feedback. This deck is meant to succinctly summarize major factors influencing the results of the 2023 Consolidated RES model.

Modeling Exercise – Scenarios Analyzed

MODEL INPUTS	LOW INCREMENTAL COST		MOST LIKELY COST SCENARIO		HIGH INCREMENTAL COST	
REC Price Forecast	LOW		MID		HIGH	
Net Meter Adoption Rate	LOW		MID		HIGH	
Peak contribution of New Load	10%		25%		75%	
Fossil Fuel Price	HIGH		MID		LOW	
Load Forecast Scenario	Baseline	High	Baseline	High	Baseline	High

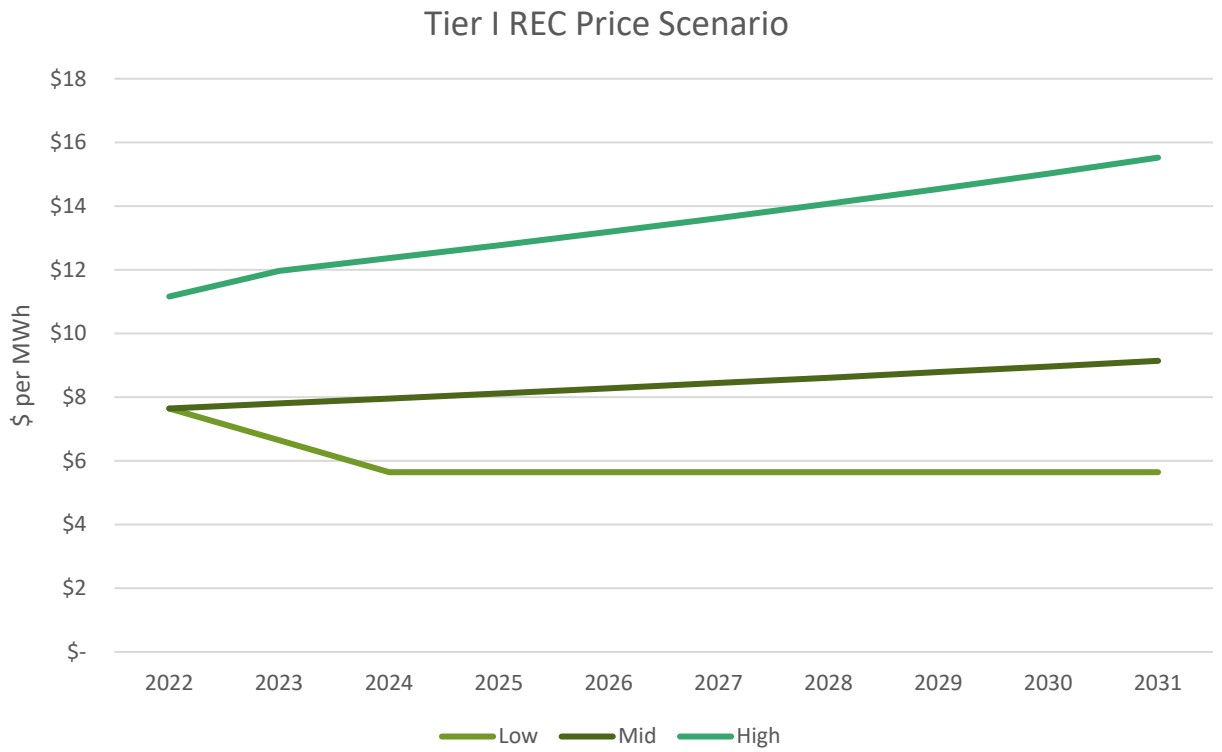
Model Input: Load Forecasts

- **Baseline Forecast (BAU):** Actual 2021 sales escalated at the rate of VELCO's 2021 Long-Range Transmission Plan
- **High Forecast (CEP/CAP):** Based on modeling conducted for Comprehensive Energy Plan (CEP)/Global Warming Solutions Act (GWSA) carbon reduction pathways



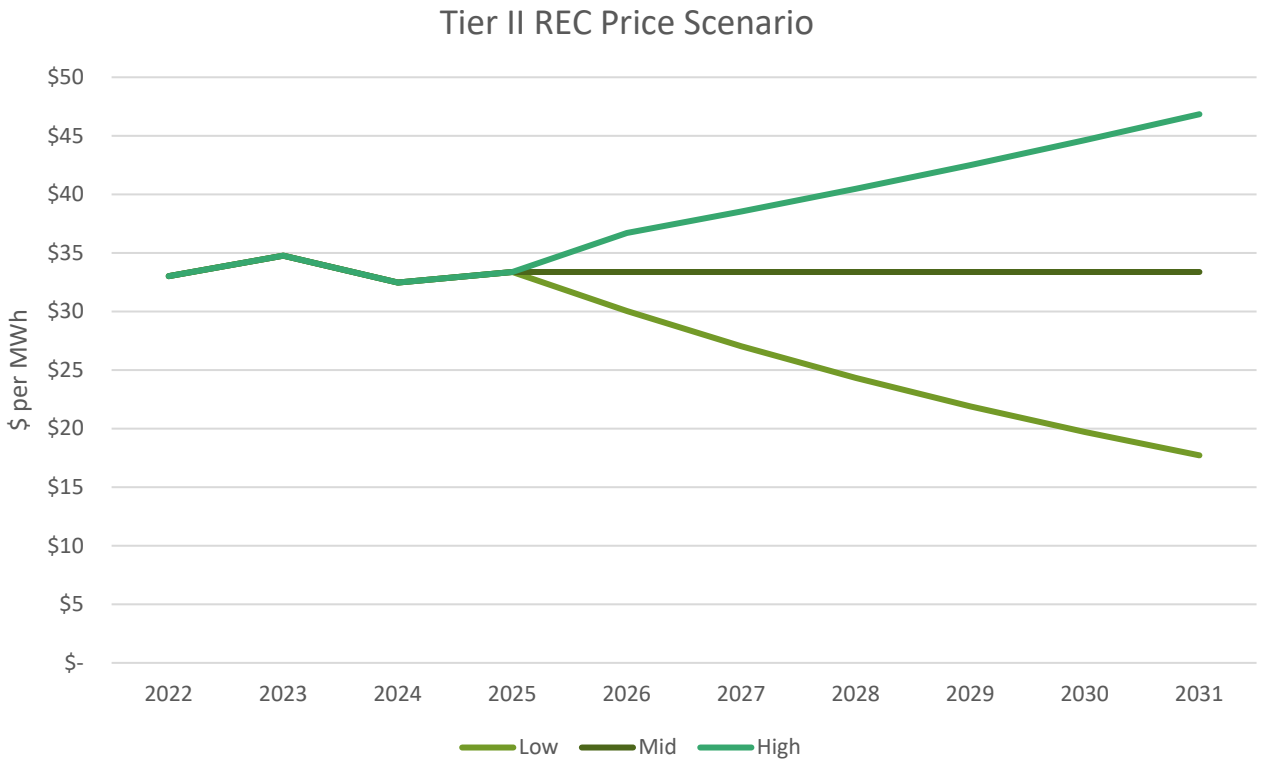
Model Input: Tier I REC Scenarios

- **Low Scenario:** Assumes some tapering in out years if new transmission lines bring Canadian Hydro to southern New England where these resources are valued for clean energy standards
- **Mid Scenario:** Stable with current price trends
- **High Scenario:** Continued pricing at the Alternative Compliance Payment (ACP)
- **Example Qualifying Resource:** Maine Class II RECs are a good proxy measurement of an existing resource that qualifies for Tier I. These RECs have recently traded at $8 to $11 per MWh



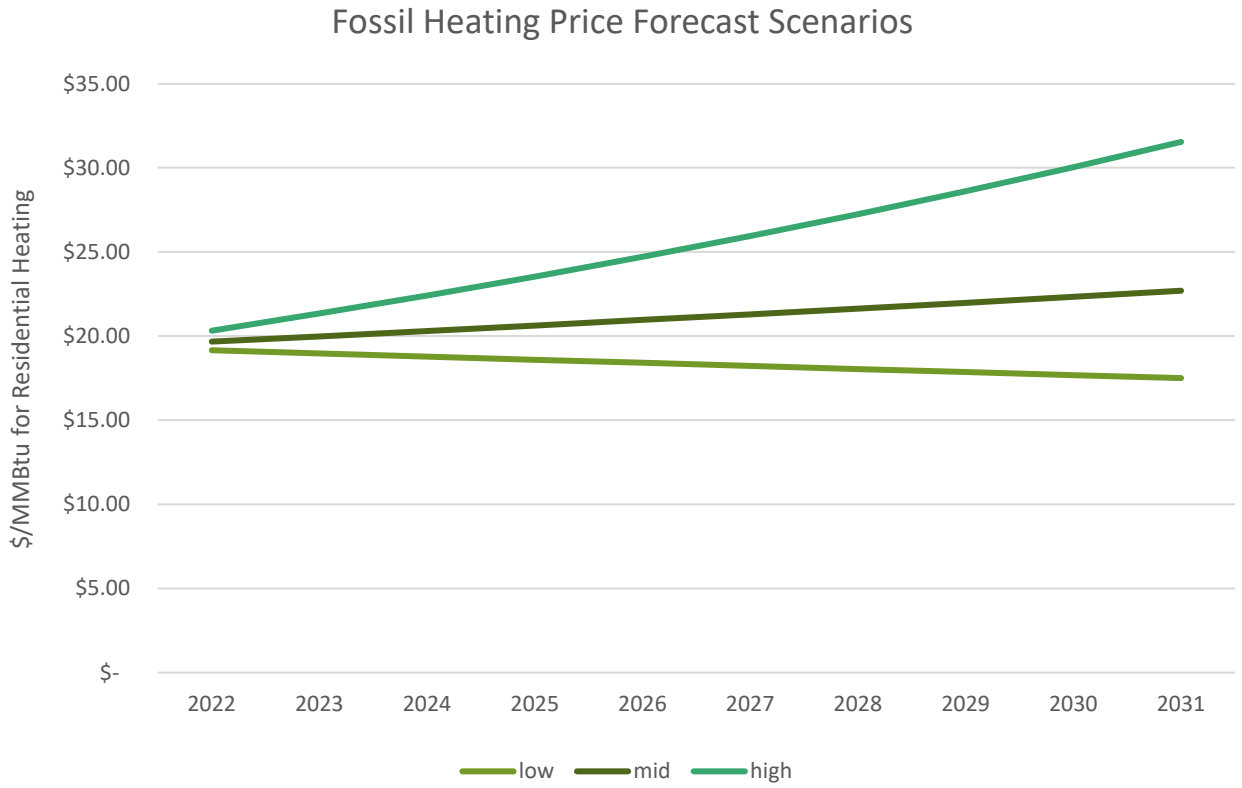
Model Input: Tier II REC Scenarios

- **Low Scenario:** Steady reductions as large new offshore wind resources come online
- **Mid Scenario:** Stable with current price trends
- **High Scenario:** Delays/attrition of offshore wind projects result in higher prices in the low to mid $40s per MWh
- **Example Qualifying Resource:** Massachusetts Class I RECs are a good proxy measurement of an existing resource that qualifies for Tier II. These RECs have recently traded around $32 to $34 per MWh



Model Input: Fossil Fuel Scenarios

- **Low Scenario:** Slight decline from present
- **Mid Scenario:** Stable with current
- **High Scenario:** Steady, growth from present
- From EIA Annual Energy Outlook (AEO) 2022
  - Weighted average Residential $/MMBtu of oil, propane and gas
  - Weights based on VT household fossil fuel for heating distribution (excludes wood and electric)
  - 2022 AEO was published in March 2022 and may not fully price in recent increase in fossil fuel prices, especially propane/gas



Model Input: Tier III Technology Allocations

- **Prior Modeling Assumptions:** Initial assumptions used for all prior year models

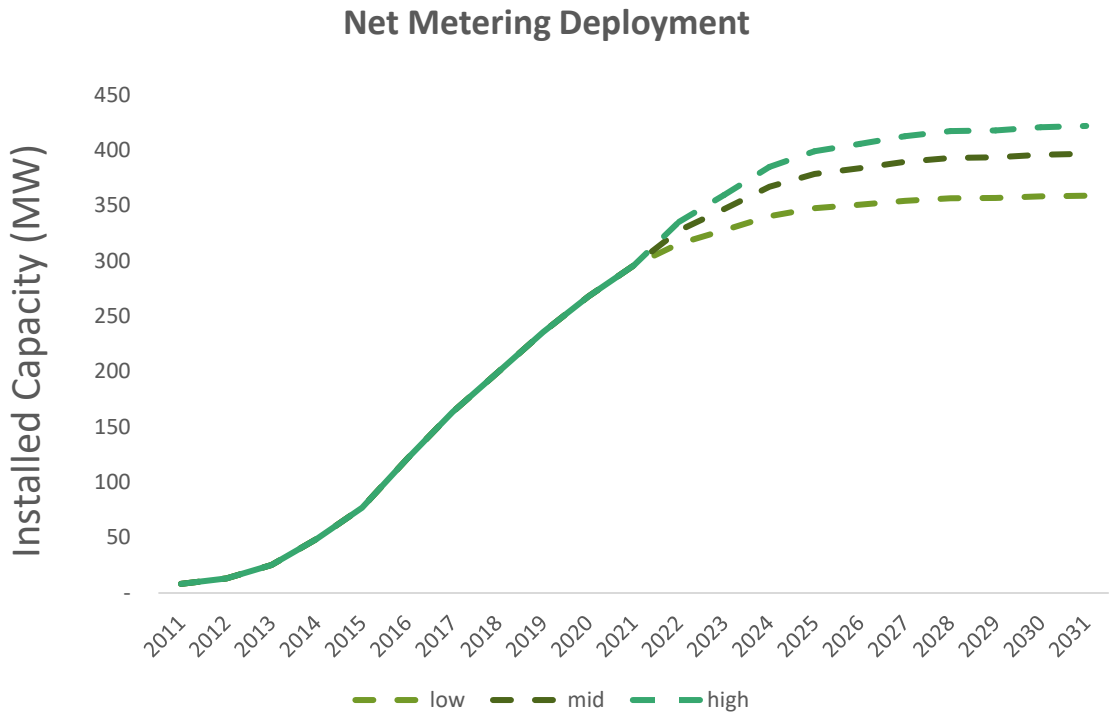
Cold Climate Heat Pump	40%
Electric Vehicle	40%
Weatherization	5%
Custom Projects	10%
Tier II RECs	5%

- **Draft 2023 Modeling Assumptions:** updated to better reflect actual Tier III measure savings to-date and expected savings distribution over the 10-year modeling period

Cold Climate Heat Pump	56%
Electric Vehicle	30%
Weatherization	2%
Custom Projects	10%
Tier II RECs	2%

Model Input: Net Metering Adoption

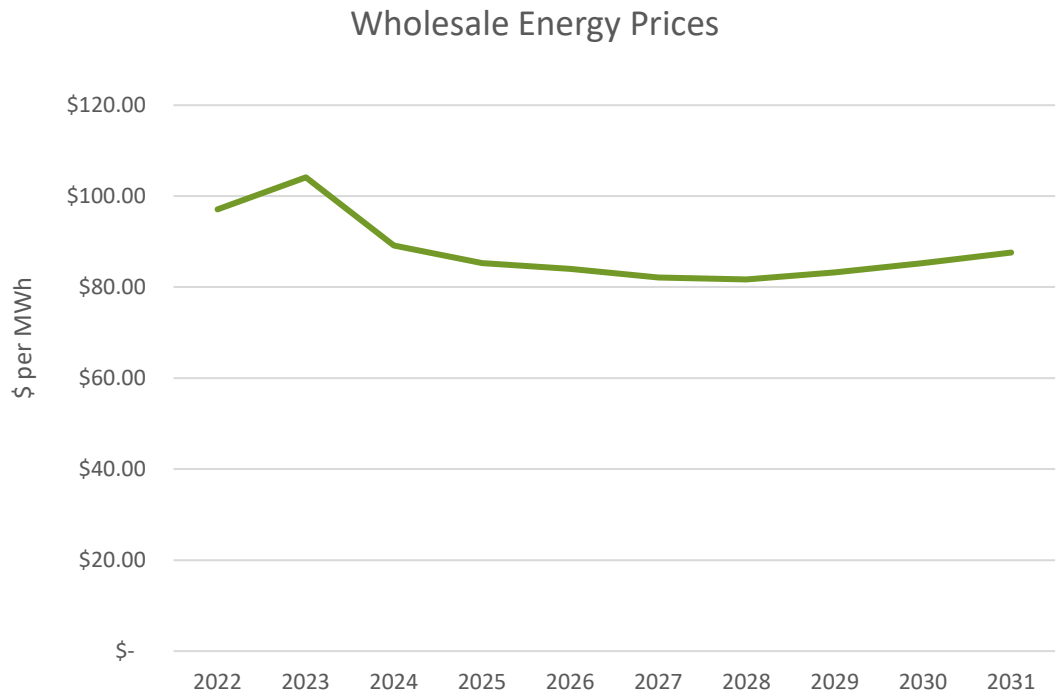
- 2020 - 2021 = Actuals
- **2022-2031 Forecast =** from Vermont Electric Power Company (VELCO) 2021 Long-Range Transmission Plan
- **Low Scenario:** 50% of VELCO's forecasted net metering
- **Mid Scenario:** 80% of VELCO's forecasted net metering
- **High Scenario:** 100% of VELCO's forecasted net metering



VELCO 2021 Long Range Transmission Plan: https://www.velco.com/assets/documents/2021%20VLRTP%20to%20PUC_FINAL.pdf

Model Input: Wholesale Electric Prices

- Method
  - 2022 YTD + average of Independent Service Operator of New England (ISO-NE) electric forwards over multiple months for end of 2022 and calendar 2023
  - Escalated at rate of Henry Hub gas forwards to 2031
- Use
  - New England wholesale price forecast *trend* is used to escalate the portion of current statewide cost of service (2021) tied to energy markets
- Cost of Service Share tied to Market – 20%
  - Wholesale market exposure limited to "open" positions and indirectly through long-term contracts with price components such fuel adjustment (biomass) or market-following (Hydro Quebec) price components

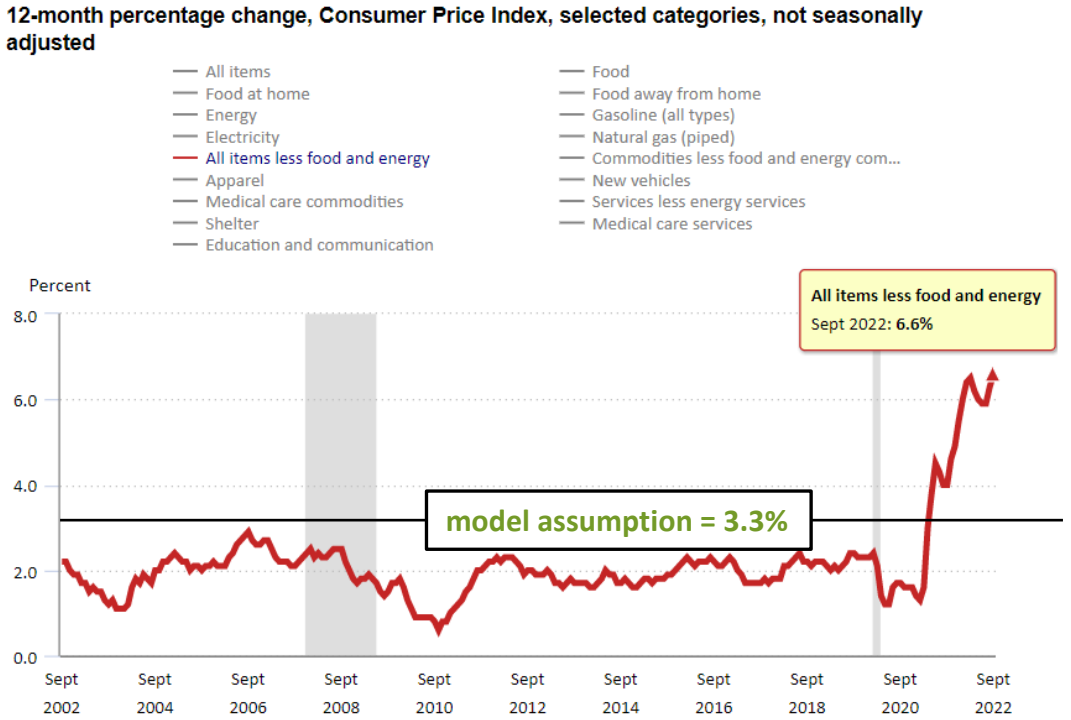


Cost of Service Escalation	
share tied to market	20%
share tied to inflation	70%
share tied to depreciation	10%

*This assumption influences the projected cost of service tied to energy markets

Model Input: Inflation

- Method
  - Current 12-month average 6.6% Core Inflation curtailed by monetary policy over the 10yr model horizon, but near-term high inflation will bring the 10-year average up from historical ~2%
  - Core inflation (CPI less food and energy) used because model already ties a portion of cost of service to energy ("share tied to market")
- Use
  - Model uses this as a trending tool to escalate the portion of current (2021) statewide cost of service tied to inflation over the modeling horizon of 2022-2031
- Cost of Service tied to Inflation – 70%
  - Most T&D costs, many long-term power supply contracts, RES ACP all escalate at rate of inflation



Cost of Service Escalation	
share tied to market	20%
share tied to inflation	**70%**
share tied to depreciation	10%

*This assumption influences the projected cost of service tied to inflation, a proxy for utility capital escalation

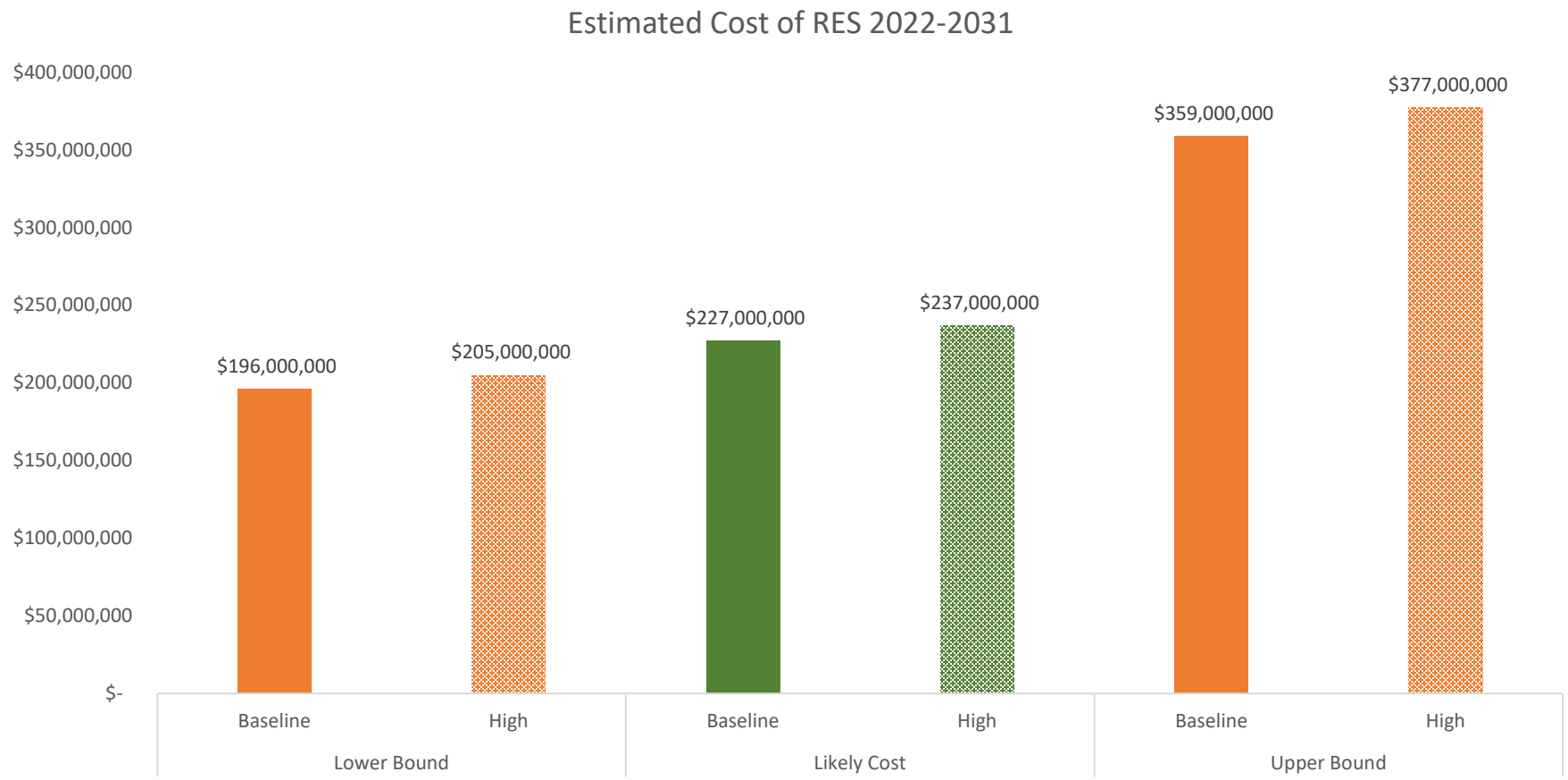
Model Input: Depreciation

- 2022-2031 depreciation assumption = -1%
  - No change from prior years
- Cost of Service tied to Inflation – 10%
  - Assumption for COS share tied to depreciation taken from recent rate cases

Cost of Service Escalation	
share tied to market	20%
share tied to inflation	70%
share tied to depreciation	**10%**

*This assumption influences the projected cost of service tied to depreciation

Current Year Model: DRAFT Projected Costs

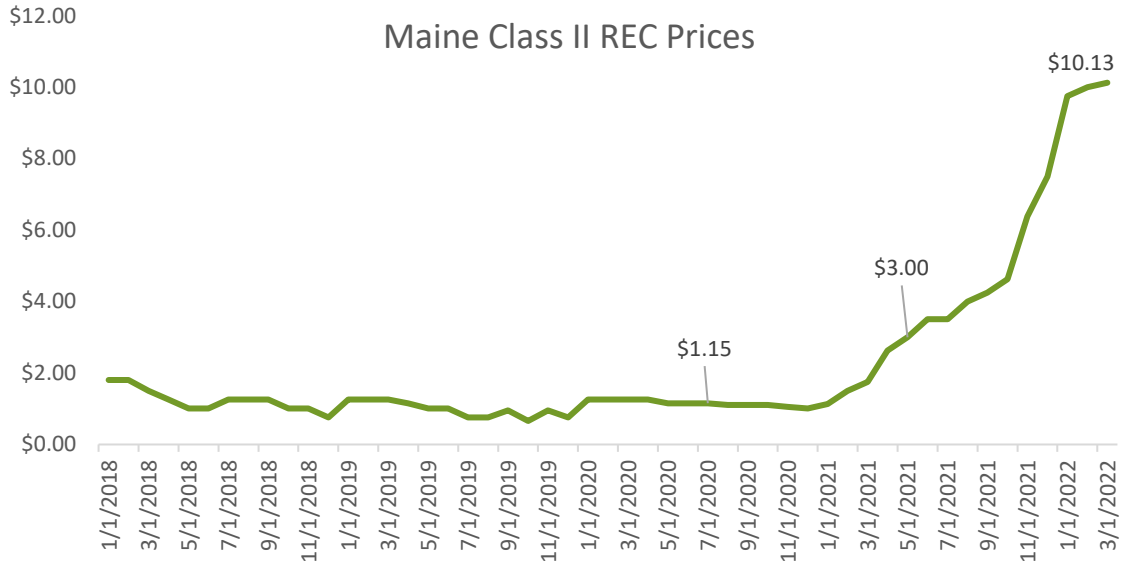


Current Year Model: Estimated RES compliance costs: 2022-2031

	LOW INCREMENTAL COST		HIGH INCREMENTAL COST	
REC Price Forecast	LOW		HIGH	
Net Metering Adoption Rate	LOW		HIGH	
Peak contribution of New Load	10%		75%	
Fossil Fuel Price	HIGH		LOW	
Load Forecast Scenario	Baseline	High	Baseline	High
Tier 1 Cost	**$87,000,000**	**$95,000,000**	**$190,000,000**	**$206,000,000**
Tier 2 Cost	**$106,000,000**	**$113,000,000**	**$116,000,000**	**$125,000,000**
+Tier 3 Cost	$261,000,000	$278,000,000	$390,000,000	$325,000,000
-Tier 3 Additional Revenue	-$258,000,000	-$281,000,000	-$256,000,000	-$279,000,000
Tier 3 Net Cost	$3,000,000	-$3,000,000	$53,000,000	$46,000,000
TOTAL Cost of RES	**$196,000,000**	**$205,000,000**	**$359,000,000**	**$377,000,000**
Rate Impact	1.86%	1.68%	4.99%	4.91%

Year-over-year notable changes

- Increase in projected 10-year RES costs compared to 2022 RES model (2021-2030)
  - "Likely Cost" Estimate = ~25% increase over 2022 modeled Likely Cost
- Sharp increases in prices for Tier I RECs raises the expected price floor (lower bound).
  - Maine Class II (existing renewables) are an example of a qualified Tier I resource traded regionally
  - Is this a good measure of Tier I REC costs? What other resources could we use to forecast Tier I costs?



Year-over-year notable changes

- Other Notable changes
  - Retail sales used for load forecast in this period (2021) is 1.5% higher than prior year (2020),
  - RES requirements increase over time, so the model's embedded requirements are higher in this 10-year period than the 10-year period modeled last year
  - Adjusting the technology allocation assumptions for Tier III resources to reflect actual and expected savings coming more from heat pumps than EVs results in higher costs. Heat pump consumption patterns lead to more usage during peak times than EVs, which are often encouraged to charge overnight during off-peak hours when energy is cheaper.
  - Inflation and higher energy market prices also contribute to across-the-board higher costs of service and RES costs

Request for Feedback

- PSD would like feedback on the model inputs and assumptions described in this presentation
- Any other thoughts stakeholders have based on review of the model itself are also welcome

Please send feedback or questions directly to:
adam.jacobs@vermont.gov

Thank You!