2024 Draft Consolidated RES Model – for Review

November 2023

DEPARTMENT OF PUBLIC SERVICE

VERMONT
PUBLIC SERVICE DEPARTMENT

Topics Covered

- Overview of the Renewable Energy Standard (RES)
- RES model
  - RES model statutory requirements from 30 V.S.A. 8005b(b)(2)
  - Differences from Ongoing PSD RES/CES Public Engagement
- Input Assumptions
- Draft Results
- Appendix Slides
  - What are RECs
  - Overview of Tiers I, II and III

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

RES Model Projections of Future Costs 2023-2032

- 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

- 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.

Context: Differences from Ongoing PSD RES/CES Public Engagement

THIS model is a statutorily required exercise the Department conducts on an annual basis pursuant to 30 V.S.A. §8005b intended to provide specific answers to questions around costs, energy consumption and GHG emissions reductions as a result of the current 75% RES.

More info here: https://legislature.vermont.gov/statutes/section/30/089/08005b

Separately - the Vermont Public Service Department has been engaged in a broad review of our current state electricity policies and programs, as recommended by the state Comprehensive Energy Plan and Climate Action Plan. That effort includes an assessment by Sustainable Energy Advantage (SEA) of a variety of different potential changes to the RES that would achieve 100% renewable or carbon-free supply as well as their potential costs and benefits.

More info here: https://publicservice.vermont.gov/renewables

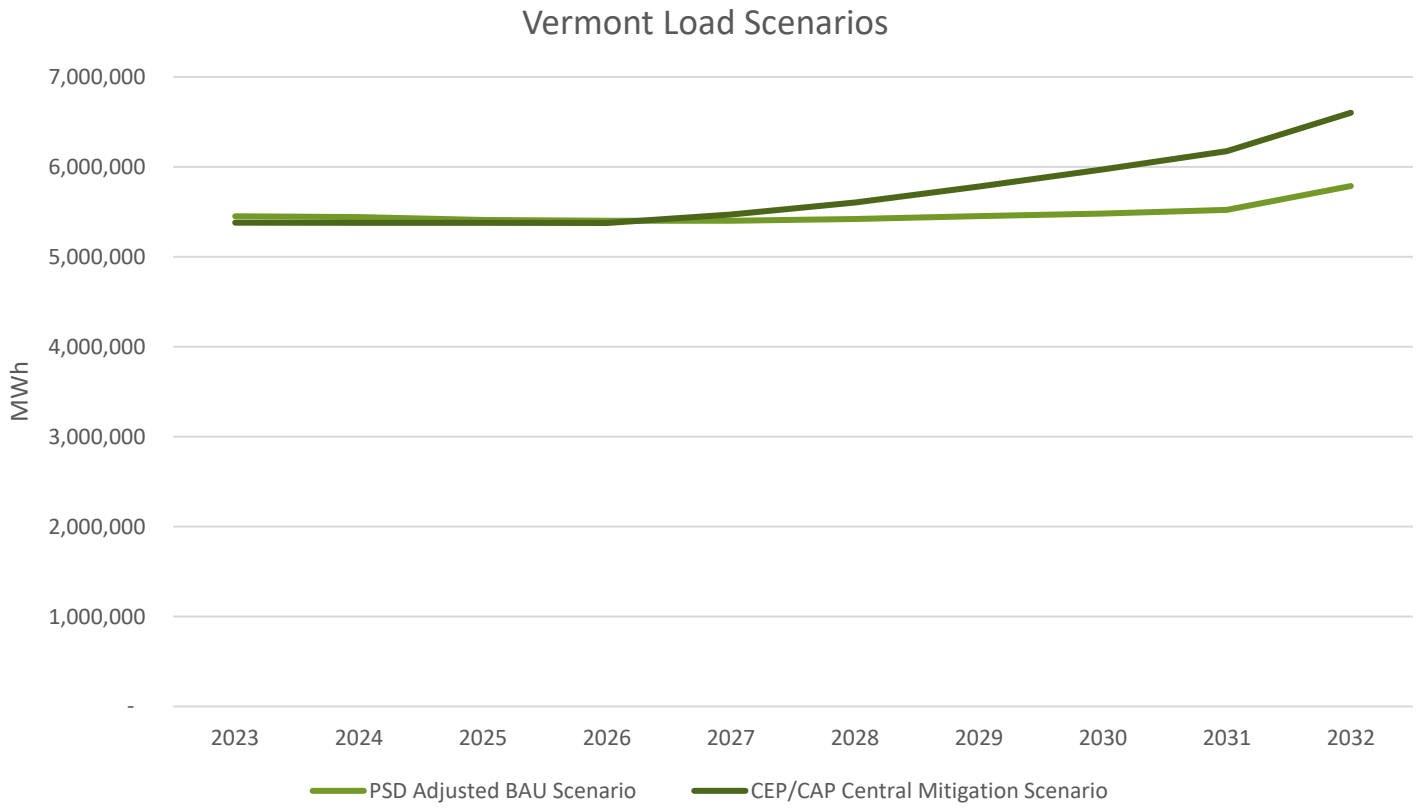
Department's 30 V.S.A. §8005b Required Model	SEA Technical Analysis of 100% RES or CES
Models RES as it exists today 75% by 2032; includes several obligatory sensitivities such as energy prices and net-metering deployment rates	Models hypothetical future 100% Renewable or Clean Energy Standard law options and changes to eligibility criteria of current resources
Considers Tiers I, II, and III (supply resources and energy transformation projects)	Considers Tiers I and II only (supply resources only)

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 2022 sales escalated at the rate of VELCO's 2021 Long-Range Transmission Plan
- **High Forecast (CEP/CAP):** Based on latest modeling conducted for Comprehensive Energy Plan (CEP)/Global Warming Solutions Act (GWSA) carbon reduction pathways

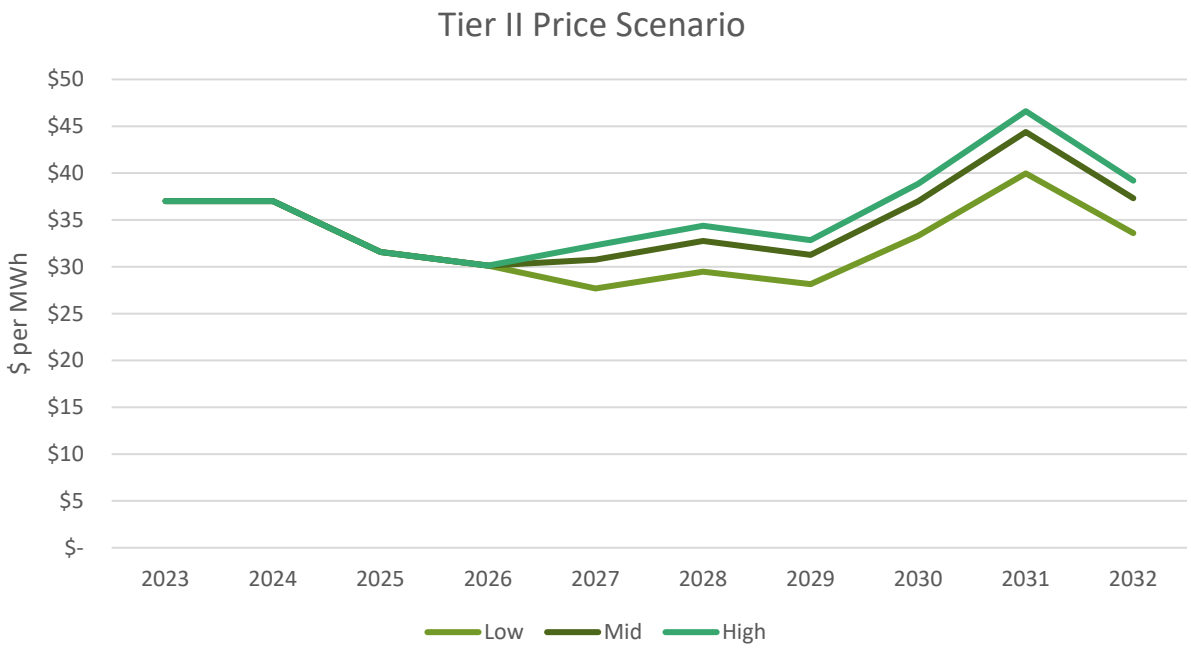


Model Input: Tier I REC Scenarios

- **Low Scenario:** Assumes low/stable Tier I REC pricing with new transmission lines bring Canadian Hydro to New England
- **Mid Scenario:** Assumes 50% higher price than low scenario
- **High Scenario:** return to pricing near the Alternative Compliance Payment (ACP) as seen at times in 2022/2023

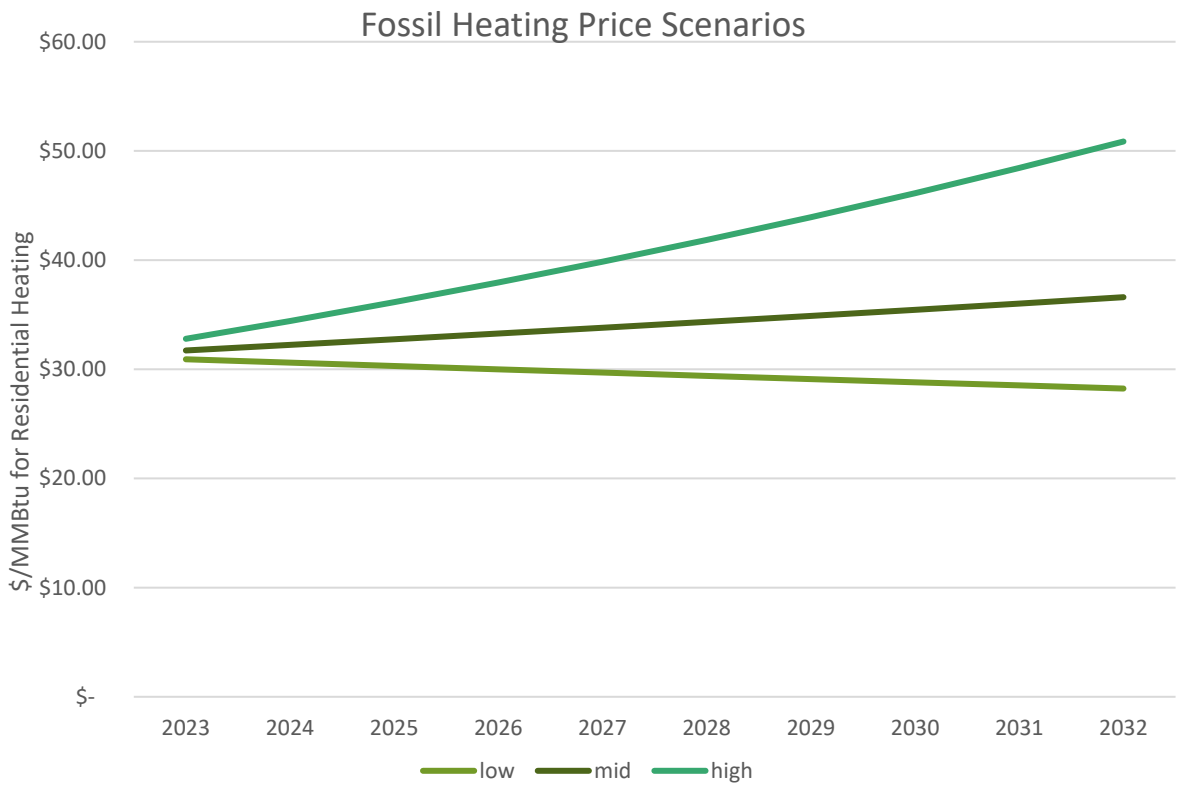
Model Input: Tier II REC Scenarios

- **Low Scenario:** Assumes 10% lower than mid scenario starting 2027
- **Mid Scenario:** Follows trend of new renewables market in New England with increases around 2030 due to demand exceeding supply
- **High Scenario:** Assumes 5% higher than mid scenario starting 2027



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) 2023
  - Weighted average Residential $/MMBtu of oil, propane and gas
  - Weights based on VT household fossil fuel for heating distribution (excludes wood and electric)



Model Input: Tier III Incentives

- Tier III incentives are as follows:

Technology	$/MWhe
Cold Climate Heat Pump	$ 26.00
Electric Vehicle	$ 52.00
Weatherization	$ 25.00
Custom Projects	$ 16.00

- Tier III incentive factor are as follows:
  - Assumes that low fossil fuel prices will require higher incentives and high fossil fuel prices will require lower incentives

Fossil Fuel Price Scenario	Low	Mid	High
Tier III Incentive Factor	1.3	1	0.9

Model Input: Tier III Technology Allocations

- Draft 2024 Modeling Assumptions:

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

- Previously more Tier III savings was assumed to come from electric vehicles (~40%) than shown.
- This distribution was updated to better reflect actual Tier III measure savings to-date, which has been majority heat pumps.

Model Input: Tier III Wholesale Energy Price Multipliers

- The cost of serving new Tier III loads depends on when the new electrified load occurs
- The Tier III **wholesale energy price multiplier** is a factor applied to predicted wholesale electricity prices to determine approximately how much more (or less) expensive it will be to serve these new loads compared to an all-hours average price

Tier III Technology	Energy Price Multiplier	Notes
Heat Pumps	1.1	Heat pumps consume more energy during extreme temperatures (cooling in summer; heating in winter) when wholesale energy prices tend to be higher
Electric Vehicle	0.83	Electric vehicles are often charged off-peak overnight when wholesale energy prices are lower
Weatherization	1.0	Weatherization measures save energy year-round, so an all-hours average price is appropriate
Custom	1.0	Custom measures are non-standard and could occur at any time of day/year, so an all-hours average price is appropriate

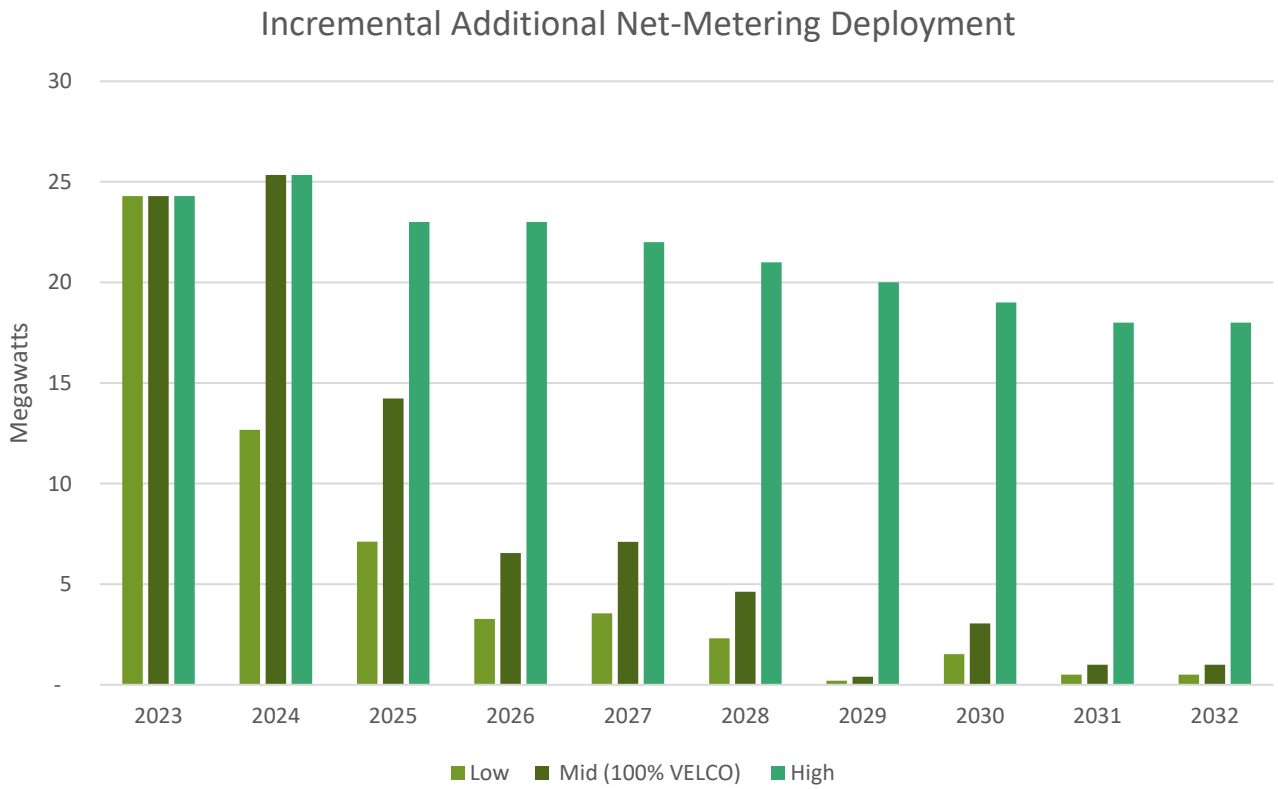
Model Input: Tier III Contribution to Peaks

- New electrified loads will contribute to 2 different electric system peaks creating additional cost
  - Regional Network Services (RNS) charges –calculated based on Monthly Regional Network Load value for any transmission customer (VELCO in Vermont)
  - Forward Capacity Market (FCM) charges– calculated based on a load-serving entity's load during the New England grid's peak hour

	Low	Mid	High
Forward Capacity Market (FCM) Peak	0.1	0.25	0.75
Regional Network Services (RNS) Peak	0.1	0.25	0.75
(0 = no additional peak load; 1 = 100% of load at the time of peaks)			

Model Input: Net Metering Adoption

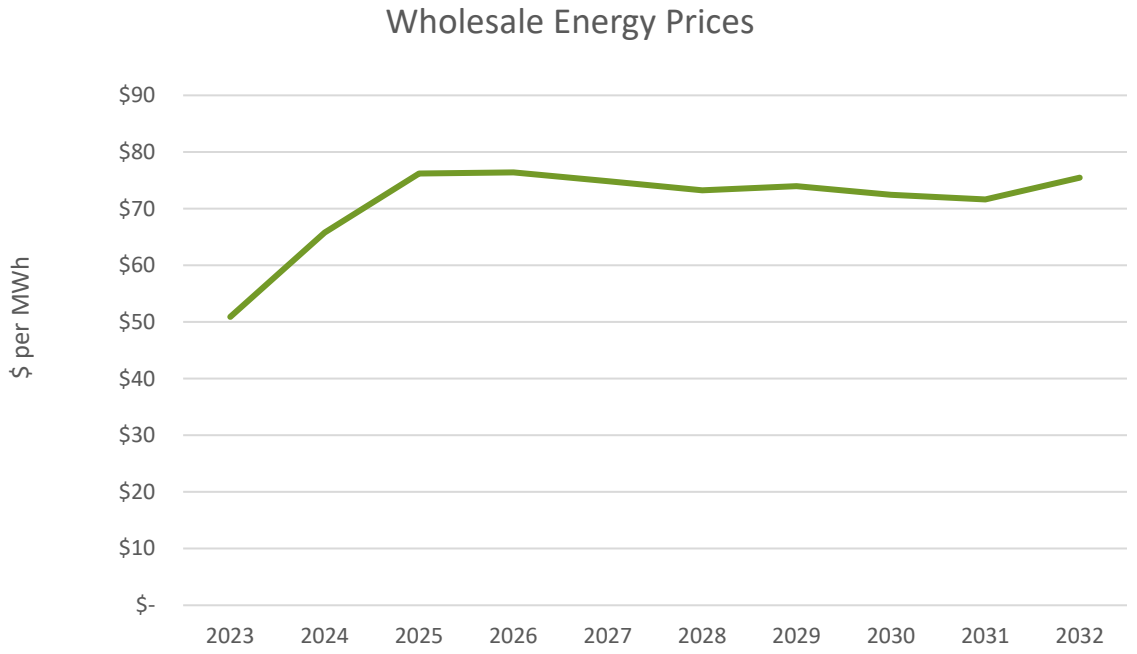
- **Low Scenario:** 50% of VELCO's forecasted net metering
- **Mid Scenario:** VELCO's forecasted net metering from their 2021 Long-range transmission plan*
- **High Scenario:** 100% of VELCO's forecasted net metering



VELCO 2021 Long Range Transmission Plan: https://www.velco.com/assets/documents/2021%20VLRTP%20to%20PUC_FINAL.pdf
*Note – VELCO in process of updating their 2024 Long Range Transmission Plan which will be used in next year's model

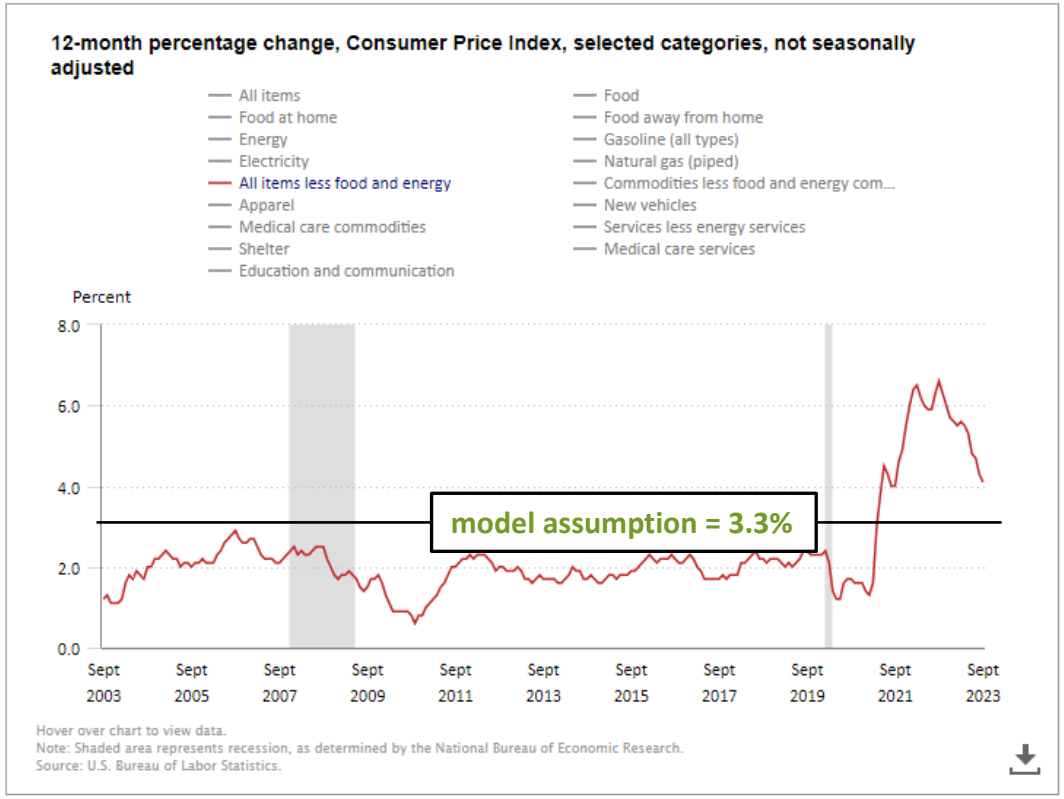
Model Input: Wholesale Electric Prices

- Method
  - 2023 YTD + average of Independent Service Operator of New England (ISO-NE) electric forwards for calendar 2023
  - Escalated at rate of Henry Hub gas forwards to 2032
- Use
  - New England wholesale price forecast *trend* is used to escalate the portion of current statewide cost of service (2022) tied to energy markets

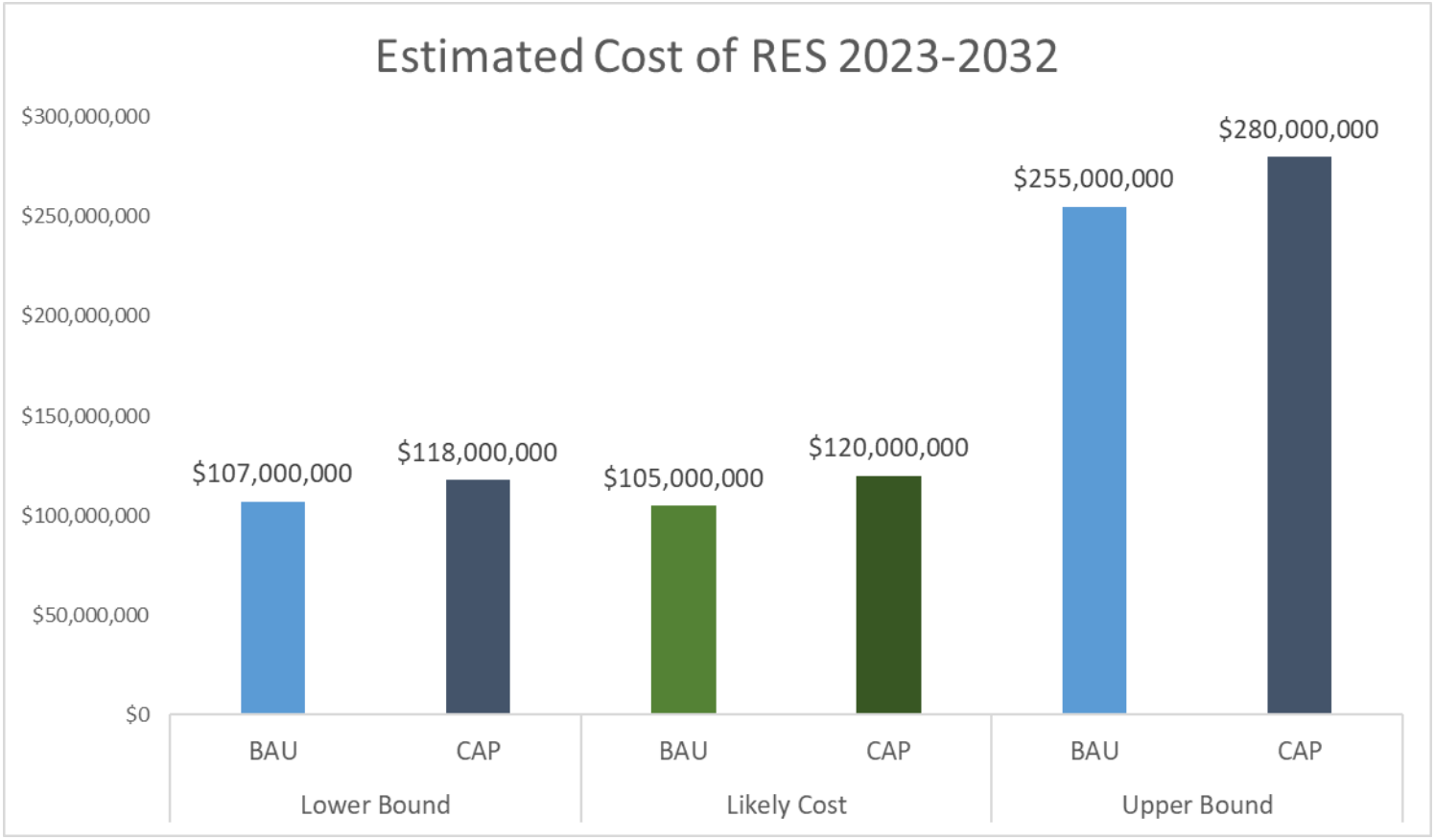


Model Input: Inflation

- Method
  - Core inflation (CPI less food and energy) used because model already ties a portion of cost of service to energy ("share tied to market")
  - Current 12-month average 4.1% as of September 2023; assume some return to lower levels through the 10-year model horizon
- Use
  - Model uses this as a trending tool to escalate the portion of current (2022) statewide cost of service tied to inflation over the modeling horizon of 2023-2032



Current Year Model: DRAFT Projected Costs

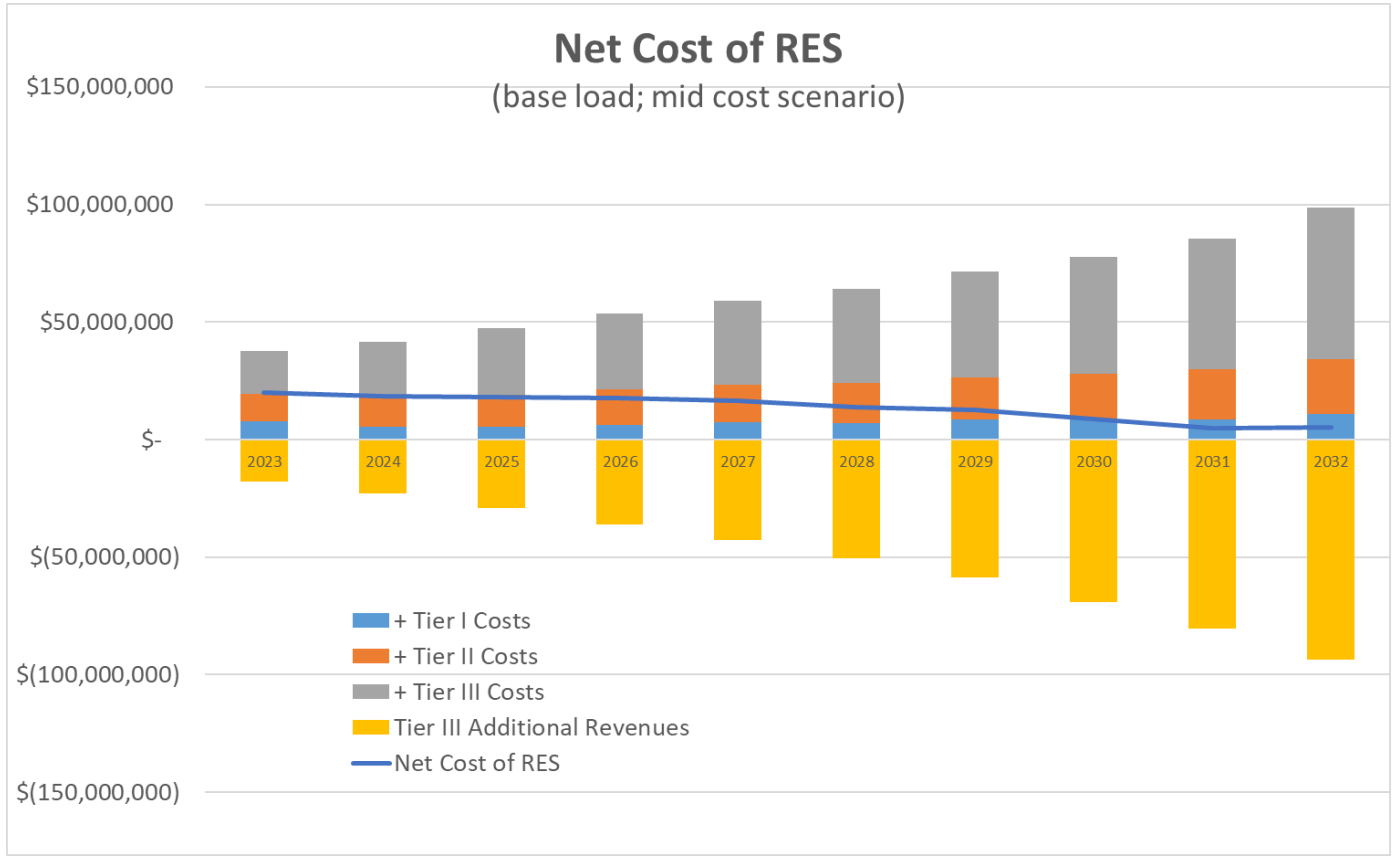


Current Year Model: DRAFT Projected Costs

	LOW INCREMENTAL COST		HIGH INCREMENTAL COST	
REC Price Scenari	HIGH		LOW	
NM Adoption Rat	HIGH		LOW	
Peak contributior	75%		10%	
Fossil Fuel Price	LOW		HIGH	
Load Scenario Sc	Baseline	High	Baseline	High
Tier 1 Cost	**$51,000,000**	**$55,000,000**	**$122,000,000**	**$135,000,000**
Tier 2 Cost	**$118,000,000**	**$122,000,000**	**$120,000,000**	**$125,000,000**
+Tier 3 Cost	*$279,000,000*	*$287,000,000*	*$351,000,000*	*$363,000,000*
-Additional Re	*-$341,000,000*	*-$346,000,000*	*-$338,000,000*	*-$343,000,000*
Tier 3 Net Cos	**-$62,000,000**	*-$59,000,000*	*$13,000,000*	**$20,000,000**
TOTAL Cost of RI	**$107,000,000**	**$118,000,000**	**$255,000,000**	**$280,000,000**
Rate Impact	0.63%	0.75%	3.80%	4.12%

Result for discussion: Tier III cost/benefit

- Annual costs from Tiers I, II and III generally increase over time
  - Fluctuate based on REC prices but as % requirements increase so do costs
- Benefit of additional sales from Tier III (electrification) are cumulative/compounding
  - Electrified loads and the associated benefits that occur in 2023 occur in each of the following 9 years of the model
- As modeled, the total cost and % rate impact of the RES declines the higher the requirements go due to Tier III additional revenue
  - Does this feature of Tier III make sense?
  - Are we properly characterizing the costs/benefits of Tier III?



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!

APPENDIX

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