2023 CONSERVATION POTENTIAL ASSESSMENT

Richland Energy Services

August 22, 2023

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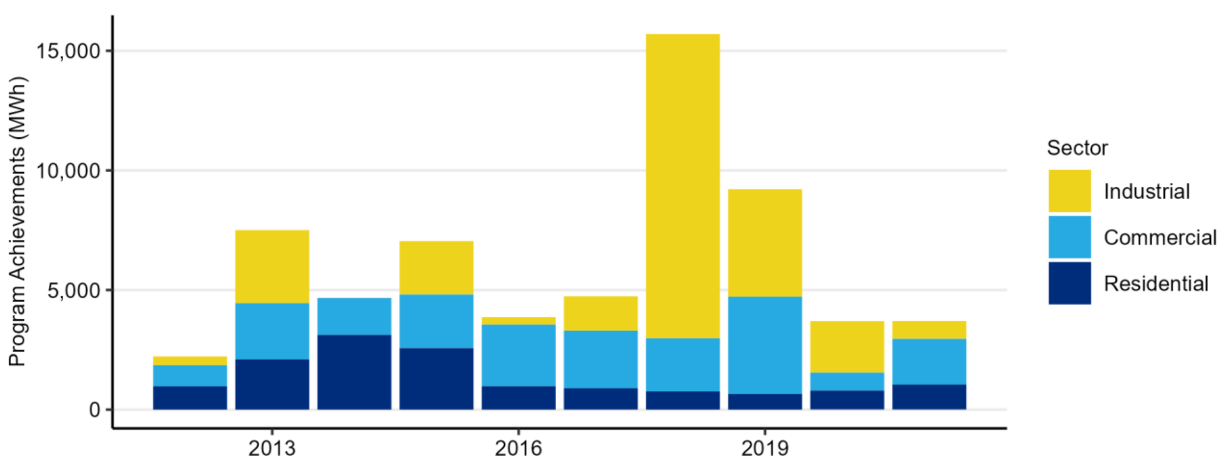
Executive Summary

Overview

This report describes the methodology and results of a conservation potential assessment (CPA) conducted by Lighthouse Energy Consulting (Lighthouse) for Richland Energy Services (RES). The CPA estimated the cost-effective energy efficiency savings potential available in RES's service territory over the 20-year period from 2024 to 2043. This report describes the results of the full 20-year period, with additional detail on the two- and 10-year periods that are the focus of Washington's Energy Independence Act (EIA). The initial two years of this study are also the final two years of the four-year period covered by RES's first Clean Energy Implementation Plan (CEIP). If desired, the results of this study can be used to update the conservation target identified in that CEIP.

RES provides electricity service to over 25,000 customers across a service territory that covers 48 square miles. The EIA requires that utilities with more than 25,000 customers identify and acquire all cost-effective energy efficiency resources and meet targets set every two years through a CPA. While RES only recently surpassed this threshold, it has been implementing energy efficiency programs since at least 2008, when the Regional Technical Forum (RTF) began tracking regional conservation achievements by utility. A summary of RES's program achievements since 2012 is shown in Figure 1, based on the Regional Technical Forum's (RTF) Regional Conservation Progress Report.

Figure 1: Historic RES Program Achievements



The EIA specifies the requirements for setting conservation targets in RCW 19.285.040 and WAC 194-37-070 Section (5), parts (a) through (d). The methodology used in this assessment complies with these requirements and is consistent with the methodology used by the Northwest Power and Conservation Council (Council) in the 2021 Power Plan. Washington's Clean Energy Transformation Act (CETA) has additional requirements for CPAs; namely, that the assessment of cost-effectiveness make use of specific values for the social cost of carbon. Appendix III details these requirements and how this assessment fulfills those requirements.

This CPA used much of the final 2021 Power Plan materials, with customizations to make the results specific to RES's service territory and customers. Notable changes in this CPA relative to RES's previous assessment include the following:

- Energy Efficiency Measures
    - This assessment uses the measures savings, costs, and other characteristics based on the measures included in the final 2021 Power Plan, with updates to dozens of measures based on new information from the RTF and additional customizations to make the measures specific to RES.
- Avoided Costs
    - A new market price forecast was incorporated, which has a 20-year levelized value of $47/MWh (2016$), an increase of 34% over the market prices used in RES's 2021 CPA.
- Customer Characteristics
    - Updated counts of residential homes.
    - Updated estimates of commercial floor area
    - Updated breakdowns of RES's industrial sector loads
    - Updated sector growth rates.
- Program Impacts
    - Consideration of RES's recent conservation program achievements

Results

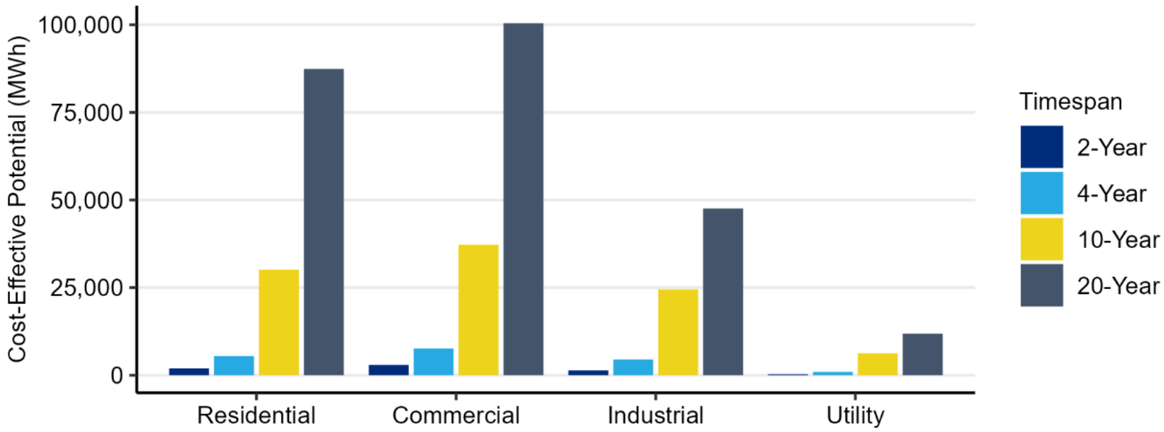
Table 1 and Figure 2 show the cost-effective energy efficiency potential by sector over two-, four-, 10-, and 20-year periods. Over the 20-year planning period, RES has over 247,000 MWh of cost-effective conservation available, which is approximately 24% of its projected 2043 load. The EIA focuses on the two- and 10-year potential, which are 6,538 MWh and 98,102 MWh, respectively.

Table 1: Cost-Effective Energy Savings Potential by Sector (MWh)

Sector	2-Year	4-Year	10-Year	20-Year
Residential	1,961	5,467	30,121	87,415
Commercial	2,922	7,598	37,227	100,452
Industrial	1,369	4,503	24,508	47,582
Utility	285	937	6,246	11,839
Total	**6,538**	**18,506**	**98,102**	**247,287**

Note: In this and all subsequent tables, totals may not match due to rounding.

Figure 2: Cost-Effective Energy Savings Potential by Sector



Over the long term, the residential and commercial sectors have the largest potential. In the near term, the industrial sector makes up 20% of the 2-year potential. A much smaller amount of potential is available in the utility sector.

This assessment does not specify how the energy efficiency potential will be achieved. Possible mechanisms include RES's own energy efficiency programs, market transformation driven by the Northwest Energy Efficiency Alliance (NEEA), state building codes, and state or federal product standards. Often, the savings associated with a measure will be acquired by several of these mechanisms over the course of its technological maturity. For example, heat pump water heaters started as one of NEEA's market transformation initiatives. Subsequently, they became a regular offering in utility programs across the Northwest and are starting to work their way into federal product standards.

Energy efficiency also contributes to reductions in peak demand. This assessment used hourly load and savings profiles developed by the Council to identify the demand savings from each measure that would occur at the time of RES's system peak. The cost-effective energy savings potential identified in this assessment will result in more than 51 MW of peak demand savings over the 20-year planning period, as shown in Table 2. This represents 24% of RES's estimated 2043 peak demand.

Table 2: Cost-Effective Peak Demand Savings Potential by Sector (MW)

Sector	2-Year	4-Year	10-Year	20-Year
Residential	0.5	1.4	8.4	25.4
Commercial	0.5	1.4	7.0	17.6
Industrial	0.2	0.6	3.3	6.6
Utility	0.0	0.1	0.9	1.7
Total	**1.3**	**3.6**	**19.7**	**51.3**

This CPA used ramp rates to reflect the share of available potential that could be acquired in each year of the study period. The ramp rates are based on those developed by the Council in the 2021 Power Plan and reflect the market and program maturity of each measure. For this CPA, Lighthouse selected ramp rates that would align the near-term potential of each measure with RES's recent program achievements and the savings from NEEA's market transformation initiatives that were estimated to occur in RES's service territory. RES provided program achievement data for 2021 and 2022 and Lighthouse assigned appropriate ramp rates for each measure so that the future acquisition of energy efficiency was aligned with recent program history while allowing for the acquisition of all cost-effective energy efficiency over the 20-year planning period.

The estimate of annual energy efficiency potential by sector is shown in Figure 3. The available cost-effective potential starts at 2,731 MWh in 2022 and grows to a maximum of nearly 18,000 MWh in 2034. After that point, the available potential diminishes through the remaining years of the planning period.

Figure 3: Annual Incremental Energy Efficiency Potential

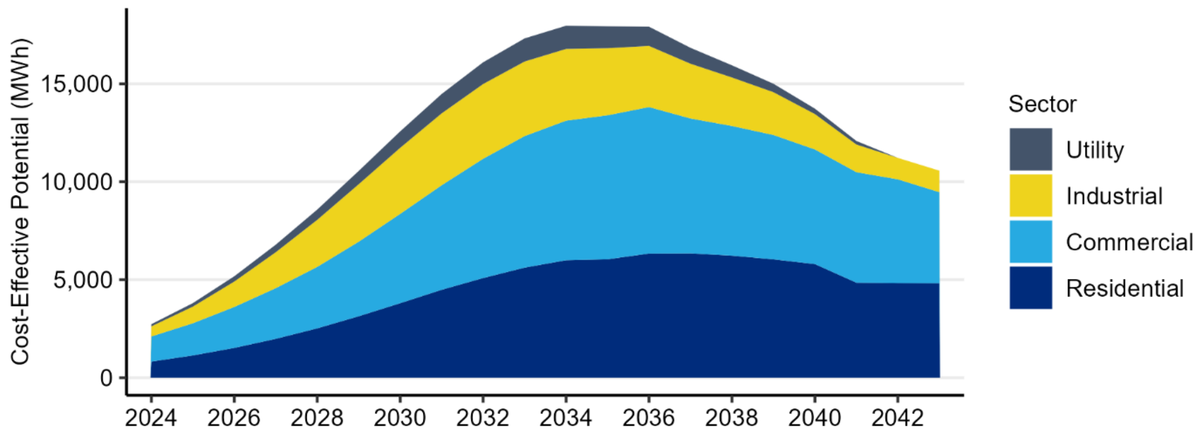
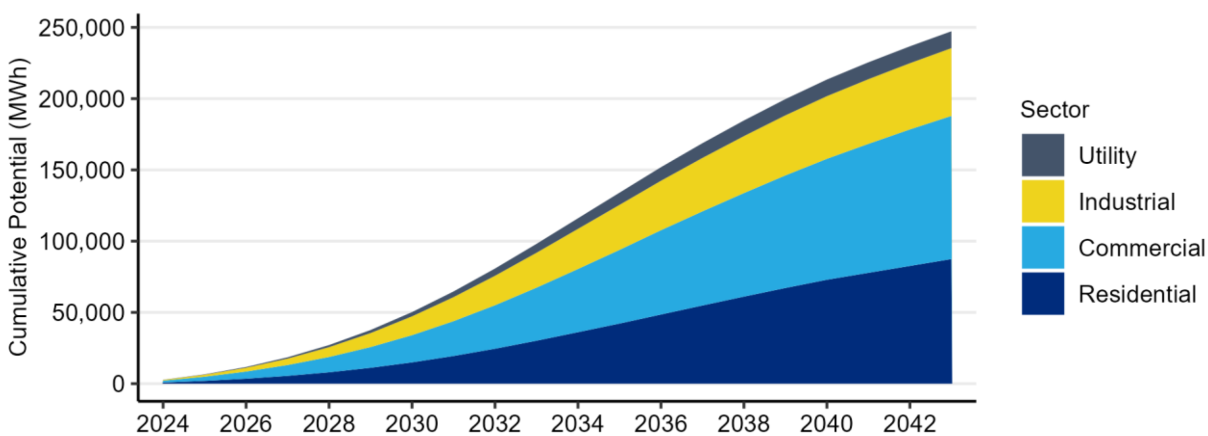


Figure 4 shows how the energy efficiency potential grows on a cumulative basis through the study period, totaling over 247,000 MWh over the 20-year planning period.

Figure 4: Annual Cumulative Energy Efficiency Potential



Comparison to Previous Assessment

Table 3 shows a comparison of the two-, 10-, and 20-year cost-effective potential by sector as quantified by the previous 2021 CPA and this 2023 CPA. The two-year comparison shows an overall reduction across all sectors. Over the long term, both the 10- and 20-year potential have increased by 12%.

Table 3: Comparison of 2021 and 2023 CPA Cost-Effective Potential (MWh)

Sector	2-Year Potential			10-Year Potential			20-Year Potential		
	2021 CPA	2023 CPA	% Change	2021 CPA	2023 CPA	% Change	2021 CPA	2023 CPA	% Change
Residential	1,126	1,961	74%	22,859	30,121	32%	80,369	87,415	9%
Commercial	4,808	2,922	-39%	40,894	37,227	-9%	95,334	100,452	5%
Industrial	3,161	1,369	-57%	19,647	24,508	25%	33,273	47,582	43%
Utility	91	285	213%	4,022	6,246	55%	11,844	11,839	0%
Total	**9,186**	**6,538**	**-29%**	**87,422**	**98,102**	**12%**	**220,819**	**247,287**	**12%**

Discussion of the factors leading to these changes is provided below.

Avoided Costs

As described above, the higher market prices used in this CPA have resulted in additional cost-effective potential. Some measures that were not cost-effective in the 2021 CPA are now included in the cost-effective potential identified by this CPA.

Customer Characteristics

This CPA used updated customer data for each sector.

In the commercial sector, RES provided updated load data by commercial building type. Lighthouse translated these loads to estimates of floor area with estimates of energy use intensities (EUI) from the 2019 Commercial Building Stock Assessment (CBSA). The new data resulted in an increase in the estimated floor area.

RES also provided updated loads for the industrial sector by segment. The updated values showed a significant increase in load and resulted in a corresponding increase in potential.

Conclusion

This report summarizes the CPA conducted for RES for the 2024 to 2043 timeframe. The CPA identified a lower amount of cost-effective potential in the near-term relative to the 2021 CPA, with higher amounts of potential available in the long-term.

Aligning the near-term potential to RES's recent program achievements resulted in an increase in near-term potential in the residential sector and decreases in the commercial and industrial sectors. Over the long term, updated customer characteristics and higher market prices resulted in additional potential across all three sectors.

Introduction

Objectives

This report describes the methodology and results of a CPA conducted for RES by Lighthouse. The CPA estimated the cost-effective energy savings potential available in RES's service territory over the 20-year period from 2024 to 2043. This report describes the results of the full 20-year study period, with additional details on the two- and 10-year periods that are the focus of Washington's EIA.

This assessment was conducted in a manner consistent with the requirements of Washington's RCW 19.285, and WAC 194-37. As such, this report is part of the documentation of RES's compliance with these requirements. In addition, the state of Washington's recently passed CETA includes an additional requirement for CPAs to use specific values for the social cost of carbon. The required values were used in this assessment.

The results of this CPA can be used to assist RES in planning its energy efficiency programs by identifying the amount of cost-effective energy savings available in various sectors, end uses, and measures. The results of this CPA can also be used to update the four-year energy efficiency target included in RES's CEIP. Finally, the results can be used inform RES resource planning.

Background

Washington State's EIA defines "qualifying utilities" as those with 25,000 customers or more and requires them to achieve all conservation that is cost-effective, reliable, and feasible. Since RES now serves more than 25,000 customers, it is required to comply with the EIA. The requirements of the EIA specify that all qualifying utilities complete the following by January 1 of every even-numbered year:[1]

- Identify the achievable cost-effective conservation potential for the upcoming 10 years using methodologies consistent with the Council's latest power plan.
- Establish a biennial acquisition target for cost-effective conservation that is no lower than the utility's pro rata share for that two-year period of its cost-effective conservation potential for the subsequent 10 years. [2]

Appendix III further details how this assessment complies with each of the requirements specified for CPAs by Washington's EIA.

Study Uncertainties

There are uncertainties inherent in any long-term planning effort. While this assessment makes use of the latest forecasts of customers, loads, energy prices, and other variables, these are still subject to uncertainties and limitations, as recent global events have shown. These uncertainties include, but are not limited to:

- <u>Customer Characteristic Data</u>: This assessment used the best available data to reflect RES's customers. In some cases, however, the assessment relied upon data beyond RES's service territory

[1] Washington RCW 19.285.040

[2] In CA No. 2011-03, the State Auditor's Office has defined "pro rata" as "a proportion of an exactly calculable factor" and expects utilities to have analysis and documentation to support their identified targets, which could be more or less than 20% of the 10-year potential.

due to limitations of data availability or adequate sample sizes. There are uncertainties, therefore, related to the extent that this data is reflective of RES's customer base.

- Measure Data: Measure savings and cost estimates are based on values prepared by the Council and RTF. These estimates will vary across the region due to local climate variations and market conditions. Additionally, some measure inputs such as applicability are based on limited data or professional judgement.
- Market Price Forecasts: This assessment uses an updated market price forecast that was based on prices in March of 2023. Market prices and forecasts are continually changing.
- Utility System Assumptions: Measures in this CPA reflect cost credits based on their ability to provide transmission and distribution system capacity. The actual value of these credits is dependent on the demands on and capacity of these systems, which vary across RES's service territory. Additionally, a value for generation capacity is included, but the value of this credit is subject to the evolving need for capacity in the Northwest.
- Load and Customer Growth Forecasts: This CPA projects future customer growth based over a 20-year period. Any forecast over a similar time period will include a significant level of uncertainty.

Due to these uncertainties and the continually changing planning environment, the EIA requires qualifying utilities to update their CPAs every two years to reflect the best available data and latest market conditions.

Report Organization

The remainder of this report is organized into the following sections:

- Methodology
- Historic Conservation Achievement
- Customer Characteristics
- Results
- Scenario Results
- Summary
- References & Appendices

Methodology

This section provides an overview of the methodology used to develop the estimate of cost-effective conservation potential for RES.

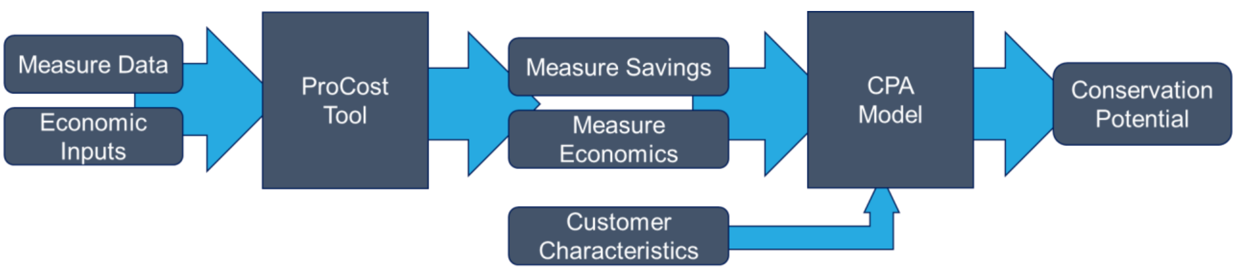
Requirements for this CPA are laid out in RCW 19.285.040 and WAC 194-37-070, Section 5 parts (a) through (d). Additional requirements are specified in the rules of Washington's CETA. The methodology used to produce this assessment is consistent with these requirements. The development of the conservation potential follows much of the methodology used by the Council in developing its regional power plans, including the final 2021 Power Plan.

Appendix III provides a detailed breakdown of the requirements of the EIA and CETA and how this assessment complies with those standards.

High-level Methodology

The methodology used for this assessment is illustrated in Figure 5. At a high level, the process combines data on individual energy efficiency measures and economic assumptions using the Council's ProCost tool. This tool calculates a benefit-cost ratio using the Total Resource Cost (TRC) test, which is used to determine whether a measure is cost-effective. The TRC test considers all of the costs and benefits of energy efficiency measures, regardless of who receives the benefit or pays the cost. The measure savings and economic results are combined with customer data in Lighthouse's CPA model, which quantifies the number of remaining implementation opportunities. The savings associated with each of these opportunities are aggregated in the CPA model to determine the overall potential.

Figure 5: Conservation Potential Assessment Methodology



Economic Inputs

Lighthouse worked closely with RES staff to define the economic inputs that were used in this CPA. The inputs included avoided energy costs, carbon costs, transmission and distribution capacity costs, and generation capacity costs. Some of these are highlighted below. A full discussion of the avoided costs is included in Appendix IV.

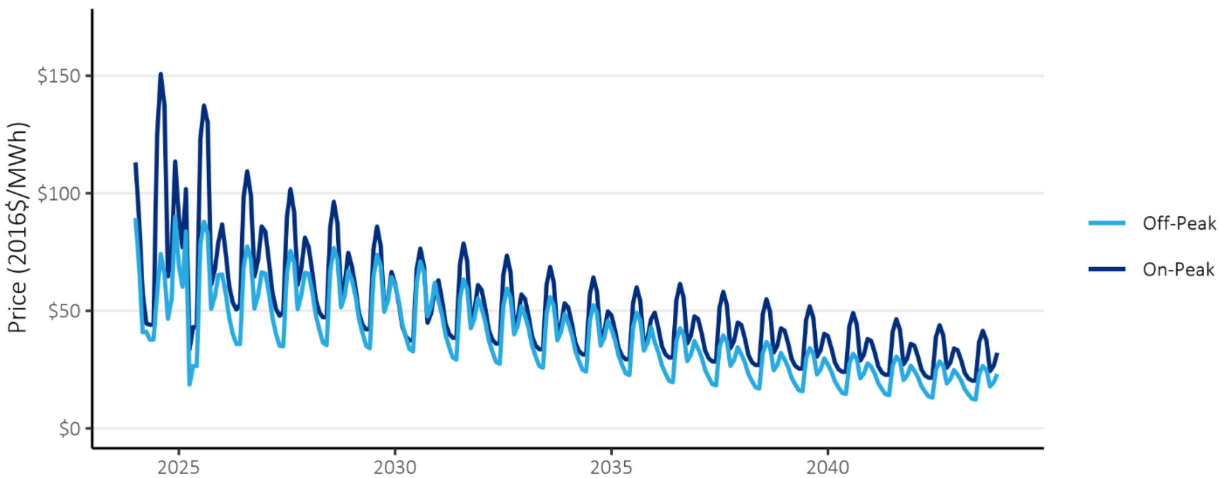
Avoided Energy Costs

Avoided energy costs represent the cost of energy purchases that are avoided through energy efficiency savings. The EIA requires utilities to "set avoided costs equal to a forecast of market prices." [3] For this CPA, Lighthouse developed a forecast of on- and off-peak market prices at the Mid-Columbia trading hub. Figure 6 below shows the market price forecast that was used for the base case scenario of this assessment. The

[3] WAC 194-37-070

20-year levelized value of these prices is $47/MWh (2016$), a 34% increase from the price forecast used in the 2021 CPA ($35/MWh, 2016$). Lighthouse also created high and low variations of this forecast to be used in the avoided cost scenarios, which are described later in this report.

Figure 6: Avoided Energy Costs



Social Cost of Carbon

In addition to avoiding purchases of energy, energy efficiency measures have the potential to avoid emissions of greenhouse gases like carbon dioxide. The EIA requires that CPAs include the social cost of carbon, which the U.S. EPA defines as "a measure of the long-term damage done by a ton of carbon dioxide emissions in a given year." It includes, among other things, changes in agricultural productivity, human health, property damages from increased flood risk, and changes in energy system costs, including increases in the costs of cooling and decreases in heating costs.[4] In addition to this requirement, Washington's CETA requires that utilities use the social cost of carbon values developed by the Federal Interagency Workgroup using a 2.5% discount rate. [5]

Renewable Portfolio Standard Compliance Costs

By reducing RES's overall load, energy efficiency reduces the cost of complying with Washington's requirements for renewable and carbon-neutral energy. Beginning in 2026, RES will need fulfill the EIA requirement of sourcing 3% of its sales from renewable energy resources. With a 3% requirement for renewable energy, RES can reduce its requirement by 3 Renewable Energy Credits (RECs) by saving 100 MWh of energy. In 2030, CETA requires all sales to be greenhouse gas neutral, while allowing up to 20% of the requirement to be met through REC purchases. Based on this requirement, it is assumed that after 2030, every unit of energy savings results in an equivalent reduction in REC purchases. If RES already has sufficient RECs to meet the requirement in a given year, RECs freed up through energy efficiency can be sold.

[4] See https://www.epa.gov/sites/production/files/2016-12/documents/social_cost_of_carbon_fact_sheet.pdf
[5] WAC 194-40-100

Deferred Transmission and Distribution System Costs

Unlike supply-side resources, energy efficiency does not require capacity on transmission and distribution infrastructure. Instead, it frees up capacity by reducing the peak demands on these systems and can help defer future capacity expansions and the associated capital costs.

In the development of the 2021 Power Plan, the Council developed a standardized methodology for calculating these values and surveyed Northwest utilities to update the values associated with these cost deferrals. This CPA uses the values developed by the Council through that process. The resulting values are \$3.54 and \$7.82 per kW-year (in 2016 dollars) for transmission and distribution capacity, respectively.[6] These values are applied to the demand savings coincident with the timing of the respective system peaks.

Program Administration Costs

In each of the past three power plans, the Council has assumed that program administrative costs are equal to 20% of the cost of each measure. This CPA uses that assumption, which is also consistent with RES's previous CPAs.

Risk Mitigation

Investing in energy efficiency can reduce the risks that utilities face by the fact that it is made in small increments over time, rather than the large, singular sums required for generation resources.

This CPA follows the process used in RES's previous CPAs. A scenario analysis is used to account for uncertainty, where present, in avoided cost values. The variation in inputs covers a range of possible outcomes and the amount of cost-effective energy efficiency potential is identified under each scenario. In selecting its biennial target based on this range of outcomes, RES is selecting its preferred risk strategy and the associated risk credit. This process is similar to the one used by the Council to identify the risk mitigation credit in the regional power plans.

Northwest Power Act Credit

The EIA requires that a 10% cost credit be given to energy efficiency measures. This benefit is specified in the Northwest Electric Power Planning and Conservation Act and is included by the Council in their power planning work.

Other Financial Assumptions

In addition, this assessment makes use of an assumed discount rate to convert future costs and benefits to present-year values so that values occurring in different years can be compared. This assessment uses a real discount rate of 3.75%. This is the same value that was used in RES's 2019 and 2021 CPAs and is consistent with the value used in the 2021 Power Plan. For most energy efficiency measures, the costs are incurred up front while the benefits accrue over the lifetime of the measure. A higher discount rate results in lower present values for benefits occurring in future years and generally reduces the cost effectiveness of measures.

Measure Characterization

Measure characterization is the process of defining each individual measure, including the savings, cost, lifetime, non-energy impacts, and a load or savings shape that defines when the savings occur. The Council's

[6] These values are slightly higher than those used in the 2021 CPA and reflect updates from the Council as the 2021 Power Plan was finalized.

2021 Power Plan materials are the primary source for this information, although Lighthouse incorporated updated information from the RTF for many measures. Appendix V contains the full list of energy efficiency measures considered and sources of information used for each.

Measure savings are typically defined by a "last in" approach. With this methodology, each measure's savings is determined as if it was the last measure installed. For example, savings from home weatherization measures are determined based on the assumption that the home's heating system has already been upgraded. Similarly, the heating system measures are quantified based on the assumption that the home has already been weatherized. This approach is conservative but prevents overcounting savings over the long term as homes are likely to install both measures.

Measure savings also consider measure interaction. Interaction occurs when measures in one end use impact the energy use of other end uses. Examples of this include energy efficient lighting and other appliances. The efficiency of these appliances results in less wasted energy released as heat and the corresponding impacts to heating and cooling system energy demands.

These measure characteristics, along with the economic assumptions, are used as inputs to the Council's ProCost tool. This tool determines the savings at the generator, factoring in line losses, as well as the demand savings that occur coincident with RES's system peak. It also calculates the levelized-cost and benefit-cost ratios, which are used to determine whether measures are cost-effective.

Customer Characteristics

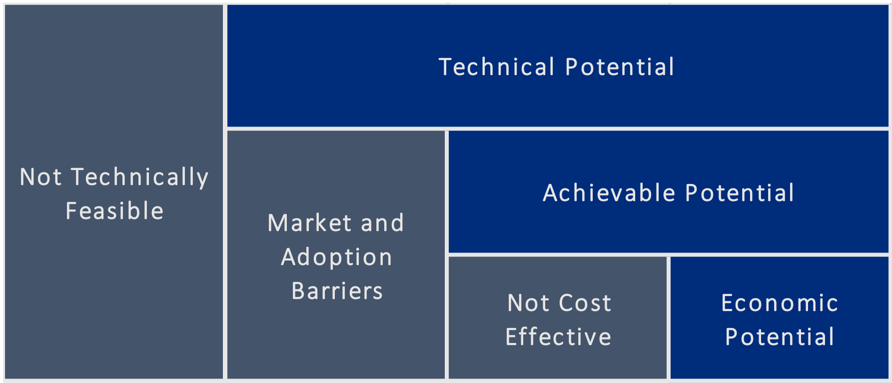
The assessment of customer characteristics is used to determine the number of available measure installation opportunities for each measure. This includes both the number of opportunities overall, as well as the share that have already been completed. The characterization of RES's customer base was completed using data provided by RES, customer data analysis, NEEA's commercial and residential building stock assessments, U.S. Census data, and other data sources. Details for each sector are described subsequently in this report.

This CPA used baseline measure saturation data from the Council's 2021 Power Plan. This data was developed from NEEA's stock assessments, market research and other studies. This data was supplemented with RES's conservation achievements, where applicable. This achievement is discussed in the next section.

Energy Efficiency Potential

The energy efficiency measure data and customer characteristics are combined in Lighthouse's CPA model. The model calculates the economic or cost-effective energy savings potential in calculations that progress through the three types of energy efficiency potential shown in Figure 7 below. Each type of potential is discussed in further detail below.

Figure 7: Types of Energy Efficiency Potential



First, technical potential is the theoretical maximum of energy efficiency available, regardless of cost or market constraints. It is determined by multiplying the measure savings by the number of remaining feasible installation opportunities.

The model then applies several filters that incorporate market and adoption barriers to estimate the achievable potential. These filters include assumptions about the maximum potential adoption and the pace of annual achievements. Energy efficiency planners generally assume that not all measure opportunities will be installed; some portion of the technically possible measure opportunities will remain unavailable due to unsurmountable barriers. In the Northwest, planners have historically assumed that 85% of all measure opportunities can be achieved. This assumption came from a pilot study conducted in Hood River, Oregon, where home weatherization measures were offered at no cost. The pilot was able to reach over 90% of homes and complete 85% of identified measure opportunities. In the 2021 Power Plan, the Council took a more nuanced approach to this assumption. Measures that are likely to be subject to future codes or product standards have higher maximum achievability assumptions. This CPA follows the Council's new approach.

In addition to the maximum achievability assumptions, ramp rates identify the portion of the available potential that can be acquired each year. The selection of ramp rates reflects each measure's level of program and market maturity as well as the practical constraints of what utility programs can accomplish each year.

Finally, economic, or cost-effective potential is determined by limiting the achievable potential to those measures that pass an economic screen. Per the EIA, this assessment uses the TRC test to determine economic potential. The TRC evaluates all measure costs and benefits, regardless of who pays the cost or receives the benefit. The costs and benefits include the full incremental capital cost of the measure, any operations and maintenance costs, program administrative costs, avoided energy and carbon costs, deferred capacity costs, and quantifiable non-energy impacts. Because the TRC test considers the full cost of energy efficiency measures, RES could pay up to the full cost of measures with its incentives without needing to reevaluate the cost-effectiveness of the measure, although practical constraints such as program budgets may limit this.

Recent Conservation Achievement

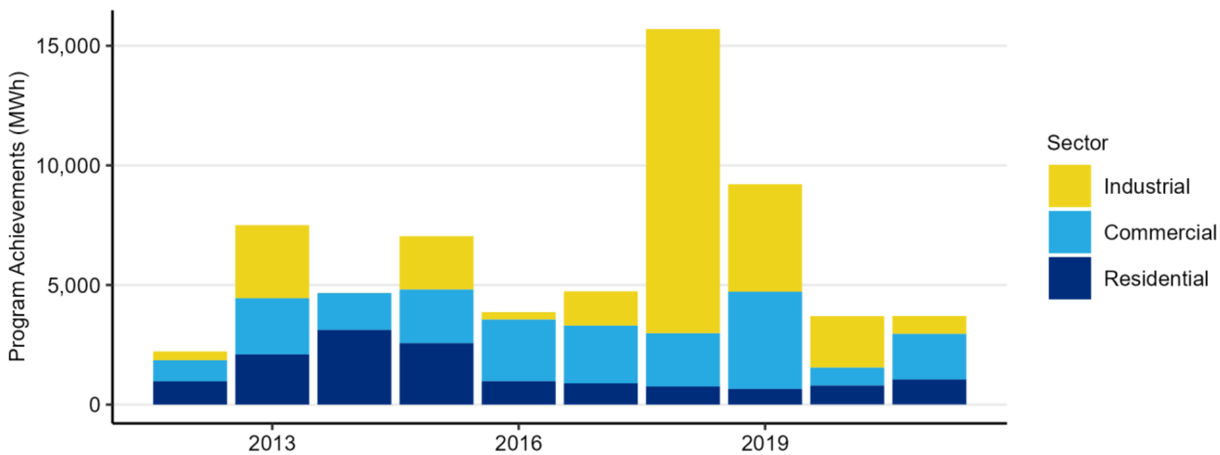
RES has a long history of energy efficiency achievement and, according to the RTF's 2021 Regional Conservation Progress Report, has averaged savings equal to 0.7% of its retail sales in each year over the 2016-2021 time period.

RES currently offers programs for its residential, commercial, and industrial customers. In addition to these programs, RES receives credit for the savings from NEEA's market transformation initiatives that happen within its service territory. In addition to this market transformation work, NEEA has helped to bring energy efficient emerging technologies, like ductless heat pumps and heat pump water heaters, to the Northwest.

Overall

Figure 8 summarizes RES's conservation achievements from 2012-2021 by sector, as reported by the RTF's 2021 Regional Conservation Progress Report.

Figure 8: Recent Conservation Achievements by Sector



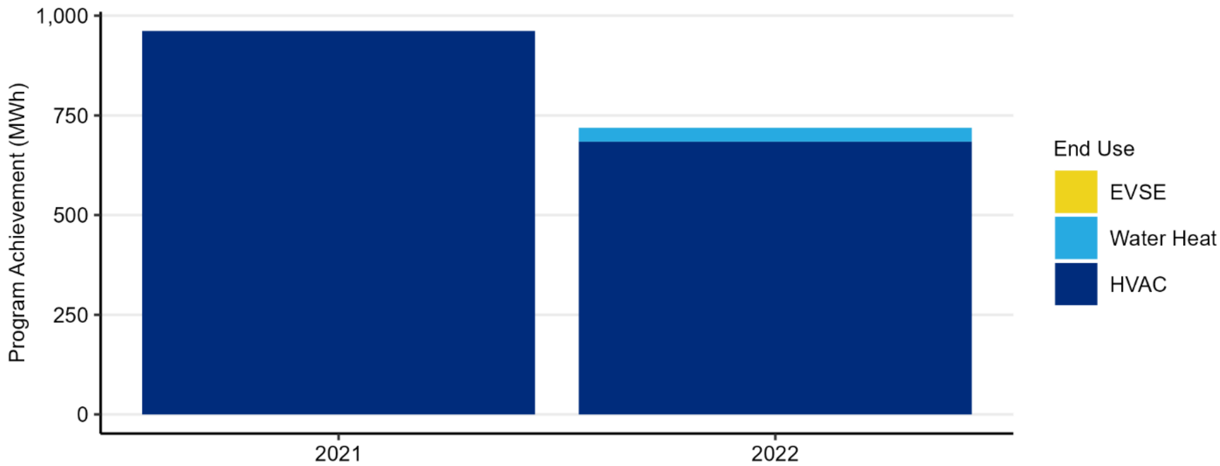
The average savings over this ten-year period is 6,236 MWh per year. Savings from NEEA's market transformation initiatives contribute additional savings that are not included in this figure. The savings from NEEA's initiatives are primarily in the residential sector.

RES provided additional details on recent savings for 2021 and 2022 for each sector, which are discussed below.

Residential

The recent residential program achievements by end use are shown in Figure 9. Most of the savings are in the HVAC end use, which includes both weatherization measures as well as heating system equipment. In 2022, RES added program offerings for heat pump water heaters and electric vehicle supply equipment (EVSE).

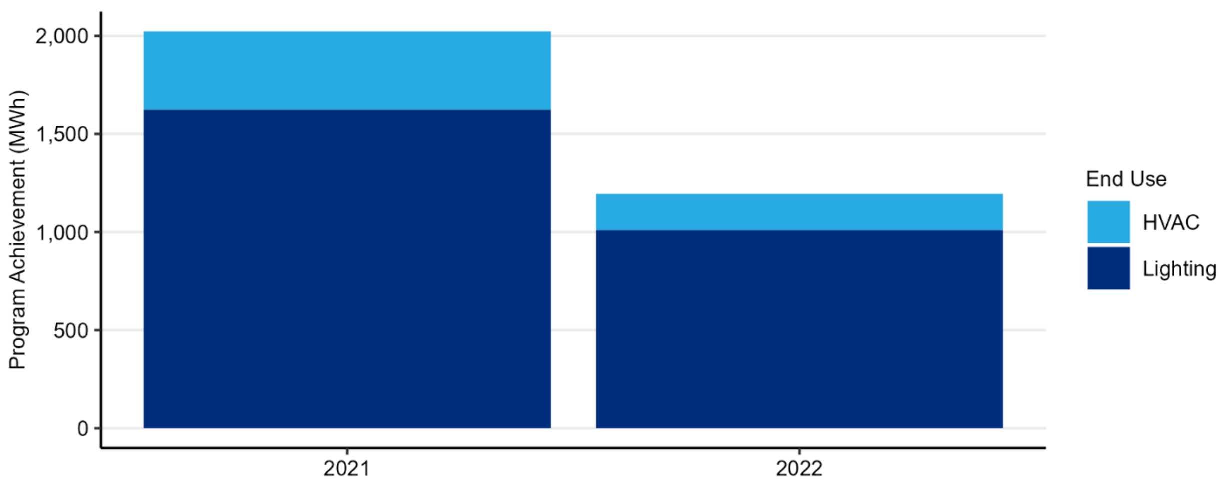
Figure 9: 2021-2022 Residential Program Achievements by End Use



Commercial

RES's commercial sector savings are primarily in the lighting end use, as shown in Figure 10. Smaller amounts of savings come from projects in the HVAC end use.

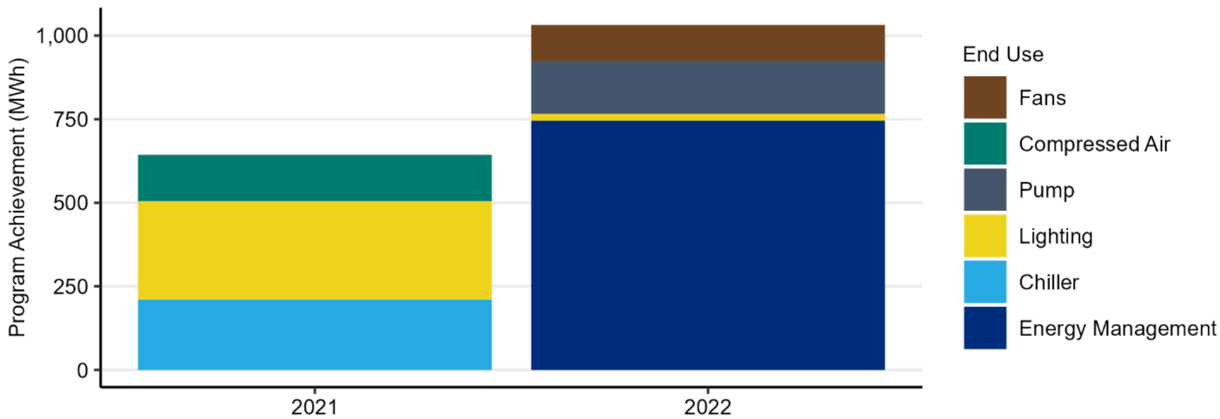
Figure 10: 2021-2022 Commercial Program Achievements by End Use



Industrial

In the industrial sector, the savings come from a variety of end uses, including energy management, chiller equipment, lighting, and other end uses. Savings from the industrial sector are often lumpy with savings varying from year to year, depending on the projects identified and chosen for capital investment by industrial facilities. These savings are summarized in Figure 11 below.

Figure 11: 2021-2022 Industrial Program Achievements by End Use



Customer Characteristics

This section describes the characterization of RES's customer base. This process includes defining the makeup and characteristics of each individual sector. Defining the customer base determines the type and quantity of remaining opportunities to implement energy efficiency measures. Additional information about the local climate and service territory population is used to characterize some measures. This information is summarized in Table 4.

Table 4: Service Territory Characteristics

Heating Zone	Cooling Zone	Total Homes (2021)	Total Population (2021)
1	3	24,735	61,929

The count of homes is based on the number of residential customers reported to the US EIA by RES. This number is slightly lower than the value used in the 2021 CPA, but the change reflects a difference in data source. Lighthouse assumed a growth rate based on the long-term growth of residential customers over the 2013-2021 timeframe.

Lighthouse also applied a demolition rate based on assumptions for Washington State in the Council's 2021 Power Plan. The demolition rate is used to quantify the number of existing homes that are converted to new homes through demolition or major renovation where building codes for new construction apply.

The population is based on census data for the City of Richland.

Residential

Within the residential sector, the key characteristics are the number and type of homes as well as the saturation of end use appliances such as space and water heating equipment.

Lighthouse used the same values for the distribution of home types from RES's 2021 CPA. These were calculated based on Benton County Assessor data. Homes were classified into one of four building types: single family, manufactured homes, and low-rise multifamily apartments. According to the Benton County Assessor, no buildings were identified as high-rise multifamily dwellings and all residential buildings within the City of Richland appeared to be 3 stories or less.

To perform this classification, meters that showed minimal energy consumption (less than 1200 kWh/year in energy use) were flagged as potentially unoccupied (approximately 70 meters). Of the remaining meters, mobile homes were labelled as such using the county assessor data. Land parcels and buildings with multiple units were flagged as multifamily properties. Some meters were associated with addresses that didn't have a match in the county assessor data. These phantom addresses belong mostly to accessory dwelling units (ADUs) or duplexes - they were geocoded using the Google Maps API to obtain the latitude and longitude, then they were matched to specific land parcels using the assessor's GIS data.

HVAC and other appliance saturation data was based on analysis of customer usage data in combination with NEEA's 2016 Residential Building Stock Assessment and input from RES staff. Table 5 and Table 6 summarize the characteristics that were used for this assessment for existing homes and new homes, respectively.

Table 5: Residential Existing Home Characteristics

	Single Family	Low Rise Multifamily	Manufactured
Share of Homes	68%	28%	4%
HVAC Equipment			
Electric Forced Air Furnace	7%	10%	61%
Air Source Heat Pump	52%	4%	30%
Ductless Heat Pump	2%	0%	0%
Electric Zonal/Baseboard	7%	72%	3%
Central Air Conditioning	27%	9%	42%
Room Air Conditioning	16%	64%	16%
Other Appliances			
Electric Water Heater	79%	77%	94%
Refrigerator	136%	105%	119%
Freezer	45%	16%	50%
Clothes Washer	96%	53%	100%
Electric Clothes Dryer	91%	49%	100%
Dishwasher	87%	67%	88%
Electric Oven	96%	100%	100%
Desktop	49%	40%	56%
Laptop	53%	35%	38%
Monitor	51%	44%	56%

Table 6: Residential New Home Characteristics

	Single Family	Low Rise Multifamily	Manufactured
Growth Rate	1.85%	2.31%	0.62%
HVAC Equipment			
Electric Forced Air Furnace	5%	0%	50%
Air Source Heat Pump	49%	10%	50%
Ductless Heat Pump	2%	0%	0%
Electric Zonal/Baseboard	0%	90%	0%
Central Air Conditioning	48%	10%	40%
Room Air Conditioning	0%	80%	10%
Other Appliances			
Electric Water Heater	79%	77%	94%
Refrigerator	136%	105%	119%
Freezer	45%	16%	50%
Clothes Washer	96%	53%	100%
Electric Clothes Dryer	91%	49%	100%
Dishwasher	87%	67%	88%
Electric Oven	96%	100%	100%
Desktop	49%	40%	56%
Laptop	53%	35%	38%
Monitor	51%	44%	56%

In the tables above, numbers greater than 100% imply an average of more than one appliance per home. For example, the single family refrigerator saturation of 136% means that single family homes average approximately 1.4 refrigerators per home.

Commercial

In the commercial sector, building floor area is the primary variable in determining the number of conservation opportunities, as many of the commercial measures are quantified based on the applicable amount of floor area. To estimate the commercial floor area in RES's service territory, RES provided updated loads by commercial building type. These loads were combined with energy use intensities (EUIs) from the 2019 CBSA to estimate floor area by building type. The estimated commercial floor area increased by 10 percent relative to the 2021 CPA.

Table 7 summarizes the resulting floor area estimates for each of the 18 commercial building segments.

Table 7: Commercial Floor Area by Segment

Building Type	2022 Floor Area (square feet)
Large Office	7,137,915
Medium Office	4,713,910
Small Office	4,829,210
Extra Large Retail	622,065
Large Retail	322,417
Medium Retail	1,238,355
Small Retail	1,061,638
School (K-12)	2,926,453
University	879,996
Warehouse	712,699
Supermarket	371,552
Mini Mart	55,824
Restaurant	483,601
Lodging	671,793
Hospital	526,108
Residential Care	227,541
Assembly	2,586,698
Other Commercial	1,613,442
Total	**30,981,214**

The commercial floor area was assigned a growth rate of 1.2% based on the growth in commercial and industrial sales reported to the EIA.

Industrial

The methodology used to estimate potential in the industrial sector is different from the residential and commercial sectors. Instead of building a bottom-up estimate of the savings associated with individual measures, potential in the industrial sector is quantified using a top-down approach that uses the annual energy consumption within individual industrial segments which is then further disaggregated into end uses. Savings for individual measures are calculated by applying the assumed savings, expressed as a percentage, to the applicable end use consumption within each industrial segment.

To quantify the industrial segment loads, RES provided 2022 energy consumption data for its industrial customers categorized by industry. The overall industrial consumption totals 226,756 MWh, as summarized in Table 8. This represents an increase of 36% over the 2021 CPA and was driven by increased loads in the frozen food segment.

Lighthouse based the growth rate based on the compound annual growth of commercial and industrial sales reported to the EIA, which was 1.16 percent.

Table 8: Industrial Sector Sales by Segment

Segment	2020 Sales (MWh)
Water Supply	15,721
Sewage Treatment	4,303
Frozen Food	106,168
Other Food	11,321
Paper Conversion Plants	472
Chemical Manufacturing	202
Cement/Concrete Products	1,661
Primary Metal Manufacturing	24,746
Fabricated Metal Manufacturing	42,080
Misc. Manufacturing	13,459
Refrigerated Warehouse	6,624
Total	**226,756**

Distribution System Efficiency

The 2021 Power Plan used a new approach for quantifying the potential energy savings in measures that improve the efficiency of utility distribution systems. The Council's new approach estimated potential based on an estimate of the number of distribution substations and feeders for each utility, as well as the 2018 sales within each sector as reported to the U.S. EIA. Table 9 summarizes the assumptions used for this sector.

Table 9: Utility Distribution System Efficiency Assumptions

Characteristic	Count
Distribution Substations*	14
Residential/Commercial Substations*	12
Urban Feeders*	10
Rural Feeders*	10
2018 Residential Sales (MWh)	338,631
2018 Commercial Sales (MWh)	435,831
2018 Industrial/Other Sales (MWh)	157,422

**Note that these are estimates from the Council and may not reflect RES's actual system*

Results

This section discusses the results of the 2023 CPA. It begins with a discussion of the high-level achievable and cost-effective conservation potential and then covers the cost-effective potential within individual sectors and end uses.

Achievable Conservation Potential

The achievable conservation potential is the amount of energy efficiency that can be saved without considering the cost-effectiveness of measures. It considers market barriers and the practical limits of acquiring energy savings by efficiency programs, but not cost.

Figure 12 shows the supply curve of achievable potential over the 20-year study period. A supply curve depicts the cumulative potential against the levelized cost of energy savings, with the measures sorted in order of ascending cost. No economic screening is applied. Levelized costs are used to make the costs comparable between measures with different lifetimes as well as supply-side resources considered in utility resource planning. The costs include credits for deferred transmission and distribution system costs, avoided generation capacity, avoided periodic replacements, and non-energy impacts. With these credits, some of the lowest-cost measures have a net levelized cost that is negative, meaning that the credits exceed the measure costs.

Figure 12: 20-Year Supply Curve

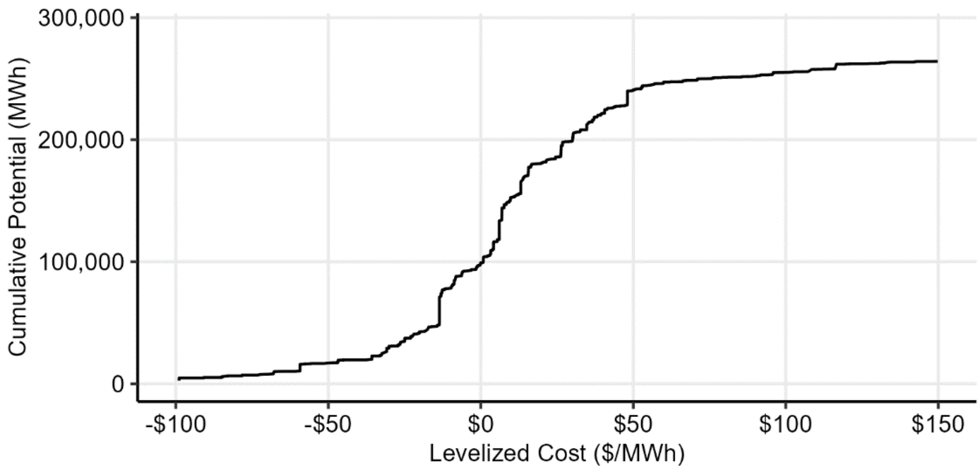


Figure 12 shows that approximately 100,000 MWh of potential are available at a cost at or below $0/MWh. These are measures where benefits such as the deferral of capacity costs and non-energy benefits exceed the measure costs. Nearly 250,000 MWh of achievable potential is available at costs at or below approximately $50/MWh. A total of more than 289,000 MWh is available in RES's service territory over the 20-year period, but only potential below $150/MWh is shown in the supply curve. After approximately $50/MWh, the supply curve flattens and any increases in potential come at increasingly higher costs.

Supply curves based on levelized cost are limited in that not all energy savings are equally valued. For example, two measures could have the same levelized cost but provide different reductions in peak demand, and therefore have different ultimate values to RES. An alternative to the supply curve based on levelized cost is one based on the benefit-cost ratio. This is shown below in Figure 13.

Figure 13: 20-Year Benefit-Cost Ratio Supply Curve

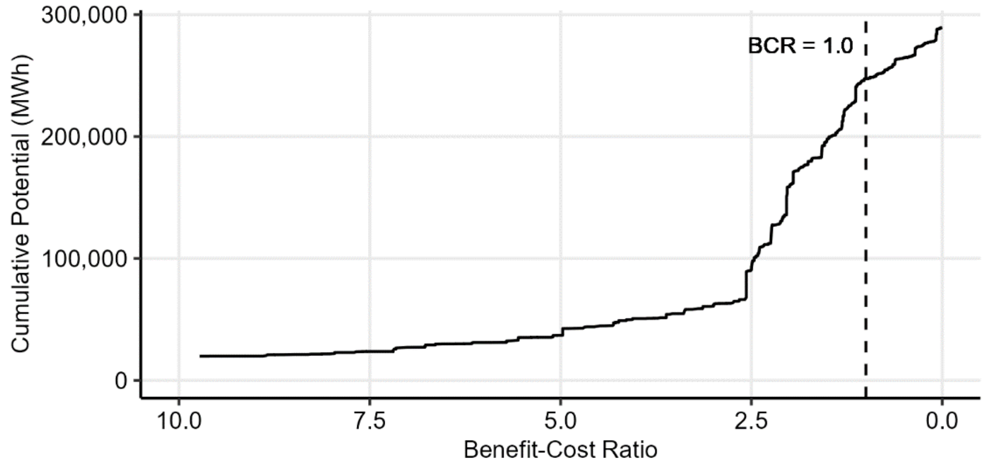


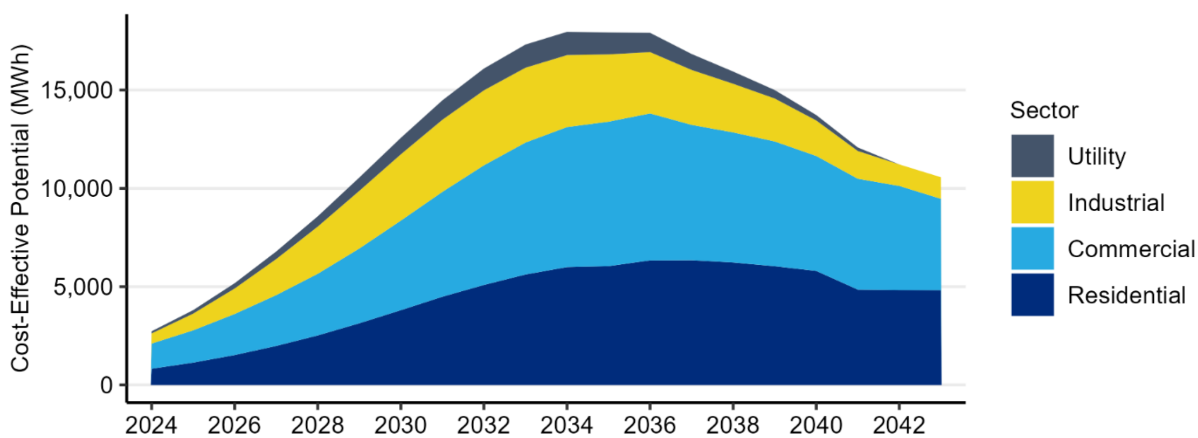
Figure 13 includes a dashed line where the benefit-cost ratio is equal to one. There are approximately 250,000 MWh of cost-effective savings potential to the left of this line, with benefit-cost ratios greater than one. This is the 20-year cost-effective potential identified earlier in this report. The slope of the line is steeper to the left of the dashed line and becomes more horizontal to the right. This suggests higher sensitivities to lower avoided costs, which would effectively shift the dashed line to the left.

The economic or cost-effective potential is described further below.

Cost-Effective Conservation Potential

Figure 14 shows the cost-effective potential by sector on an annual basis. Most of the potential is in RES's residential and commercial sectors, followed by the industrial sector, with smaller amounts available in the utility sector.

Figure 14: Annual Cost-Effective Potential by Sector



Ramp rates from the 2021 Power Plan were used to establish reasonable rates of acquisition for all sectors. Lighthouse made modifications to the assigned ramp rates for some measures to align the near-term potential with recent and expected savings in each sector. Appendix VII has more detail on the alignment of ramp rates with program expectations.

Sector Summary

The sections below describe the cost-effective potential within each sector.

Residential

Relative to RES's 2021 CPA, the cost-effective potential in the residential sector has increased notably in the near term and modestly in the long term. RES's recent program achievements, combined with NEEA's market transformation savings show that potential can be acquired more quickly than the initial two-year period of the 2021 CPA. In addition, higher market prices have increased the amount of cost-effective potential available in the long term.

Figure 15 shows the cost-effective potential by end use for the first 10 years of the study period. Measures in the HVAC (which includes both equipment and weatherization) and water heating end uses make up the largest share of potential in the sector in the near term.

The potential for these and other end uses grows during the initial 10 years of the study as the expected market share of energy efficient equipment increases.

In Figure 15, the other end use category is primarily comprised of measures in the cooking end use. The cost-effective potential in this end use is very small in the initial 10 years of the study period.

Figure 15: Annual Residential Potential by End Use

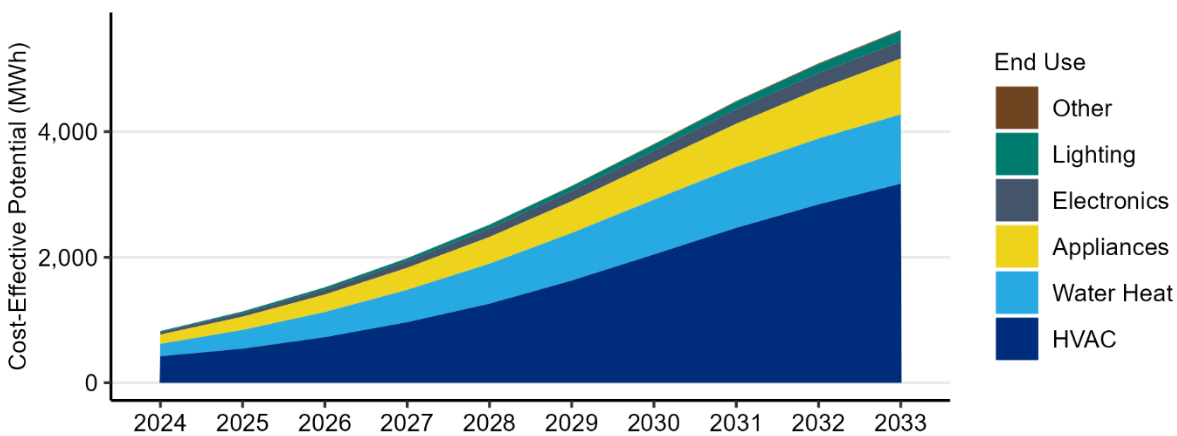
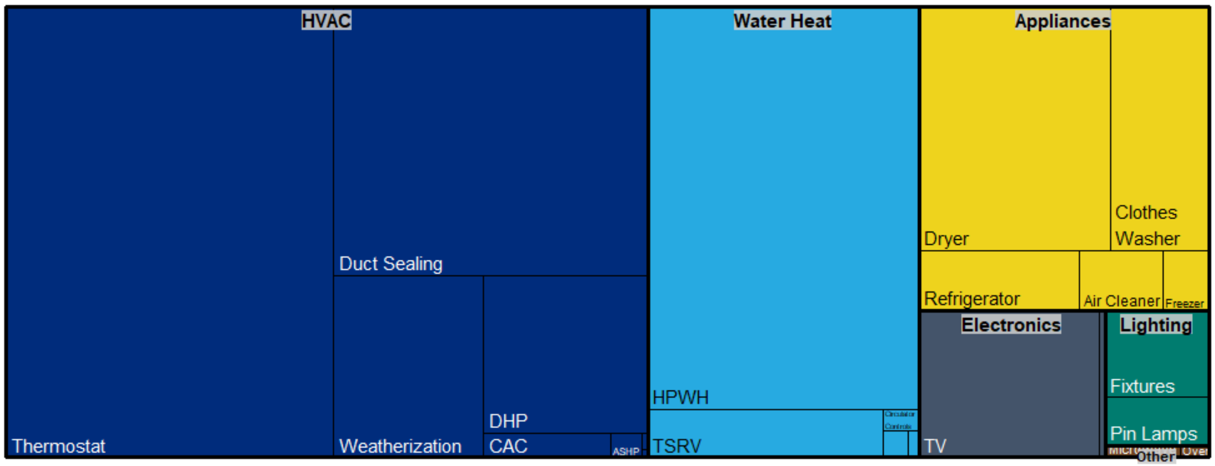


Figure 16 shows how the 10-year potential breaks down into end uses and measure categories. The area of each block represents the share of the total 10-year residential potential. Smart thermostats and duct sealing make up most of the potential in the HVAC end use, while heat pump water heaters (HPWH) and thermostatic restriction valves (TSRV) are the key measures within the water heating end use.

Note that some residential measures, such as smart thermostats and heat pump water heaters, can provide benefits as both energy efficiency and demand response resources. Any demand response benefits were not included in this CPA, although energy efficiency programs can help build a stock of flexible equipment that could be called upon by demand response programs in the future. Lighthouse assessed the demand response potential of these measures in a separate Demand Response Potential Assessment.

Figure 16: Residential Potential by End Use and Measure Category

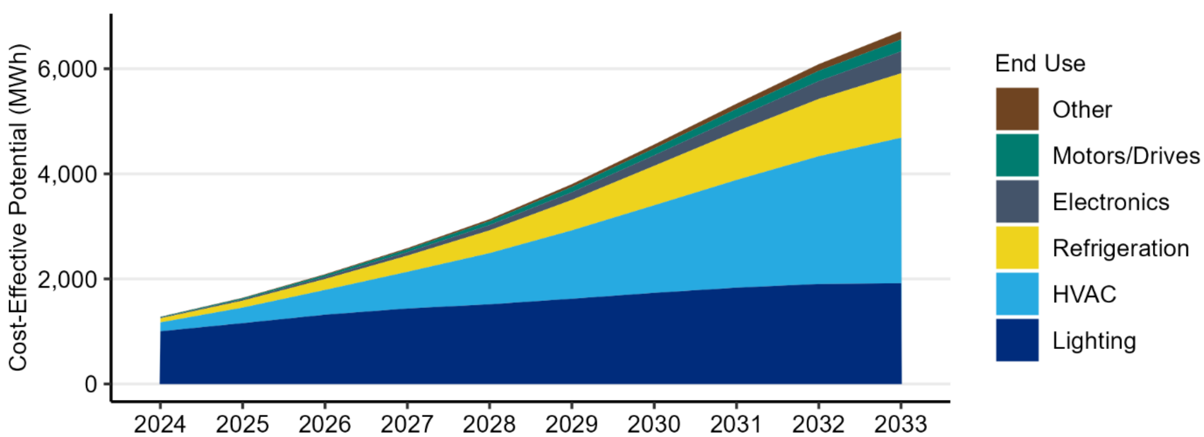


Commercial

In the commercial sector, lighting, HVAC, and refrigeration measures are the end uses with the highest potential. The lighting end use includes measures applicable to both interior and exterior lighting and remains fairly flat over the study period. The potential in other end uses grows over time, showing opportunities to pursue additional savings in these end uses.

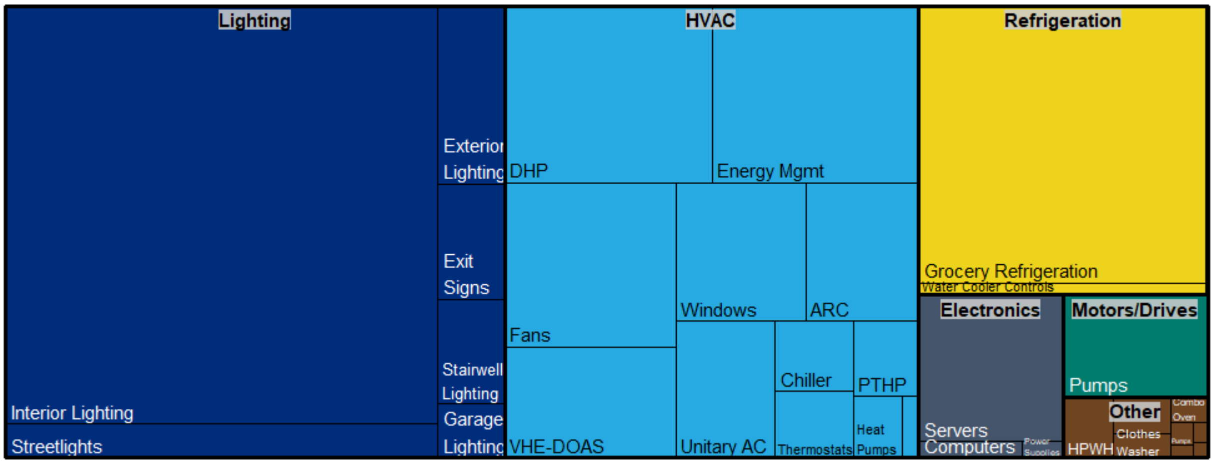
In Figure 17, the other category includes measures in the compressed air, food preparation, process loads, and water heating end uses.

Figure 17: Annual Commercial Potential by End Use



The key end uses and measure categories within the commercial sector are shown in Figure 18. The area of each block is proportional to its share of the 10-year commercial potential. Most of the potential in the lighting end use is in interior lighting, while the potential in the HVAC end use is distributed across a range of measures and equipment types. This reflects the variety of building types and HVAC system types found in the sector.

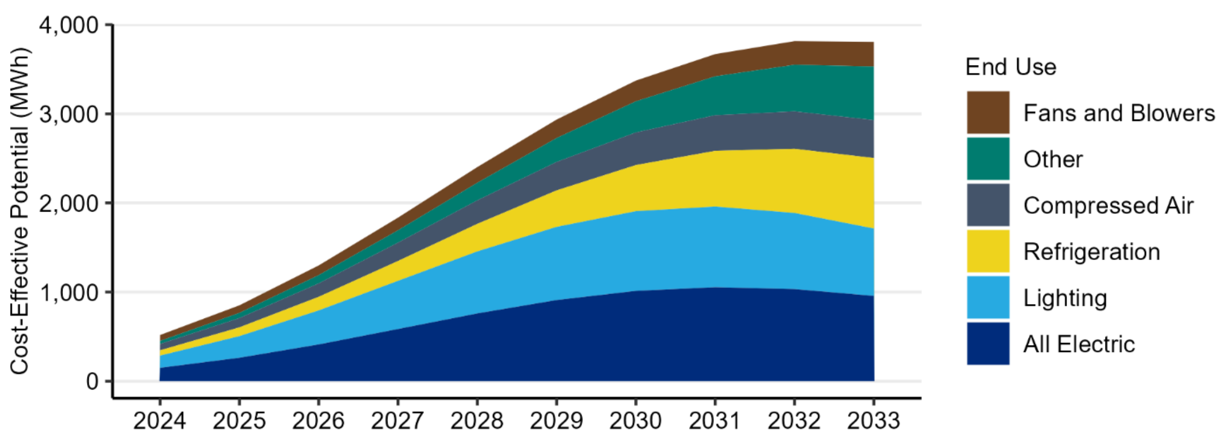
Figure 18: Commercial Potential by End Use and Measure Category



Industrial

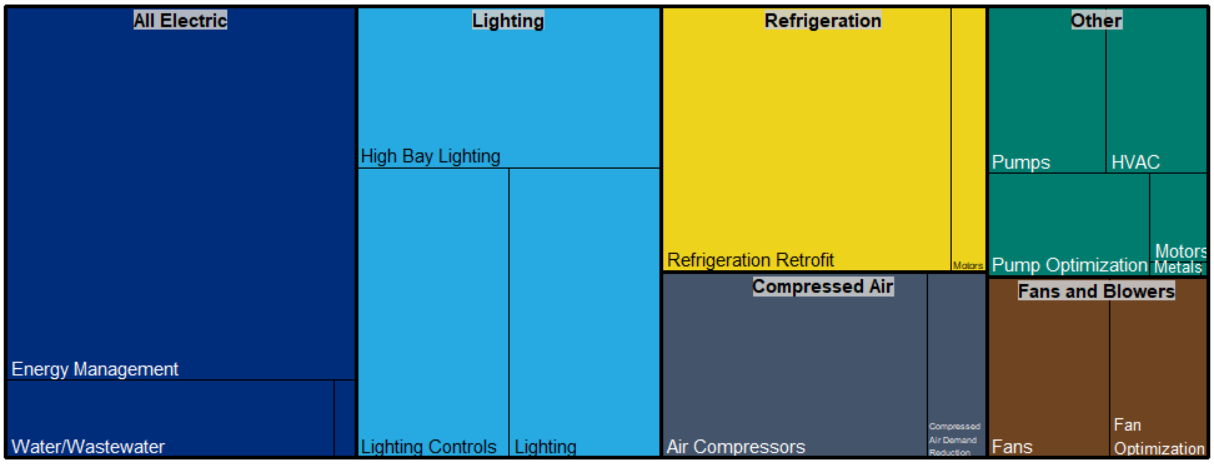
The annual industrial sector potential is shown in Figure 19. Significant amounts of potential are spread across the all electric and lighting end uses. The all electric end use includes measures applicable to all end uses, such as strategic energy management programs. Smaller amounts of potential are available through measures in the refrigeration, compressed air, and other end uses. The other category in Figure 19 includes a variety of end uses, including material handling and processing, HVAC, pump systems, and several other smaller end uses.

Figure 19: Annual Industrial Potential by End Use



The breakdown of 10-year industrial potential into end uses and measure categories is shown in Figure 20.

Figure 20: Industrial Potential by End Use and Measure Category

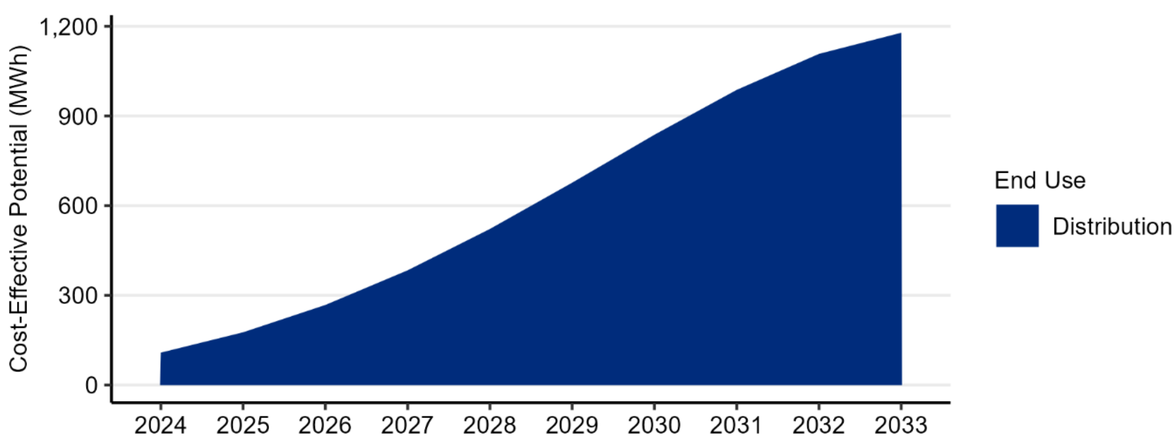


Utility

Measures in the utility sector involve the regulation of voltage to improve the efficiency of the utility distribution system. This analysis includes the measures characterized for the 2021 Power Plan, which are based on an estimate of the number of distribution substations and feeders for RES.

The annual distribution system potential is shown in Figure 21. The Council characterized three measures in the 2021 Power Plan, which use increasingly sophisticated control systems. Note that the scale for this figure has changed relative to the figures above, as the potential in this sector is much smaller than those sectors.

Figure 21: Annual Distribution System Potential



Scenario Results

This section discusses the results of two additional scenarios that were considered in addition to the base case scenario covered in the previous section. These scenarios feature low and high variations in the avoided costs values in order to understand the range of possible outcomes due to the uncertainty of these values. These scenarios allow RES to understand the sensitivity of the cost-effective potential to variations in avoided cost. All other inputs were held constant.

Table 10 summarizes the avoided cost assumptions used in each scenario, which are discussed further in Appendix IV.

Table 10: Avoided Cost Assumptions by Scenario

		Low Scenario	Base Scenario	High Scenario
Energy Values	Avoided Energy Costs (20-Year Levelized Price, 2016$)	Market Forecast minus 20%-80% ($25)	Market Forecast ($47)	Market Forecast plus 20%-80% ($70)
	Social Cost CO_2	Federal 2.5% Discount Rate Values	Federal 2.5% Discount Rate Values	Federal 2.5% Discount Rate Values
	RPS Compliance	WA EIA & CETA Requirements	WA EIA & CETA Requirements	WA EIA & CETA Requirements
Capacity Values	Distribution Capacity (2016$)	$7.82/kW-year	$7.82/kW-year	$7.82/kW-year
	Transmission Capacity (2016$)	$3.54/kW-year	$3.54/kW-year	$3.54/kW-year
	Generation Capacity (2016$)	$69/kW-year	$79/kW-year	$123/kW-year
	Implied Risk Adder (Difference from Base) (2016$)	-$22/MWh -$10/kW-year	N/A	$23/MWh $44/kW-year
	NW Power Act Credit	10%	10%	10%

Instead of using a single risk adder applied to each unit of energy, the two alternate scenarios consider potential futures with higher and lower values for the avoided cost inputs where some degree of uncertainty exists, including variations in the value of both energy and capacity. The implied risk adder row calculates the implied risk adders for the low and high scenarios by totaling the differences in both energy and capacity-based values relative to the base scenario. Further discussion of these values is provided in Appendix IV.

Table 11 summarizes the cost-effective potential across each avoided cost scenario. As discussed above, the results show higher sensitivities to the low avoided cost scenario.

Table 11: Cost Effective Potential (MWh) by Avoided Cost Scenario

Scenario	2-Year	4-Year	10-Year	20-Year
Low Scenario	5,534	15,634	82,655	202,561
Base Case	6,538	18,506	98,102	247,287
High Scenario	6,808	19,184	100,852	254,927

Overall, energy efficiency remains a low-risk resource for RES since it is purchased in small increments over time, making it unlikely that significant amounts of the resource be acquired that were over-valued.

Summary

This report has summarized the results of the 2023 CPA conducted for RES. The assessment provided estimates of the cost-effective energy savings potential for the 20-year period beginning in 2024, with details on the first ten years per the requirements of Washington State's EIA. The assessment considered a wide range of measures that are reliable and available during the study period.

Compared to RES's 2021 CPA, the potential has decreased in the near term but increased in the long term. Lighthouse aligned the near-term potential with RES's recent program achievements, which resulted in decreases in near-term potential in the commercial and industrial sectors and an increase in the residential sector.

In the longer term, increases in commercial floor space and industrial loads combined with higher market prices resulted in an increase in potential available over the 10- and 20- year time periods.

Compliance with State Requirements

The methodology used to estimate the cost-effective energy efficiency potential described in this report is consistent with the methodology used by the Council to determine the potential and cost-effectiveness of conservation resources in the 2021 Power Plan. Appendix III provides a list of Washington's EIA requirements for CPAs and a description of how each was implemented in this assessment. In addition to using a methodology consistent with the Council's 2021 Power Plan, this assessment used assumptions from the 2021 Power Plan where utility-specific inputs were not used. Utility-specific inputs covering customer characteristics, previous conservation achievements, and economic inputs were used. The assessment included the measures considered in the 2021 Power Plan materials, with additional RTF updates made available since its publication.

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Appendix I: Acronyms

aMW	Average Megawatt
BPA	Bonneville Power Administration
CEIP	Clean Energy Implementation Plan
CETA	Clean Energy Transformation Act
CPA	Conservation Potential Assessment
EIA	Energy Independence Act
EUI	Energy Use Intensity
HPWH	Heat Pump Water Heater
HVAC	Heating, Ventilation, and Air Conditioning
IRP	Integrated Resource Plan
kW	kilowatt
kWh	kilowatt-hour
LED	Light-Emitting Diode
MW	Megawatt
MWh	Megawatt-hour
NEEA	Northwest Energy Efficiency Alliance
O&M	Operations and Maintenance
RPS	Renewable Portfolio Standard
RTF	Regional Technical Forum
SEM	Strategic Energy Management
TRC	Total Resource Cost

Appendix II: Glossary

Achievable Technical Potential	Conservation potential that includes considerations of market barriers and programmatic constraints, but not cost effectiveness. This is a subset of technical potential.
Average Megawatt (aMW)	An average hourly usage of electricity, measured in megawatts, across the hours of a day, month, or year.
Avoided Cost	The costs avoided through the acquisition of energy efficiency.
Cost Effective	A measure is described as cost effective when the present value of its benefits exceeds the present value of its costs.
Economic Potential	Conservation potential that passes a cost-effectiveness test. This is a subset of achievable potential. Per the EIA, a Total Resource Cost (TRC) test is used.
Levelized Cost	A measure of costs when they are spread over the life of the measure, like a car payment. Levelized costs enable the comparison of resources with different useful lifetimes.
Megawatt (MW)	A unity of demand equal to 1,000 kilowatts (kW).
Renewable Portfolio Standard	A requirement that a certain percentage of a utility's portfolio come from renewable resources. In 2020, Washington utilities with more than 25,000 customers are required to source 15% of their energy from renewable resources.
Technical Potential	The set of possible conservation savings that includes all possible measures, regardless of market or cost barriers.
Total Resource Cost (TRC) Test	A test for cost-effectiveness that considers all costs and benefits, regardless of who they accrue to. A measure passes this test if the present value of all benefits exceeds the present value of all costs. The TRC test is required by Washington's Energy Independence Act and is the predominant cost effectiveness test used throughout the Northwest and U.S.

Appendix III: Compliance with State Requirements

This Appendix details the specific requirements for Conservation Potential Assessments listed in WAC 194-37-080. The table below lists the specific section and corresponding requirement along with a description of how the requirement is implemented in the model and where the implementation can be found.

Table 12: CPA Compliance with EIA Requirements

WAC 194-37-080 Section	Requirement	Implementation
(5)(a)	**Technical potential.** Determine the amount of conservation that is technically feasible, considering measures and the number of these measures that could physically be installed or implemented, without regard to achievability or cost.	The model calculates technical potential by multiplying the quantity of stock (number of homes, building floor area, industrial load) by the number of measures that could be installed per each unit of stock. The model further constrains the potential by the share of measures that have already been completed. See calculations in the "Units" tabs within each of the sector model files.
(5)(b)	**Achievable technical potential**. Determine the amount of the conservation technical potential that is available within the planning period, considering barriers to market penetration and the rate at which savings could be acquired.	The model applies maximum achievability factors based on the Council's 2021 Power Plan assumptions and ramp rates to identify how the potential can be acquired over the 20-year study period. See calculations in the "Units" tabs within each of the sector model files. The complete set of the ramp rates used is on the "Ramp Rates" tab.
(5)(c)	**Economic achievable potential**. Establish the economic achievable potential, which is the conservation potential that is cost-effective, reliable, and feasible, by comparing the total resource cost of conservation measures to the cost of other resources available to meet expected demand for electricity and capacity.	Lighthouse used the Council's ProCost model to calculate TRC benefit-cost ratios for each measure after updating ProCost with utility-specific inputs. The ProCost results are collected through an Excel macro in the "ProCost Measure Results-(scenario).xlsm" files and brought into the CPA models through Excel's Power Query. See Appendix IV for further discussion of the avoided cost assumptions.
(5)(d)	**Total resource cost**. In determining economic achievable potential as provided in (c) of this subsection, perform a life-cycle cost analysis of measures or programs to determine the net levelized cost, as described in this subsection.	A life-cycle cost analysis was performed using the Council's ProCost tool, which Lighthouse configured with utility-specific inputs. Costs and benefits were included consistent with the TRC test. The measure files within each sector contain the ProCost results. These results are then rolled up into the ProCost Measure Results files, which are

WAC 194-37-080 Section	Requirement	Implementation
		linked to each sector model file through Excel's Power Query functionality.
(5)(d)(i)	Conduct a total resource cost analysis that assesses all costs and all benefits of conservation measures regardless of who pays the costs or receives the benefits.	The costs considered in the economic analysis included measure capital costs, O&M costs, periodic replacement costs, and any non-energy costs. Benefits included avoided energy, T&D capacity costs, avoided generation capacity costs, non-energy benefits, O&M savings, and periodic replacement costs. Measure costs and benefits can be found in the individual measure files as well as the "ProCost Measure Results" files.
(5)(d)(ii)	Include the incremental savings and incremental costs of measures and replacement measures where resources or measures have different measure lifetimes.	Assumed savings, cost, and measure lifetimes are based on 2021 Power Plan and subsequent RTF updates, where applicable. Measure costs and benefits can be found in the individual measure files as well as the "ProCost Measure Results" files.
(5)(d)(iii)	Calculate the value of the energy saved based on when it is saved. In performing this calculation, use time differentiated avoided costs to conduct the analysis that determines the financial value of energy saved through conservation.	Lighthouse used a 20-year forecast of monthly on- and off-peak market prices and the load shapes developed for the 2021 Power Plan as part of the economic analysis conducted in ProCost. The "MC and Loadshape" file contains both the market price forecast as well as the library of load shapes. Individual measure files contain the load shape assignments.
(5)(d)(iv)	Include the increase or decrease in annual or periodic operations and maintenance costs due to conservation measures.	Measure analyses include changes to O&M costs as well as periodic replacement costs, where applicable. These assumptions are based on the 2021 Plan and/or RTF. Measure assumptions can be found in the individual measure files.
(5)(d)(v)	Include avoided energy costs equal to a forecast of regional market prices, which represents the cost of the next increment of available and reliable power supply available to the utility for the life of the energy efficiency measures to which it is compared.	Lighthouse developed a forecast of on- and off-peak market prices at the mid-Columbia trading hub. Further discussion of this forecast can be found in Appendix IV.

WAC 194-37-080 Section	Requirement	Implementation
		See the "MC and Loadshape" file for the market prices. These prices include the value of avoided REC purchases as applicable.
(5)(d)(vi)	Include deferred capacity expansion benefits for transmission and distribution systems.	Deferred transmission and distribution system benefits are based on the values developed by the Council for the 2021 Power Plan. These values can be found on the "ProData" tab of the ProCost files, cells C50 and C54.
(5)(d)(vii)	Include deferred generation benefits consistent with the contribution to system peak capacity of the conservation measure.	Deferred generation capacity expansion benefits are based on BPA's monthly demand charges, which are used as a proxy for the cost of capacity. The development of these values is discussed in Appendix IV. These values can be found on the "ProData" tab of the ProCost files, cells C60.
(5)(d)(viii)	Include the social cost of carbon emissions from avoided non-conservation resources.	This assessment uses the social cost of carbon values determined by the federal Interagency Workgroup using a 2.5% discount rate, as required by the Clean Energy Transformation Act. The emissions intensity of energy savings is based on an updated Council analysis of the regional marginal emissions intensity. The carbon costs and emissions intensities can be found in the MC and Loadshape file.
(5)(d)(ix)	Include a risk mitigation credit to reflect the additional value of conservation, not otherwise accounted for in other inputs, in reducing risk associated with costs of avoided non-conservation resources.	This analysis uses a scenario analysis to consider risk. Avoided cost values with uncertain future values were varied across three different scenarios and the resulting sensitivity and risk were analyzed. The Scenario Results section of this report discusses the inputs used and the implicit risk adders used in the analysis.
(5)(d)(x)	Include all non-energy impacts that a resource or measure may provide that can be quantified and monetized.	All quantifiable non-energy benefits were included where appropriate, based on values from the Council's draft 2021 Plan materials and RTF. Measure assumptions can be found in the individual measure files.

WAC 194-37-080 Section	Requirement	Implementation
(5)(d)(xi)	Include an estimate of program administrative costs.	This assessment uses the Council's assumption of administrative costs equal to 20% of measure capital costs. Program admin costs can be found in the "ProData" tab of the ProCost files, cell C29.
(5)(d)(xii)	Include the cost of financing measures using the capital costs of the entity that is expected to pay for the measure.	This assessment utilizes the financing cost assumptions from the draft 2021 Plan materials, including the sector-specific cost shares and cost of capital assumptions. Financing assumptions can be found in the ProData tab of the ProCost files, cells C37:F46.
(5)(d)(xiii)	Discount future costs and benefits at a discount rate equal to the discount rate used by the utility in evaluating non-conservation resources.	This assessment uses a real discount rate of 3.75% to determine the present value of all costs and benefits. This represents RES's long-term cost of capital. The discount rate used in this analysis can be found in the ProCost files, on cell C27 of the ProData tab.
(5)(d)(xiv)	Include a ten percent bonus for the energy and capacity benefits of conservation measures as defined in 16 U.S.C. § 839a of the Pacific Northwest Electric Power Planning and Conservation Act.	A 10% bonus is applied consistent with the Northwest Power Act. The 10% credit used in the measure analyses can be found in the ProCost files, on cell C29 of the ProData tab.

Appendix IV: Avoided Costs

The methodology used to conduct conservation potential assessments for electric utilities in the State of Washington is dictated by the requirements of the Energy Independence Act (EIA) and the Clean Energy Transformation Act (CETA). Specifically, WAC 194-37-070 requires utilities to determine the economic, or cost-effective, potential by "comparing the total resource cost of conservation measures to the total cost of other resources available to meet expected demand for electricity and capacity."[7] This CPA will determine the cost-effectiveness of conservation measures through a benefit-cost ratio approach, which uses avoided costs to represent the costs avoided by acquiring efficiency instead of other resources. The EIA specifies that these avoided costs include the following components:

- Time-differentiated energy costs equal to a forecast of regional market prices
- Deferred capacity expansion costs for the transmission and distribution system
- Deferred generation capacity costs consistent with each measure's contribution to system peak capacity savings
- The social cost of carbon emissions from avoided non-conservation resources
- A risk mitigation credit to reflect the additional value of conservation not accounted for in other inputs
- A 10% bonus for energy and capacity benefits of conservation measures, as defined by the Pacific Northwest Electric Power Planning and Conservation Act

In addition to these requirements, Washington's CETA requires specific values be used for the social cost of carbon. [8] Lighthouse has also included the value of avoided renewable portfolio standard compliance costs in the avoided costs.

This memo discusses each of these inputs in detail in the following sections.

Avoided Energy Costs

Avoided energy costs are the energy costs avoided by RES through the acquisition of energy efficiency instead of supply-side resources. For every megawatt-hour of conservation achieved, RES will avoid the purchase of one megawatt-hour of energy.

For this CPA, Lighthouse has developed a forecast of avoided on- and off-peak energy prices at the Mid-Columbia trading hub. The forecast is based on forward on- and off-peak prices reported by the CME Group[9,10] on March 1, 2023. The prices cover the current year through 2028.

To develop a forecast that would cover the 20-year study period of this CPA, Lighthouse developed a set of multipliers that would transition the prices in 2028 to the mid-range of longer-term prices expected in the Northwest Power & Conservation Council's most recent market price forecast.[11] Lighthouse identified this approach as a good balance that reflected both the near-term high prices and volatility while also including

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[7] WAC 194-37-070. Accessed January 20, 2021. https://app.leg.wa.gov/wac/default.aspx?cite=194-37-070

[8] WAC 194-40-100. Accessed March 7, 2023. https://app.leg.wa.gov/WAC/default.aspx?cite=194-40-100

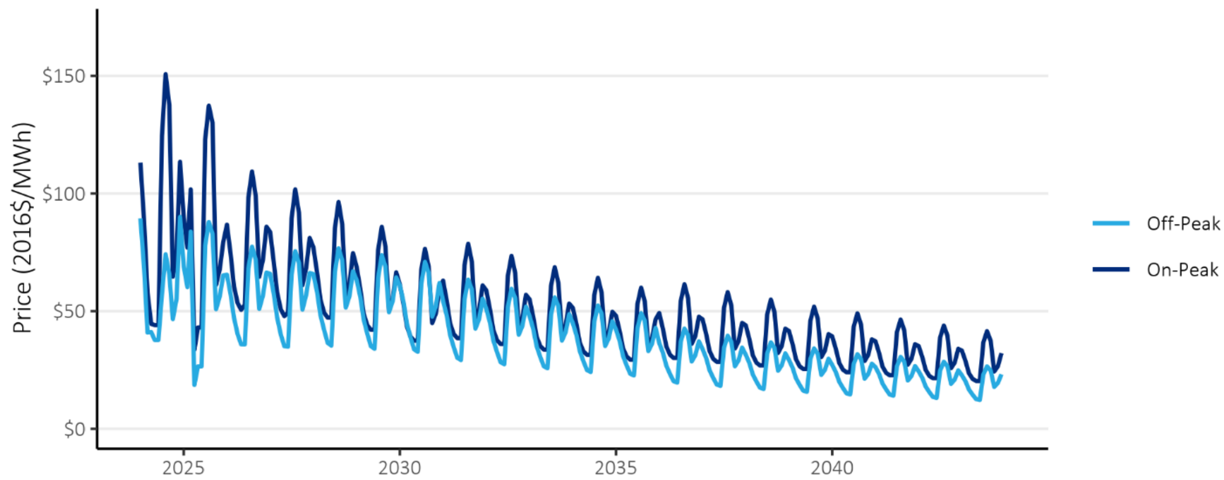
[9] https://www.cmegroup.com/trading/energy/electricity/mid-columbia-day-ahead-peak-calendar-month-5-mw-futures.html. Accessed March 1, 2023.

[10] https://www.cmegroup.com/trading/energy/electricity/mid-columbia-day-ahead-off-peak-calendar-month-5-mw-futures.html. Accessed March 1, 2023.

[11] https://www.nwcouncil.org/fs/18190/2023_02_p3.pdf. Accessed March 3, 2023.

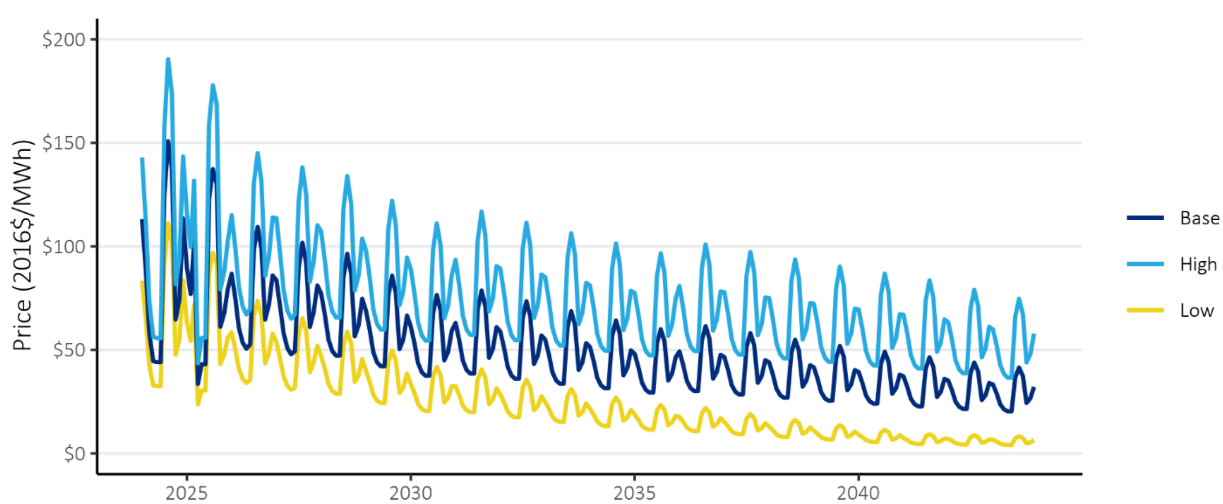
the longer-term forecast based on market fundamentals from the Council. Figure 22 shows the resulting on- and off-peak prices resulting from this process.

Figure 22: On- and Off-Peak Price Forecast



The levelized value of the 20-year price forecast is $47/MWh (2016$). In RES's 2021 CPA, the levelized value of market prices was approximately $35/MWh (2016$), an increase of 34%.

Lighthouse also created high and low variations of this forecast to be used in the avoided cost scenarios, which are described subsequently. To develop the forecast variations, Lighthouse assumed that the high and low prices would vary by approximately 20% in the near term and 80% in the long term, relative to the base case price forecast. A similar approach was used in RES's 2021 CPA based on the variation observed in price forecasts in the 2021 Power Plan. Lighthouse applied this variation to the forecast described above to create high and low scenario forecasts. The resulting forecasts for on- and off-peak prices are shown in Figure **23: Comparison of On-Peak** Price Scenarios



and Figure 24 below.

Figure 23: Comparison of On-Peak Price Scenarios

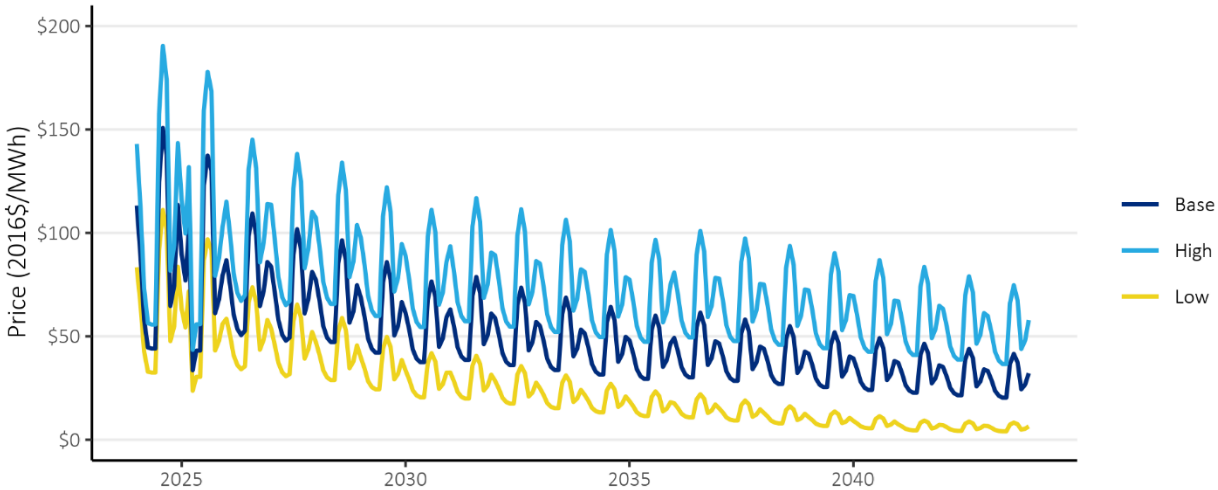
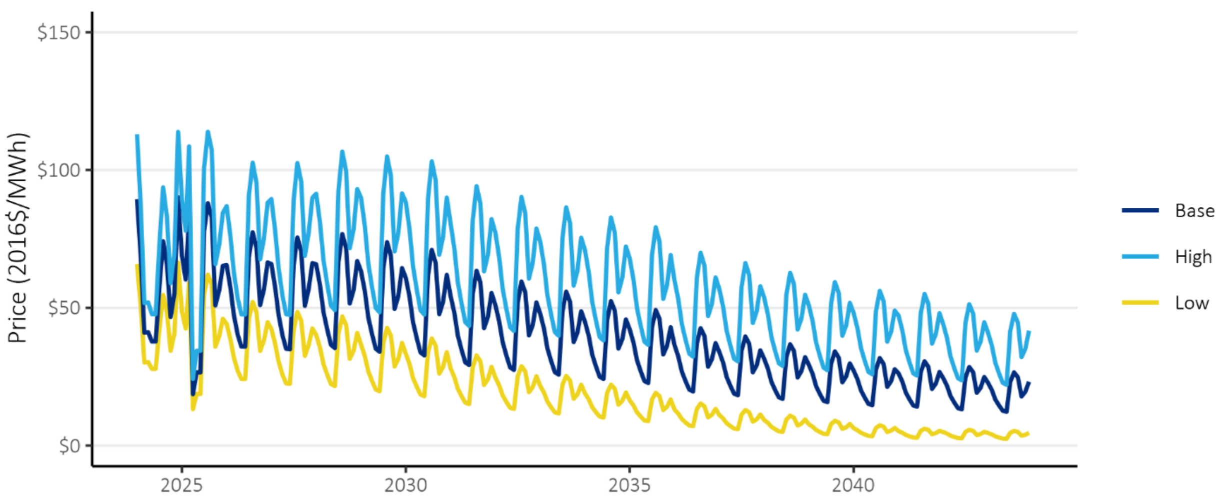


Figure 24: Comparison of Off-Peak Price Scenarios



Deferred Transmission and Distribution Capacity Costs

Unlike supply-side resources, energy efficiency does not require transmission and distribution infrastructure. Instead, it frees up capacity in these systems by reducing the peak demands and over time can help defer future capacity expansions and the associated capital costs.

In the development of the 2021 Power Plan, the Council surveyed Northwest utilities to update the values associated with these cost deferrals. The resulting values were $3.54/kW-year for transmission capacity and $7.82/kW-year for distribution capacity (2016$). These values were used in RES's 2019 and 2021 CPAs and will be used again in this assessment across all avoided cost scenarios.

These are applied to demand savings coincident with the timing of the respective transmission and distribution system peaks.

Deferred Generation Capacity Costs

Similar to the transmission and distribution systems discussed above, acquiring energy efficiency resources can also help defer or eliminate the costs of new generation resources built or acquired to meet peak demands for electricity. While there is currently no organized capacity market in the Northwest, RES does pay a demand charge to BPA based on its monthly peak demand. These charges effectively function as a generation capacity value for RES.

Lighthouse followed a methodology similar to what was used in RES's previous CPAs to convert BPA's monthly demand charges to an annual generation capacity value. Using assumptions about energy efficiency capacity contributions by month, BPA's 2022-2023 monthly demand charges were scaled and added to calculate an annual value. In the base case, Lighthouse assumed that these demand charges would increase by 2% each year to calculate a 20-year series of annual generation capacity values and then levelized them to provide a single value that is required for the Council's ProCost model. This resulted in a base case value of $79/kW-year, a slight decrease from the value used in the 2021 CPA, which was $88/kW-year.

For the low case, a price escalation of 0.4% was assumed, resulting in a value of $69/kW-year. In the high scenario, Lighthouse used Council's 2021 Power Plan value, which is $123/kW-year. This value reflects the levelized cost of capacity for a battery storage system after accounting for projected cost declines in the future.

Social Cost of Carbon

In addition to avoiding purchases of energy, energy efficiency measures avoid emissions of greenhouse gases like carbon dioxide. Washington's EIA requires that CPAs include the social cost of carbon, which the US EPA defines as a measure of the long-term damage done by a ton of carbon dioxide emissions in a given year. The EPA describes it as including, among other things, changes in agricultural productivity, human health, property damages from increased flood risk, and changes in energy system costs, including increases in the costs of cooling and decreases in heating costs.[12] In addition to this requirement, Washington's CETA requires that utilities use the social cost of carbon values developed by the federal Interagency workgroup using a 2.5% discount rate. These values were used in all scenarios of the CPA.

To implement a cost of carbon emissions, additional assumptions must be made about the intensity of carbon emissions associated with a marginal unit of energy. This assessment uses an updated forecast of marginal emissions rates developed by the Council in 2022. The values from this analysis are used for years before 2030. Beginning in 2030, the marginal emissions rate is set to zero to reflect that CETA requires carbon-free energy. The Council's updated values generally follow those used in the 2021 Power Plan and the District's 2021 CPA, but are now available on a more granular basis, reflecting variations by month and on- and off-peak periods.

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[12] https://www.epa.gov/sites/production/files/2016-12/documents/social_cost_of_carbon_fact_sheet.pdf. Accessed January 21, 2021.

Renewable Portfolio Standard Compliance Costs

The renewable portfolio standard established under Washington's EIA requires that utilities source a portion of retail sales from renewable resources throughout the study period of this CPA. For RES, the requirement begins at 3% for the years 2026 through 2029. The subsequently passed CETA furthers these requirements, mandating that 100% of sales be greenhouse gas neutral in 2030, with an allowance that up to 20% of the requirement can be achieved through other options, such as the purchase of Renewable Energy Credits (RECs).

Energy efficiency can reduce the cost of complying with these requirements by reducing RES's overall load. In 2026, a reduction in load of 100 MWh through energy efficiency would reduce the number of RECs required for compliance by 3. This equates to a value of 3% of the cost of a REC for every megawatt-hour of energy savings. In 2030, it was assumed that marginal energy purchases would also include the purchase of a REC, thus the full price of a REC was added to the energy price beginning in 2030.

Lighthouse developed a forecast of REC prices based on input from several clients.

Risk Mitigation Credit

Any purchase of a resource involves risk. The decision to invest is based on uncertain forecasts of loads and market conditions. Investing in energy efficiency can reduce the risks that utilities face by the fact that it is made in small increments over time, rather than the large, singular sums required for generation resources. A decision not to invest in energy efficiency could result in exposure to higher market prices than forecast, an unneeded infrastructure investment, or one that cannot economically dispatch due to low market prices. While over-investments in energy efficiency are possible, the small and discrete amounts invested in energy efficiency limit the scale of any exposure to this risk.

In its power planning work, the Council develops a risk mitigation credit to account for this risk. This credit accounts for the value of energy efficiency not explicitly included in the other avoided cost values, ensuring that the level of cost-effective energy efficiency is consistent with the outcomes of the power planning process and the conservation targets set by the Council. The value of the credit is determined by identifying a value that results in a level of cost-effective energy efficiency potential that is equivalent to the regional targets set by the Council.

In the 2021 Power Plan, the Council determined that no risk credit was necessary after including carbon costs and a generation capacity value in its avoided cost.

This CPA follows the process used in RES's previous CPAs and is similar to the process followed by the Council. A scenario analysis is used to account for uncertainty, where present, in avoided cost values. The variation in energy and capacity avoided cost inputs covers a range of possible outcomes and the sensitivity of the cost-effective energy efficiency potential is identified by comparing the outcomes of each scenario. In selecting its biennial target based on this range of outcomes, RES is selecting its preferred risk strategy and the associated risk credit.

Northwest Power Act Credit

Finally, this CPA includes a 10% cost credit for energy efficiency. This credit is specified in the Pacific Northwest Electric Power Planning and Conservation Act for regional power planning work completed by the Council and by Washington's EIA for CPAs completed for Washington utilities. This credit is applied as a 10% bonus to the energy and capacity benefits described above.

Summary

Table 13 summarizes the avoided cost assumptions used in each of the scenarios in this CPA update.

Table 13: Avoided Cost Assumptions by Scenario

		Low Scenario	Base Scenario	High Scenario
Energy Values	Avoided Energy Costs (20-Year Levelized Price, 2016$)	Market Forecast minus 20%-80% ($25)	Market Forecast ($47)	Market Forecast plus 20%-80% ($70)
	Social Cost CO_2	Federal 2.5% Discount Rate Values	Federal 2.5% Discount Rate Values	Federal 2.5% Discount Rate Values
	RPS Compliance	WA EIA & CETA Requirements	WA EIA & CETA Requirements	WA EIA & CETA Requirements
Capacity Values	Distribution Capacity (2016$)	$7.82/kW-year	$7.82/kW-year	$7.82/kW-year
	Transmission Capacity (2016$)	$3.54/kW-year	$3.54/kW-year	$3.54/kW-year
	Generation Capacity (2016$)	$69/kW-year	$79/kW-year	$123/kW-year
	Implied Risk Adder (2016$)	-$22/MWh -$10/kW-year	N/A	$23/MWh $44/kW-year
	NW Power Act Credit	10%	10%	10%

Appendix V: Measure List

This appendix provides a list of the measures that were included in this assessment and the data sources that were used for any measure characteristics. The assessment used all measures from the 2021 Power Plan that were applicable to RES. Lighthouse customized these measures to make them specific to RES's service territory and updated many with new information available from the RTF. The RTF continually updates estimates of measure savings and cost. This assessment used the most up to date information available when the CPA was developed.

This list is high-level and does not reflect the thousands of variations for each individual measure. Instead, it summarizes measures by category. Many measures include variations specific to different home or building types, efficiency level, or other characterization. For example, attic insulation measures are differentiated by home type (e.g., single family, multifamily, manufactured home), heating system (e.g., heat pump or furnace), baseline insulation level (e.g., R0, R11, etc.) and maximum insulation possible (e.g., R22, R30, R38, R49). This differentiation allows for savings and cost estimates to be more precise.

The measure list is grouped by sector and end use. Note that all measures may not be applicable to an individual utility service territory based on the characteristics of individual utilities and their customer sectors.

Table 14: Residential End Uses and Measures

End Use	Measure Category	Data Source(s)
Appliances	Air Cleaner	2021 Power Plan, RTF
	Clothes Washer	2021 Power Plan, RTF
	Clothes Dryer	2021 Power Plan, RTF
	Freezer	2021 Power Plan
	Refrigerator	2021 Power Plan
Cooking	Electric Oven	2021 Power Plan
	Microwave	2021 Power Plan
Electronics	Advanced Power Strips	2021 Power Plan, RTF
	Desktop	2021 Power Plan
	Laptop	2021 Power Plan
	Monitor	2021 Power Plan
	TV	2021 Power Plan
EVSE	EVSE	2021 Power Plan
HVAC	Air Source Heat Pump	2021 Power Plan
	Central Air Conditioner	2021 Power Plan
	Cellular Shades	2021 Power Plan
	Circulator	2021 Power Plan
	Circulator Controls	2021 Power Plan
	Ductless Heat Pump	2021 Power Plan, RTF
	Duct Sealing	2021 Power Plan, RTF
	Ground Source Heat Pump	2021 Power Plan
	Heat Recovery Ventilator	2021 Power Plan
	Room Air Conditioner	2021 Power Plan
	Smart Thermostats	2021 Power Plan, RTF
	Weatherization	2021 Power Plan, RTF
	Whole House Fan	2021 Power Plan
Lighting	Fixtures	2021 Power Plan, RTF
	Lamps	2021 Power Plan, RTF
	Pin Lamps	2021 Power Plan, RTF
Motors	Well Pump	2021 Power Plan
Water Heat	Aerators	2021 Power Plan, RTF
	Circulator	2021 Power Plan
	Circulator Controls	2021 Power Plan
	Dishwasher	2021 Power Plan
	Gravity Film Heat Exchanger	2021 Power Plan
	Heat Pump Water Heater	2021 Power Plan, RTF
	Pipe Insulation	2021 Power Plan
	Showerhead	2021 Power Plan
	Thermostatic Restrictor Valve	2021 Power Plan, RTF
Whole Home	Behavior	2021 Power Plan

Table 15: Commercial End Uses and Measures

End Use	Measure Category	Data Source(s)
Compressed Air	Air Compressor	2021 Power Plan
Electronics	Computers	2021 Power Plan
	Power Supplies	2021 Power Plan
	Smart Power Strips	2021 Power Plan, RTF
	Servers	2021 Power Plan
Food Preparation	Combination Ovens	2021 Power Plan, RTF
	Convection Ovens	2021 Power Plan, RTF
	Fryers	2021 Power Plan, RTF
	Griddle	2021 Power Plan, RTF
	Hot Food Holding Cabinet	2021 Power Plan, RTF
	Overwrapper	2021 Power Plan
	Steamer	2021 Power Plan, RTF
HVAC	Advanced Rooftop Controller	2021 Power Plan, RTF
	Chiller	2021 Power Plan
	Circulation Pumps	2021 Power Plan, RTF
	Ductless Heat Pump	2021 Power Plan
	Energy Management	2021 Power Plan
	Fans	2021 Power Plan
	Heat Pumps	2021 Power Plan
	Package Terminal Heat Pumps	2021 Power Plan
	Pumps	2021 Power Plan, RTF
	Smart Thermostats	2021 Power Plan
	Unitary Air Conditioners	2021 Power Plan
	Very High Efficiency Dedicated Outside Air System	2021 Power Plan
	Variable Refrigerant Flow Dedicated Outside Air System	2021 Power Plan
	Windows	2021 Power Plan
Lighting	Exit Signs	2021 Power Plan
	Exterior Lighting	2021 Power Plan
	Garage Lighting	2021 Power Plan
	Interior Lighting	2021 Power Plan
	Stairwell Lighting	2021 Power Plan
	Streetlights	2021 Power Plan
Motors & Drives	Pumps	2021 Power Plan, RTF
Process Loads	Elevators	2021 Power Plan
	Engine Block Heater	2021 Power Plan, RTF
Refrigeration	Freezer	2021 Power Plan
	Grocery Refrigeration	2021 Power Plan, RTF
	Ice Maker	2021 Power Plan, RTF
	Refrigerator	2021 Power Plan, RTF
	Vending Machine	2021 Power Plan, RTF
	Water Cooler Controls	2021 Power Plan
Water Heating	Commercial Clothes Washer	2021 Power Plan, RTF
	Heat Pump Water Heater	2021 Power Plan, RTF
	Pre-Rinse Spray Valve	2021 Power Plan, RTF
	Pumps	2021 Power Plan, RTF
	Showerheads	2021 Power Plan

Table 16: Industrial End Uses and Measures

End Use	Measure Category	Data Source(s)
All Electric	Energy Management	2021 Power Plan
	Forklift Charger	2021 Power Plan
	Water/Wastewater	2021 Power Plan
Compressed Air	Air Compressor	2021 Power Plan
	Air Compressors	2021 Power Plan
	Compressed Air Demand Reduction	2021 Power Plan
Fans and Blowers	Fan Optimization	2021 Power Plan
	Fans	2021 Power Plan, RTF
HVAC	HVAC	2021 Power Plan
Lighting	High Bay Lighting	2021 Power Plan
	Lighting	2021 Power Plan
	Lighting Controls	2021 Power Plan
Low Temp Refer	Motors	2021 Power Plan
	Refrigeration Retrofit	2021 Power Plan
Material Handling	Motors	2021 Power Plan
	Paper	2021 Power Plan
	Wood Products	2021 Power Plan
Material Processing	Hi-Tech	2021 Power Plan
	Motors	2021 Power Plan
	Paper	2021 Power Plan
	Pulp	2021 Power Plan
	Wood Products	2021 Power Plan
Med Temp Refer	Food Storage	2021 Power Plan
	Motors	2021 Power Plan
	Refrigeration Retrofit	2021 Power Plan
Melting and Casting	Metals	2021 Power Plan
Other	Pulp	2021 Power Plan
Other Motors	Motors	2021 Power Plan
Pollution Control	Motors	2021 Power Plan
Pumps	Pulp	2021 Power Plan
	Pump Optimization	2021 Power Plan
	Pumps	2021 Power Plan, RTF

Table 17: Utility Distribution End Uses and Measures

End Use	Measure Category	Data Source
Distribution	Line Drop Control with no Voltage/VAR Optimization	2021 Power Plan
	Line Drop Control with Voltage Optimization & AMI	2021 Power Plan

Appendix VI: Energy Efficiency Potential by End Use

The tables in this appendix document the cost-effective energy efficiency savings potential by end use for each sector.

Table 18: Residential Potential by End Use (MWh)

End Use	2-Year	4-Year	10-Year	20-Year
Appliances	361	991	4,885	17,391
Cooking	2	7	70	379
Electronics	97	281	1,523	2,229
EV Supply Equipment	-	-	-	-
HVAC	966	2,658	16,070	48,338
Lighting	41	121	776	3,257
Motors	-	-	-	-
Water Heat	494	1,409	6,797	15,820
Whole Home	-	-	-	-
Total	**1,961**	**5,467**	**30,121**	**87,415**

Table 19: Commercial Potential by End Use (MWh)

End Use	2-Year	4-Year	10-Year	20-Year
Compressed Air	3	13	143	687
Electronics	38	147	1,622	3,648
Food Preparation	2	10	122	737
HVAC	464	1,633	12,825	42,355
Lighting	2,162	4,918	15,446	31,911
Motors/Drives	34	121	1,010	3,416
Process Loads	-	-	-	-
Refrigeration	211	726	5,725	15,972
Water Heating	8	30	334	1,725
Total	**2,922**	**7,598**	**37,227**	**100,452**

Table 20: Industrial Potential by End Use (MWh)

End Use	2-Year	4-Year	10-Year	20-Year
All Electric	413	1,410	7,139	10,375
Compressed Air	176	533	2,730	5,374
Fans and Blowers	151	401	1,807	4,942
HVAC	33	110	769	1,508
Lighting	380	1,302	6,230	8,394
Low Temp Refrigeration	123	415	3,035	7,181
Material Handling	1	3	35	197
Material Processing	3	12	139	785
Med Temp Refrigeration	35	118	870	2,115
Melting and Casting	1	5	33	65
Other	0	0	0	0
Other Motors	1	5	56	322
Pollution Control	0	0	5	27
Pumps	53	188	1,660	6,295
Total	**1,369**	**4,503**	**24,508**	**47,582**

Table 21: Utility Distribution System Potential by End Use (MWh)

End Use	2-Year	4-Year	10-Year	20-Year
LDC with no VVO	66	215	1,435	2,720
LDC with VVO & AMI	220	722	4,811	9,119
Total	**285**	**937**	**6,246**	**11,839**

Appendix VII: Ramp Rate Alignment Documentation

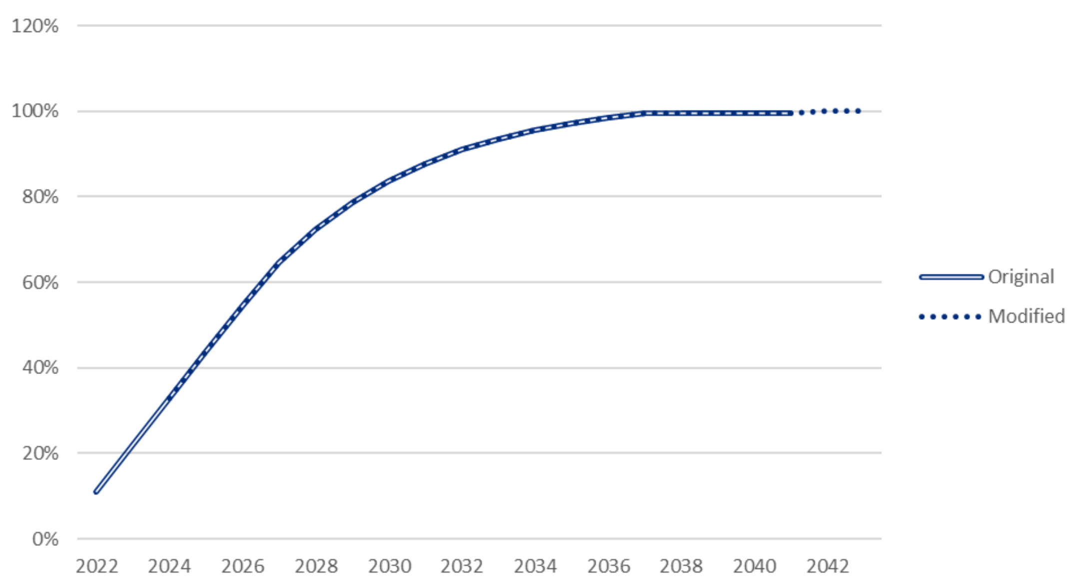
This appendix documents how Lighthouse adjusted the ramp rates from the 2021 Power Plan to be applicable to the 2024-43 time period of this CPA and then selected appropriate adjusted ramp rates to align the near-term potential quantified in Richland Energy Services' (RES) CPA with its recent energy efficiency achievements. Aligning the potential with recent achievements provides the best way to ensure that the near-term potential is feasible for RES's programs as energy efficiency programs take time to ramp up and are subject to local market conditions.

Ramp Rate Adjustments

The CPA model used for this assessment uses the ramp rates developed by the Northwest Power and Conservation Council for the 2021 Power Plan. The 2021 Power Plan, however, covers an earlier time period and so the ramp rates require adjustment to correspond to the 2024-43 time period of this CPA.

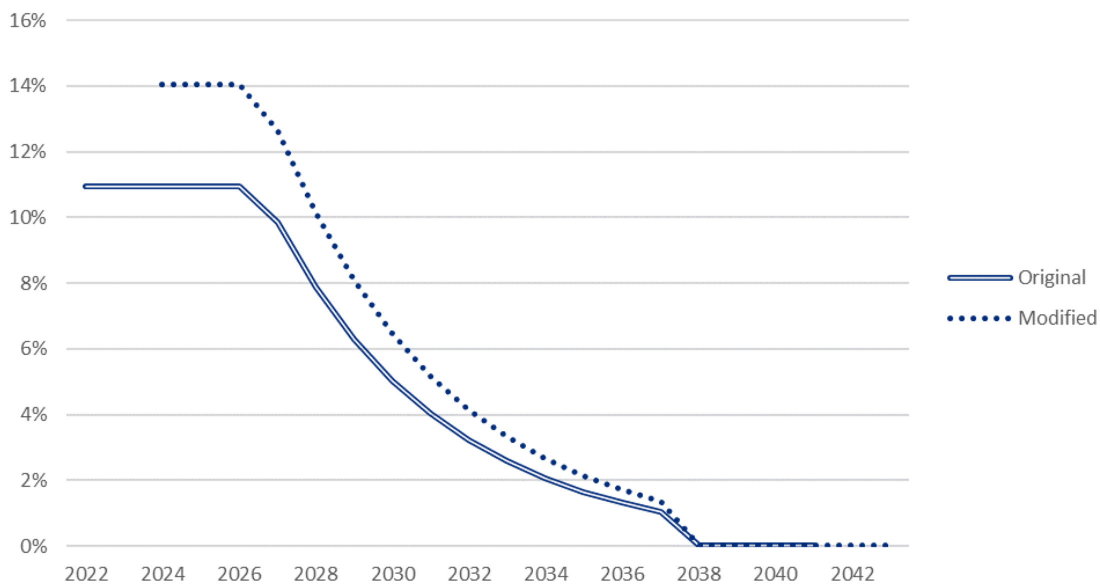
There are two different types of ramp rates, which correspond with the two types of measure under consideration. For lost opportunity measures that are associated with equipment replacement cycles or new construction, the ramp rate values reflect the amount of energy efficiency potential captured among the equipment being purchased in a given year. These ramp rates typically approach 100% in the later years and were adjusted to cover the timeline of the CPA by simply extending the final value of the ramp rate an additional two years. Figure 25 shows how one lost opportunity ramp rate was modified to cover the 2024-43 timeline of this CPA. The original ramp rate reaches 100% at approximately 2037 and the modified ramp rate simply extends this trend for another two years.

Figure 25: Lost Opportunity Ramp Rate Adjustment



For retrofit measures, the ramp rate values reflect the portion of the total available potential that is achieved in a given year. Because retrofit measures can be achieved in any year, the ramp rate values typically sum to 100% over a 20-year time period. To adjust the ramp rates for retrofit measures, Lighthouse assumed that the potential associated with the first two years of the 2021 Power Plan had been achieved and the remaining potential was distributed across the 18 remaining years of the original 2021 Power Plan timeline, in proportion to the original ramp rate projection. This results in higher ramp rate values relative to the original 2021 Power Plan, but equivalent amounts of potential after program achievements have been accounted for. Figure 26 shows the original and modified versions of one retrofit measure ramp rate.

Figure 26: Retrofit Ramp Rate Adjustment



For this ramp rate, nearly 100% of the remaining potential is captured by 2038 in both the original and modified versions of the ramp rate.

Ramp Rate Alignment Process

RES provided program achievement data for 2021-22, which Lighthouse summarized by sector and end use. Lighthouse also summarized the residential program achievements by high-level measure categories.

RES also receives credit for savings from market transformation that the Northwest Energy Efficiency Alliance (NEEA) estimates has occurred in RES' service territory. These savings were allocated to customer sectors based on the historical makeup of the savings but could not be allocated within end uses or measure categories. Because of this, in the tables below, NEEA's historical savings are included on a designated row, but future potential is not distinguished between NEEA and RES programs. For example, Lighthouse has no way to determine the future split of savings from ductless heat pumps or heat pump water heaters between RES programs and NEEA market transformation savings.

Lighthouse has a general sense of NEEA's initiatives, however, and can therefore identify the end uses or measures where NEEA's market transformation initiatives may contribute additional savings. These are noted in the discussion below.

Lighthouse compared the recent savings from RES's programs and NEEA's market transformation initiatives with the cost-effective energy efficiency potential identified in the 2023 CPA. Lighthouse started with the ramp rates that were assigned to each measure in the 2021 Power Plan and compared the resulting cost-effective potential in the first few years of the assessment with RES' recent programmatic achievements. Lighthouse then made changes to the ramp rate assignments for each measure to accelerate or decelerate the pace of savings acquisition to align with recent programmatic achievements. In areas where there were no recent program achievements, Lighthouse typically assigned a slower ramp rate, if one was not already assigned, to account for the fact that a program may need to start from scratch and build momentum over several years.

NEEA resets the baseline against which it quantifies its market transformation savings with every new Power Plan. This happened in 2022 with the publication of the 2021 Power Plan. For consistency in projecting future savings, Lighthouse assumed a similar level of NEEA savings in 2021 as in 2022. This level of savings best represents the expected level of savings going forward with the 2021 Power Plan baseline.

The following tables show how RES' recent achievements compare to the potential after Lighthouse adjusted the ramp rates to align. Color scaling has been applied to highlight the larger values. Discussion follows each table with additional detail.

Residential

The table below shows how the residential potential was aligned with recent achievements by measure category.

Table 22: Alignment of Residential Program History and Potential by Measure Category (MWh)

		Program History		CPA Cost-Effective Potential		
End Use	Category	2021	2022	2024	2025	2026
Appliances	Air Cleaner			7	11	15
Appliances	Clothes Washer			60	83	104
Appliances	Dryer			50	76	108
Appliances	Freezer			7	10	12
Appliances	Refrigerator			24	33	41
Cooking	Microwave			0	1	1
Cooking	Oven			0	0	1
Electronics	Laptop			0	1	1
Electronics	TV			39	57	78
EVSE	EVSE	-	0.3	-	-	-
HVAC	ASHP	859	549	2	4	4
HVAC	Central AC			1	3	4
HVAC	Circulator			0	0	0
HVAC	Circulator Controls			0	0	0
HVAC	DHP	38	48	232	231	229
HVAC	Duct Sealing			44	78	131
HVAC	Thermostat			56	124	233
HVAC	Weatherization	65	87	86	104	124
Lighting	Lighting			17	25	34
Water Heat	Circulator			0	0	0
Water Heat	Circulator Controls			0	1	1
Water Heat	Dishwasher			2	2	3
Water Heat	HPWH	-	35	185	279	370
Water Heat	TSRV			9	16	25
NEEA	NEEA	628	628	*n/a*	*n/a*	*n/a*
	Total	**1,590**	**1,347**	**824**	**1,137**	**1,521**

Note: For clarity, measure categories with no program achievements and no cost-effective potential have been removed. In addition, note that some measures have savings values that are small and cannot be shown at this level of resolution. These values show as 0 in this and following tables while a true zero value is shown as a dash.

The following sections discuss the alignment within each residential end use.

Appliances & Cooking

While there are no program achievements in these end uses, NEEA's market transformation work includes an initiative for retail products and appliances that targets these measures. The ramp rate assignments for these measures were mostly left at the default 2021 Power Plan assignments. Only the ramp rate for clothes dryers was slowed, as this category includes heat pump dryers that have gained a limited market share to date.

Electronics

The potential in this end use is limited to TVs and laptops. The potential from TVs will likely be achieved through NEEA's Retail Product Portfolio, similar to the appliance end use discussed above. Lighthouse slowed the ramp rate for laptops since there is no current program or NEEA initiative that would address this category of measures.

HVAC

In the HVAC end use, as with RES' 2021 CPA, only certain applications of air-source heat pumps (ASHP) were cost-effective, limiting the ability to match recent program achievement and future potential. However, the tax credits and incentives provided for heat pumps through the federal Inflation Reduction Act have the potential to make these measures cost-effective, especially the more generous incentives provided to income-qualified households. The measures in this category were accelerated to align with recent program activity as much as possible.

The potential with ductless heat pumps (DHP) was also accelerated as this is another area where NEEA's market transformation work contributes some additional savings. The potential with duct sealing, smart thermostats, and weatherization was given slower ramp rates to align with recent program activity. Similar to the ASHP category discussed above, there is limited weatherization potential that passed the cost-effectiveness test.

Like RES's 2021 CPA, a measure for efficient central air conditioning systems was found to be cost-effective, but this measure was given a slow ramp rate since there is currently no program for this measure and, given the need for future fuel switching under Washington's Climate Commitment Act, RES may prefer to steer customers to heat pump technologies.

Lighting

The lighting end use is now subject to Washington state standards that took effect in 2020 covering many screw-in lamps. While there is potential that remains in fixtures with integrated LEDs and less common bulb types, there is not currently a program to incentivize LED fixtures, so these measures were given a slower ramp rate.

Water Heat

The cost-effective potential in the water heating category consists mostly of savings from heat pump water heaters. While RES has recently ramped up their program activity in this area, it is also an area where NEEA has a market transformation initiative which contributes additional savings. Lighthouse applied the default 2021 Power Plan ramp rates to the heat pump water heater measures.

Washington's recent HB 1444 specified standards for showerheads and aerators, so there is no longer potential in these measure categories. Lighthouse applied slower ramp rates to the thermostatic restrictor valve and other measures in this end use.

Table 23 below summarizes the residential measure category results in Table 22 by end use.

Table 23: Alignment of Residential Program History and Potential by End Use (MWh)

	Program History		CPA Cost-Effective Potential		
End Use	2021	2022	2024	2025	2026
Appliances	-	-	149	212	279
Cooking	-	-	1	1	2
Electronics	-	-	39	58	79
EVSE	-	0.3	-	-	-
HVAC	962	684	423	543	727
Lighting	-	-	17	25	34
Water Heat	-	35	196	298	400
NEEA	628	628	*n/a*	*n/a*	*n/a*
Total	**1,590**	**1,347**	**824**	**1,137**	**1,521**

Commercial

In the commercial sector, RES' savings declined in 2020 due to the pandemic and are returning to normal levels. RES' recent achievement is in the lighting and HVAC end uses, which are the end uses with most of the future savings potential. Lighthouse applied slower ramp rates to measures throughout the commercial sector.

Table 24 below shows the alignment of program history and potential in the commercial sector.

Table 24: Alignment of Commercial Program History and Potential by End Use (MWh)

	Program History		CPA Cost-Effective Potential		
End Use	2021	2022	2024	2025	2026
Compressed Air			1	2	4
Electronics			13	25	42
Food Preparation			1	2	3
HVAC	399	186	168	296	471
Lighting	1,623	1,009	1,003	1,159	1,319
Motors/Drives			13	22	35
Refrigeration			78	132	208
Water Heat			3	5	9
NEEA	165	165	-	-	-
Total	**2,187**	**1,360**	**1,281**	**1,642**	**2,090**

Industrial

Energy efficiency programs in the industrial sector are subject to ups and downs depending on the projects that are completed in a given year. The potential in RES' industrial sector is distributed across a variety of end uses, including lighting, energy management, and refrigeration. Lighthouse applied slower ramp rates to the potential across the industrial sector.

Table 25 shows the alignment of industrial potential and recent program history by end use.

Table 25: Alignment of Industrial Program History and Potential by End Use (MWh)

	Program History		CPA Cost-Effective Potential		
End Use	**2021**	**2022**	**2024**	**2025**	**2026**
Energy Management	-	746	150	263	412
Compressed Air	138	-	72	104	151
Fans and Blowers	-	109	66	85	109
HVAC	-	-	12	20	31
Lighting	294	20	137	243	382
Motors	-	-	0	1	1
Refrigeration	-	-	59	99	153
Process	211	-	2	3	6
Pumps	-	156	19	33	54
Other	-	-	0	0	0
NEEA	3	3	*n/a*	*n/a*	*n/a*
Total	**646**	**1,034**	**518**	**851**	**1,299**

Utility Distribution System

The amount of potential in this sector is limited compared to other sectors. No changes were made to the default ramp rate assigned in the 2021 Power Plan.

Table 26: Alignment of Distribution System Program History and Potential by End Use (MWh)

	Program History		CPA Cost-Effective Potential		
End Use	**2021**	**2022**	**2024**	**2025**	**2026**
Distribution System	-	-	109	177	268