2025 CONSERVATION POTENTIAL ASSESSMENT

Chelan County Public Utility District

October 15, 2025

Prepared by:

LIGHTHOUSE ENERGY CONSULTING

Nauvoo Solutions

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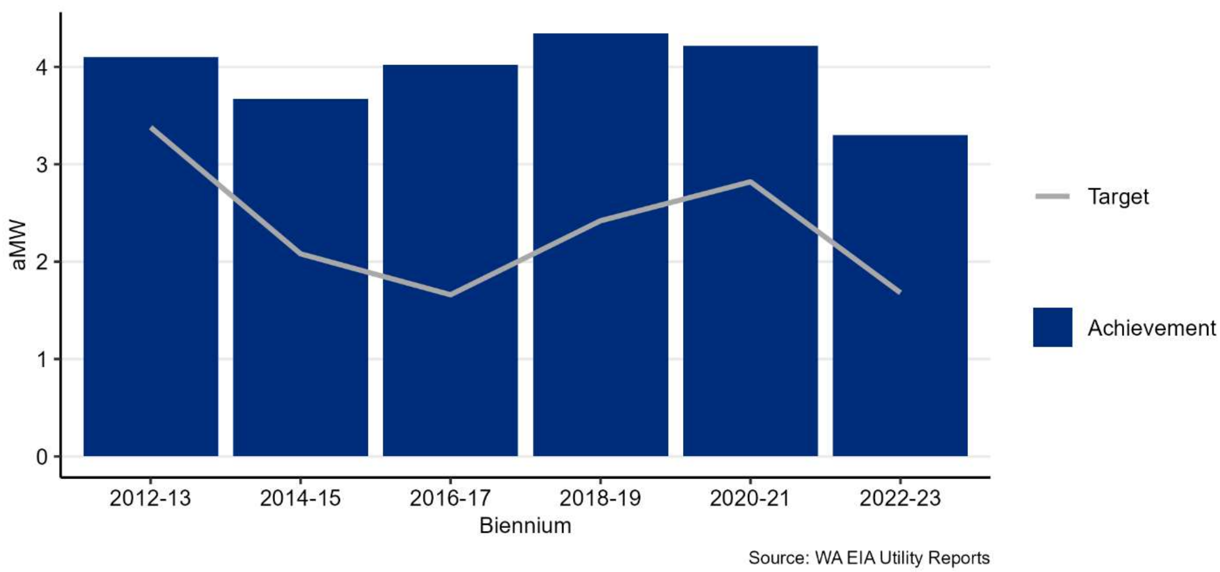
Executive Summary

Overview

This report describes the methodology and results of a conservation potential assessment (CPA) conducted by Lighthouse Energy Consulting and Nauvoo Solutions (the project team) for Chelan County Public Utility District (Chelan PUD). The CPA estimated the cost-effective energy savings potential for the period of 2026 to 2045. This report describes the results of the full 20-year period, with additional details on the 2- and 10-year periods that are the focus of Washington's Energy Independence Act (EIA) and the 4-year interim compliance period per the state's Clean Energy Transformation Act (CETA).

Chelan PUD provides electricity service to over 49,000 customers in Chelan County. 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. Chelan PUD's history of consistently exceeding these biennial conservation targets is shown in Figure 1.

Figure 1: Historic Targets and Achievements (aMW)



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. Appendix III details the requirements of the EIA and how this assessment fulfills those requirements. Washington's CETA includes an additional requirement for CPAs; namely, that the assessment of cost-effectiveness use specific values for the social cost of carbon.

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

- Energy Efficiency Measures
    - Measure savings, costs, and other characteristics were updated based on new information from the Regional Technical Forum (RTF). Multiple measures were updated across the assessment, generally resulting in decreases in potential.
- Avoided Costs
    - The assessment incorporated an updated market prices forecast that is lower than what was used in the 2023 CPA.
    - The 2025 CPA avoided distribution capacity cost assumptions are lower than those of the 2023 CPA.
- Customer Characteristics
    - Residential equipment saturations were updated with American Community Survey and 2022 Northwest Energy Efficiency Alliance (NEEA) Residential Building Stock Assessment (RBSA) data. This update reduced the residential potential due to a reduced prevalence of electric heat and inefficient electric furnaces relative to the 2023 CPA.
    - Chelan PUD provided updated customer counts, sales, and forecasts for all sectors. Higher residential growth counteracted some of the decreases due to the avoided cost update and equipment saturation updates. The estimated commercial floor area decreased due to Chelan PUD specific energy use intensity (EUI) values that were incorporated. Long-term forecasts for industrial loads increased. Increasing potential.
- Program Impacts
    - Chelan PUD's recent conservation program achievements were incorporated to account for what was already accomplished and inform near-term potential.

Results

Figure 2 and Table 1 show the cost-effective energy efficiency potential by sector over 2-, 4-, 10-, and 20-year periods. Over the 20-year planning period, Chelan PUD has nearly 33 aMW of cost-effective conservation available, which is approximately 10% of its projected 2045 load. The Washington EIA focuses on the 2- and 10-year potential, which are 1.71 aMW and 15.55 aMW, respectively. In the 4-year period covered by Chelan PUD's 2025 Clean Energy Implementation Plan (CEIP), there are 3.94 aMW of cost-effective conservation potential available.

Figure 2: Cost-Effective Potential by Sector (aMW)

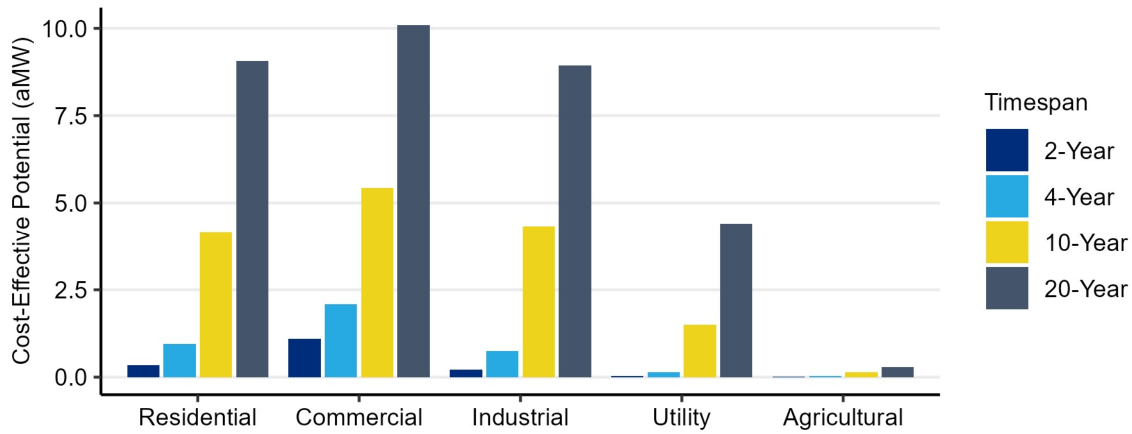


Table 1: Cost-Effective Potential by Sector (aMW)

Sector	2-Year	4-Year	10-Year	20-Year
Residential	0.35	0.95	4.16	9.07
Commercial	1.10	2.09	5.43	10.09
Industrial	0.22	0.74	4.33	8.94
Utility	0.03	0.14	1.49	4.39
Agricultural	0.01	0.02	0.15	0.29
Total	**1.71**	**3.94**	**15.55**	**32.78**

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

While there is more near-term potential in the commercial sector, over the longer term, the cost-effective potential is spread roughly equally across the residential, commercial, and industrial sectors, with smaller amounts of potential available in the utility and agricultural sectors.

This assessment does not specify how the energy efficiency potential will be achieved. Possible mechanisms include Chelan PUD's own energy efficiency programs, market transformation driven by the NEEA, state building codes, and state or federal product standards. Often, the savings associated with a measure will be achieved through 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. They subsequently became a regular offering in utility programs across the Northwest and have recently become subject to federal product standards taking effect in 2029.

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 Chelan PUD's system peak. The cost-effective energy savings potential identified in this assessment will result in more than 55 MW of winter peak demand savings over the 20-year planning period, as shown in Table 2. This represents approximately 8% of Chelan PUD's projected 2045 peak demand. Energy efficiency savings tend to occur when demand for energy is the greatest, resulting in significant contributions to reductions in peak demand.

Table 2: Winter Peak Demand Savings from Cost-Effective Energy Efficiency Potential by Sector (MW)

Sector	2-Year	4-Year	10-Year	20-Year
Residential	0.9	2.5	11.0	22.1
Commercial	2.8	5.1	11.0	17.3
Industrial	0.3	0.8	4.9	10.5
Utility	0.0	0.2	1.8	5.3
Agricultural	0.0	0.0	0.0	0.0
Total	**4.0**	**8.6**	**28.7**	**55.1**

The estimate of annual cost-effective potential by sector is shown in Figure 3. The available potential starts at approximately 0.8 aMW in 2026 and grows to a maximum of 2.4 aMW in 2036. After that point, the available potential diminishes through the remaining years of the planning period.

Figure 3: Annual Incremental Cost-Effective Energy Efficiency Potential (aMW)

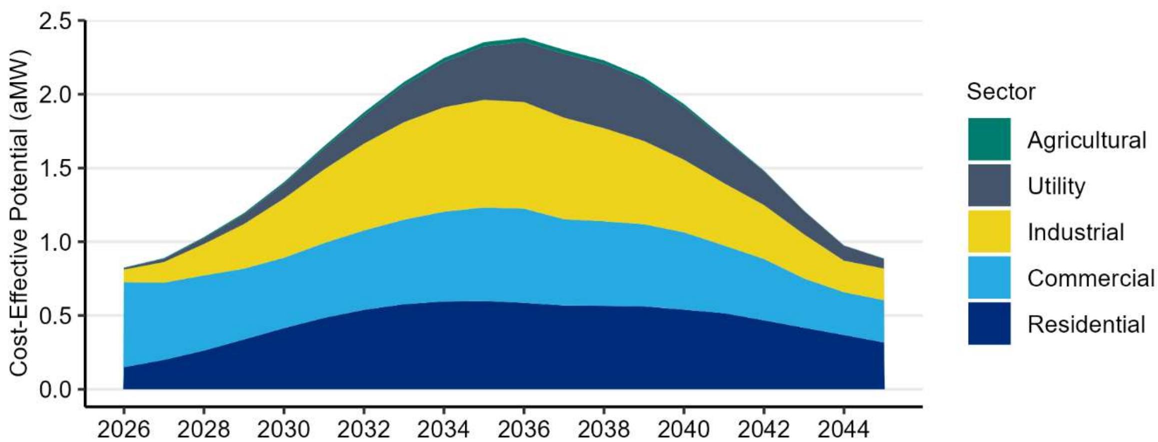
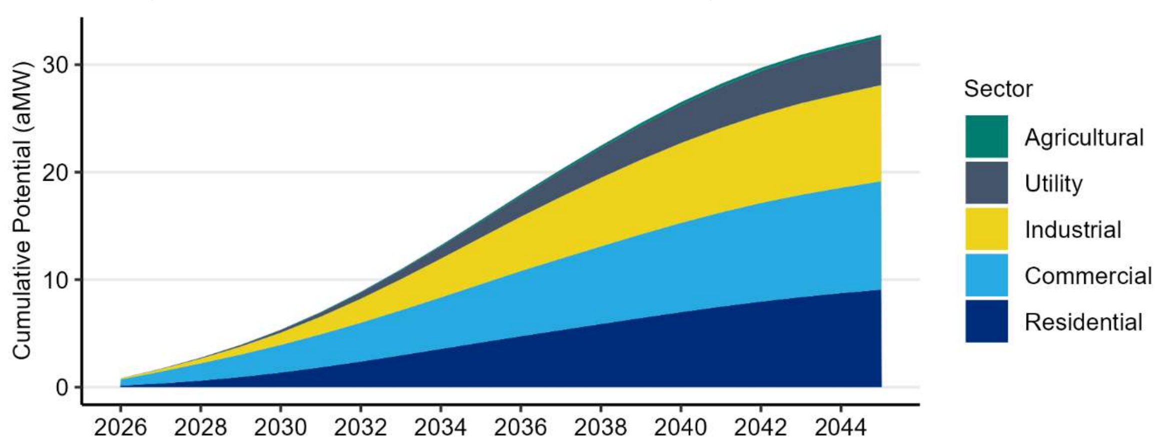


Figure 4 shows how the energy efficiency potential grows on a cumulative basis through the study period, totaling nearly 33 aMW over the 20-year planning period.

Figure 4: Annual Cumulative Cost-Effective Energy Efficiency Potential (aMW)



The year-by-year estimates of energy efficiency potential are based on ramp rates developed by the Council. Ramp rates identify the share of each measure's available potential that is projected to be acquired in each year based on its market and program maturity. For each measure, the project team applied a ramp rate that would align the near-term potential with Chelan PUD's recent program achievements and the savings from NEEA's market transformation initiatives that were estimated to occur in Chelan PUD's service territory. Program achievement data was provided by Chelan PUD staff and the project team assigned appropriate ramp rates to each measure so that the future acquisition of energy efficiency was aligned with recent program history while ensuring the acquisition of all energy efficiency potential over the 20-year planning period.

Comparison to Previous Assessment

Table 3 shows a comparison of the 2-, 10-, and 20-year cost-effective potential by sector as quantified by the previous 2023 CPA and this 2025 CPA. The 2-year potential declined significantly while there were smaller decreases in the 10- and 20-year potential.

Table 3: Comparison of 2023 and 2025 CPA Results (aMW)

Sector	2-Year Potential			10-Year Potential			20-Year Potential		
	2023 CPA	2025 CPA	% Change	2023 CPA	2025 CPA	% Change	2023 CPA	2025 CPA	% Change
Residential	0.41	0.35	-14%	4.92	4.16	-15%	10.65	9.07	-15%
Commercial	1.29	1.10	-15%	8.04	5.43	-32%	15.80	10.09	-36%
Industrial	0.90	0.22	-75%	5.43	4.33	-20%	7.67	8.94	17%
Utility	0.06	0.03	-44%	1.31	1.49	14%	2.48	4.39	77%
Agricultural	0.01	0.01	-7%	0.16	0.15	-5%	0.29	0.29	-2%
Total	**2.67**	**1.71**	**-36%**	**19.85**	**15.55**	**-22%**	**36.89**	**32.78**	**-11%**

The near-term changes were driven by Chelan PUD's recent accomplishments and expectations for future savings. This is the best indicator of what Chelan PUD's programs can likely accomplish in the early years of the study period. In the mid- to longer term, the decreases are driven by multiple factors, including lower market price forecasts, a lower avoided distribution capacity assumption, reduced floor area forecasts in the commercial sector, higher loads in the industrial sector, and updated measure assumptions reducing the cost-effectiveness of some measures.

Conclusion

This report summarizes the CPA conducted for Chelan PUD for the 2026 to 2045 timeframe. The CPA identified a smaller amount of cost-effective potential relative to the previous CPA. The cost-effective potential identified in this assessment can reduce Chelan PUD's annual energy and peak demand by 10% and 8%, respectively in 2045.

Introduction

Objectives

This report describes the methodology and results of a CPA conducted for Chelan PUD. The CPA estimated the cost-effective potential energy savings for the period of 2026 to 2045. This report describes the results of the full 20-year period, with additional detail on the 2- and 10-year periods that are the focus of Washington's EIA as well as the 4-year period covering 2026-2029 that aligns with Chelan PUD's 2025 CEIP.

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 Chelan PUD's compliance with these requirements. The state of Washington's CETA includes an additional requirement for CPAs to use specific values for the social cost of carbon. The required values were incorporated into this analysis.

The results of this assessment can be used to assist Chelan PUD in planning its energy efficiency programs by identifying the amount of cost-effective energy savings available in various sectors, end uses, and measures.

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 Chelan PUD serves more than 49,000 customers, it is required to comply with Washington's EIA. The requirements of the EIA specify that all qualifying utilities complete the following by January 1st 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 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 and loads, it is still subject to remaining uncertainties and limitations. These uncertainties include, but are not limited to:

- Customer Characteristic Data: This assessment used the best available data to reflect Chelan PUD's customers. In some cases, however, the assessment relied upon data beyond

[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.

Chelan PUD's service territory due to limitations of adequate sample sizes. There are uncertainties, therefore, related to the extent that this data is reflective of Chelan PUD'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 developed in May of 2025. While this is an up-to-date forecast, market prices and forecasts are continually changing.
- Utility System Assumptions: Measures in this CPA receive cost credits based on their ability to free up transmission and distribution system capacity. The actual value of these credits is dependent on local conditions, which vary across Chelan PUD's service territory.
- Load and Customer Growth Forecasts: This CPA uses projections of future customer counts and load growth over a 20-year period. Any forecast over a similar time period will include a significant level of uncertainty.
- Policy Changes: The CPA reflects policies currently in effect at the time of its development. Future changes to the policy environment are difficult to predict and could lead to significant changes to loads, cost-effectiveness of measures, or other study outcomes.

Due to these uncertainties and the continually changing planning environment, Washington's 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
- Customer Characteristics
- Recent Conservation Achievement
- Results
- Sensitivity Results
- Summary
- References & Appendices

Methodology

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

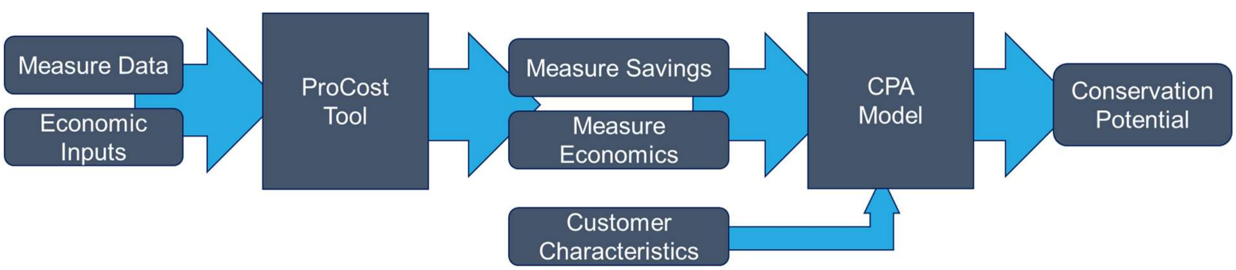
Washington's requirements for CPAs are spelled out in RCW 19.285.040 and WAC 194-37-070, Section 5 parts (a) through (d). Additional requirements are specified in the rules of Washington's CETA. The methodology used to produce this assessment is consistent with these requirements and follows much of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

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

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 economics are then combined with customer data in Lighthouse's CPA model, which quantifies the number of remaining implementation opportunities. The CPA model aggregates the savings associated with each of these opportunities to determine the overall potential.

Figure 5: Conservation Potential Assessment Methodology



Economic Inputs

The project team worked closely with Chelan PUD staff to define the economic inputs that were used in this CPA, including avoided energy costs, carbon costs, transmission and distribution capacity costs, and generation capacity costs. Each of these are discussed below. A full discussion of the avoided costs is included in Appendix IV.

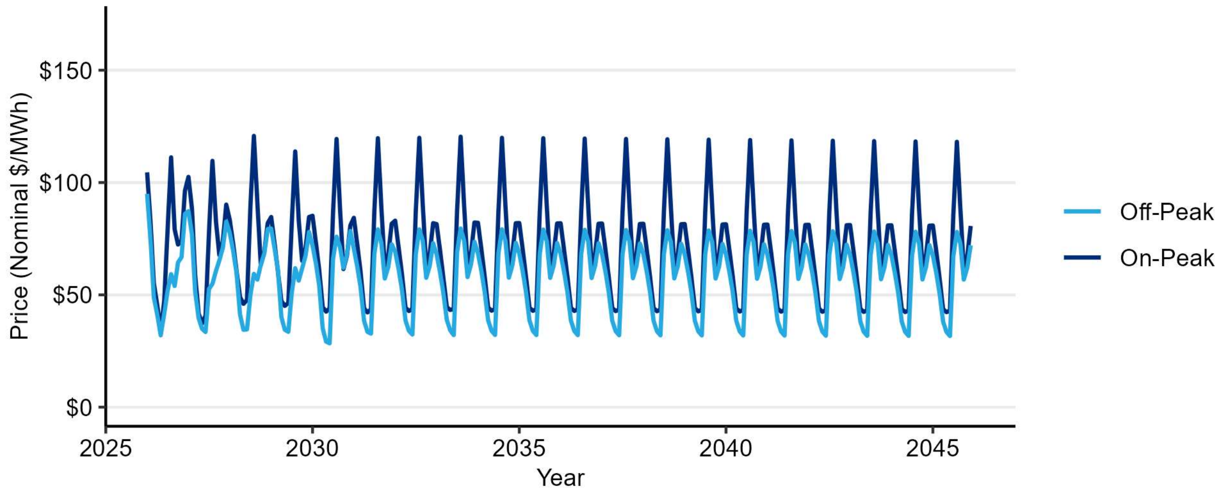
Avoided Energy Costs

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 regional market prices."[3] For this CPA, Chelan PUD provided a forecast of on- and off-peak market prices at

[3] WAC 194-37-070

the Mid-Columbia trading hub. Figure 6 below shows the market price forecast that was used for the base case of this assessment. High and low sensitivity price forecasts were developed based on this forecast and are discussed in Appendix IV.

Figure 6: Avoided Energy Costs



Social Cost of Carbon

In addition to avoiding purchases of energy, energy efficiency measures can avoid emissions of greenhouse gases like carbon dioxide. The EIA requires that CPAs include a 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." 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]

Chelan PUD's past CPAs have used a carbon-free premium value to reflect the additional or premium value that Chelan PUD can receive over market prices when selling its excess carbon-free power. This CPA continues that approach but with a slight modification to reflect the fact that Chelan PUD's current policy is to serve approximately 80% of its load with its carbon-free resources while having the remaining 20% served from unspecified sources.

Chelan PUD's carbon premium values begin at $15/MWh in 2026 and rise to a maximum of $25/MWh in 2035 before decreasing again to $16/MWh in 2044 (2025$). To reflect the fact that only 80% of its load is served by carbon-free resources, only 80% of these values are included. To account for the remaining 20% of load served by unspecified sources, this CPA uses 20% of the social cost of carbon

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

values prescribed by CETA converted to a dollar per MWh value using the Council's latest[6] estimate of regional marginal emissions rates.

Deferred Transmission and Distribution System Costs

Unlike supply-side resources, energy efficiency and demand response do not require transmission and distribution infrastructure. Instead, they free up transmission and distribution system capacity by reducing the peak demands. Over time, this can help defer future capacity expansions and the associated capital costs. However, because Chelan PUD's resources are located close to its load, any transmission losses are minimal. Accordingly, only savings on the distribution system will be considered in the CPA. This approach is consistent with Chelan PUD's prior potential assessments.

In the development of the 2021 Power Plan, the Council developed a standardized methodology and surveyed the region to calculate the avoided costs of transmission and distribution capacity. This CPA uses the avoided distribution capacity value developed by the Council through that process: $7.82 per kW-year (2016$). This value is lower than the 2023 CPA avoided distribution capacity value of $56.41 per kW-year. The previous value was based on a cost of service study but does not reflect the fact that distribution capacity expansions may not be necessary throughout the service territory in the near term.

The deferred distribution capacity value is applied to the demand savings that are coincident with the timing of Chelan PUD's distribution system peak.

Program Administration Costs

In its past 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 Chelan PUD'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 Chelan PUD's previous CPAs. A sensitivity 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 presented under each sensitivity. In selecting its biennial target based on this range of outcomes, Chelan PUD is selecting its preferred risk strategy and the associated risk credit.

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 values so that values occurring in different years can be compared. This

[6] As of September 2025.

assessment uses a real discount rate of 4.39%. Energy efficiency's benefits accrue over the lifetime of the measure, so a lower discount rate results in higher present values for benefits occurring in future years.

Assumptions about finance costs are applied to measures as well. The cost of each measure is assumed to be split across various entities, including Bonneville Power Administration (BPA), Chelan PUD, and end use customers. For each of these entities, additional assumptions are made about whether the measure costs are financed, and if so, the cost of that financing. This assessment uses the finance cost assumptions that were used in the 2021 Power Plan.

Measure Characterization

Measure characterization is the process of defining each individual measure, including the savings at the meter as well as the cost, lifetime, non-energy impacts, and a load or savings shape that defines when the savings occur. The Council's 2021 Power Plan materials are the primary source for this information, although the project team incorporated updated information from the RTF for many measures. Appendix V contains the full list of energy efficiency measures considered the source(s) of information used for each.

Measure savings are typically defined via 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 double counting 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, which impacts the demands on heating and cooling systems.

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 Chelan PUD's system peak. The outputs of ProCost are used to calculate each measure's levelized cost and benefit-cost ratio, the latter of which is used to determine whether the measure is cost effective.

Customer Characteristics

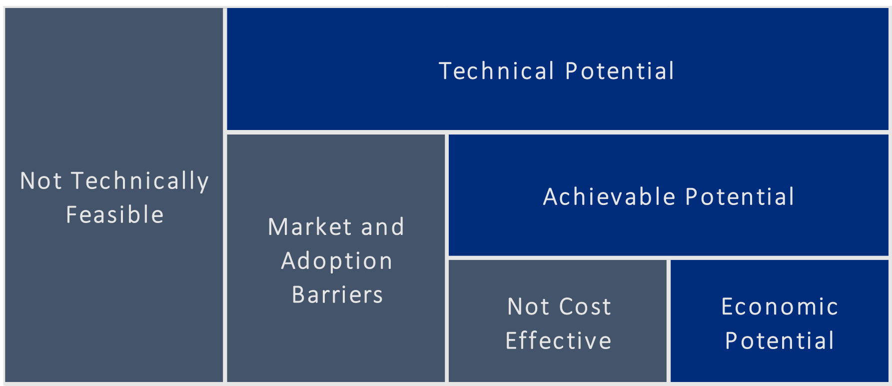
The assessment of customer characteristics is used to determine the number of remaining measure installation opportunities for each measure. This requires identifying the number of opportunities overall as well as the share that has already been completed. The characterization of Chelan PUD's customer base was completed primarily using data provided by Chelan PUD, NEEA's commercial and residential building stock assessments, and US Census data. Additional data sources and further details by 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 Chelan PUD'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 estimates the economic (or cost-effective) energy efficiency savings potential as a subset of the technical and achievable potential based on the process shown in Figure 7. 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, energy efficiency planners typically assume that 85% of all measure opportunities can be achieved. This assumption comes 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.[7] In the 2021 Power Plan, the Council has taken 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, ramp rates are used to identify the portion of the available potential that can be acquired each year. The selection of ramp rates incorporates the different levels of program and market maturity as well as the practical constraints of what utility programs can accomplish in a given year.

Finally, economic 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

[7] See https://eta-publications.lbl.gov/sites/default/files/lbnl-3960e-hrcp.pdf

potential. The TRC test considers 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, Chelan PUD could pay up to the full cost of measures with its incentives without impacting the cost effectiveness. However, practical constraints such as annual program budgets and rate impacts may limit this.

Customer Characteristics

This section describes the characterization of Chelan PUD's customers, which is an essential component of a CPA. It includes defining the makeup and characteristics of each sector, which determines the type and quantity of opportunities to implement energy efficiency measures. Additional information about the local climate and population of the service territory is used to characterize some measures. This information is summarized in Table 4.

Table 4: Service Territory Characteristics

Heating Zone	Cooling Zone	Total Homes (2024)	Total Population (2024)
1	3	39,392	81,228

The number of homes was based on census data for Chelan County and reflects a 3% increase over Chelan PUD's 2023 CPA. The number of homes was projected to grow at 1.4%, based on Chelan PUD's forecast. This is an increase from the 0.9% growth rate used in the previous CPA. An additional demolition rate, based on assumptions for Washington State from the Council's 2021 Power Plan, was also used. The demolition rate quantifies the number of existing homes that are converted to new homes through demolition or major renovations, where building codes for new homes apply.

The population is based on census estimates for Chelan County.

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. Table 5 and Table 6 summarize the characteristics that were used for this assessment for existing and new homes, respectively.

Table 5: Residential Existing Home Characteristics

	Single Family	Low Rise Multifamily	High Rise Multifamily	Manufactured
Share of Homes	78%	5%	6%	11%
HVAC Equipment				
Electric Forced Air Furnace	17%	0%	1%	50%
Air Source Heat Pump	43%	0%	13%	23%
Ductless Heat Pump	6%	4%	4%	15%
Electric Zonal/Baseboard	22%	84%	63%	9%
Central Air Conditioning	33%	2%	0%	18%
Room Air Conditioning	26%	31%	15%	21%
Other Appliances				

Electric Water Heater	94%	90%	100%	97%
Refrigerator	125%	99%	100%	104%
Freezer	50%	6%	4%	51%
Clothes Washer	96%	35%	40%	98%
Electric Clothes Dryer	80%	34%	40%	85%
Dishwasher	88%	68%	47%	85%
Electric Oven	90%	71%	77%	98%
Desktop	49%	21%	19%	31%
Laptop	70%	75%	70%	66%
Monitor	74%	50%	52%	34%

Table 6: Residential New Home Characteristics

	Single Family	Low Rise Multifamily	High Rise Multifamily	Manufactured
HVAC Equipment				
Electric Forced Air Furnace	0%	0%	1%	50%
Air Source Heat Pump	61%	0%	13%	23%
Ductless Heat Pump	28%	4%	4%	15%
Electric Zonal/Baseboard	0%	84%	63%	9%
Central Air Conditioning	33%	2%	0%	18%
Room Air Conditioning	26%	31%	15%	21%
Other Appliances				
Electric Water Heater	94%	90%	100%	97%
Refrigerator	125%	99%	100%	104%
Freezer	50%	6%	4%	51%
Clothes Washer	96%	35%	40%	98%
Electric Clothes Dryer	80%	34%	40%	85%
Dishwasher	88%	68%	47%	85%
Electric Oven	90%	71%	77%	98%
Desktop	49%	21%	19%	31%
Laptop	70%	75%	70%	66%
Monitor	74%	50%	52%	34%

In these tables, numbers greater than 100% imply an average of more than one appliance per home. For example, the single family refrigerator saturation of 125% means that single family homes average 1.25 refrigerators per home.

For this assessment, the project team used the latest information from the American Community Survey to identify the type of home and heating fuel. HVAC and other appliance saturations were based on data from NEEA's 2022 Residential Building Stock Assessment (RBSA), which was not available at the time the 2023 CPA was developed. These were supplemented with program data to account for heating system changes subsequent to the RBSA field data collection. The updated data sources resulted in a lower overall prevalence of electric heating along with a 50% reduction in the homes with electric forced air furnaces.

Commercial

In the commercial sector, the 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 Chelan PUD's service territory, the project team used Chelan PUD's commercial sales by segment. The project team then converted the sales to estimates of floor area using energy use intensities from Chelan PUD data in combination with the 2019 Commercial Building Stock Assessment (CBSA).

Table 7 summarizes the resulting floor area estimates for each of the 18 commercial building segments. The total commercial floor area was estimated to be approximately 33 million square feet, a significant decrease over the baseline floor area estimate of nearly 50 million square feet used in the 2023 CPA. The decrease is driven by the use of Chelan PUD-specific EUI values which are higher than the Northwest region-wide values from the CBSA.

Table 7: Commercial Floor Area by Segment

Building Type	2024 Floor Area (square feet)
Large Office	0
Medium Office	668,514
Small Office	5,245,318
Extra Large Retail	0
Large Retail	0
Medium Retail	781,314
Small Retail	3,355,272
School (K-12)	4,853,226
University	575,108
Warehouse	2,981,541
Supermarket	418,653
Mini Mart	148,002
Restaurant	497,360
Lodging	3,333,659
Hospital	1,233,182
Residential Care	1,591,880
Assembly	2,304,197
Other Commercial	4,761,592
Total	**32,748,818**

The project team applied a growth rate of 0.7% to the commercial sector, which is Chelan PUD's expected future growth in non-industrial loads.

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 an assumed savings percentage to the applicable end use consumption within each industrial segment.

Chelan PUD provided 2024 consumption for customers in the industrial sector. The total 2024 industrial consumption totaled nearly 337,000 MWh, as summarized in Table 8. This represents an increase of 9% over the initial loads used in the 2023 CPA.

Chelan PUD projects that overall industrial loads will grow at a rate of 1.3%, an increase from the growth rate assumed in the 2023 CPA, 0.9%.

Table 8: Industrial Sector Sales by Segment

Segment	Sales (MWh)
Water Supply	1,205
Sewage Treatment	5,340
Frozen Food	-
Other Food	14,961
Wood - Lumber	-
Wood - Panel	-
Wood - Other	485
Pulp and Paper Mills (TMP)	-
Pulp and Paper Mills (Kraft)	-
Paper Conversion Plants	22,362
Refinery	-
Chemical Manufacturing	-
Silicon Growing/Manufacturing	-
Cement/Concrete Products	-
Primary Metal Manufacturing	7,824
Fabricated Metal Manufacturing	-
Semiconductor Manufacturing	-
Transportation Equipment	-
Misc. Manufacturing	159,242
Refrigerated Warehouse	-
Fruit Storage	125,400
Indoor Agriculture	-
Total	**336,817**

Utility Distribution System

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 savings potential based on the number of distribution substations and feeders for each utility, as well as the 2018 sales within each sector as reported to the US Energy Information Administration. Table 9 summarizes the assumptions used for this sector.

Table 9: Utility Distribution System Efficiency Assumptions

Characteristic	Count
Distribution Substations	11
Residential/Commercial Substations	9
Urban Feeders	17
Rural Feeders	7
2018 Residential Sales (MWh)	809,774
2018 Commercial Sales (MWh)	486,579
2018 Industrial/Other Sales (MWh)	338,664

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

Recent Conservation Achievement

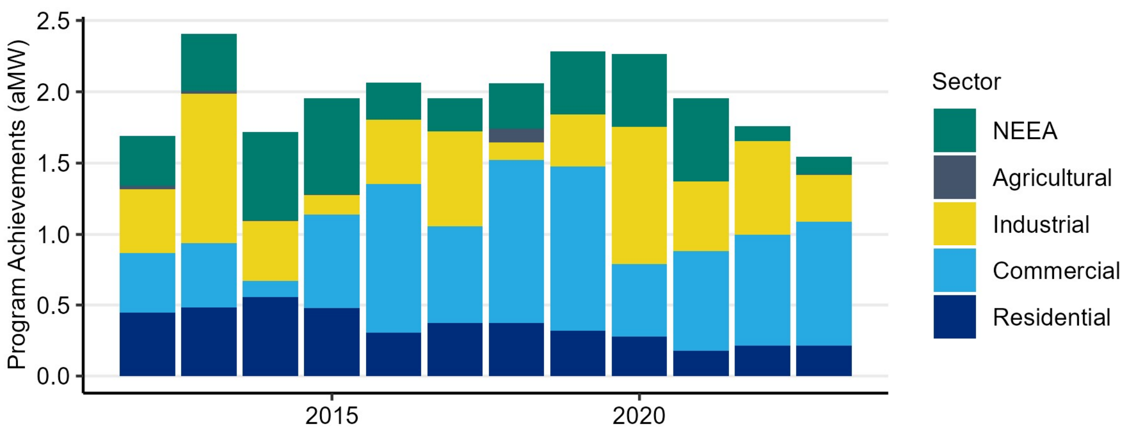
Chelan PUD has a long history of energy efficiency achievement and, according to the RTF's Regional Conservation Progress Report, has achieved annual savings equal to 0.9% of its retail sales on average over the 2016-2023 timeframe.

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

Overall

Figure 8 summarizes Chelan PUD's 2012-2023 conservation achievement by sector as well as the savings attributed to NEEA, as reported under Washington's EIA.

Figure 8: Past Conservation Achievements by Sector (aMW)



Source: WA EIA Utility Reports

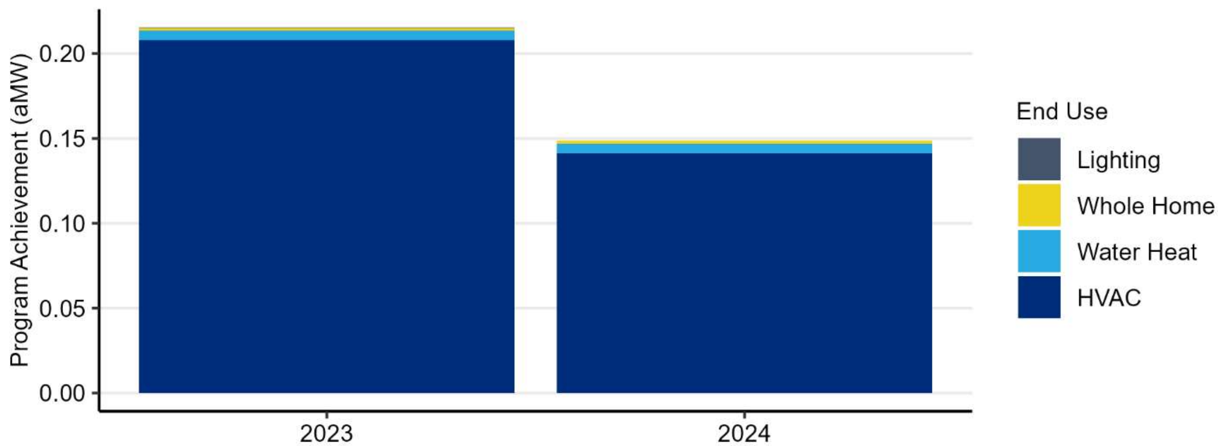
The average savings over this 12-year period is just under 2 aMW per year. Savings from the residential sector are relatively stable over time while commercial and industrial sector savings make up the largest share and are more varied. Savings from NEEA's market transformation initiatives are primarily in the residential sector. Savings from NEEA decreased in 2022 when the baselines that are used to quantify its market transformation efforts were reset to align with the 2021 Power Plan. A similar adjustment happened in 2016.

Chelan PUD provided detailed program achievement data for 2023 and 2024. The sections below summarize these recent achievements.

Residential

The recent residential program achievements by end use are shown in Figure 9. The savings total 0.36 aMW over the two years. The HVAC end use is the largest end use, at nearly 96% of the total. This end use includes both weatherization measures as well as heating system equipment. After HVAC, the remaining sources of savings include water heating, whole home, and lighting measures.

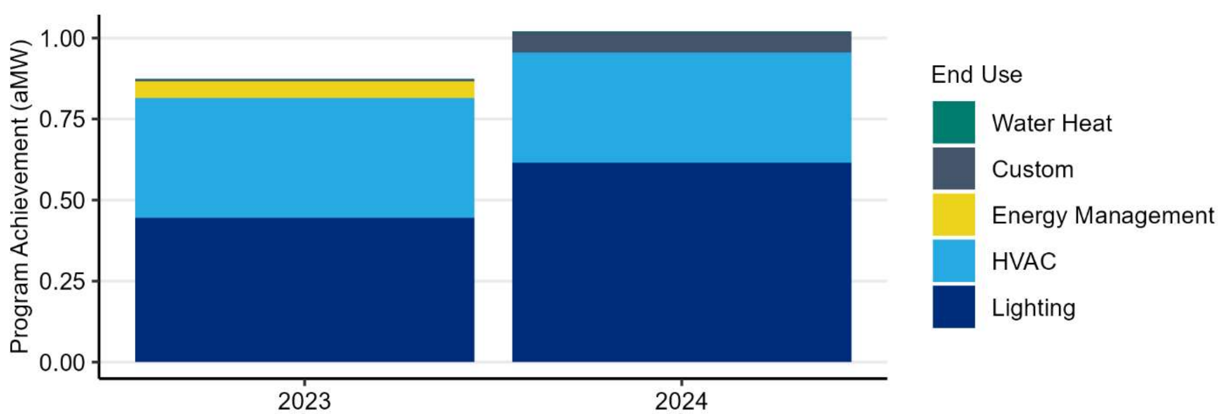
Figure 9: Recent Residential Program Achievements by End Use (MWh)



Commercial

Chelan PUD's commercial savings are primarily from lighting and HVAC end uses, as shown in Figure 10. In total, commercial savings were nearly 2 aMW over the two-year period.

Figure 10: Recent Commercial Program Achievements by End Use

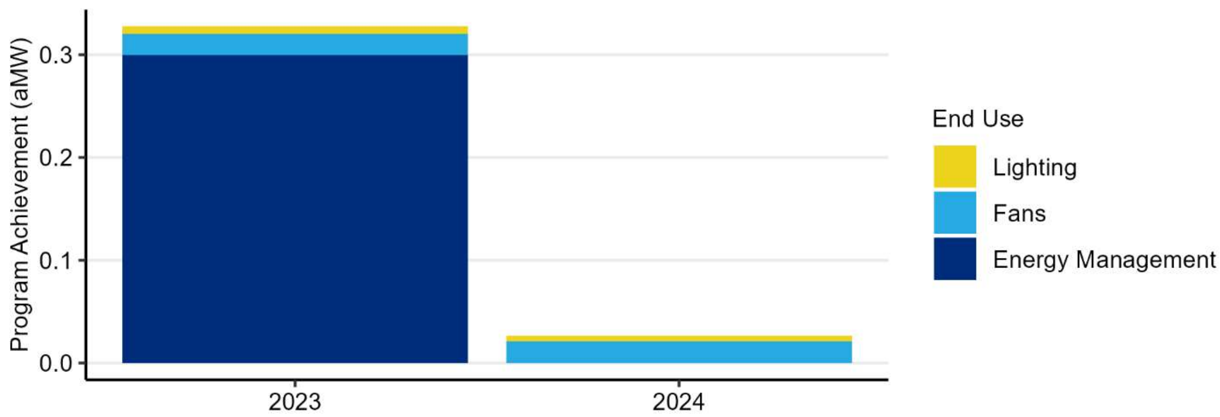


Industrial

Savings in the industrial sector are often uneven, subject to the nature of the small number of projects that are completed in a given year. This is apparent in Figure 11, where the amount and makeup of the savings varies greatly between the two years.

Energy management, fans, and lighting measures are the sources of savings in the industrial sector. The industrial savings total more than 0.35 aMW over the two years.

Figure 11: Recent Industrial Program Achievements by End Use



Results

This section discusses the results of the 2025 CPA. It begins with a discussion of the high-level achievable conservation potential and then covers additional detail on the cost-effective potential within the individual sectors and end uses.

Achievable Conservation Potential

The achievable technical 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 through efficiency programs.

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 with supply-side resources. The costs include credits for deferred distribution system costs, avoided periodic replacements, and non-energy impacts to make them comparable with other resources. With these credits, some of the lowest cost measures have a net levelized cost that is negative, meaning the credits exceed the measure costs.

Figure 12: 20-Year Supply Curve

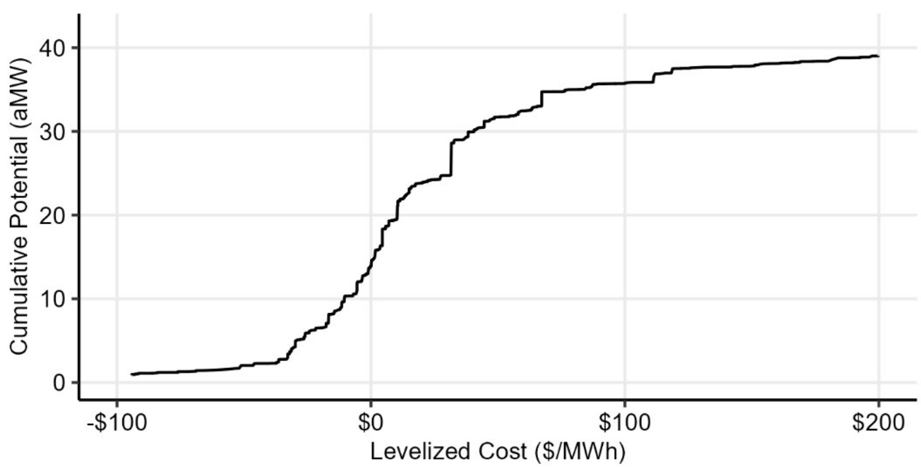


Figure 12 shows that approximately 14 aMW of potential are available at a cost at or below $0/MWh. More than 31 aMW of achievable potential is available for costs below $50/MWh. After approximately $60/MWh, the levelized cost curve flattens as the cost of additional potential comes at increasing costs. In total, there is nearly 42 aMW of achievable technical potential available in Chelan PUD's service territory over the 20-year study period, but only potential below $200/MWh is shown.

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 or deliver energy savings when energy costs are more or less valuable. 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

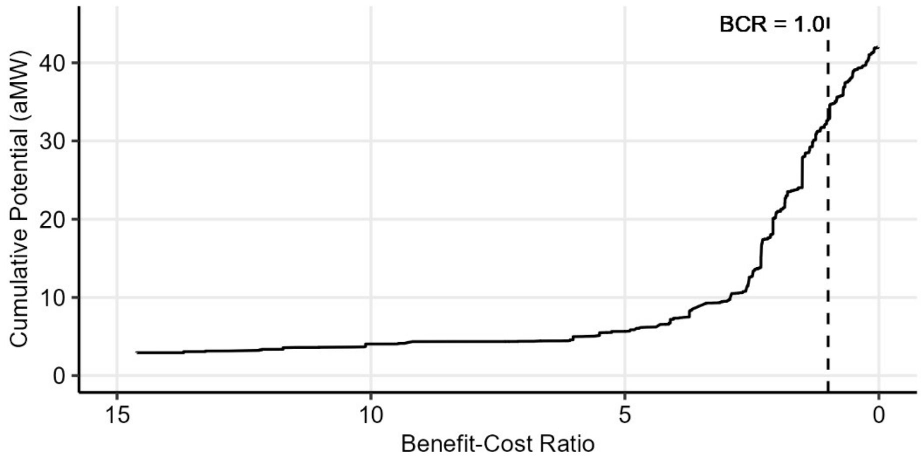


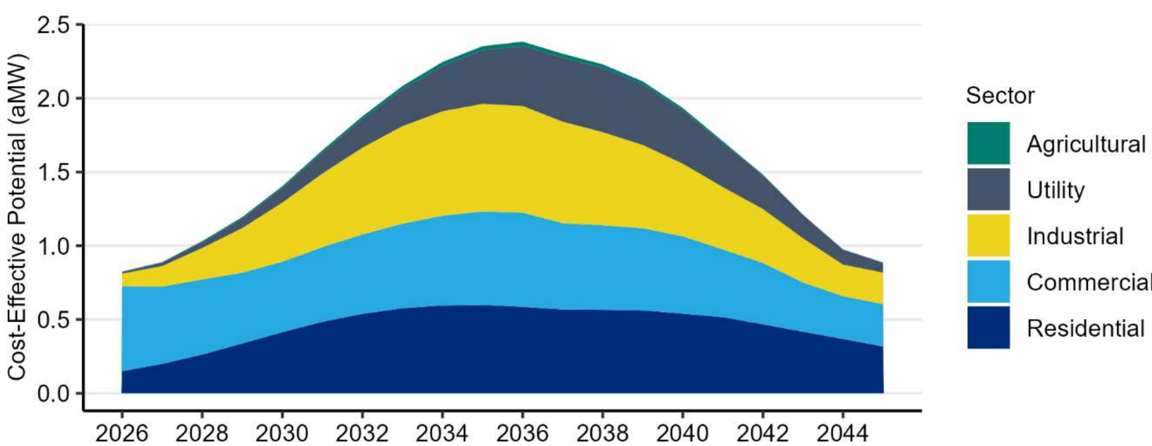
Figure 13 shows that nearly 6 aMW of savings are available with a benefit-cost ratio of five or more. These measures deliver benefits that are five times their cost over their lifetime. The figure includes a dashed line where the benefit-cost ratio is equal to one. There is approximately 33 aMW of cost-effective savings potential to the left of this line, which is the cost-effective potential identified in this CPA. There is a small vertical step along this dashed line with approximately equal slope above and below the step. This suggests equal sensitivity to both upward and downward changes in avoided cost. The vertical step is largely comprised of heat pump dryers that fell just below the cost effectiveness threshold.

The economic or cost-effective potential is described below.

Cost-Effective Conservation Potential

Figure 14 shows the cost-effective potential by sector on an annual basis. The potential is fairly evenly between Chelan PUD's residential, commercial, and industrial sectors. The potential in the agricultural sector is very small.

Figure 14: Annual Cost-Effective Potential by Sector



The project team used the ramp rates from the 2021 Power Plan to establish reasonable rates of acquisition for all measures and sectors. The project team assigned ramp rates to individual measures in order 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.

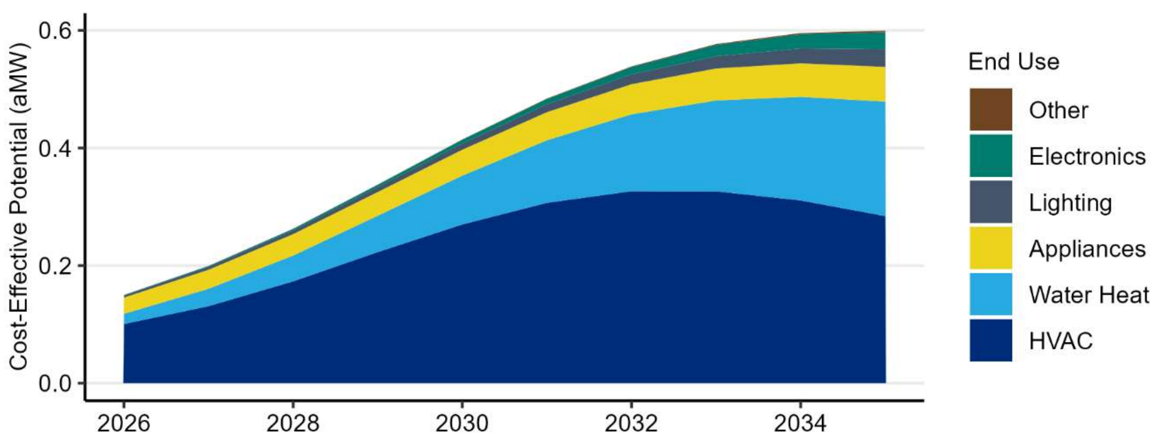
The sections below describe the achievable potential within each sector.

Residential

Relative to the 2023 CPA, the cost-effective potential in the residential sector has decreased by approximately 15% in the near and long term. Near-term potential is aligned with recent program achievements, while long-term potential is based on measure cost effectiveness and customer landscape. For example, the saturation of electric heat and inefficient electric forced air furnaces declined relative to the 2023 CPA while the number of homes has increased. This change in assumptions regarding the current and future customer landscape resulted in slightly less potential compared to the 2023 CPA. Additionally, lower avoided cost assumptions led to lower potential in the residential sector in the long term compared to the previous assessment.

Figure 15 shows the cost-effective potential by end use for the first 10 years of the study period. HVAC measures (including weatherization) make up 59% of potential in the sector, followed by water heating (24%), appliances (11%), lighting (3%), and electronics (3%). In Figure 15, the other end use category primarily includes cooking measures.

Figure 15: Annual Residential Potential by End Use



The potential grows during the initial years of the study as the expected market share of efficient equipment increases along with increases in the rate of the acquisition of retrofit measures, like attic insulation, which can be achieved at any time. By 2033, the rate of savings achievement begins to level off as the market shares of efficient equipment reach maximum values and the remaining available retrofit measures begin to diminish.

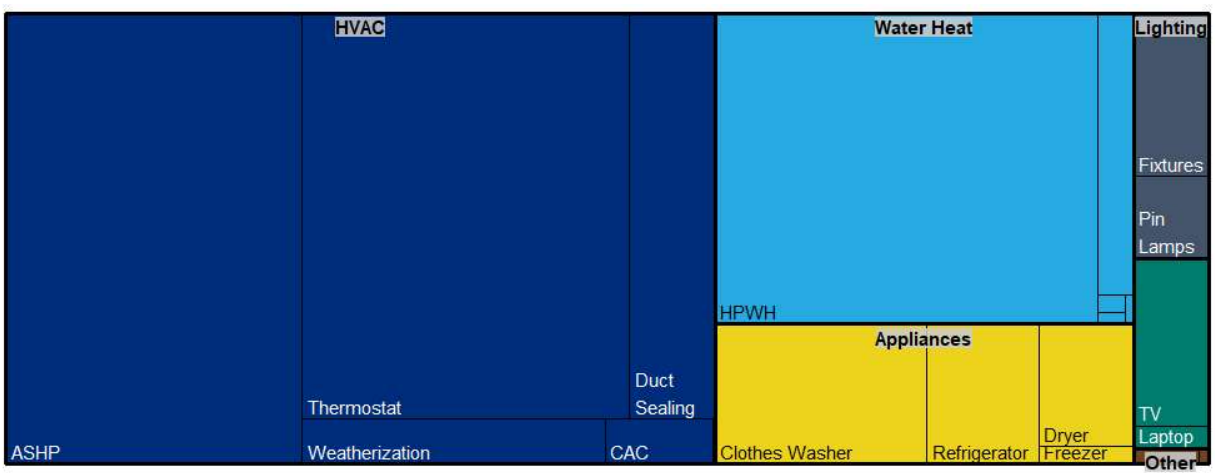
Note that some residential measures, such as smart thermostats and heat pump water heaters can provide benefits as both energy efficiency and demand response resources. Demand response benefits were not included in this CPA. The decision to use them as demand response resources was treated as an incremental decision and included in Chelan PUD's Demand Response Potential Assessment, although energy efficiency programs can help build a stock of flexible equipment that could be called upon in the future through demand response programs.

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. Air source heat pumps (ASHP), smart thermostats, duct sealing, and weatherization make up most of the potential in the HVAC end use, while heat pump water heaters (HPWH) are the primary source of potential in the water heating end use.

The project team included incentives from Inflation Reduction Act (IRA) programs in the ASHP costs, improving the cost effectiveness of this measure, especially relative to prior CPAs. Ductless heat pumps were not cost effective after updating the measure with the latest RTF assumptions.

Beginning in 2029, heat pump water heaters are subject to a federal standard that will require the technology for many common tank sizes. As there are questions on possible loopholes that leave the future role of utility programs in question, the project team kept the savings potential for these measures after 2029 to show the savings that are possible and will be seen on Chelan PUD's system, whether they are achieved through Chelan PUD's programs or the federal standard. The state of this market can be re-evaluated in Chelan PUD's 2027 CPA.

Figure 16: Residential Potential by End Use and Measure Category



Commercial

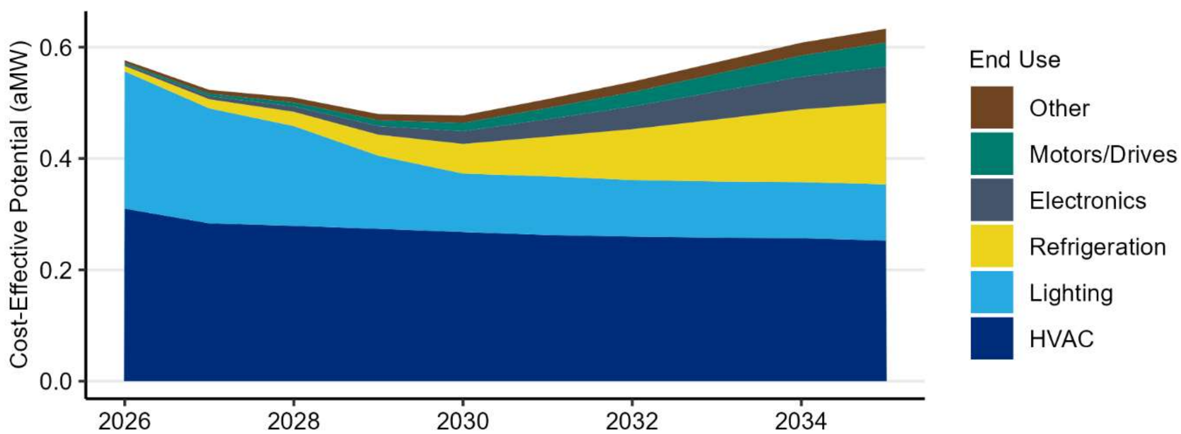
In commercial sector, HVAC and lighting measures are the end uses with the highest potential. These two end uses comprise 50% and 25% of the 10-year potential, respectively. The lighting end use includes measures applicable to both interior and exterior lighting.

The potential in the commercial sector has declined significantly compared to the 2023 CPA. This is largely driven by the decrease in estimated floor area discussed above. In addition, the savings potential in the lighting end use is subject to a state law banning mercury in lighting beginning in

2029.[8] In effect, this will raise the baseline for lighting programs to LED products. The project team reduced the lighting savings beginning in 2029 to reflect this change.

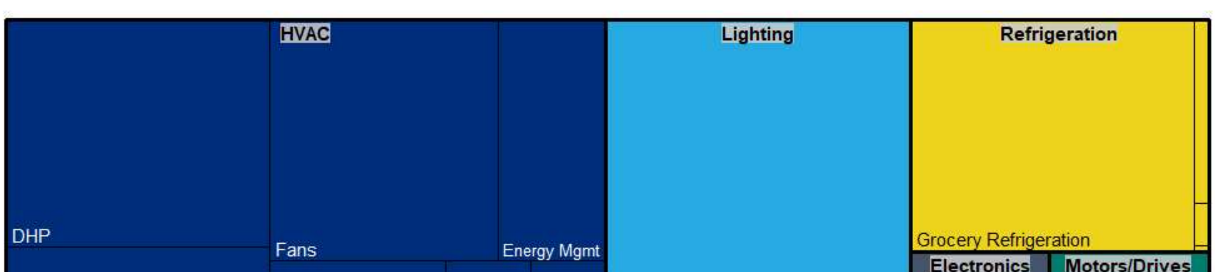
In Figure 17, the other end use category includes measures in the compressed air, food preparation, and water heating end uses.

Figure 17: Annual Commercial Potential by End Use



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. The commercial sector includes a variety of building types with different end uses. This is apparent in the range of measures included in Figure 18, especially the range of HVAC equipment.

Figure 18: Commercial Potential by End Use and Measure Category



Industrial

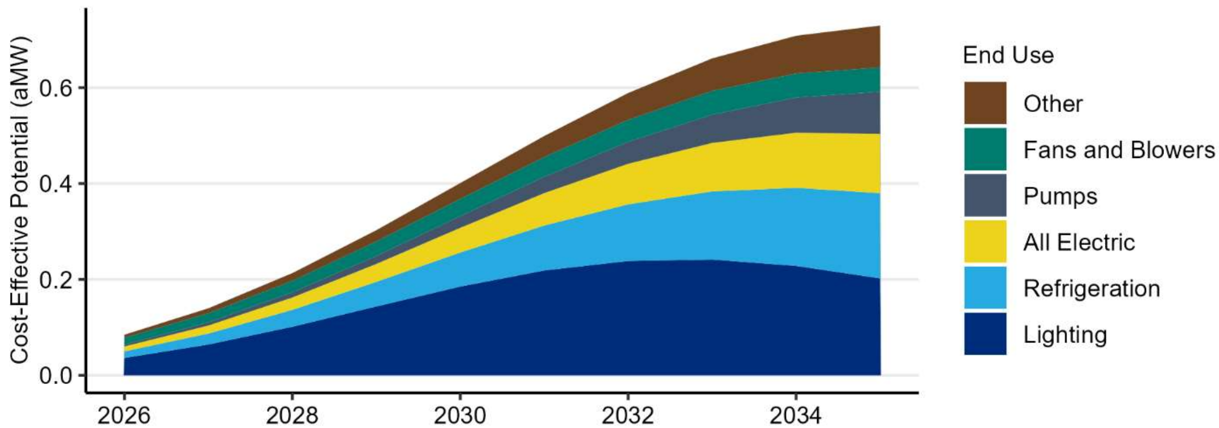
The annual industrial sector potential is shown in Figure 19. The lighting and refrigeration end uses are the largest areas of potential, comprising 38% and 21% of the 10-year potential, respectively. The "all electric" end use category includes measures applicable to all end uses, such as strategic energy management programs, and measures applicable to the water and wastewater segments.

8 https://app.leg.wa.gov/billsummary?BillNumber=1185&Year=2023&Initiative=false

The lighting potential decreases in the later years due to Chelan PUD's past successes and limited remaining available potential. The other category in Figure 19 includes a variety of end uses, including compressed air, HVAC, material handling, motors, and several other smaller end uses.

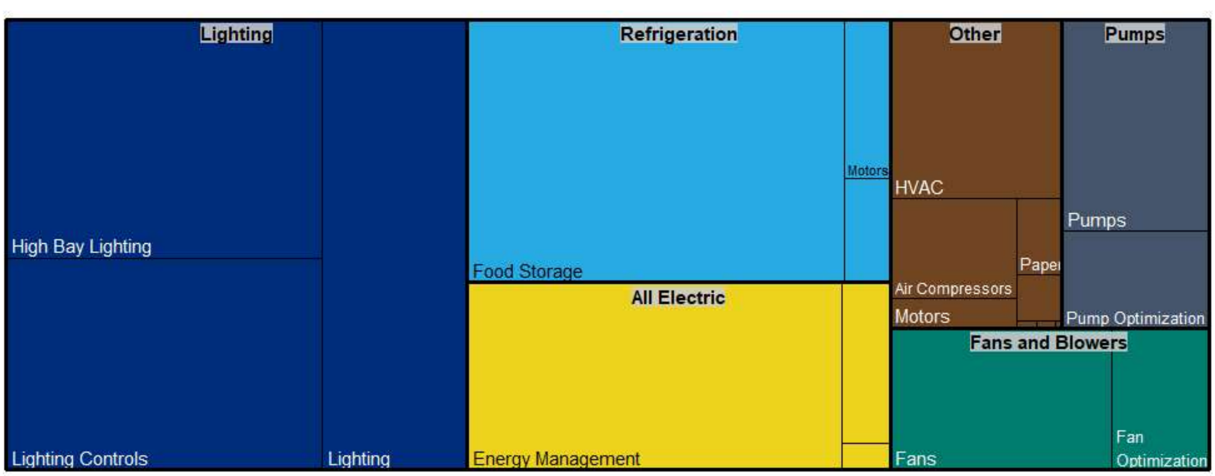
Relative to Chelan PUD's 2023 CPA, the industrial potential declined in the near term but increased in the long term. The decrease in near-term potential is based on recent program history while the long-term increase is driven by higher long-term growth projections for the sector.

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

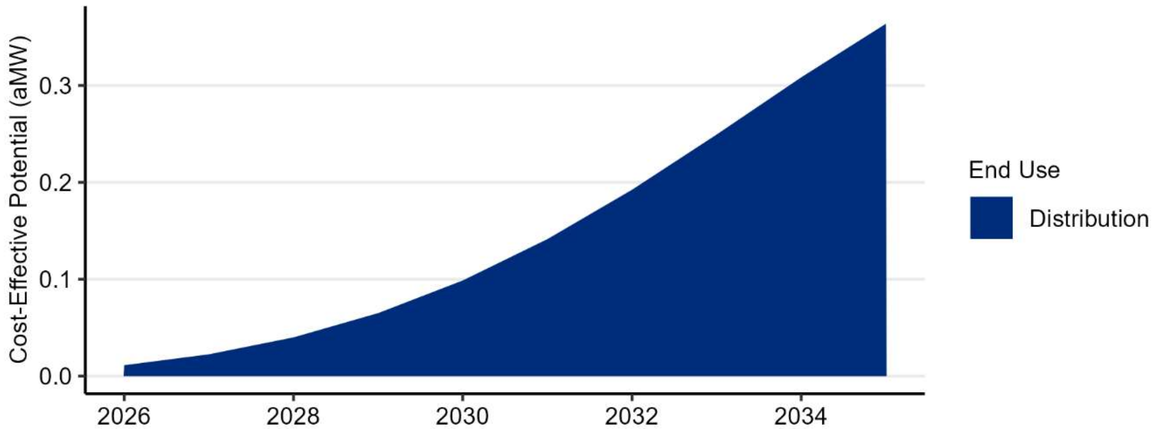


Utility Distribution System

The measures in the distribution efficiency sector involve the regulation of voltage to improve the efficiency of utility distribution systems. This analysis includes the measures characterized in the 2021 Power Plan, which includes several levels that use increasingly sophisticated control systems.

The annual distribution system potential is shown in Figure 21.

Figure 21: Annual Distribution System Potential



Agricultural

The potential in the agricultural sector is largely driven by the irrigated acreage and number in Chelan PUD's service territory. Overall, Chelan PUD has a small amount of agricultural activity in its service area and the potential is small. The primary sources of savings are related to irrigation. Note, the scale used in Figure 22 has changed significantly from what was used in other figures above.

Figure 22: Annual Agricultural Potential by End Use

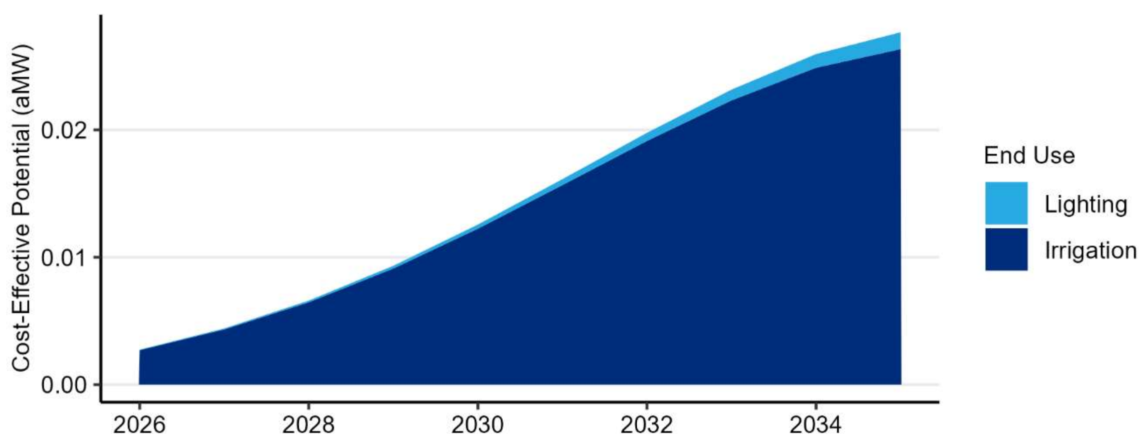
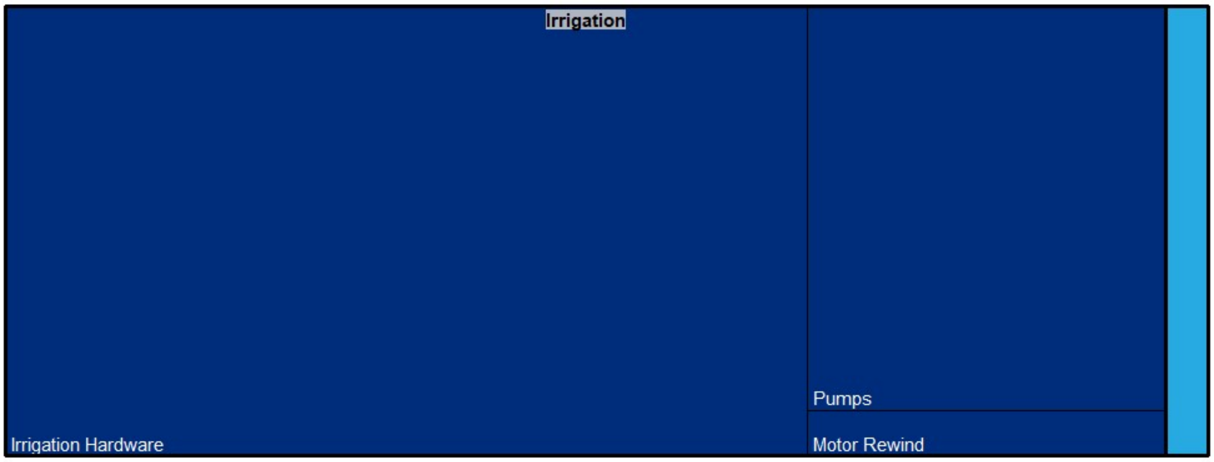


Figure 23 shows the breakdown of 10-year agricultural potential by end use and measure category.

Figure 23: Agricultural Potential by End Use and Measure Category



Sensitivity Results

This section discusses the results of two sensitivity analyses that were evaluated in addition to the base case results described in the preceding sections. These sensitivities examined low and high variations of the avoided costs values to provide a range of possible outcomes given the uncertainty inherent in estimating these costs over a 20-year period. This allows Chelan PUD to understand how the cost-effective potential varies with changes in the avoided cost. All other inputs were held constant.

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

Table 10: Avoided Cost Assumptions by Sensitivity

		Low	Base	High
Energy Values	**Avoided Energy Costs (20-Year Levelized Price, 2016$)**	Market Forecast minus 20%-80% ($24)	Market Forecast ($45)	Market Forecast plus 20%-80% ($65)
	Social Cost CO_2	80% Chelan PUD Carbon-Free Premium Value 20% CETA Carbon Value	80% Chelan PUD Carbon-Free Premium Value 20% CETA Carbon Value	80% Chelan PUD Carbon-Free Premium Value 20% CETA Carbon Value
Capacity Values	**Distribution Capacity (2016$)**	$7.82/kW-year	$7.82/kW-year	$7.82/kW-year
	Transmission Capacity (2016$)	$0/kW-year	$0/kW-year	$0/kW-year
	Generation Capacity (2016$)	$50/kW-year, Winter $57/kW-year, Summer	$67/kW-year, Winter $75/kW-year, Summer	$83/kW-year, Winter $94/kW-year, Summer
	Implied Risk Adder (2016$)	-$21/MWh -$17/kW-year, Winter -$18/kW-year, Summer	N/A	$20/MWh $16/kW-year, Winter $19/kW-year, Summer
	NW Power Act Credit	10%	10%	10%

Instead of using a single risk adder applied to each unit of energy, these two sensitivities consider potential futures with higher and lower values for the avoided cost inputs with larger degrees of uncertainty: the value of avoided energy and generation capacity.

Table 11 summarizes the variation in cost-effective potential across each avoided cost sensitivity. As noted in the earlier discussion of Figure 13, the magnitude of change from the base sensitivity to both the higher and lower sensitivity is similar.

Table 11: Cost-Effective Potential (aMW) by Avoided Cost Sensitivity

Sensitivity	2-Year	4-Year	10-Year	20-Year
Low Sensitivity	1.43	3.29	13.39	29.20
Base Case	1.71	3.94	15.55	32.78
High Sensitivity	1.84	4.22	16.66	35.66

Summary

This report summarized the results of the 2025 CPA conducted for Chelan PUD. The assessment provided estimates of the cost-effective energy savings potential for the 20-year period beginning in 2026, with details on the first two and 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 Chelan PUD's 2023 CPA, the cost-effective potential has decreased notably in the near term and slightly in the long term. Near-term potential decreases are based on the project team's alignment with Chelan PUD's recent program history, while long-term potential decreases are based on updates to the customer characteristics and cost-effectiveness assumptions for the 2025 CPA.

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 in determining the potential and cost effectiveness of conservation resources in the 2021 Power Plan. Appendix III provides a list of Washington's EIA requirements and a description of how each was implemented. In addition to using a methodology consistent with the Council's 2021 Power Plan, the 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 some economic inputs were used. The assessment included the measures considered in the 2021 Power Plan materials, updated with new information from the RTF made available since its publication.

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Appendix I: Acronyms

aMW	Average Megawatt
BPA	Bonneville Power Administration
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
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 Washington 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, similar to 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 US.

Appendix III: Compliance with State Requirements

This Appendix details the specific requirements for Conservation Potential Assessments listed in WAC 194-37-070. 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

WAC 194-37-070 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 measure savings 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 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.	The project team used the benefit-cost ratio approach described in (5)(c)(ii), using 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-[sensitivity name].xlsx" 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	A life-cycle cost analysis was performed using the Council's ProCost tool, which the project team configured with utility-specific inputs. Costs and benefits were included consistent with the TRC test.

WAC 194-37-070 Section	Requirement	Implementation
	programs to determine the net levelized cost, as described in this subsection:	The measure files within each sector contain the ProCost results. These results are then rolled up into the ProCost Measure Results file, which is linked to each sector model file.
(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 levelized cost include 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, periodic replacement costs. Measure costs and benefits can be found in the individual measure files as well as the "ProCost Measure Results" file.
(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	The project team 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. "MC and Loadshape" files contain both the market price forecast and the library of load shapes. Individual measure files contain the load profile 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. 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	The project team incorporated a 20-year forecast of on- and off-peak market prices at the mid-Columbia trading hub based on

WAC 194-37-070 Section	Requirement	Implementation
	available to the utility for the life of the energy efficiency measures to which it is compared	available forward prices. Further discussion of this forecast can be found in Appendix IV. See the "MC and Loadshape" file for the market prices.
(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 Chelan PUD. 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 monthly capacity values. 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	Chelan PUD's resources 80% are carbon free, so this analysis uses 80% of a carbon-free premium value that is based on the market premium it can receive when selling its carbon-free excess power. 20% of CETA's required social cost of carbon values was used to represent the carbon value from the remaining 20% of Chelan PUD's portfolio. The carbon costs 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 sensitivity analysis to consider risk. Avoided cost values with uncertain future values were varied across three different sensitivity and the resulting variation and risk were analyzed. The Sensitivity 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 2021 Power Plan materials and updates from the RTF.

WAC 194-37-070 Section	Requirement	Implementation
		Measure assumptions can be found in the individual measure files.
(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 file, 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 2021 Power 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 batch runner 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 4.39% to determine the present value of all costs and benefits. This represents the utility's long-term cost of capital. The discount rate used in this analysis can be found in the ProCost file, 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 NW 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 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."[9] 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.[10]

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 Chelan PUD through the acquisition of energy efficiency instead of supply-side resources. For each megawatt-hour conserved, Chelan PUD can either avoid buying that amount of energy or sell an extra megawatt-hour of surplus energy.

For this CPA, Chelan PUD provided a forecast of monthly on- and off-peak energy prices at the Mid-Columbia trading hub. The forecast was prepared on May 15, 2025, and covers the 20-year period considered in this CPA. To benchmark these prices, the project team compared them to monthly on- and off-peak price futures for the Mid-Columbia trading hub reported by the Intercontinental Exchange (ICE) on April 4, 2025. Comparisons of the on- and off-peak prices from two sources are shown below in Figure 24 and Figure 25, respectively. While the prices from the ICE cover a more limited period, the prices are quite similar, with Chelan PUD's prices being slightly higher, likely due to the differences in forecast dates.

[9] WAC 194-37-070. Accessed January 20, 2021. https://app.leg.wa.gov/wac/default.aspx?cite=194-37-070
[10] WAC 194-40-100. Accessed March 7, 2023. https://app.leg.wa.gov/WAC/default.aspx?cite=194-40-100

Figure 24: Benchmarking of On-Peak Prices

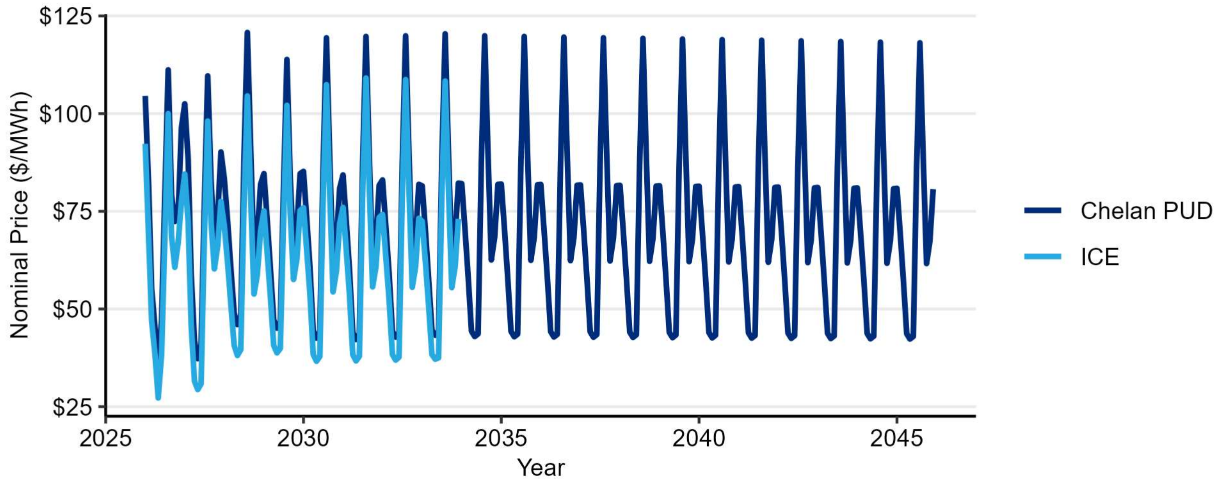
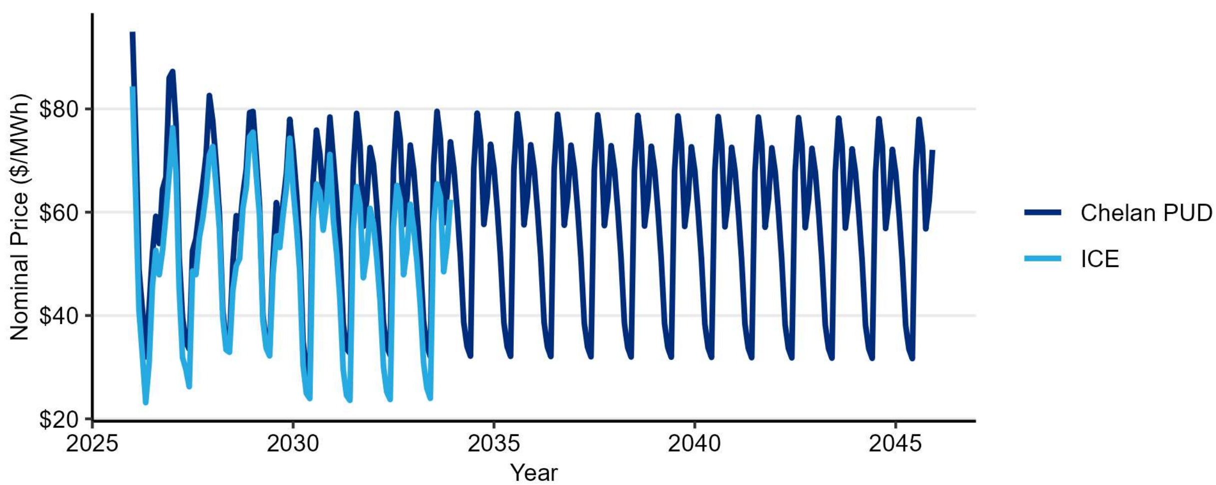
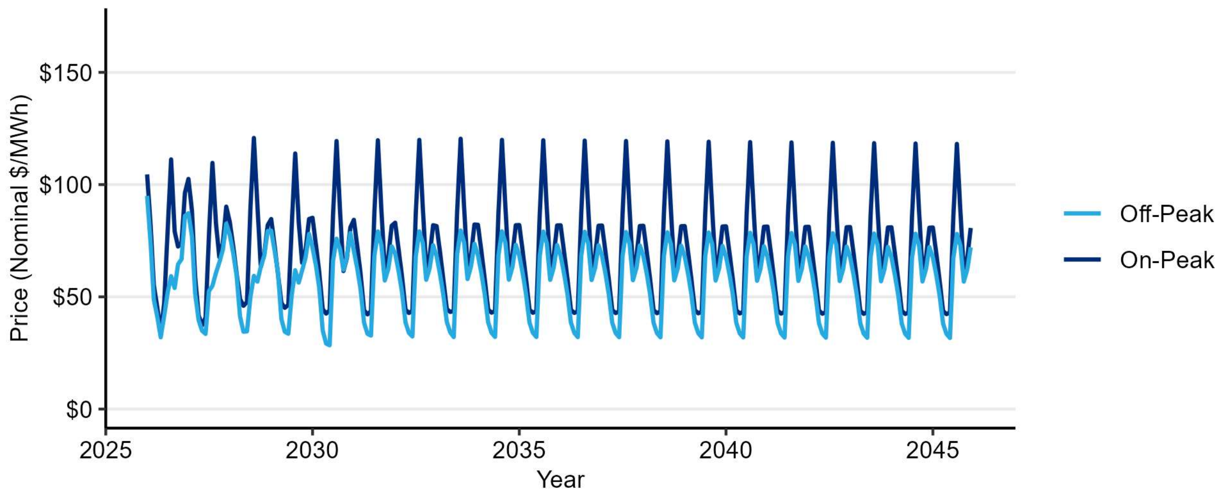


Figure 25: Benchmarking of Off-Peak Prices



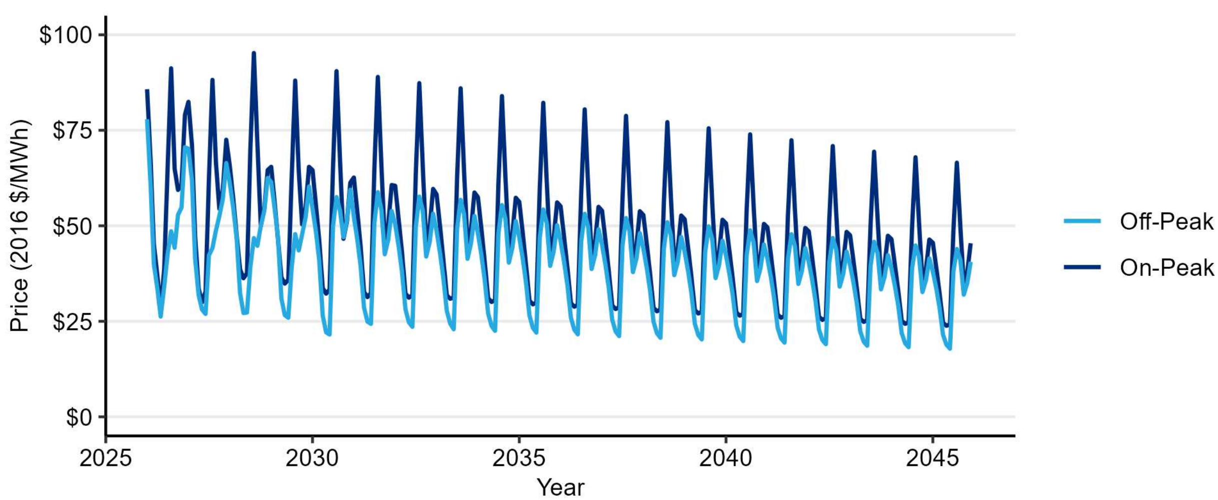
The project team used the prices provided by Chelan PUD to cover the full 20-year study period. The complete forecast is shown in Figure 26.

Figure 26: On- and Off-Peak Price Forecast



These prices were converted to real 2016 dollars for consistency with the measure cost assumptions used in the 2021 Power Plan, which are also expressed in 2016 dollars. The results are shown in Figure 27.

Figure 27: On- and Off-Peak Price Forecast (2016$)



The 20-year levelized value of this forecast is approximately $45 per megawatt-hour (2016$), using a discount rate of 4.39%. This price is approximately 70% the levelized price from Chelan PUD's 2023 CPA, which was $65 per megawatt-hour (2016$).

The project team also created high and low variations of this forecast to be used in the avoided cost sensitivity analysis, since the actual future values of these prices are uncertain. To develop the forecast variations, the project team 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. This approach is based on the variation observed in price forecasts in the 2021 Power Plan.

A similar approach was used in Chelan PUD's previous CPAs. The resulting forecasts for on- and off-peak prices are shown in Figure 28 and Figure 29 below.

Figure 28: On-Peak Price Sensitivity

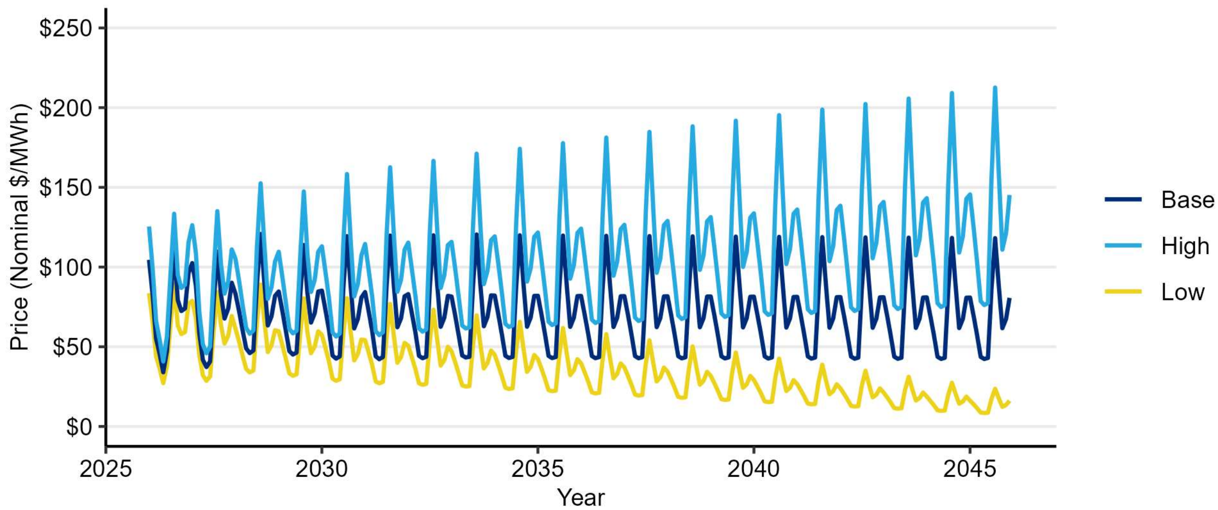
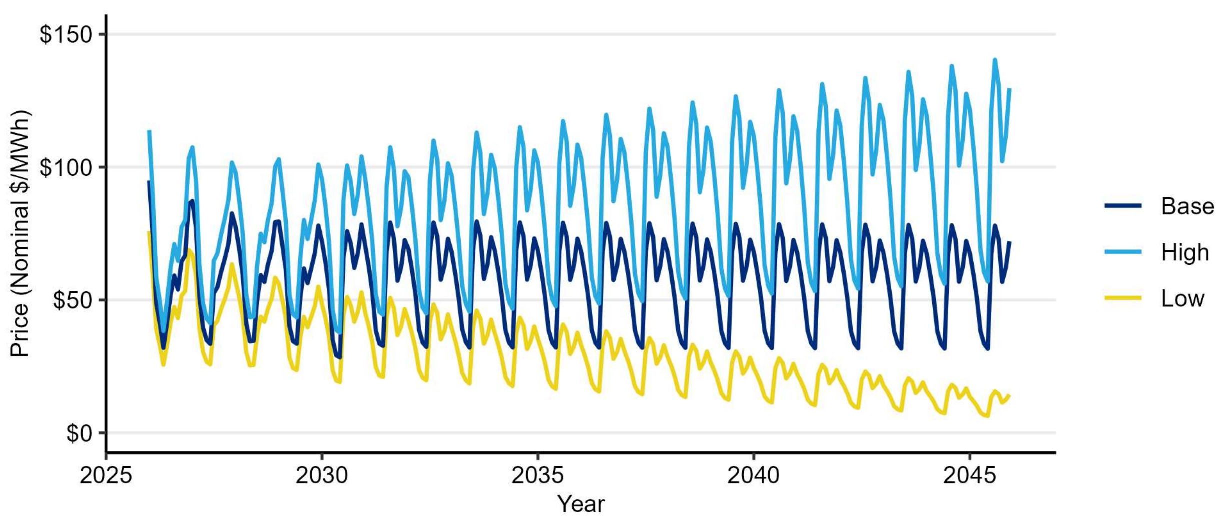


Figure 29: Off-Peak Price Sensitivity



Deferred Transmission and Distribution Capacity Costs

Unlike supply-side resources, energy efficiency and demand response do not require transmission and distribution infrastructure. Instead, they free up transmission and distribution system capacity by reducing the peak demands. Over time, this can help defer future capacity expansions and the associated capital costs. However, because Chelan PUD's resources are located close to its load, any transmission losses are minimal. Accordingly, only savings on the distribution system will be considered in the CPA and DRPA. This approach is consistent with Chelan PUD's prior potential assessments.

In the development of the 2021 Power Plan, the Council developed a standardized methodology and surveyed the region to calculate the avoided costs of transmission and distribution capacity. This

CPA and DRPA use the avoided distribution capacity value developed by the Council through that process: $7.82 per kW-year (2016$). This value is lower than the 2023 CPA avoided distribution capacity value of $56.41 per kW-year. The previous value was based on a cost of service study but does not reflect the fact that distribution capacity expansions may not be necessary throughout the service territory in the near term.

The deferred distribution capacity value is applied to the demand savings that are coincident with the timing of Chelan PUD's distribution system peak.

Deferred Generation Capacity Costs

Similar to the transmission and distribution systems discussed above, acquiring energy efficiency can help defer or eliminate the costs of new generation resources built or acquired to meet peak demands for electricity. Similarly, in periods where Chelan PUD may have excess capacity, additional energy savings create additional capacity that can be sold.

For this CPA, Chelan PUD provided a forecast of future monthly capacity values. These values are based on the value for capacity that Chelan PUD sees when it markets the output from its resources. The project team turned the series of monthly capacity values into 20-year levelized values for the summer and winter seasons, which are required for the Council's ProCost model. This resulted in a base case value of $80/kW-year for the winter and $90/kW-year summer in 2025 dollars, or $67/kW-year and $75/kW-year in 2016 dollars.

For the high and low sensitivity, the project team varied this value by +/-25 percent, resulting in values of $83/kW-year and $94/kW-year (2016$) for winter and summer, respectively, for the high sensitivity and $50/kW-year and $57/kW-year (2016$) for winter and summer in the low sensitivity.

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. 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 each 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.[11]

Chelan PUD's past CPAs have used a carbon-free premium value to reflect the additional or premium value that Chelan PUD can receive over market prices when selling its excess carbon-free power. This CPA continues that approach but with a slight modification to reflect the fact that Chelan PUD's current policy is to serve approximately 80% of its load with its carbon-free resources while having the remaining 20% served from unspecified sources.

Chelan PUD's carbon premium values begin at $15/MWh in 2026 and rise to a maximum of $25/MWh in 2035 before decreasing again to $16/MWh in 2044 (2025$). To reflect the fact that only 80% of its load is served by carbon-free resources, only 80% of these values are included. To account for the

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

remaining 20% of load served by unspecified sources, this CPA uses 20% of the social cost of carbon values prescribed by CETA converted to a dollar per MWh value using the Council's latest[12] estimate of regional marginal emissions rates.

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. The credit is determined by identifying the 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 the avoided costs.

This CPA follows the process used in Chelan PUD's recent CPAs. A sensitivity 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 sensitivity. In selecting its biennial target based on this range of outcomes, Chelan PUD 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 sensitivities in this CPA update.

[12] As of September 2025.

Table 13: Avoided Cost Assumptions by Sensitivity

		Low	Base	High
Energy Values	**Avoided Energy Costs (20-Year Levelized Price, 2016$)**	Market Forecast minus 20%-80% ($24)	Market Forecast ($45)	Market Forecast plus 20%-80% ($65)
	Social Cost CO_2	80% Chelan PUD Carbon-Free Premium Value 20% CETA Carbon Value	80% Chelan PUD Carbon-Free Premium Value 20% CETA Carbon Value	80% Chelan PUD Carbon-Free Premium Value 20% CETA Carbon Value
Capacity Values	**Distribution Capacity (2016$)**	$7.82/kW-year	$7.82/kW-year	$7.82/kW-year
	Transmission Capacity (2016$)	$0/kW-year	$0/kW-year	$0/kW-year
	Generation Capacity (2016$)	$50/kW-year, Winter $57/kW-year, Summer	$67/kW-year, Winter $75/kW-year, Summer	$83/kW-year, Winter $94/kW-year, Summer
	Implied Risk Adder (2016$)	-$21/MWh -$17/kW-year, Winter -$18/kW-year, Summer	N/A	$20/MWh $16/kW-year, Winter $19/kW-year, Summer
	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 Chelan PUD. The project team customized these measures to make them specific to Chelan PUD's service territory and updated many with new information available from the Regional Technical Forum. 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, RTF
	Refrigerator	2021 Power Plan, RTF
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, RTF
	Central Air Conditioner	2021 Power Plan, RTF
	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, RTF
	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, DHP
	Energy Management	2021 Power Plan
	Fans	2021 Power Plan
	Heat Pumps	2021 Power Plan
	Package Terminal Heat Pumps	2021 Power Plan, RTF
	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, RTF
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

Table 18: Agricultural End Uses and Measures

End Use	Measure Category	Data Source
Irrigation	Irrigation Hardware	2021 Power Plan, RTF
	Motor Rewind	2021 Power Plan, RTF
	Pumps	2021 Power Plan, RTF
	Variable Rate Irrigation	2021 Power Plan
Lighting	Dairy Lighting	2021 Power Plan
	Exterior Lights	2021 Power Plan
Process Heating	Block Heater	2021 Power Plan, RTF
	Stock Tanks	2021 Power Plan, RTF
Refrigeration	Dairy Refrigeration	2021 Power Plan
Ventilation	Fans	2021 Power Plan

Appendix VI: Cost-Effective Energy Efficiency Potential by End Use

Table 19: Cost-Effective Residential Potential by End Use (aMW)

End Use	2-Year	4-Year	10-Year	20-Year
Appliances	0.06	0.14	0.45	0.90
Cooking	0.00	0.00	0.01	0.05
Electronics	0.00	0.01	0.11	0.36
EVSE	0.00	0.00	0.00	0.00
HVAC	0.23	0.63	2.45	3.92
Lighting	0.01	0.02	0.14	0.58
Motors	0.00	0.00	0.00	0.00
Water Heat	0.05	0.15	1.00	3.25
Whole Home	0.00	0.00	0.00	0.00
Total	**0.35**	**0.95**	**4.16**	**9.07**

Table 20: Cost-Effective Commercial Potential by End Use (aMW)

End Use	2-Year	4-Year	10-Year	20-Year
Compressed Air	0.00	0.00	0.02	0.08
Electronics	0.01	0.03	0.30	0.42
Food Preparation	0.00	0.01	0.02	0.03
HVAC	0.59	1.15	2.70	4.73
Lighting	0.45	0.76	1.38	2.09
Motors/Drives	0.01	0.02	0.20	0.61
Process Loads	0.00	0.00	0.00	0.00
Refrigeration	0.03	0.09	0.69	1.85
Water Heat	0.01	0.02	0.11	0.27
Total	**1.10**	**2.09**	**5.43**	**10.09**

Table 21: Cost-Effective Industrial Potential by End Use (aMW)

End Use	2-Year	4-Year	10-Year	20-Year
All Electric	0.03	0.09	0.63	1.25
Compressed Air	0.00	0.01	0.12	0.38
Fans and Blowers	0.03	0.09	0.36	0.85
HVAC	0.01	0.03	0.25	0.48
Lighting	0.10	0.35	1.66	2.24
Low Temp Refrigeration	0.00	0.00	0.03	0.08
Material Handling	0.00	0.00	0.02	0.07
Material Processing	0.00	0.00	0.04	0.14
Med Temp Refrigeration	0.04	0.12	0.86	1.90
Melting and Casting	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00
Other Motors	0.00	0.00	0.00	0.02
Pollution Control	0.00	0.00	0.00	0.01
Pumps	0.01	0.04	0.36	1.54
Total	**0.22**	**0.74**	**4.33**	**8.94**

Table 22: Cost-Effective Utility Distribution Efficiency by End Use (aMW)

End Use	2-Year	4-Year	10-Year	20-Year
LDC with no VVO	0.00	0.02	0.20	0.58
LDC with VVO & AMI	0.03	0.12	1.30	3.82
Total	**0.03**	**0.14**	**1.49**	**4.39**

Table 23: Cost-Effective Agricultural Potential by End Use (aMW)

End Use	2-Year	4-Year	10-Year	20-Year
Irrigation	0.01	0.02	0.14	0.26
Lighting	0.00	0.00	0.01	0.03
Process Heating	0.00	0.00	0.00	0.00
Refrigeration	0.00	0.00	0.00	0.00
Ventilation	0.00	0.00	0.00	0.00
Total	**0.01**	**0.02**	**0.15**	**0.29**

Appendix VII: Ramp Rate Alignment Documentation

This appendix documents the application of ramp rates in Chelan PUD's 2025 Conservation Potential Assessment (CPA), developed by Lighthouse Energy Consulting and Nauvoo Solutions (the study team). Ramp rates are annual values that approximate the portion of technical potential that can be realistically achieved in each year. For example, all unweatherized homes in Chelan PUD's service territory could theoretically be weatherized in a single year. However, program budgets, workforce availability, and other dynamics make this impractical. As a result, only a percentage of homes could realistically be weatherized in a single year.

For equipment measures like clothes washers, upgrading to more efficient equipment is most likely to occur when the equipment reaches the end of its life and needs to be replaced. Therefore, ramp rates for equipment measures reflect the share of equipment turning over in a given year that is replaced with a more efficient model.

The ramp rates used in this study are based on those used in the 2021 Power Plan but were updated to reflect the fact that some time has elapsed since the 2021 Power Plan. The study team assigned ramp rates that align the near-term cost-effective potential quantified in the CPA with the recent and expected achievements of Chelan PUD's energy efficiency programs. Under both CETA and EIA, utilities are required to pursue all conservation that is cost-effective, reliable, and achievable. Therefore, the ramp rates in this study are designed to ensure that the near-term potential is feasible and achievable for Chelan PUD's programs and the measures considered for adoption meet regulatory cost-effectiveness criteria.

Ramp Rate Alignment Process

Chelan PUD staff provided recent program achievement data, which the study team summarized by sector and end use. For the residential sector, the study team further classified program achievements by high-level measure categories.

Additionally, Chelan PUD benefits from the regional market transformation work of the Northwest Energy Efficiency Alliance (NEEA). To reflect this, the study team incorporated estimated energy efficiency savings from NEEA market transformation activity occurring in Chelan PUD's service territory. These savings were allocated across sectors, end uses, and measure categories based on recent reporting of NEEA's regional savings.

The study team compared the recent savings from Chelan PUD's programs and NEEA's market transformation initiatives with the initial estimates of the cost-effective energy efficiency potential identified in the CPA. The study team made changes to the assigned ramp rates to accelerate or decelerate the forecasted pace of savings acquisition to align future savings potential with recent programmatic achievements. Areas where there were little to no recent program achievements typically have a slow ramp rate applied to account for the fact that a program may need to build momentum over several years.

The following tables show how Chelan PUD's recent programmatic achievements and allocated NEEA market transformation savings compare to the potential estimated to be cost effective after adjusting the ramp rates. Color scaling has been applied to highlight the larger values. Discussion follows each table with additional detail.

Residential

Table 24 shows how residential potential was aligned with recent achievements by measure category.

Note that ramp rate choices are discrete and may not provide exact alignment. The overall goal is to achieve a general alignment across end uses and measures.

Table 24: Alignment of Residential Program History and Potential by Measure Category (MWh)

		Program History			CPA Cost-Effective Potential			
End Use	**Category**	**2022**	**2023**	**2024**	**2026**	**2027**	**2028**	**2029**
Appliances	Clothes Washer	165	195	224	126	151	171	188
Appliances	Dryer	70	83	95	20	30	42	56
Appliances	Freezer	-	-	-	1	2	3	5
Appliances	Refrigerator	99	116	134	94	101	104	106
Cooking	Microwave	-	-	-	1	1	2	3
Cooking	Oven	-	-	-	0	0	0	0
Electronics	Advanced Power Strips	1	1	1	-	-	-	-
Electronics	Desktop	14	16	18	-	-	-	-
Electronics	Laptop	-	-	-	1	1	2	4
Electronics	TV	-	-	-	6	11	20	31
HVAC	ASHP	757	488	653	417	556	719	912
HVAC	CAC	-	-	-	3	5	9	14
HVAC	Circulator	-	-	-	0	0	0	0
HVAC	Circulator Controls	-	-	-	0	0	0	0
HVAC	DHP	540	495	405	-	-	-	-
HVAC	Duct Sealing	1	3	1	40	64	97	138
HVAC	Room AC	1	1	1	-	-	-	-
HVAC	Thermostat	60	820	214	201	361	560	786
HVAC	Weatherization	460	374	374	221	162	132	104
Lighting	Fixtures	-	-	-	32	43	56	72
Water Heat	Circulator	-	-	-	0	0	1	1
Water Heat	Circulator Controls	-	-	-	0	0	1	1
Water Heat	Dishwasher	-	-	-	0	0	0	1
Water Heat	HPWH	172	217	243	141	240	355	498
Water Heat	Pipe Insulation	0	1	-	-	-	-	-
Water Heat	Showerhead	-	0	-	-	-	-	-
Water Heat	TSRV	-	-	-	11	18	28	41
	Total	**2,339**	**2,808**	**2,364**	**1,315**	**1,748**	**2,301**	**2,959**

Note: For clarity, in the table above, 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

In this end use, the savings are from both Chelan PUD programs and NEEA's market transformation initiatives. NEEA's work includes an initiative for retail products and appliances that contributes savings. The savings from this work typically grow over time as markets transform. Ramp rates were adjusted to align with the combination of Chelan PUD and NEEA savings.

Cooking

Neither Chelan PUD nor NEEA have savings in this end use, so the measures—microwaves and ovens—were given slow ramp rates.

Electronics

Most of the historical savings in this end use come from NEEA's work advancing efficient desktop computers. The more efficient Energy Star desktop computer is not cost effective and therefore not incorporated in the future potential. The Regional Technical Forum (RTF) has recently deactivated advanced power strips due to a lack of data and confidence in the savings, so the measure was removed from this CPA. Going forward, the cost-effective potential is associated with TVs and laptops. The study team slowed the ramp rate for these categories since there are no current Chelan PUD programs or NEEA initiatives that would address these measures.

HVAC

The HVAC category is Chelan PUD's largest source of program savings in the past three years, and the top program measures include air source heat pumps (ASHP), ductless heat pumps (DHP), smart thermostats, and weatherization measures.

Measures in the HVAC end use are often expensive. Although ASHPs typically struggle to be cost-effective, the study team included the tax credits and incentives provided for heat pumps through the federal Inflation Reduction Act (IRA). While much of IRA has recently been repealed, program funding has already been distributed to the states. Including these federal credits and incentives improves the cost effectiveness of ASHPs, particularly for income-qualified households, who are eligible for more substantial benefits.

None of the DHP measures were identified as cost effective after updating measure assumptions with recent RTF updates.

Additional cost-effective potential is available through smart thermostats, duct sealing, efficient central air conditioning systems, and weatherization, which were assigned ramp rates to align with Chelan PUD's recent program history.

Lighting

The lighting end use is now subject to product standards that cover many screw-in lamps. The potential that remains is 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 past savings in the water heating category are from heat pump water heaters, both from Chelan PUD's programs and NEEA's market transformation efforts.

Washington has state product standards for showerheads and aerators, so there is no potential in these categories. The study team applied slower ramp rates to the remaining measure categories with cost-effective potential, which includes circulator pumps and controls, dishwashers, and thermostatic restrictor valves (TSRV).

Table 25 below summarizes the residential measure category results in Table 24 by end use. This table also incorporates savings from whole home measures that do not align with categories included in the CPA but could be grouped in the end uses listed below. Savings in the HVAC end use could not be aligned as the program history includes significant savings from ductless heat pumps, which were not found to be cost effective in this CPA.

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

	Program History			CPA Cost-Effective Potential			
End Use	**2022**	**2023**	**2024**	**2026**	**2027**	**2028**	**2029**
Appliances	334	394	453	242	284	319	354
Cooking	-	-	-	1	1	2	3
Electronics	14	17	19	7	13	22	35
EVSE	-	-	-	-	-	-	-
HVAC	1,819	2,180	1,648	882	1,148	1,517	1,953
Lighting	-	-	-	32	43	56	72
Motors	-	-	-	-	-	-	-
Water Heat	172	218	243	152	259	385	542
Whole Home	7	11	17	-	-	-	-
Total	**2,347**	**2,819**	**2,381**	**1,315**	**1,748**	**2,301**	**2,959**

Commercial

In the commercial sector, the greatest potential lies within lighting and HVAC end uses, which are also the areas where Chelan PUD's program achievements are the greatest. NEEA also contributes additional savings in these end uses. The ramp rates associated with these end uses were aligned as best as possible, but there is limited remaining potential. This is especially noticeable in the lighting end use. The end uses outside of the lighting and HVAC end uses were generally given slower ramp rates to reflect the lower program activity in these areas.

Note that lighting in the commercial sector is impacted by Washington House Bill 1185's[13] ban on the sale of lighting products containing mercury, which includes fluorescent lighting. The ban takes effect in the second half of 2029. After this, much of the remaining lighting potential is associated with lighting controls and lighting technologies where fluorescent lighting is not the baseline technology.

Table 26 below shows the alignment of program history and potential in the commercial sector.

[13]Accessed July 11, 2025. https://lawfilesext.leg.wa.gov/biennium/2023-24/Pdf/Bills/Session%20Laws/House/1185-S2.SL.pdf?q=20250714075226

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

	Program History			CPA Cost-Effective Potential			
End Use	**2022**	**2023**	**2024**	**2026**	**2027**	**2028**	**2029**
Compressed Air	-	-	-	1	2	4	6
Electronics	35	41	48	24	48	84	135
Food Preparation	13	15	18	12	14	16	16
HVAC	1,167	3,287	3,031	2,716	2,484	2,445	2,397
Lighting	3,159	3,905	5,392	2,160	1,809	1,569	1,150
Motors/Drives	31	36	42	23	39	62	92
Process Loads	1	1	1	-	-	-	-
Refrigeration	7	-	-	86	144	225	331
Water Heat	-	20	25	28	44	59	76
Total	**4,413**	**7,306**	**8,556**	**5,050**	**4,584**	**4,463**	**4,203**

Industrial

Savings in the industrial sector are often irregular and uneven, subject to the projects that are completed in a given year. Table 27 shows the alignment of industrial potential and recent program history by end use. Since the savings in any particular end use may not be known in advance, the study team sought to align the overall level of potential with recent program history.

Table 27: Alignment of Industrial Program History and Potential by End Use (MWh)

	Program History			CPA Cost-Effective Potential			
End Use	**2022**	**2023**	**2024**	**2026**	**2027**	**2028**	**2029**
All Electric	-	2,624	-	89	147	226	327
Compressed Air	-	-	-	14	23	36	54
Fans and Blowers	-	182	185	127	167	210	264
HVAC	-	-	-	35	57	88	127
Lighting	845	63	47	318	564	888	1,258
Low Temp Refer	-	-	-	3	6	9	13
Material Handling	-	-	-	2	3	4	7
Material Processing	-	-	-	4	7	12	17
Med Temp Refer	-	-	-	117	194	299	436
Melting and Casting	-	-	-	0	0	0	1
Other	-	-	-	0	0	0	0
Other Motors	-	-	-	0	0	1	1
Pollution Control	-	-	-	0	0	0	0
Pumps	-	-	-	32	57	94	145
Total	**845**	**2,869**	**232**	**742**	**1,225**	**1,867**	**2,651**

Utility Distribution System

The potential in the utility distribution system is from conservation voltage reduction, where system voltages are lowered while remaining within required ranges. The potential in this sector is limited compared to other sectors. In addition, the 2021 Power Plan assumes that the potential in this sector will be acquired slowly.

Table 28: Alignment of Distribution System Program History and Potential by End Use (MWh)

	Program History		CPA Cost-Effective Potential			
End Use	**2023**	**2024**	**2026**	**2027**	**2028**	**2029**
Distribution System	-	-	99	197	350	570

Agricultural

The potential in the agricultural sector is also limited relative to other sectors. Most of the savings potential is related to the irrigation end use, with smaller amounts available in the lighting end use. The study team applied slower ramp rates to the agricultural sector since the sector is not currently a focus of Chelan PUD's programs.

Table 29: Alignment of Agricultural Program History and Potential by End Use (MWh)

	Program History		CPA Cost-Effective Potential			
End Use	**2023**	**2024**	**2026**	**2027**	**2028**	**2029**
Irrigation	18	4	24	38	57	80
Lighting	-	-	0	1	1	2
Process Heating	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-
Ventilation	-	-	-	-	-	-
Total	**18**	**4**	**24**	**39**	**58**	**82**

Appendix VIII: IRP Inputs

Chelan PUD requested that the project team provide details from the CPA for inclusion in its IRP. In addition to detailing the annual savings from each sector, the project team provided an annual levelized cost value for the savings that were identified as cost effective in the CPA. As discussed above, levelized costs allow for the comparison of resources of different sizes and lifetimes. The project team calculated the levelized cost for each measure as follows:

$$Levelized\ Cost = \frac{Net\ Present\ Value\ of\ Costs}{Net\ Present\ Value\ of\ Savings}$$

The project team used a real discount rate of 4.39% to calculate the net present values of the costs and savings over the lifetime of each measure. The costs include the full cost of the measure, as well as program administration costs, any operations and maintenance costs or savings, periodic replacement costs or savings, and any non-energy benefits. The levelized costs do not include credits for deferred generation and transmission capacity costs or carbon credits. Unless accounted for elsewhere, these credits would need to be incorporated to make apples-to-apples comparisons between supply side resources. The project team then calculated a savings weighted average levelized cost for each year based on the incremental savings that were projected to be acquired in each year. Table 30 shows the resulting values in both real and nominal dollars, assuming a 2.5% inflation rate.

Table 30: Annual Levelized Cost of Cost-Effective Potential

Year	Real Levelized Cost (2016$/MWh)	Nominal Levelized Cost ($/MWh)
2026	$38	$48
2027	$39	$51
2028	$41	$55
2029	$42	$58
2030	$43	$61
2031	$43	$62
2032	$42	$63
2033	$42	$64
2034	$41	$65
2035	$41	$66
2036	$41	$67
2037	$41	$70
2038	$41	$71
2039	$41	$72
2040	$41	$73
2041	$40	$75
2042	$41	$79
2043	$40	$77
2044	$37	$75
2045	$35	$72