Clark Public Utilities

Conservation Potential Assessment

Final Report

September 3, 2019

Prepared by:

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September 3, 2019

Mr. Larry Blaufus
Clark Public Utilities
P.O. Box 8900
Vancouver, Washington 98668

SUBJECT: 2019 Conservation Potential Assessment – Final Report

Dear Mr. Blaufus:

Please find attached the final report summarizing the 2019 Clark Public Utilities Conservation Potential Assessment (CPA). This report covers the 20-year period from 2020 through 2039. The potential has decreased from the 2017 CPA, largely due to standards impacting many residential lighting measures and changes in the avoided cost assumptions.

We would like to thank you and your staff for the excellent support in developing and providing the baseline data for this project.

Best Regards,

Ted Light

Ted Light
Senior Project Manager

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Executive Summary

This report describes the methodology and results of the Clark Public Utilities (CPU) 2019 Conservation Potential Assessment (CPA). This assessment provides estimates of energy and peak demand savings by sector for the period 2020 to 2039. The assessment considered a wide range of conservation resources that are reliable, available, and cost-effective within the 20-year time horizon.

Background

CPU provides electricity service to more than 203,000 customers located in Clark County, Washington. CPU's service territory covers 628 square miles and includes 6,600 miles of transmission and distribution lines.

Washington's Energy Independence Act (EIA), effective January 1, 2010 and modified October 4, 2016, requires that utilities with more than 25,000 customers (known as qualifying utilities) pursue all cost-effective conservation resources and meet conservation targets set using a utility-specific conservation potential assessment methodology.

The EIA sets forth specific requirements for setting, pursuing and reporting on conservation targets. The methodology used in this assessment complies with RCW 19.285.040 and WAC 194-37-070 Section 5 parts (a) through (d) and is consistent with the methodology used by the Northwest Power and Conservation Council (Council) in developing the Seventh Power Plan. Thus, this Conservation Potential Assessment will support CPU's compliance with EIA requirements.

This assessment was built on the same model used in the 2017 CPA, which was based on the completed Seventh Power Plan. The model was updated to reflect changes since the completion of the 2017 CPA. The primary model updates included the following:

- New Avoided Costs
  - Recent forecast of power market prices
  - Updated values for avoided generation capacity
  - New transmission and distribution capacity costs based on new values from the Council
- Updated Customer Characteristics Data
  - New residential home counts and characteristics
  - Updated commercial floor area
  - Updated industrial sector consumption
- Measure Updates
  - Measure savings, costs, and lifetimes were updated based on the latest updates available from the Regional Technical Forum (RTF)

- New measures not included in the Seventh Plan but subsequently reviewed by the RTF were added
- Accounting for Recent Achievements
    - Internal programs
    - NEEA programs

The first step of this assessment was to carefully define and update the planning assumptions using the new data. The Base Case conditions were defined as the most likely market conditions over the planning horizon, and the conservation potential was estimated based on these assumptions. Additional scenarios were also developed to test a range of conditions.

Results

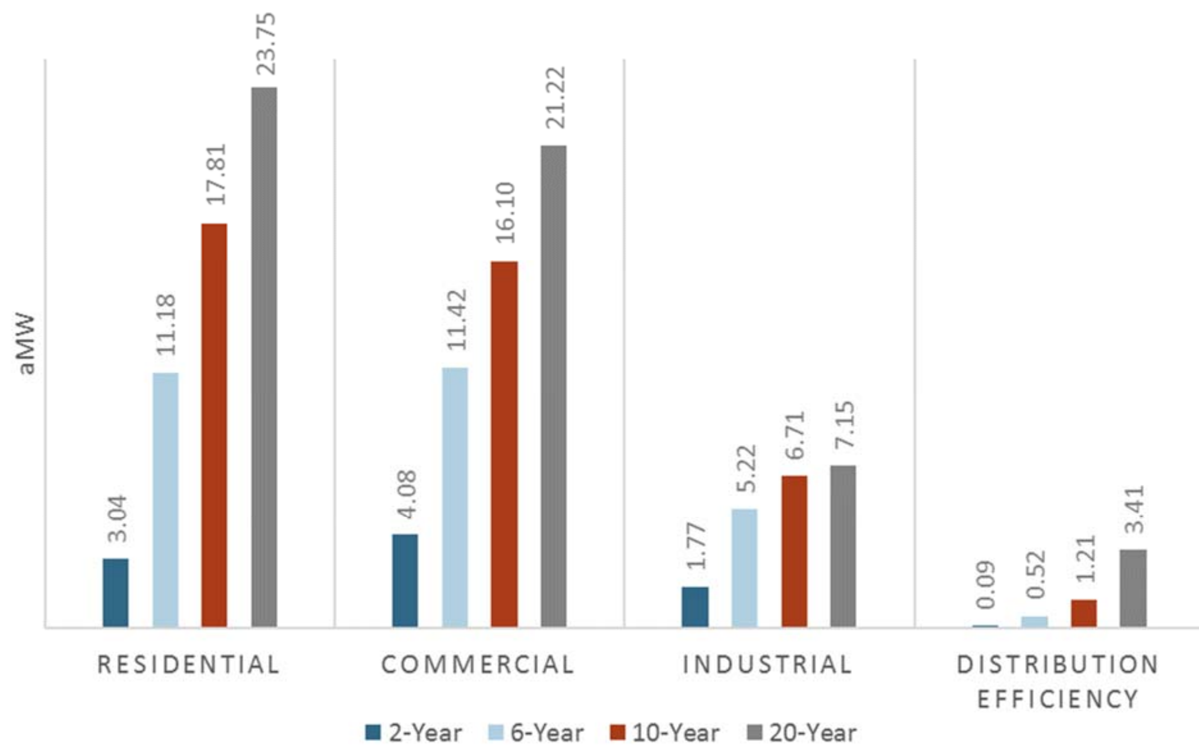
Table ES-1 and Figure ES-1 show the high-level results of this assessment. The economically achievable potential by sector in 2, 6, 10 and 20-year increments is included. The total 20-year cost-effective conservation potential is 55.53 aMW. The focus of the EIA requirement is on the 10-year potential, 41.83 aMW, and the 2-year potential, 8.97 aMW.

These estimates include energy efficiency achieved through CPU's own utility programs and through CPU's share of the Northwest Energy Efficiency Alliance (NEEA) accomplishments. Some of the potential may be achieved through code and standard changes, especially in the later years. In some cases, the savings from those changes will be quantified by NEEA or through BPA's Momentum Savings work.

Table ES-1
Cost Effective Potential (aMW)

	2-Year	6-Year	10-Year	20-Year
Residential	3.04	11.18	17.81	23.75
Commercial	4.08	11.42	16.10	21.22
Industrial	1.77	5.22	6.71	7.15
Distribution Efficiency	0.09	0.52	1.21	3.41
Total	**8.97**	**28.33**	**41.83**	**55.53**

Figure ES-1
Cost-Effective Potential



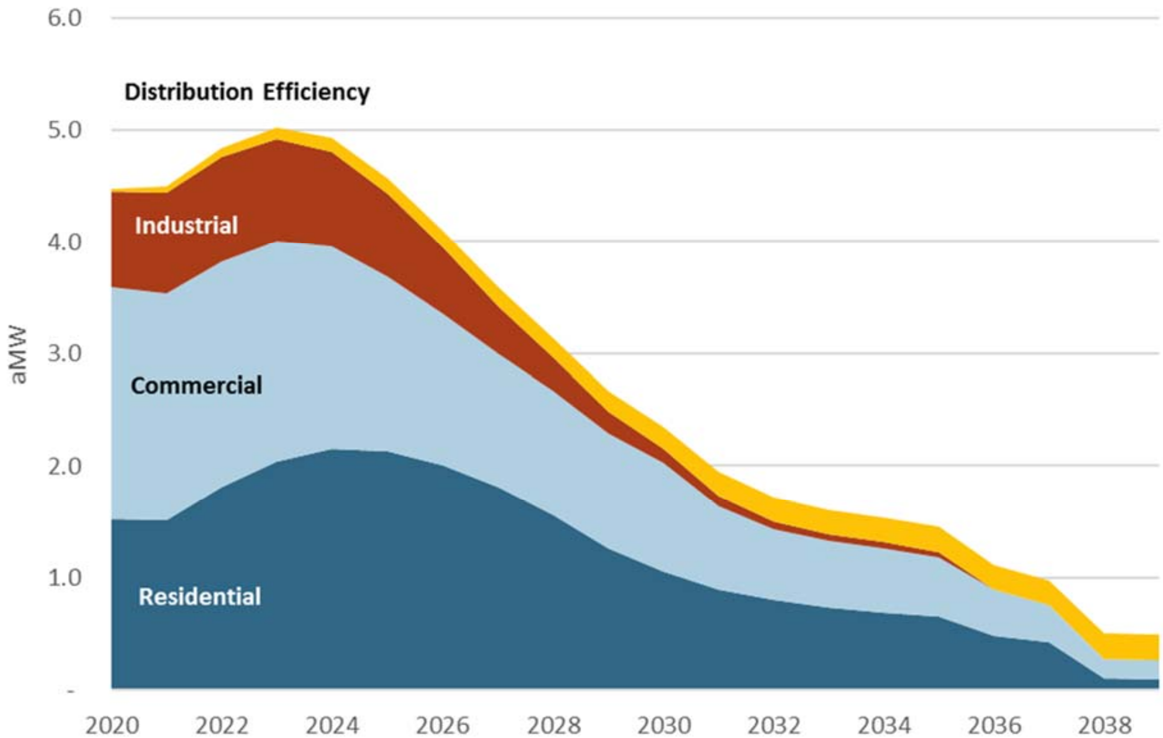
Energy efficiency also has the potential to reduce peak demands. Based upon hourly load profiles developed for the Seventh Power Plan and load data provided by CPU, the reductions in peak demand provided by energy efficiency are summarized in Table ES-2 below. Based on this table, the peak demand reduction, measured in MW, is approximately double the annual average energy savings. CPU's annual peak occurs most frequently in winter mornings, between 7 and 8 AM. In addition to these peak demand savings, demand savings would occur in varying amounts throughout the year.

Table ES-2
Cost Effective Demand Savings (MW)

	2-Year	6-Year	10-Year	20-Year
Residential	8.5	32.8	52.3	66.2
Commercial	6.9	19.6	27.2	35.2
Industrial	2.1	6.3	8.1	8.6
Agricultural	0.0	0.0	0.0	0.0
Total	**17.6**	**59.3**	**89.0**	**114.3**

The 20-year energy efficiency potential is shown on an annual basis in Figure ES-2. This assessment shows potential starting around 4.5 aMW in 2020, increasing to a maximum of 5 aMW in 2023, and then decreasing in the remaining years of the planning period as the remaining measure opportunities diminish over time.

Figure ES-2
Annual Energy Efficiency Potential Estimate



Relative to the 2017 CPA, the amount of cost-effective potential in the residential sector has decreased significantly. Much of the change is due to federal standards scheduled to take effect in 2020. These standards require efficiency levels only found in CFLs and LEDs; and with CFLs losing market share to LEDs, energy efficiency programs may not be necessary. EES has included only a small amount of savings from these residential lighting measures in 2020, acknowledging that programs will transition away from these measures over the course of the 2020 calendar year.

Further, changes in the value of capacity savings has resulted in a decrease in the cost effectiveness of some measures that contribute to reductions in peak demand. The remaining conservation potential in the residential sector is among the HVAC and water heating end uses. Some notable measures in these areas include:

- Water heating measures like heat pump water heaters, low-flow showerheads, and clothes washers
- Weatherization measures, including insulations and windows
- Behavior-based programs

There is also a significant amount of cost-effective conservation available in CPU's commercial sector, although the remaining potential decreases notably in the early years of the study period. The potential in this sector has also decreased due to the changes discussed above as well as a decrease in the estimated commercial floor area in CPU's service territory. Notable areas for commercial sector achievement are among the main end uses in the sector:

- Lighting – including interior lighting, controls, exterior building lighting, and street lighting
- HVAC – such as rooftop unit controllers and energy management programs

The industrial sector continues to be a significant source of cost-effective potential. The potential in this sector increased over the results of the 2017 study, due to increases in the overall load and some changes in how industrial sector achievements were accounted for in the CPA model. Key measures in the industrial sector include measures specific to the hi-tech sector as well as strategic energy management measures.

Table ES-3 shows the comparison of the Base Case results in the 2017 and current 2019 assessments. Both 10-year and 20-year cost-effective achievable potential are shown.

Table ES-3
Comparison of 2017 and 2019 CPA Cost-Effective Potential

	10-Year			20-Year		
	2017	**2019**	**% Change**	**2017**	**2019**	**% Change**
Residential	25.2	17.8	-29%	42.6	23.8	-44%
Commercial	16.4	16.1	-2%	31.4	21.2	-32%
Industrial	3.8	6.7	76%	3.8	7.1	87%
Distribution Efficiency	1.1	1.2	7%	3.1	3.4	11%
Total	**46.5**	**41.8**	**-10%**	**80.9**	**55.5**	**-31%**

**Note that the 2017 columns refer to the CPA completed in 2017 for the period of 2018 through 2037. The 2019 assessment is for the years 2020 through 2039.*

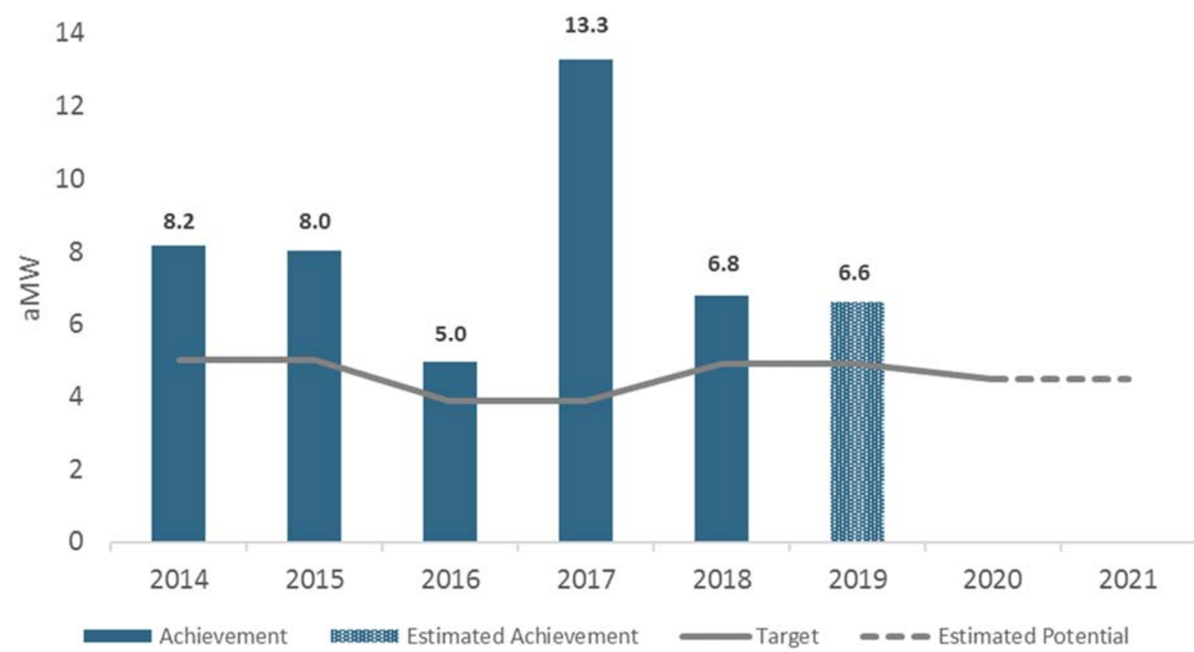
The differences between the 2017 and 2019 results are substantial and are driven by a variety of changes to measure assumptions and economic inputs. The two key changes include:

- The above-mentioned federal lighting standard impacts many residential lighting measures, which were not included after 2020. In the 2017 study, residential lighting measures accounted for nearly 25 aMW of cost-effective potential over the 20-year study period. Several commercial lighting measures were impacted by this change as well.
- The Council updated its assumptions on the value of deferred capital expenditures for transmission and distribution capacity, with the new values being significantly lower. The extent to which each measure realizes these values depends on its contribution to reducing peak demands, so measures in the residential and commercial sectors, which tend to contribute more to reducing system peaks, were more impacted. Savings in the industrial sector tend to be more evenly distributed across time, so the changes in assumptions had less of an impact to the industrial sector.

Targets and Achievement

Figure ES-3 below compares CPU's historic achievement with its targets. The estimated potential for 2020 and 2021 is based on the Base Case scenario presented in this report and represents approximately a 28% decrease over the 2018-19 biennium. A decrease was expected given the likely changes to residential lighting programs, but the target is realistic as these savings were not considered when aligning potential with recent program history. The figure shows that CPU has consistently met its energy efficiency targets, and that the potential estimates presented in this report are achievable through CPU's utility conservation programs and the utility's share of NEEA savings. ES-3 shows projected achievement for 2019.

Figure ES-3
Comparison of Conservation Targets to Achievements



Conclusion

This report summarizes the CPA conducted for Clark Public Utilities for the 2020 to 2039 planning period. Based on the results of the Base Case scenario, the total 10-year cost effective potential is 41.83 aMW and the 2-year potential is 8.97 aMW. The results of this assessment are lower than the previous assessment, largely due to the exclusion of many residential lighting measures after 2020 as well as the change in the valuation of transmission and distribution capacity costs.

Introduction

Objectives

The objective of this report is to describe the results of the Clark Public Utilities' (CPU) 2019 Conservation Potential Assessment (CPA). This assessment provides estimates of energy savings by sector for the period 2020 to 2039, with the primary focus on the initial 10 years, 2020 to 2029. This analysis has been conducted in a manner consistent with requirements set forth in 19.285 RCW (EIA) and 194-37 WAC (EIA implementation) and is part of CPU's compliance documentation. The results and guidance presented in this report will also assist CPU in strategic planning for its conservation programs in the near future. Finally, the resulting conservation supply curves can be used in CPU's integrated resource plan (IRP).

The conservation measures used in this analysis are based on the measures included in the Council's Seventh Power Plan and were updated with subsequent changes and new measures approved by the Regional Technical Forum (RTF). The assessment considered a wide range of conservation resources that are reliable, available, and cost-effective within the 20-year planning period.

Electric Utility Resource Plan Requirements

CPU provides electricity service to more than 203,000 customers located in Clark County, Washington. CPU's service territory covers 628 square miles and includes 6,600 miles of transmission and distribution lines. CPU serves its loads with a variety of resources, including demand side resources.

According to Chapter 19.280 RCW, utilities with at least 25,000 customers are required to develop integrated resource plans (IRPs) by September 2008 and biennially thereafter. The legislation mandates that these resource plans include assessments of commercially available conservation and energy efficiency measures. This CPA is designed to assist in meeting these requirements for conservation analyses. The results of this CPA may be used in the next IRP due to the state by September 2020. More background information is provided below.

Energy Independence Act

Chapter 19.285 RCW, the Energy Independence Act (EIA), requires that, "each qualifying utility pursue all available conservation that is cost-effective, reliable, and feasible." The timeline for requirements of the Energy Independence Act are detailed below:

- By January 1, 2010 – Identify achievable cost-effective conservation potential through 2019 using methodologies consistent with the Pacific Northwest Power and Conservation Council's (Council) latest power planning document. At least every two years thereafter, the qualifying utility shall review and update this assessment for the subsequent ten-year period.

- Beginning January 2010, each utility shall establish a biennial acquisition target for cost-effective conservation that is no lower than the utility's pro rata share for the two-year period of the cost-effective conservation potential for the subsequent ten years.
- By June 2012, each utility shall submit an annual conservation report to the department (the Department of Commerce or its successor). The report shall document the utility's progress in meeting the targets established in RCW 19.285.040.
- Beginning on January 1, 2014, cost-effective conservation achieved by a qualifying utility in excess of its biennial acquisition target may be used to help meet the immediately subsequent two biennial acquisition targets, such that no more than twenty percent of any biennial target may be met with excess conservation savings.

This report summarizes the preliminary results of a comprehensive CPA conducted following the requirements of the EIA. A checklist of how this analysis meets EIA requirements is included in Appendix III.

Other Legislative Considerations

Washington state recently enacted several laws that impact conservation planning. Washington HB 1444 enacts efficiency standards for a variety of appliances, some of which are included as measures in this CPA. This law takes effect on July 28, 2019 and applies to products manufactured after January 1, 2021. As the law applies to the manufacturing date, products not meeting the efficiency levels set forth in the law could continue to be sold in 2021 and a reasonable time of six months or more may be necessary for product inventories to turn over. As such, the standards contained in this law will be addressed in the 2021 CPA.

Washington also recently enacted a clean energy law, SB 5116. The bill contains two provisions that would impact potential assessments: the use of a specific set of values for the social cost of carbon and the requirement that all sales should be greenhouse gas free beginning in 2030. This bill was in development but was not finalized until after the much of the analysis of this CPA was substantially completed. The specific provisions of the bill have therefore not been incorporated, but the analysis does consider similar values for the social cost of carbon and a more stringent renewable portfolio standard in scenarios discussed later in the report. EES also completed some preliminary modelling to provide some early guidance to CPU on the approximate impacts of this law and found that including the law's provisions would increase the long-term potential by approximately 20%, mostly in the residential sector.

Study Uncertainties

The savings estimates presented in this study are subject to the uncertainties associated with the input data. This study utilized the best available data at the time of its development; however, the results of future studies will change as the planning environment evolves. Specific areas of uncertainty include the following:

- Customer characteristic data – Residential and commercial building data and appliance saturations are in many cases based on regional studies and surveys. There are uncertainties related to the extent that CPU's service area is similar to that of the region, or that the regional survey data represent the population.
- Measure Data – In particular, savings and cost estimates (when comparing to current market conditions), as prepared by the Council and RTF, will vary across the region. In some cases, measure applicability or other attributes have been estimated by the Council or the RTF based on professional judgment or limited market research.
- Market Price Forecasts – Market prices (and forecasts) are continually changing. The market price forecasts for electricity and natural gas utilized in this analysis represent a snapshot in time. Given a different snapshot in time, the results of the analysis would vary. However, alternate scenarios are included in the analysis to identify the sensitivity of the results to variation in market prices and other avoided cost inputs over the study period.
- Utility System Assumptions – Credits have been included in this analysis to account for the avoided costs of transmission and distribution system expansion. Though potential transmission and distribution system cost savings are dependent on local conditions, the Council considers these credits to be representative estimates of these avoided costs. A value for generation capacity was also included but may change as the Northwest market continues to evolve.
- Discount Rate – The Council develops a real discount rate for each Power Plan based on the relative share of the cost of conservation and the cost of capital for the various program sponsors. The Council has estimated these figures using the most current available information. This study reflects the current borrowing market although changes in borrowing rates will likely vary over the study period.
- Forecasted Load and Customer Growth – The CPA bases the 20-year potential estimates on forecasted loads and customer growth. Each of these forecasts includes a level of uncertainty.
- Load Shape Data – The Council provides conservation load shapes for evaluating the value of time-differentiated energy savings. In practice, load shapes will vary by utility based on weather, customer types, and other factors. This assessment uses the hourly load shapes used in the Seventh Plan to estimate peak demand savings over the planning period, based on shaped energy savings. Since the load shapes are a mix of older Northwest and California data, peak demand savings presented in this report may vary from actual peak demand savings.
- Frozen Efficiency – Consistent with the Council's methodology, the measure baseline efficiency levels and end-using devices do not change over the planning period. In addition, it is assumed that once an energy efficiency measure is installed, it will remain in place over the remainder of the study period.

Due to these uncertainties and the changing environment, under the EIA, qualifying utilities must update their CPAs at least every two years to reflect the best available information.

Report Organization

The main report is organized with the following main sections:

- Methodology – CPA methodology along with some of the overarching assumptions
- Recent Conservation Achievement – CPU's recent achievements and current energy efficiency programs
- Customer Characteristics – Housing and commercial building data for updating the baseline conditions
- Results – Energy Savings and Costs – Primary base case results
- Scenario Results – Results of all scenarios
- Savings Shape and Demand Savings Results – Base Case potential results by month and by sector
- Summary
- References & Appendices

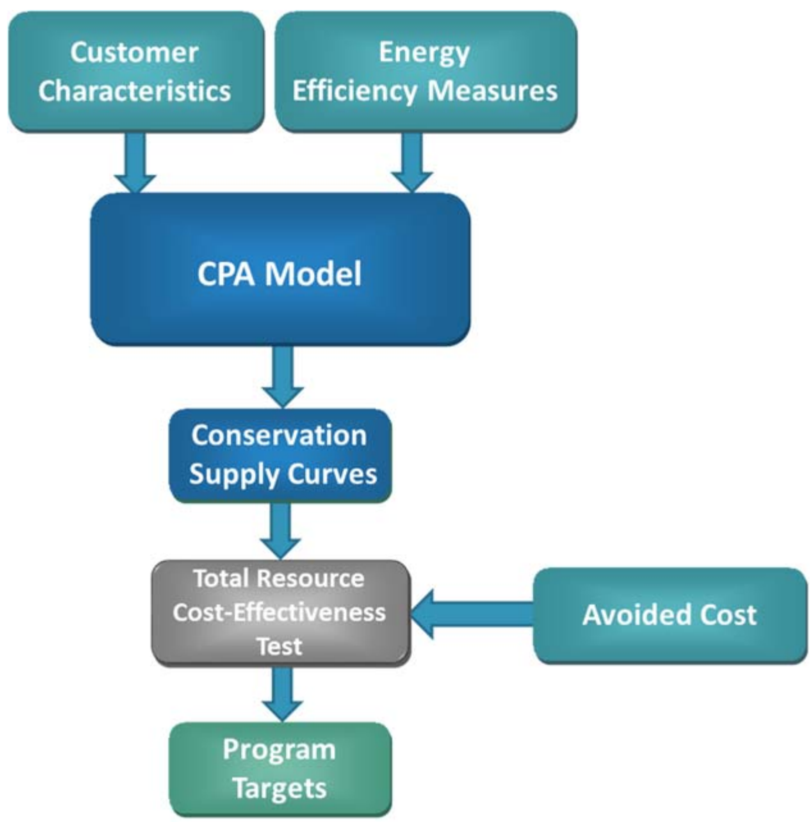
CPA Methodology

This study is a comprehensive assessment of the energy efficiency potential in CPU's service area. The methodology complies with RCW 19.285.040 and WAC 194-37-070 Section 5 parts (a) through (d) and is consistent with the methodology used by the Northwest Power and Conservation Council (Council) in developing the Seventh Power Plan. This section provides a broad overview of the methodology used to develop CPU's conservation potential target. Specific assumptions and details of methodology as it pertains to compliance with the EIA compliance are provided in Appendix III of this report.

Basic Modeling Methodology

The basic methodology used for this assessment is illustrated in Figure 1. A key factor is the kilowatt hours saved annually from the installation of an individual energy efficiency measure. The savings from each measure is multiplied by the total number of measures that could be installed over the life of the program. Savings from each individual measure are then aggregated to produce the total potential.

Figure 1
Conservation Potential Assessment Process



Customer Characteristic Data

Assessment of customer characteristics includes estimating both the number of locations where a measure could feasibly be installed, as well as the share—or saturation—of measures that have already been installed. For this analysis, the characterization of the District's service territory was determined using data from the Northwest Energy Efficiency Alliance (NEEA) commercial and residential building stock assessments. Details of data sources and assumptions are discussed for each sector later in the report.

This assessment also sourced baseline measure saturation data from the Council's Seventh Plan measure workbooks. The Council's data was developed from NEEA's Building Stock Assessments, studies, market research and other sources. This data was updated with NEEA's 2016 Residential Building Stock Assessment and CPU's historic conservation achievement data, where applicable. CPU's historic achievement is discussed in detail in the next section.

Energy Efficiency Measure Data

The characterization of efficiency measures includes measure savings, costs, and lifetime. Other features, such as measure load shape, operation and maintenance costs, and non-energy benefits are also important for measure definition. The Council's Seventh Power Plan is the primary source for conservation measure data. Where appropriate, the Council's Seventh Plan supply curve workbooks have been updated to include any subsequent updates from the RTF. New measures reviewed by the RTF were also added to the model.

The measure data include adjustments from raw savings data for several factors. The effects of space-heating interaction, for example, are included for all lighting and appliance measures, where appropriate. For example, if an electrically-heated house is retrofitted with efficient lighting, the heat that was originally provided by the inefficient lighting will have to be made up by the electric heating system. These interaction factors are included in measure savings data to produce net energy savings.

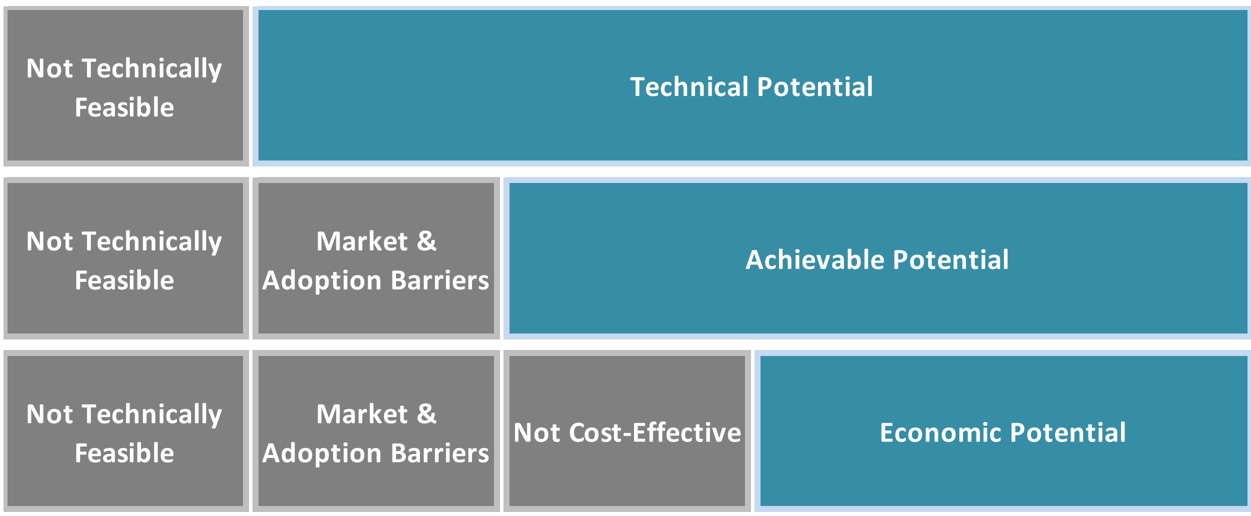
Other financial-related data needed for defining measure costs and benefits include: discount rate, line losses, and deferred capacity-expansion benefits.

A list of measures by end-use is included in this CPA in Appendix VI.

Types of Potential

Once the customer characteristics and energy efficiency measures are fully described, energy efficiency potential can be quantified. Three types of potential are used in this study: technical, achievable, and economic or cost-effective potential. Technical potential is the theoretical maximum efficiency available in the service territory if cost and market barriers are not considered. Market barriers and other consumer acceptance constraints reduce the total potential savings of an energy efficient measure. When these factors are applied, the remaining potential is called the achievable potential. Economic potential is a subset of the achievable potential that has been screened for cost effectiveness through a benefit-cost test. Figure 2 illustrates the four types of potential followed by more detailed explanations.

Figure 2
Types of Energy Efficiency Potential[1]



Technical – Technical potential is the amount of energy efficiency potential that is available, regardless of cost or other technological or market constraints, such as customer willingness to adopt a given measure. It represents the theoretical maximum amount of energy efficiency that is possible in a utility's service territory absent these constraints.

Estimating the technical potential begins with determining a value for the energy efficiency measure savings. Additionally, the number of applicable units must be estimated. Applicable units are the units across a service territory where the measure could feasibly be installed. This includes accounting for units that may have already been installed. The value is highly dependent on the measure and the housing stock. For example, a heat pump measure may only be applicable to single family homes with electric space heating equipment. A saturation factor accounts for measures that have already been completed.

In addition, technical potential considers the interaction and stacking effects of measures. For example, interaction occurs when a home installs energy efficient lighting and the demands on the heating system rise due to a reduction in heat emitted by the lights. If a home installs both insulation and a high-efficiency heat pump, the total savings of these stacked measures is less than if each measure were installed individually because the demands on the heating system are lower in a well-insulated home. Interaction is addressed by accounting for impacts on other energy uses. Stacked measures within the same end use are often addressed by considering the

[1] Adapted from U.S. Environmental Protection Agency. *Guide to Resource Planning with Energy Efficiency.* Figure 2-1, November 2007.

savings of each measure as if it were installed after other measures that impact the same end use.

The total technical potential is often significantly more than the amount of achievable and economic potential. The difference between technical potential and achievable potential is a result of the number of measures assumed to be affected by market barriers. Economic potential is further limited due to the number of measures in the achievable potential that are not cost-effective.

Achievable Technical – Achievable technical potential, also referred to as achievable potential, is the amount of potential that can be achieved with a given set of market conditions. It takes into account many of the realistic barriers to adopting energy efficiency measures. These barriers include market availability of technology, consumer acceptance, non-measure costs, and the practical limitations of ramping up a program over time. The level of achievable potential can increase or decrease depending on the given incentive level of the measure. The Council assumes that 85% of technical potential can be achieved over the 20-year study period. This is a consequence of a pilot program offered in Hood River, Oregon where home weatherization measures were offered at no cost. The pilot was able to reach over 90% of homes. The Council also uses a variety of ramp rates to estimate the rate of achievement over time. This CPA follows the Council's methodology, including both the achievability and ramp rate assumptions.

Economic – Economic potential is the amount of potential that passes an economic benefit-cost test. In Washington State, EIA requirements stipulate that the total resource cost test (TRC) be used to determine economic potential. The TRC evaluates all costs and benefits of the measure regardless of who pays a cost or receives the benefit. Costs and benefits include the following: capital cost, O&M cost over the life of the measure, disposal costs, program administration costs, environmental benefits, distribution and transmission benefits, energy savings benefits, economic effects, and non-energy savings benefits. Non-energy costs and benefits can be difficult to enumerate, yet non-energy costs are quantified where feasible and realistic. Examples of non-quantifiable benefits might include: added comfort and reduced road noise from better insulation or increased real estate value from new windows. A quantifiable non-energy benefit might include reduced detergent costs or reduced water and sewer charges from energy efficient clothes washers.

For this potential assessment, the Council's ProCost model was used to determine cost effectiveness for each energy efficiency measure. The ProCost model values measure energy savings by time of day using conservation load shapes (by end-use) and segmented energy prices. The version of ProCost used in the 2019 CPA evaluates measure savings on an hourly basis, but ultimately values the energy savings during two segments covering high and low load hour time periods.

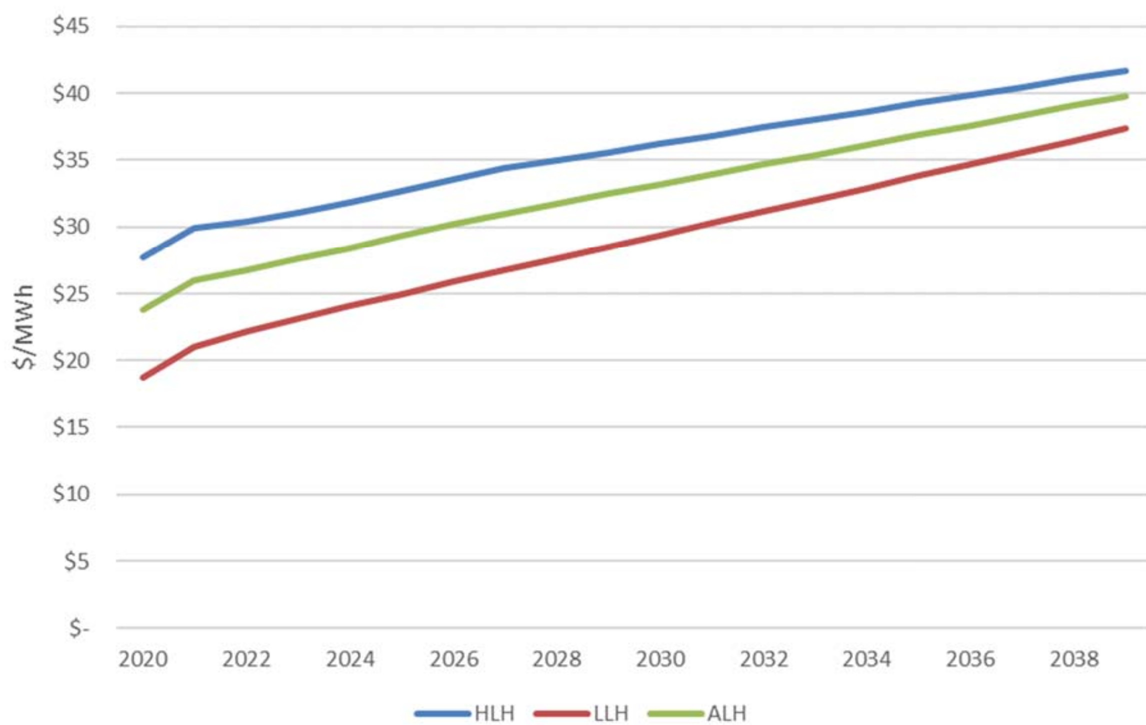
Avoided Cost

Energy

The avoided cost of energy is the cost that is avoided through the acquisition of energy efficiency in lieu of other resources. Avoided costs are used to value energy savings benefits when conducting cost effectiveness tests and are included in the numerator in a benefit-cost test. The avoided costs typically include energy-based values ($/MWh) and values associated with the demand savings ($/kW) provided by energy efficiency. These energy benefits are often based on the cost of a generating resource, a forecast of market prices, or the avoided resource identified in the resource planning process.

The EIA requires that utilities set avoided costs equal to a forecast of market prices. Figure 3 shows the Mid-Columbia market price forecast that was used as the primary avoided cost component for the planning period. The price forecast is shown for heavy load hours (HLH), light load hours (LLH), and average load hours (ALH).

Figure 3
20-Year Market Price Forecast



Social Cost of Carbon and Renewable Portfolio Standards

In addition to the avoided cost of energy, energy efficiency provides the benefit of reducing carbon emissions and lowering CPU's Renewable Portfolio Standard (RPS) requirements. The EIA rules require the inclusion of the social cost of carbon. While Washington's Clean Energy Act requires the use of a specific social cost of carbon, the details of the law were not certain during the development of this CPA. Because of the uncertainty around this value, a range of values was considered. These included a forecast of prices from California's cap and trade system, as well as the federal interagency workgroup values that were considered in the Seventh Plan.

Related to the social cost of carbon is the value of renewable energy credits. Washington's Energy Independence Act established a Renewable Portfolio Standard (RPS) for utilities with 25,000 or more customers. In 2020, CPU is required to source 15% of all electricity sold to retail customers from renewable energy resources or pursue one of several alternate compliance paths. Conservation can reduce the cost of this requirement by reducing CPU's load. Further details are discussed in Appendix IV.

Transmission and Distribution System Benefits

The EIA requires that deferred capacity expansion benefits for transmission and distribution systems be included in the cost-effectiveness analysis. To account for the value of deferred transmission and distribution system expansion, a distribution system credit value of $6.33/kW-year and a transmission system credit of $2.85/kw-year were applied to peak savings from conservation measures, at the time of the regional transmission and local distribution system peaks. These values were developed by Council staff in preparation for the 2021 Power Plan.

Generation Capacity

New to the Seventh Plan was the explicit calculation of a value for avoided generation capacity costs. The Council reasoned that in pursuing energy efficiency, in each year it was deferring the cost of a generation unit to meet the region's capacity needs. Based upon the cost savings of deferring this cost for 30 years, the Council estimated a generation capacity value of $115/kW-year. For CPU, the cost of generation capacity is best represented by call options for capacity that CPU has under contract. Currently, CPU has a call option for capacity for all months except April, May, and June and expects future prices of $2.50/kW-month, rising to approximately $10/kW-month as the region becomes more capacity constrained. These capacity costs were converted from a cost per kW-month to cost per kW-year by assuming an annual shape to the conservation savings and excluding months during which the capacity was not needed. An escalation rate of 5% was also applied, resulting value of $75.70/kW-year for the base case. In the low case, no escalation was assumed, resulting in a value of $44.44/kW-year. Finally, the Council's value of $115/kW-year was used in the high case scenario.

Risk Analysis

In the past, CPU's CPAs have included risk mitigation credits in the scenario analysis to account for risks that were not quantified. Rather than including an explicit risk credit in each of the scenarios, this CPA addresses the uncertainty of the inputs by varying the avoided cost values. The avoided cost components that were varied included the energy prices, generation capacity value, and the social cost of carbon. Through the variance of these components, implied risk credits of up to $28/MWh and $107/kW-year were included in the avoided cost. For reference, the Council has calculated risk credits using stochastic portfolio modeling resulting in risk mitigation credits of up to $55/MWh ($2016) depending on the value of the avoided cost inputs.

Additional information regarding the avoided cost forecast and risk mitigation credit values is included in Appendix IV.

Finally, a 10% benefit was added to these avoided cost components as required by the Pacific Northwest Electric Power Planning and Conservation Act.

Discount and Finance Rate

The Council develops real discount rate assumptions for each of its Power Plans. The Council used a discount rate of 4% in the Seventh Power Plan. This value was used in the 2017 CPA and was used again in the 2019 CPA. The discount rate is used to convert future cost and benefit streams into present values. The present values are then used to compare net benefits across measures that realize costs and benefits at different times and over different useful lives.

In addition, the Council uses a finance rate that is developed from two sets of assumptions. The first set of assumptions describes the relative shares of the cost of conservation distributed to various sponsors. Conservation is funded by the Bonneville Power Administration, utilities, and customers. The second set of assumptions looks at the financing parameters for each of these entities to establish the after-tax average cost of capital for each group. These figures are then weighted, based on each group's assumed share of project cost to arrive at a composite finance rate.

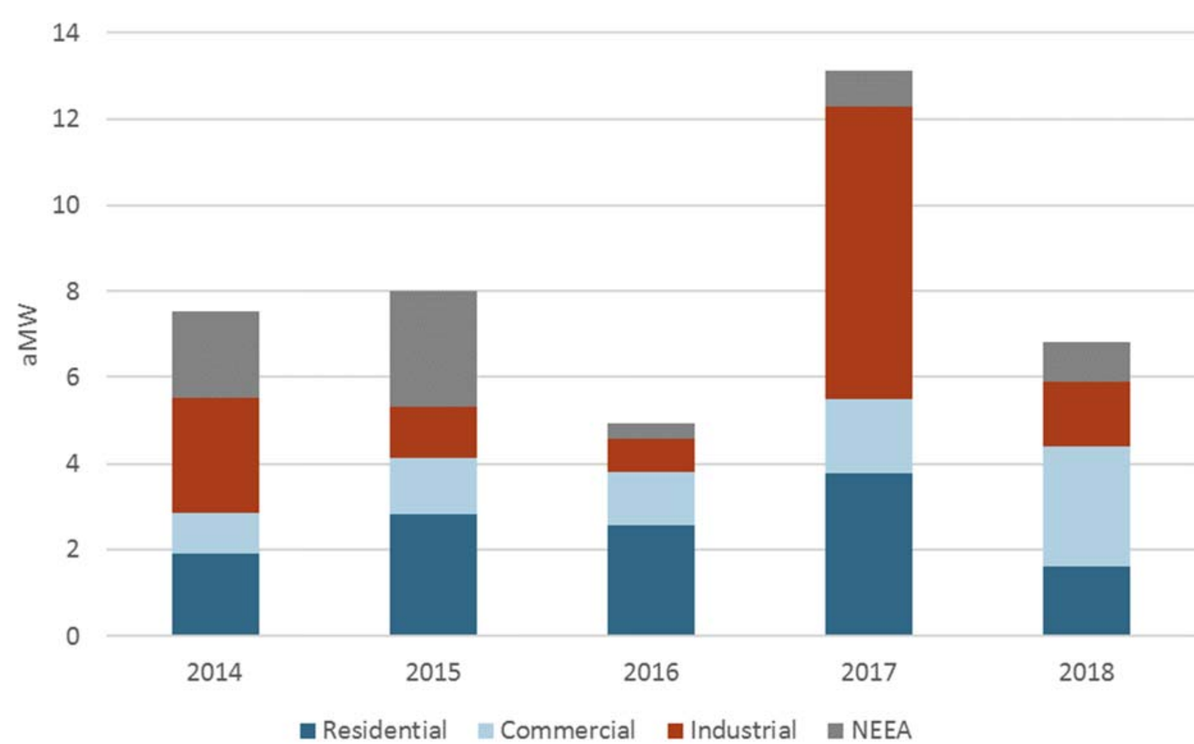
Recent Conservation Achievement

CPU has pursued conservation and energy efficiency resources since 1980. The utility offers several rebate and incentive programs for both residential and non-residential applications. CPU also provides information to customers in the form of energy-use tracking software and professional energy audits to inform customers of the types of energy efficiency applications that may be most suitable for their home or facility.

Figure 4 shows the distribution of conservation among the utility's customer sectors and through Northwest Energy Efficiency Alliance (NEEA) efforts over the past five years. This chart shows a large amount of industrial savings in 2017. More than 5 aMW of these savings came from a single project.

Savings from NEEA decline significantly in 2016. The decline was caused by the adoption of the Seventh Power Plan, which resets the baseline against which NEEA's market transformation savings are claimed. As NEEA's work to transform markets continues and its initiatives continue to build market share of efficient products, the savings will continue to grow, as is apparent below. Even with the decline in savings in 2016, savings from NEEA's initiatives remain very cost effective. Further, NEEA's work helps bring energy efficient emerging technologies, like ductless heat pumps and heat pump water heaters to the Northwest markets.

Figure 4
CPU Recent Conservation History by Sector



Current Conservation Programs

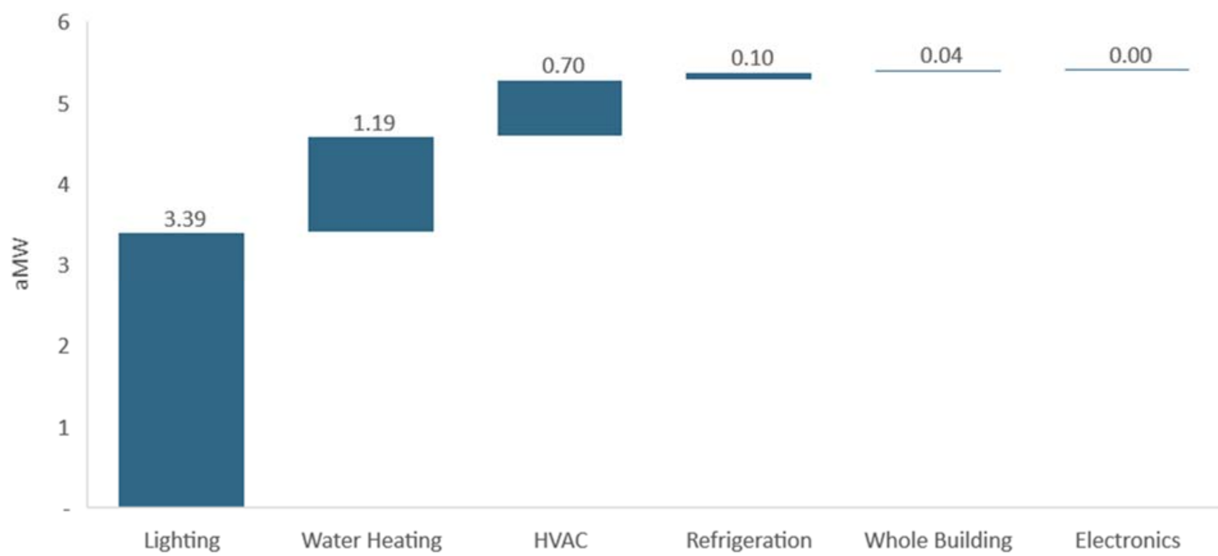
CPU offers a wide range of conservation programs to its customers. These programs include several residential loan programs, rebates, energy audits, and commercial projects. The current programs offered by CPU are detailed below followed by recent achievements for these programs.

Residential

- *Weatherization Loans* – This loan program provides five and seven-year low interest loans (3.5% minimum), up to $15,000 for air sealing, duct sealing, attic insulation, wall insulation, floor insulation and window replacement. Loan processing fees apply.
- *Weatherization Rebates* – Rebates of $0.25/Sqft, $0.20/Sqft, and $0.60/Sqft are available for floor, attic, or wall insulation improvements. Rebates of $2.00-$3.00/Sqft are available for energy efficient window replacements. CPU also offers up to $200 rebates for PTCS duct sealing and 50 % (up to $100) of the cost of air-sealing envelope.
- *Multifamily Weatherization* – CPU offers a range of rebates for weatherization improvements in electrically-heated multifamily housing. The utility currently offers incentives for attic, wall, and floor insulation, as well as improvements to windows and patio doors.
- *Weatherization & DHP Assistance* – Using state and public utility funds, CPU offers low-income weatherization and DHP grants. These programs offer insulation and minor weatherization-related repairs to Clark County families with income up to 125% of the federal poverty level. This program is open to customers with electrically-heated homes.
- *Heat Pump Loans* – The utility offers financing up to $20,000 for installation of air source or ductless heat pumps. Eligible customers include those with electrically heated homes in existing construction.
- *Heat Pump Rebates* – Rebates of up to $1,000 are available for energy efficient air-source heat pumps and up to $1,000 for ductless heat pumps.
- *Heat Pump Water Heater Rebates* – The utility offers $150 for Tier 1 qualifying heat pump water heaters and $300 for Tier 2 or greater qualifying heat pump water heaters.
- *Smart Thermostat Rebates* – The utility offers a $50 rebate for the installation of qualifying smart thermostats. Eligible customers include homes heated with an electric furnace or heat pump.
- *Photovoltaic Systems* – CPU offers financing up to $30,000 for installation of photovoltaic systems.
- *New Homes Performance Program* – Homes which exceed Washington state energy code are eligible for a sliding scale rebate, paid to the builder or rater/verifier company.

Figure 5 summarizes the recent savings achievement for the above utility-managed programs. While lighting has been a key source of savings, these measures were largely excluded from the 2017 CPA. Savings in the water heating and HVAC end uses make up the majority of the remaining achievements. Note that these savings do not include end-use savings from CPU's share of NEEA savings.

Figure 5
Residential Program Achievement by End-Use, 2017 – 2018



Commercial and Industrial

- *Commercial Lighting Improvement Program (CLIP)* – CPU offers rebates to commercial and industrial customers for approved LED lighting projects. A lighting audit is conducted to determine the upgrade opportunities and rebate amounts.
- *Refrigeration incentives* – CPU offers grocery customers, restaurants and other businesses with commercial refrigeration rebates to offset the cost of energy efficient upgrades and retrofit projects.
- *Energy Smart Industrial* – This program offers technical resources and incentives for industrial facility efficiency improvements. Current incentives may cover up to 50% of project cost for retrofit projects and 70% for new construction projects (capped at varying per kilowatt rates for verified savings).
- *Commercial Building Energy Audits* – Key account managers provide walk-throughs to identify opportunities for energy efficiency. This service is free and provides information to business owners regarding energy efficiency and bill reductions.
- *Green Motor Rewind* – Motors between 15 and 5,000 horsepower can be rewound to improve their efficiency. BPA offers incentives of at least $1 per horsepower for qualifying rewinds.
- *Compressed Air Audits* – CPU offers financial assistance to manufacturing customers to assist with the completion of compressed air audits. Professional energy specialists identify energy

efficiency gains that lead to improved air supply, enhanced maintenance cycles, and noise reductions.

- *Heat Pump Equipment Conversion and Upgrade in Commercial Buildings* – An incentive program is available for qualifying air source heat pump equipment conversions and upgrades in buildings with electric resistance heat and which meet additional program specifications.
- *Small Commercial Ductless Heat Pump (DHP)* – CPU's commercial DHP program offers reimbursement of $750 per ton of installed outdoor capacity for eligible DHP units and installations.
- *Web-Enabled Programmable Thermostats (WEPT)* – CPU offers incentives to help offset the costs of new and existing WEPTs installed in commercial buildings.
- *Energy Management Software* – CPU offers two software packages for energy tracking and analysis in commercial and industrial applications. Both E-Manager and Energy Expert are web-based programs that provide electricity consumption data to indicate areas where the facility may benefit most from energy efficiency improvements. E-Manager provides hourly consumption data and is designed for manufacturing and production facilities where electricity costs are due primarily to equipment load. Energy Expert provides building energy modeling solutions, based on daily energy consumption.
- *Custom Projects* – The custom project program provides incentives to commercial and industrial customers who install energy efficiency measures. The utility currently offers incentives for up to 50 % of project cost for retrofit projects and 70% for new construction projects (capped at varying per kilowatt rates for verified savings).

Figures 6 and 7 summarize the recent savings achievement by end-use for the commercial and industrial sectors, respectively. Lighting is a key source of savings for both sectors. These savings do not include end-use savings from CPU's share of NEEA savings. Note that Figure 7 contains the large industrial project savings discussed above, which was assigned to the HVAC category.

Figure 6
Commercial Program Achievement by End-Use, 2017 – 2018

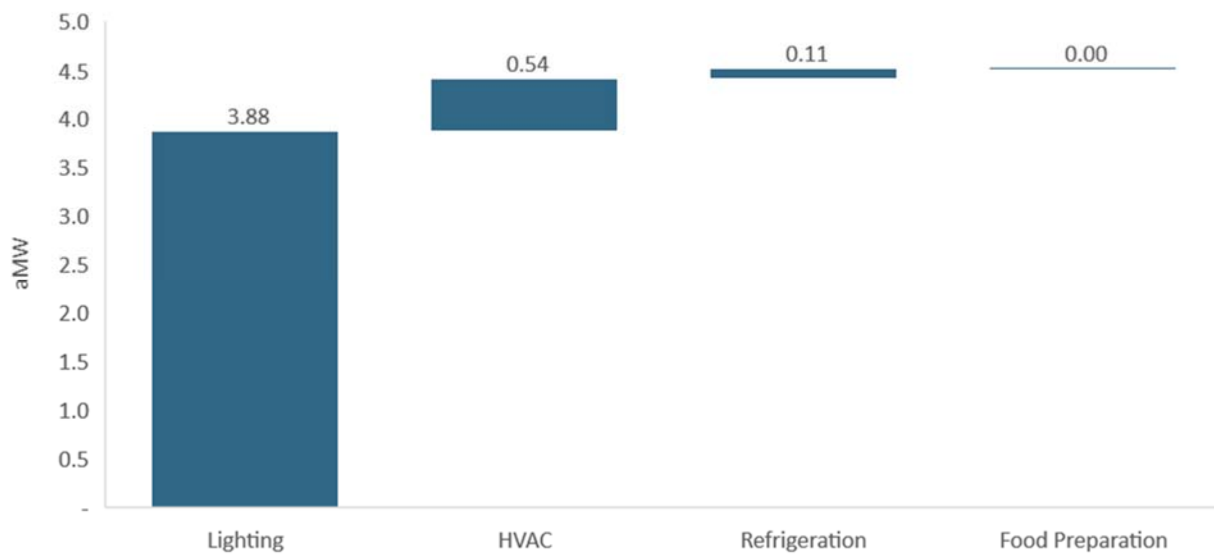
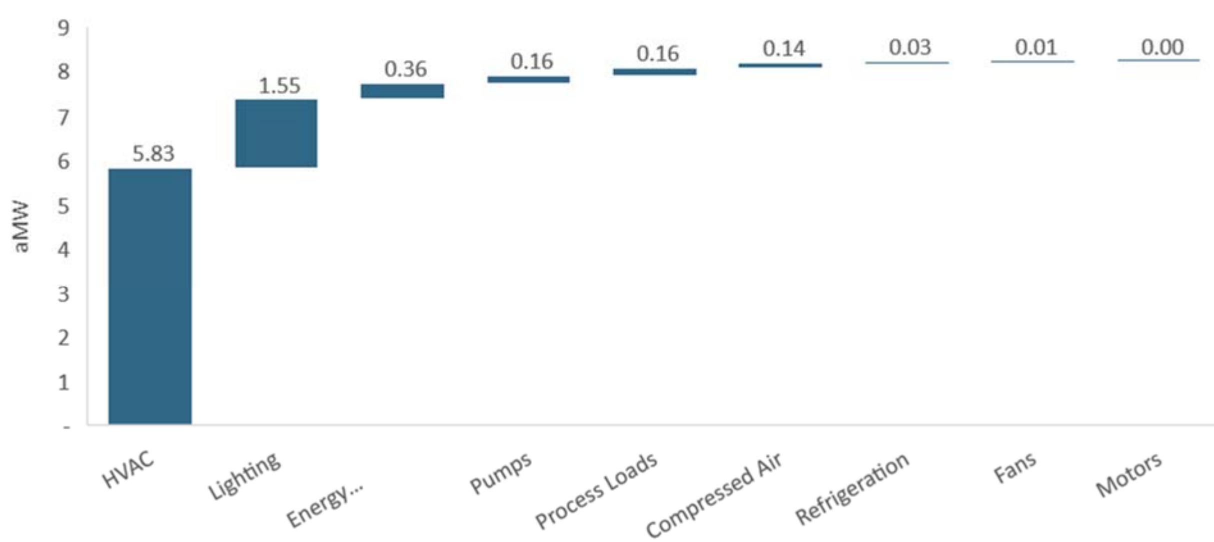


Figure 7
Industrial Program Achievement by End-Use, 2017 – 2018



Summary

CPU plans to continue offering incentives for energy efficiency investments. The results of this study will assist CPU program managers decide in strategic planning for energy efficiency program offerings, incentive levels, and program review.

Customer Characteristics Data

CPU serves approximately 203,000 electricity customers in Clark County, with a total service territory population of approximately 482,000. A key component of a conservation potential assessment is to understand the characteristics of these customers–primarily the building and end-use characteristics. Characteristics for each customer class are described below.

Residential

For the residential sector, the key characteristics include house type distribution, space-heating fuel type, and water heating fuel. Table 1 shows relevant residential data for single family, multi-family and manufactured homes in CPU's service territory. The data is based on the Northwest Energy Efficiency Alliance's (NEEA) 2016 Residential Building Stock Assessment (RBSA) as well as data from the US Census. RBSA data for homes in Clark County were used where access to natural gas may be relevant. For other data points, the RBSA stratum that included homes of BPA customer utilities in western Washington was used. These data provide an estimate of the current residential characteristics in Clark County and are utilized as the baseline in this study.

Table 1
Residential Building Characteristics

Heating Zone	Cooling Zone	Solar Zone	Residential Households	Total Population
1	1	2	178,733	482,499

	Single Family	Multifamily Low Rise	Multifamily High Rise	Manufactured
Existing Homes Heating / Cooling System Saturations				
Electric Forced Air Furnace (FAF)	3%	0%	0%	55%
Heat Pump (HP)	19%	5%	5%	26%
Ductless HP (DHP)	10%	0%	0%	6%
Electric Zonal (Baseboard)	26%	91%	91%	3%
Central AC	31%	0%	0%	0%
Room AC	11%	29%	29%	29%
% Electric Heat	59%	96%	96%	90%
New Homes - Heating / Cooling System Saturations				
Electric Forced Air Furnace (FAF)	3%	0%	0%	55%
Heat Pump (HP)	19%	5%	5%	26%
Ductless HP (DHP)	10%	0%	0%	6%
Electric Zonal (Baseboard)	26%	91%	91%	3%
Central AC	31%	0%	0%	0%
Room AC	11%	29%	29%	29%
% Electric Heat	59%	96%	96%	90%

Table 1 (continued) Residential Building Characteristics					
Heating Zone	Cooling Zone	Solar Zone	Residential Households	Total Population	
1	1	2	178,733	482,499	

	Single Family	Multifamily Low Rise	Multifamily High Rise	Manufactured
Existing Homes - Appliance Saturation				
Electric WH	58%	95%	95%	90%
Refrigerator	137%	104%	104%	126%
Freezer	44%	5%	5%	39%
Clothes Washer	97%	35%	35%	94%
Clothes Dryer	90%	29%	29%	94%
Dishwasher	87%	60%	60%	77%
Electric Oven	95%	98%	98%	100%
Desktop	68%	27%	27%	65%
Laptop	67%	29%	29%	29%
Monitor	81%	31%	31%	65%
New Homes - Appliance Saturations				
Electric WH	58%	95%	95%	90%
Refrigerator	137%	104%	104%	126%
Freezer	44%	5%	5%	39%
Clothes Washer	97%	35%	35%	94%
Clothes Dryer	90%	29%	29%	94%
Dishwasher	87%	60%	60%	77%
Electric Oven	95%	98%	98%	100%
Desktop	68%	27%	27%	65%
Laptop	67%	29%	29%	29%
Monitor	81%	31%	31%	65%

Commercial

Building floor area is the key parameter in determining conservation potential for the commercial sector, as many of the measures are based on savings as a function of building area. CPU provided 2018 commercial square footage and energy consumption (kWh) for each of the 18 building types shown in Table 2. The 2018 commercial sector square footage totaled 70.1 million square feet, a decrease of approximately 11 million square feet from the 2017 CPA.

Regional energy use intensity values (EUI) are often used to derive commercial sector square footage by segment if only energy consumption data is available. To establish square-footage using EUIs, annual kWh consumption by segment is divided by regional EUI data to produce square foot data. These figures are then benchmarked and adjusted to county building database figures. Since CPU provided square footage and energy consumption data, the EUI values shown in Table 2 were calculated based on the utility-provided data. Regional EUI values were used to benchmark building square footage for this assessment.

A 0.3% growth rate was assumed for the commercial sector. Demolition rates are based on Council assumptions, which vary by segment but average 0.4% annually.

Table 2
Commercial Building Data by Segment

Floor Space Type	2018 Commercial Load (MWh)	2018 Commercial Square Feet	2018 CPU EUI kWh/sq ft
Large Office Space	83,759	5,367,724	16
Medium Office Space	81,190	4,023,992	20
Small Office Space	112,969	8,034,781	14
Extra Large Retail Space	78,707	5,647,537	14
Large Retail Space	21,215	1,628,132	13
Medium Retail Space	39,266	2,734,671	14
Small Retail Space	49,080	3,521,689	14
School (K-12) Space	98,853	11,001,568	9
University Space	16,393	969,436	17
Warehouse Space	11,100	1,514,804	7
Supermarket Space	63,330	1,185,310	53
Mini Mart Space	26,523	327,765	81
Restaurant Space	90,345	1,783,101	51
Lodging Space	86,991	5,965,108	15
Hospital Space	82,400	3,005,107	27
Residential Care Space	5,099	342,732	15
Assembly Space	91,331	8,710,038	10
Other Commercial Space	54,533	4,369,991	12
Total	**1,093,084**	**70,133,487**	**16**

Industrial

The methodology for estimating industrial potential is different than approaches used for the residential and commercial sectors primarily because industrial energy efficiency opportunities are based on the distribution of electricity use among processes at industrial facilities. Industrial potential for this assessment was estimated based on the Council's top-down methodology that utilizes annual consumption by industrial segment and then disaggregates total electricity usage by process shares to create an end-use profile for each segment. Estimated measure savings are applied to each sector's process shares.

CPU provided energy consumption for each of the 20 industrial segments shown in Table 3. The 2018 industrial load totaled 926,059 MWh. This load is approximately 9 percent higher than the industrial load used in the 2017 CPA. Industrial sector consumption and growth rates by segment are shown in Table 3.

Table 3 Industrial Sector Load by Segment		
Industry	**Utility 2018 Industrial Load (MWh)**	**Base Case Growth Rate**
Paper	12,265	4%
Foundries	2,885	1%
Frozen Food	4,190	1%
Other Food	81,544	1%
Lumber	8,745	1%
Panel	1,049	1%
Wood	12,139	1%
Electric Fabrication	480,374	-10%
Silicon	2,873	1%
Metal Fabrication	51,594	1%
Equipment	9,734	1%
Cold Storage	25	-4%
Refinery	1,040	1%
Chemical	143,416	1%
Miscellaneous Manufacturing	106,709	1%
Indoor Agriculture	7,478	0.77%
Total	**926,059**	**-4.67%**

The indoor agriculture segment was added to CPU's 2015 CPA and included in subsequent CPAs. This segment is not part of the Council's standard industrial subsectors included in the Power Plan, so end-use electricity profiles were created based on industry research and other Council analyses. Specifically, the Council has conducted surveys of marijuana grow operations to begin modeling energy usage at these facilities.[2] The Council's research indicates that electricity use in marijuana grow operations is distributed as shown in Figure 8.

[2] Northwest Power and Conservation Council. *Impact of Cannabis Production in the Pacific Northwest on Regional Electricity Loads.* September 9, 2014. Available online: http://www.nwcouncil.org/media/7130334/p7.pdf

Figure 8
Indoor Agriculture Electricity End-Use Distribution

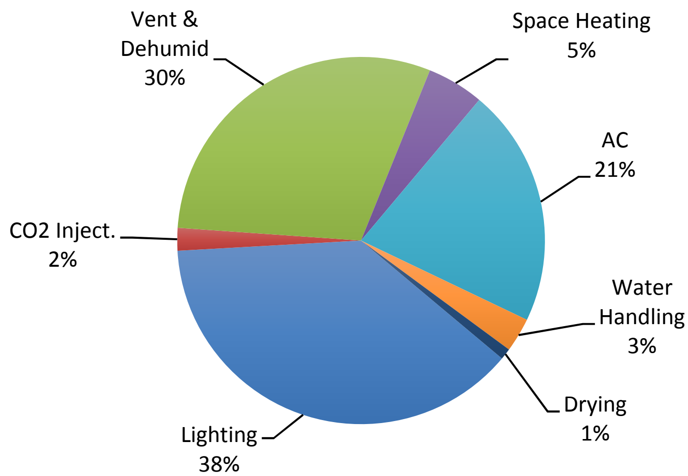


Table 4 shows the resulting end-use profile for indoor agriculture operations. Slow adoption is expected since this is a new area for energy efficiency applications; and anecdotal evidence from the region suggest indoor agriculture business owners can be difficult to reach and may be reluctant to adopt some of the measures at the risk of production volume or quality. At the same time, there is great interest in technology and what is considered baseline equipment may change quickly. Since non-medical marijuana grow operations are illegal at the federal level, CPU is not permitted to use BPA funds to pay for energy efficiency incentives for indoor agriculture customers.

Table 4
Process Shares – Indoor Agriculture Segment

Pumps	3%
Drying and Curing	1%
HVAC	51%
Lighting	38%
Other Process	7%
All Electric	100%
All Motors	44%

CPU provided load data based upon the 2018 calendar year. The 2017 assessment projected 5% annual load growth in the indoor agriculture segment for the first five years (2018-2022), and no growth for the remainder of the planning period. The 2019 CPA assumed that growth would continue from 2020-2022, which results in an effective growth rate of 0.77% over the 20-year study period.

Savings estimates were updated based upon Seventh Plan data. Total estimated conservation potential for indoor agriculture facilities is 510 MWh over the study period. This translates to 6% savings from baseline consumption for the indoor agriculture segment.

Distribution Efficiency

For this analysis, EES developed an estimate of distribution system conservation potential using the Council's Seventh Plan approach. The Seventh Plan estimates distribution potential for five measures as a fraction of end system sales ranging from 0.1 to 3.9 kWh per MWh, depending on the measure.

CPU provided a total system load for 2018. The forecast was then adjusted to account for transmission system losses only, since the savings happen at the distribution level. Distribution system potential is discussed in detail in the next section.

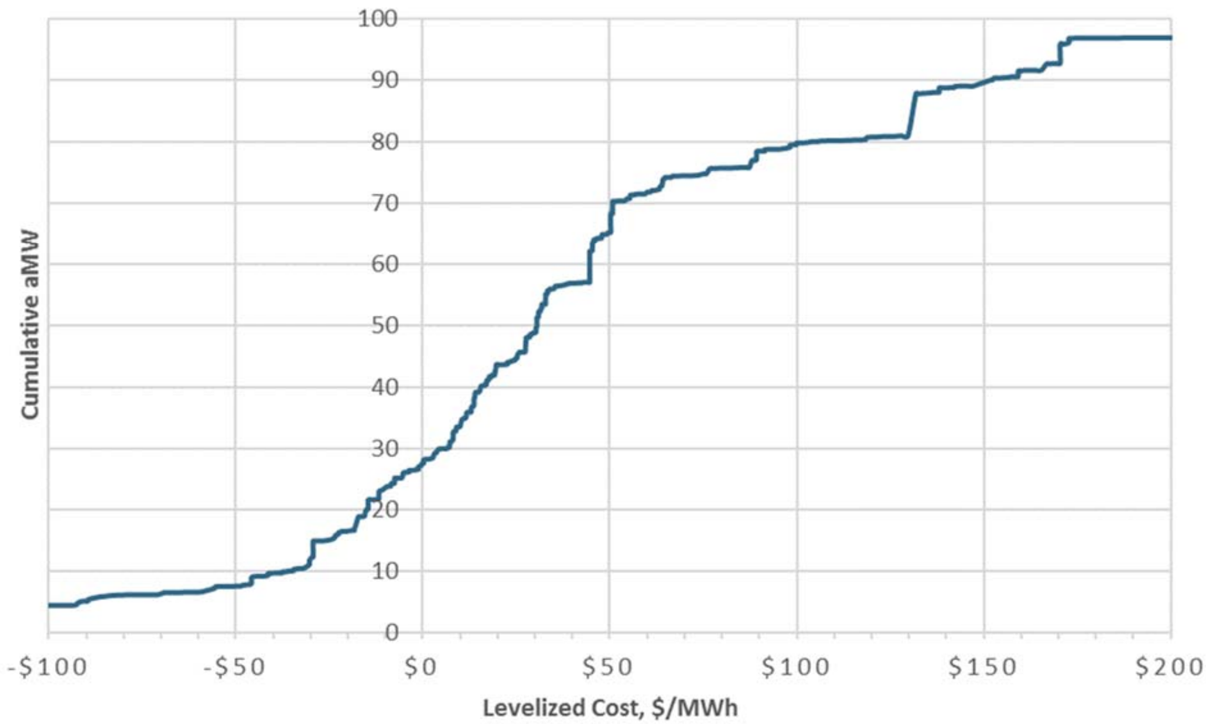
Results – Energy Savings and Costs

Achievable Conservation Potential

Achievable potential is the amount of energy efficiency potential that is available regardless of cost. It represents the theoretical maximum amount of achievable energy efficiency savings, without regard for cost.

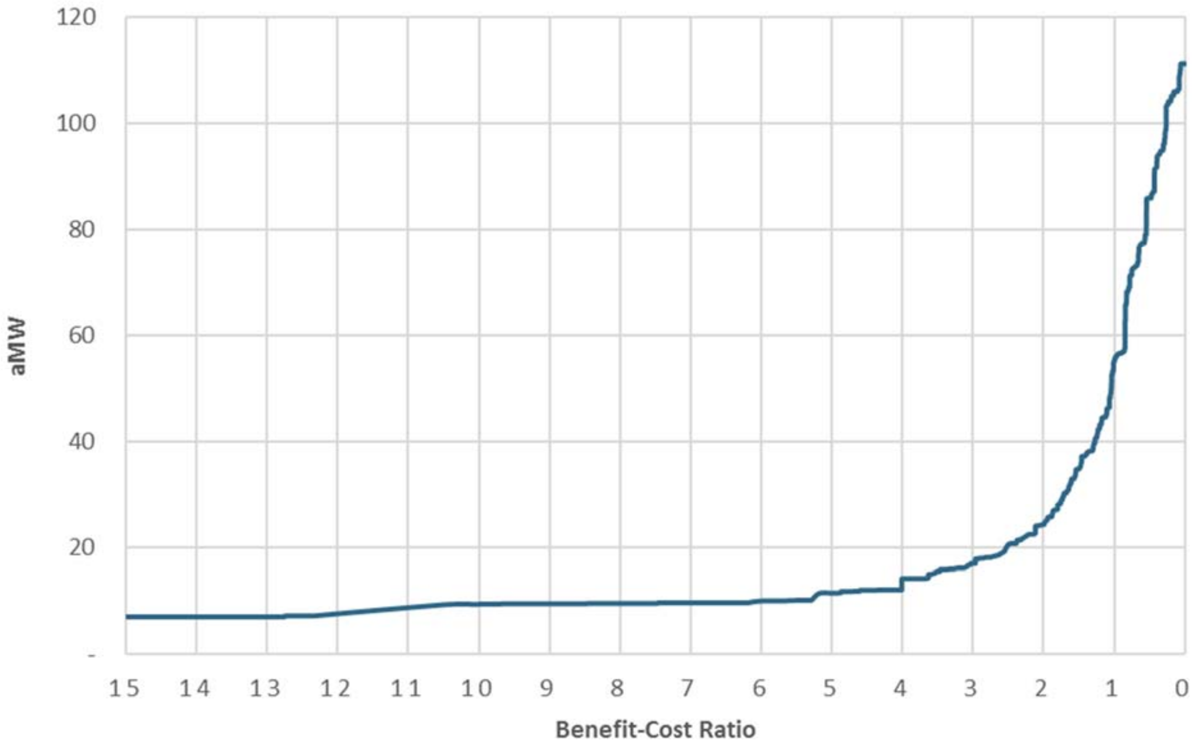
Figure 9, below, shows a supply curve of 20-year, achievable technical potential. The supply curve is developed by plotting cumulative energy efficiency savings potential (aMW) against the levelized cost ($/MWh) of the savings, when measures are sorted in order of ascending cost. The potential shown in Figure 8 has not been screened for cost effectiveness. Costs are levelized, allowing for the comparison of measures with different lifetimes. The supply curve facilitates comparison of demand-side resources to supply-side resources and is often used in conjunction with integrated resource plans. Figure 9 shows that approximately 48 aMW of potential is available for less than $30/MWh and approximately 75 aMW is available for under $80/MWh. Total achievable technical potential for CPU is approximately 111 aMW over the 20-year study period, not all of which is shown in the figure below.

Figure 9
20-Year Achievable Potential Levelized Cost Supply Curve



While useful for considering the costs of conservation measures, supply curves based on levelized cost are limited in that not all energy savings are equally valued. Another way to depict a supply curve is based on the benefit-cost ratio, as shown in Figure 10 below. This figure repeats the overall finding that approximately 55 aMW of potential is cost-effective with a benefit-cost ratio greater than or equal to 1.0. Immediately to the right of that line, the potential rises steeply, suggesting significant increases in potential if avoided cost parameters are increased.

Figure 10
20-Year Achievable Potential Benefit-Cost Ratio Supply Curve



Economic Achievable Conservation Potential

Economic achievable, also referred to as economic potential or cost-effective potential is the amount of potential that passes the Total Resource Cost (TRC) test. This means that the present value of the benefits exceeds the present value of the measure costs over its lifetime.

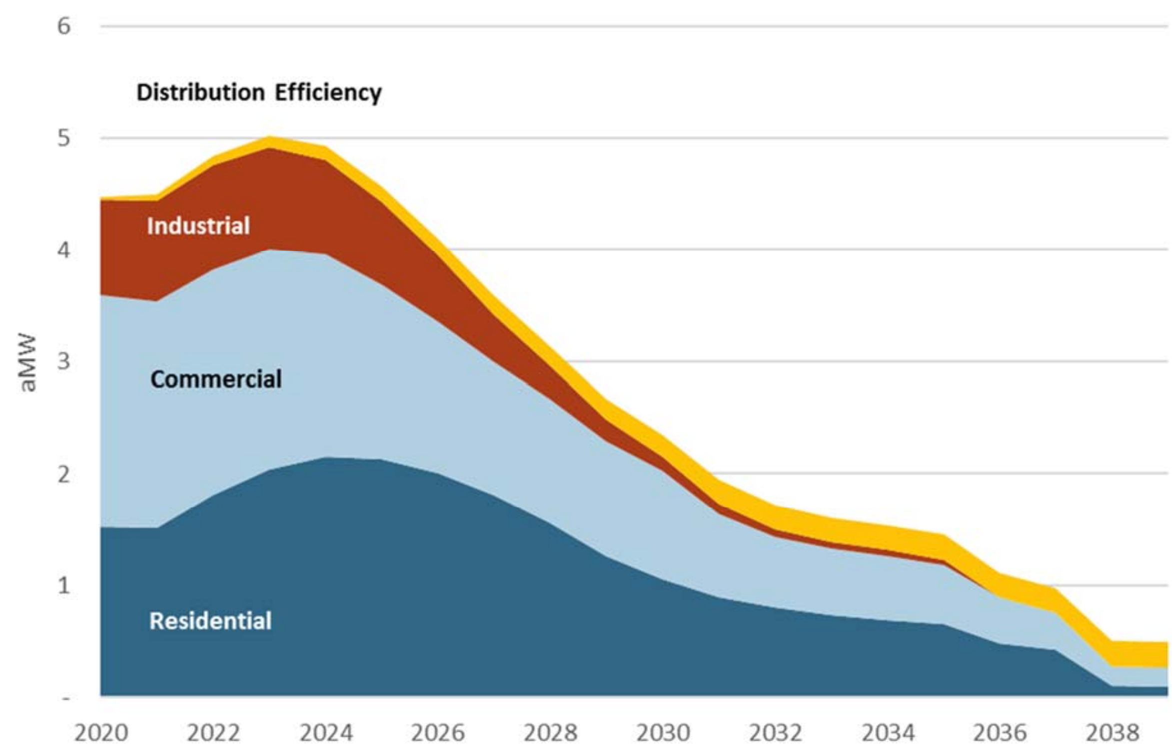
Table 5 shows aMW of economically achievable potential by sector in 2, 6, 10 and 20-year increments. Annual potential estimates by sector are included in Appendix VII. Compared with the technical and achievable potential, it shows that 38.4 aMW of the total 110 aMW is cost effective for CPU. The last section of this report discusses how these values could be used for setting targets.

Table 5 Cost-Effective Achievable Potential (aMW)				
	2-Year	6-Year	10-Year	20-Year
Residential	3.04	11.18	17.81	23.75
Commercial	4.08	11.42	16.10	21.22
Industrial	1.77	5.22	6.71	7.15
Distribution Efficiency	0.09	0.52	1.21	3.41
Total	**8.97**	**28.33**	**41.83**	**55.53**

Sector Summary

Figure 11 shows the cost-effective achievable potential by sector on an annual basis.

Figure 11
Annual Cost-Effective Achievable Potential by Sector



At the beginning of the study period, nearly half of the potential is in the commercial sector, followed by the residential and industrial sectors. Ramp rates from the Seventh Power Plan were used to establish reasonable annual conservation achievement levels. Adjustments to these ramp rates were made to reflect the timeline of this CPA. Additionally, alternate ramp rates were assigned to reflect CPU's current rate of program achievement. These changes were generally to accelerate the acquisition of potential. Achievement levels are affected by factors including timing and availability of measure installation (lost opportunity), program (technological) maturity, non-programmatic savings, and current utility staffing and funding. Ramp rates are further discussed in Appendix V.

Table 6 below shows how recent program history compares to the near-term program potential. Residential savings exclude lighting savings, as these measures were largely excluded from the program potential. Savings from NEEA have been allocated to the appropriate sectors. In addition, a very large industrial project is included the 2017 total, but not counted in the industrial average since it is a one-time project and not likely repeatable.

Table 6
Comparison of Program Achievement and Potential

	Program History				Potential		
	2017	**2018**	**2019**	**Average**	**2020**	**2021**	**2022**
Residential	4.4	2.4	2.9	3.2	1.5	1.5	1.8
Commercial	1.9	3.0	2.1	2.3	2.1	2.0	2.0
Industrial	6.8	1.5	1.6	1.5	0.9	0.9	0.9
Distribution Efficiency	-	-		-	0.0	0.1	0.1
Total	**13.1**	**6.8**	**6.6**	**7.1**	**4.5**	**4.5**	**4.8**

Residential

Residential conservation potential is lower than what was identified in the 2017 assessment. Savings potential has been impacted by the expected impact of federal lighting standards scheduled to take effect in 2020 as well as changes to the value of capacity savings in the avoided cost.

Figure 12 shows the distribution of annual residential potential across measure end uses for the first ten years of the planning period. As can be seen, the cost-effective potential is largely comprised of measures in the HVAC and water heating end uses. Residential lighting measures are impacted by the EISA standard that takes effect in 2020 in addition to a quickly-evolving market and were not included past 2020. In addition to these end uses, smaller savings are available from the electronics and food preparation end uses.

The HVAC end use includes both heating equipment and weatherization measures such as attic insulation, ductless heat pumps, and Wi-Fi-enabled thermostats.

Water heating is a growing area of potential, with heat pump water heaters providing the majority of cost-effective savings. Showerheads are also a significant contributor, though there are concerns with customer satisfaction. Other measures included in the water heating end use include aerators, behavior programs, clothes washers, and thermostatic shutoff valves.

In Figure 12, the Other category includes savings in the electronics and food preparation end uses.

Some measures such as Wi-Fi enabled thermostats and water heaters can also provide additional benefits as demand response resources. These benefits were not included in this conservation potential assessment.

Figure 12
Annual Residential Potential by End-Use

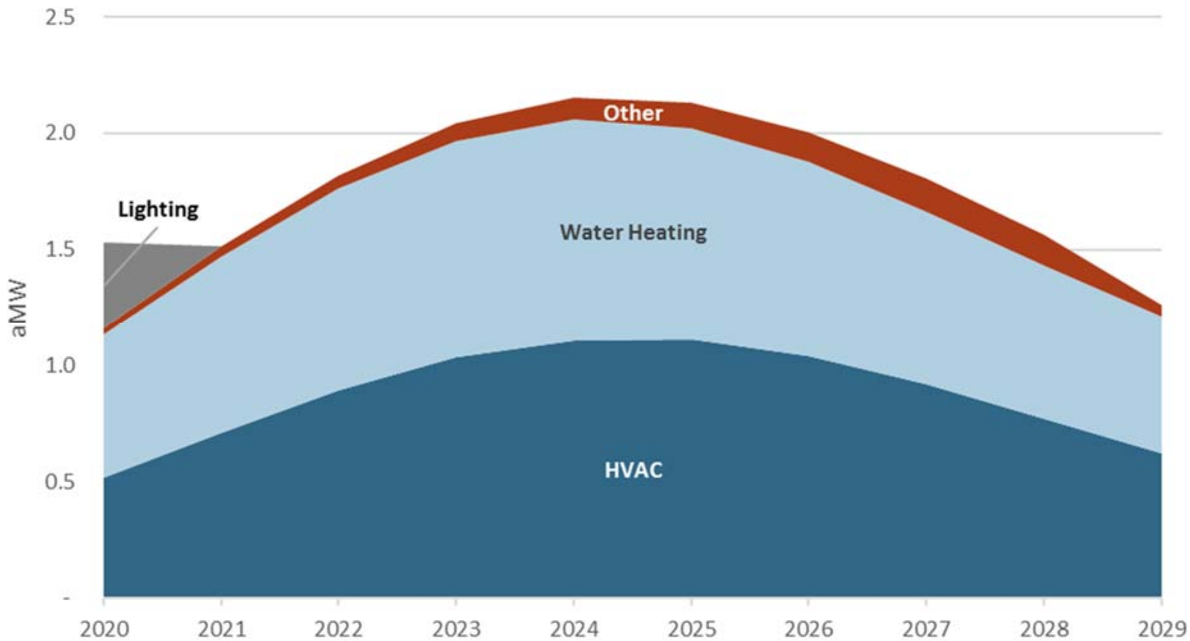
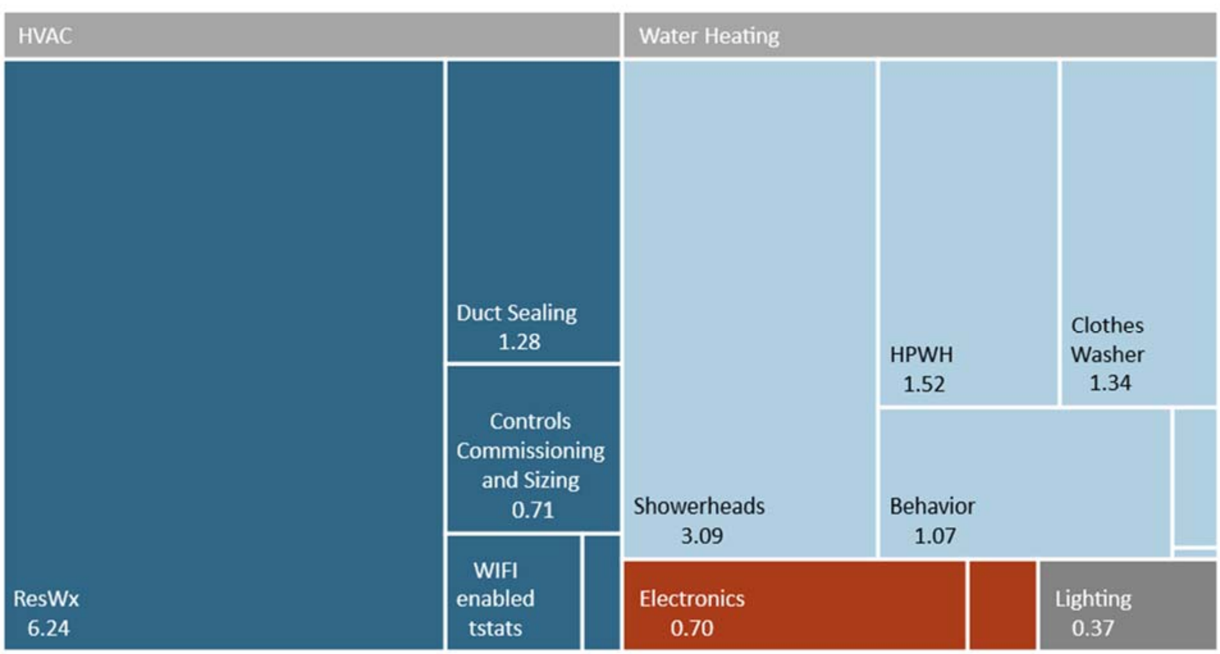


Figure 13 shows how the 10-year residential potential breaks down into end uses and key measure categories. The area of each block represents its share of the total 10-year residential potential.

Figure 13
Residential Potential by End Use and Measure Category (aMW)



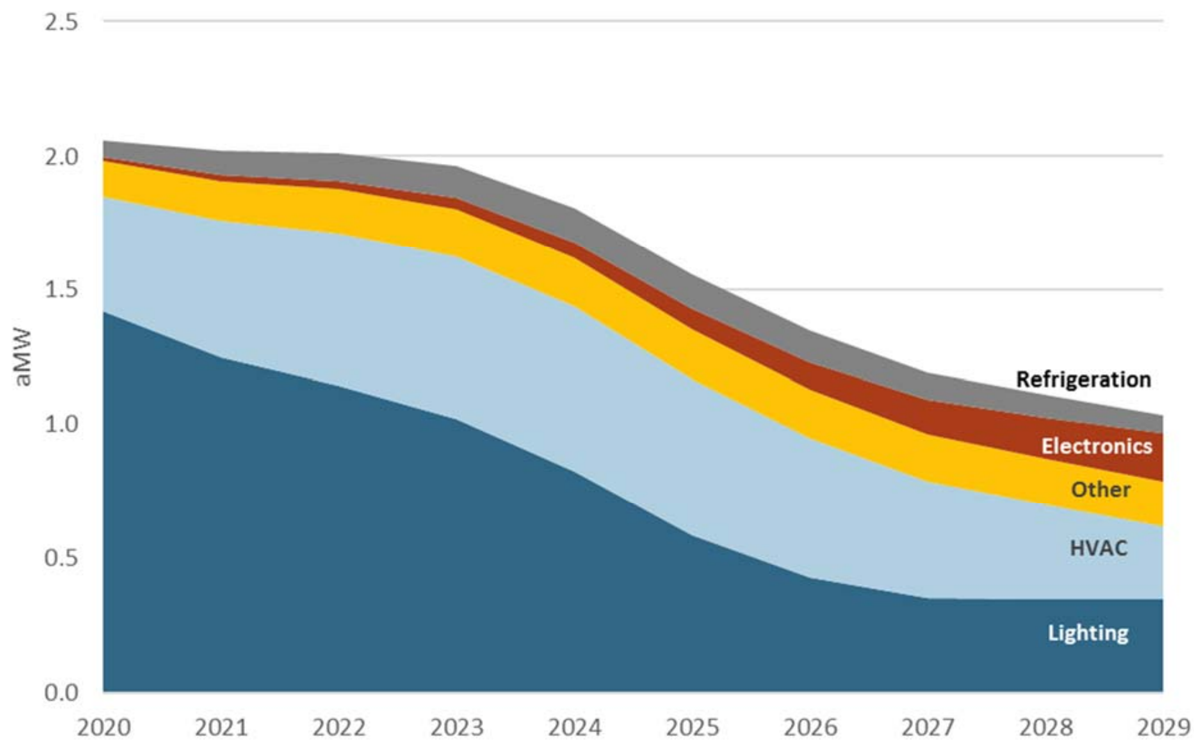
Commercial

Commercial lighting measures remain the largest contributors to commercial conservation potential (Figure 14), though this study does show potential beginning to diminish in the later years of the study as the remaining opportunities diminish. Lighting savings are lower in this assessment after accounting for the federal EISA standard, which impacts several commercial measures. Additionally, the lower value for peak capacity savings reduced the cost-effectiveness of some measures.

HVAC control measures continue to make up a substantial part of the balance of commercial conservation potential for this assessment period, although there is less potential in this category relative to the 2017 CPA. Measures in this category were also impacted by the change in capacity value, as most HVAC measures provide savings during times of peak demand.

Commercial HVAC measures are often more complicated and disruptive to install compared to lighting measures. As a result, adoption of HVAC measures will continue to be at a slower pace than that of lighting measures.

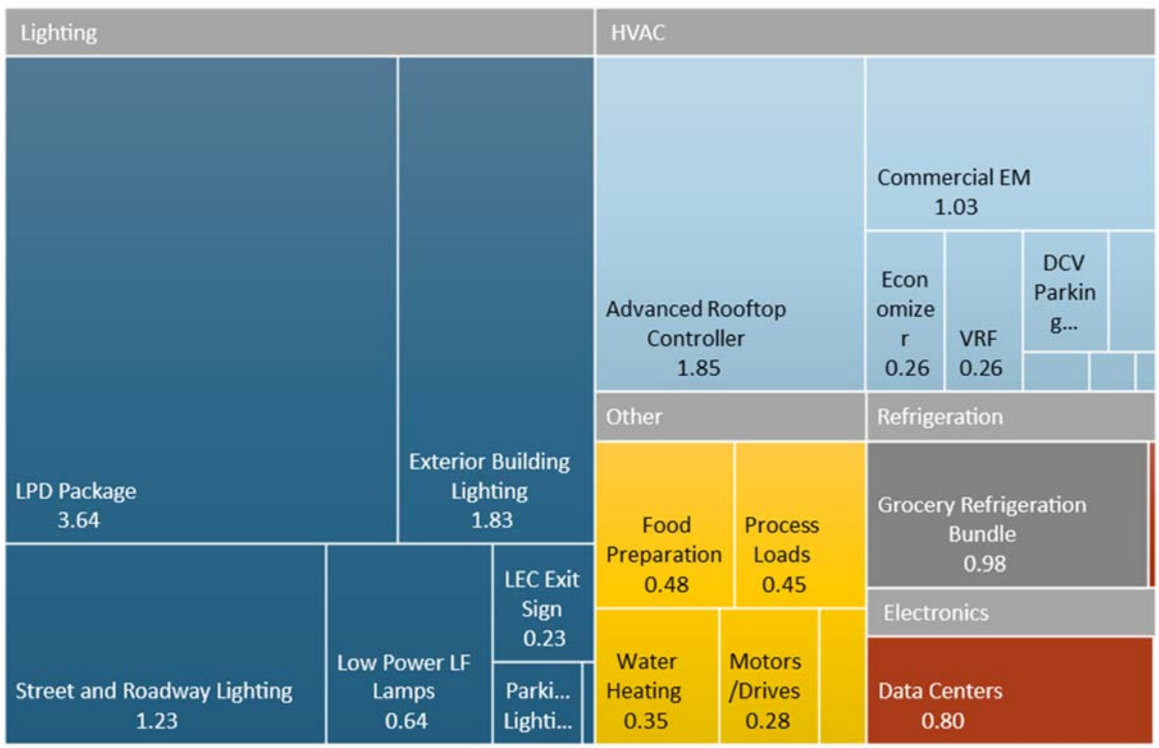
Figure 14
Annual Commercial Potential by End-Use



In Figure 14, the Other category includes measures in the food preparation, water heating, process loads, motors/drives, and compressed air end uses. Unlike residential potential, the commercial potential is characterized by a diverse set of measures and end uses due to the more varied nature of commercial buildings. Detail of the savings by these end uses can be found in Appendix V.

The key end uses and measures within the commercial sector are shown in Figure 15. The area of each block represents its share of the 10-year commercial potential.

Figure 15
Commercial Potential by End Use and Measure Category (aMW)



Industrial

Industrial conservation potential has increased from the 2017 CPA. The increases are due to higher industrial loads compared to what was used in the 2017 CPA as well changes to how the industrial achievements were accounted for.

A significant portion of the industrial sector conservation potential is in Energy Management (Figure 16). This area includes cross-segment Strategic Energy Management programs as well as the management of motor-driven systems such as pumps, fans, and air compressors.

Industrial process loads and lighting measures also account for a notable share of sector savings. Lighting measures are widely applicable across many of the industrial segments. Conservation potential for municipal wastewater treatment plants is included in Figure 16. Savings estimates for these measures are based on equipment upgrades and modifications to operations/processes and facilities. In Figure 16, the Other category includes small amounts of savings in fan and compressed air systems, as well as measures specific to the metals, paper, and wood products industries.

Figure 16
Annual Industrial Potential by End-Use

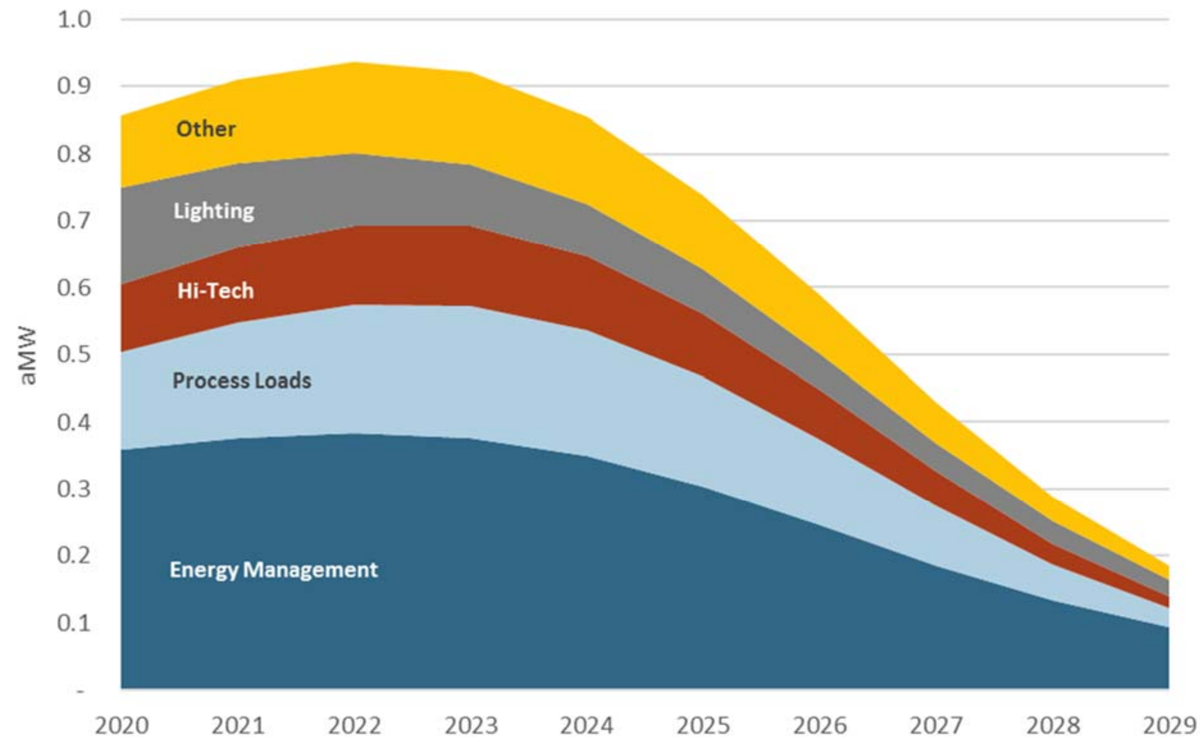
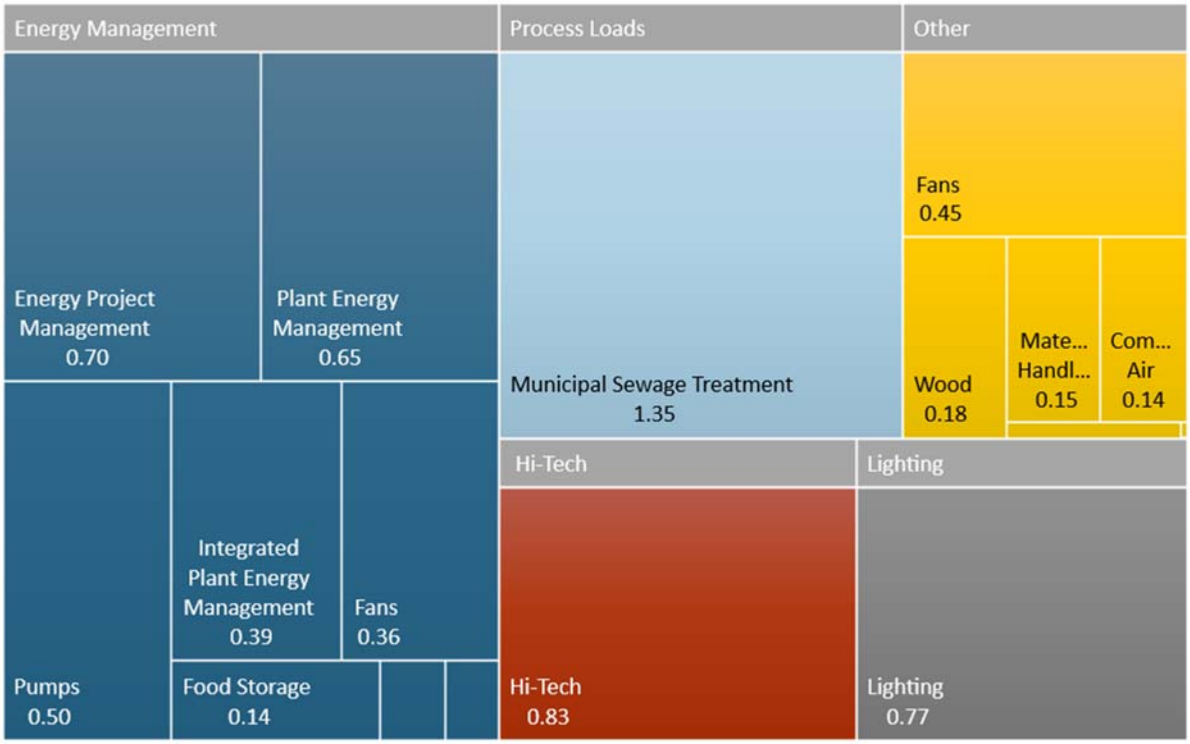


Figure 17 shows how the 10-year industrial potential breaks down by end use and measure categories.

Figure 17
Industrial Potential by End Use and Measure Category (aMW)

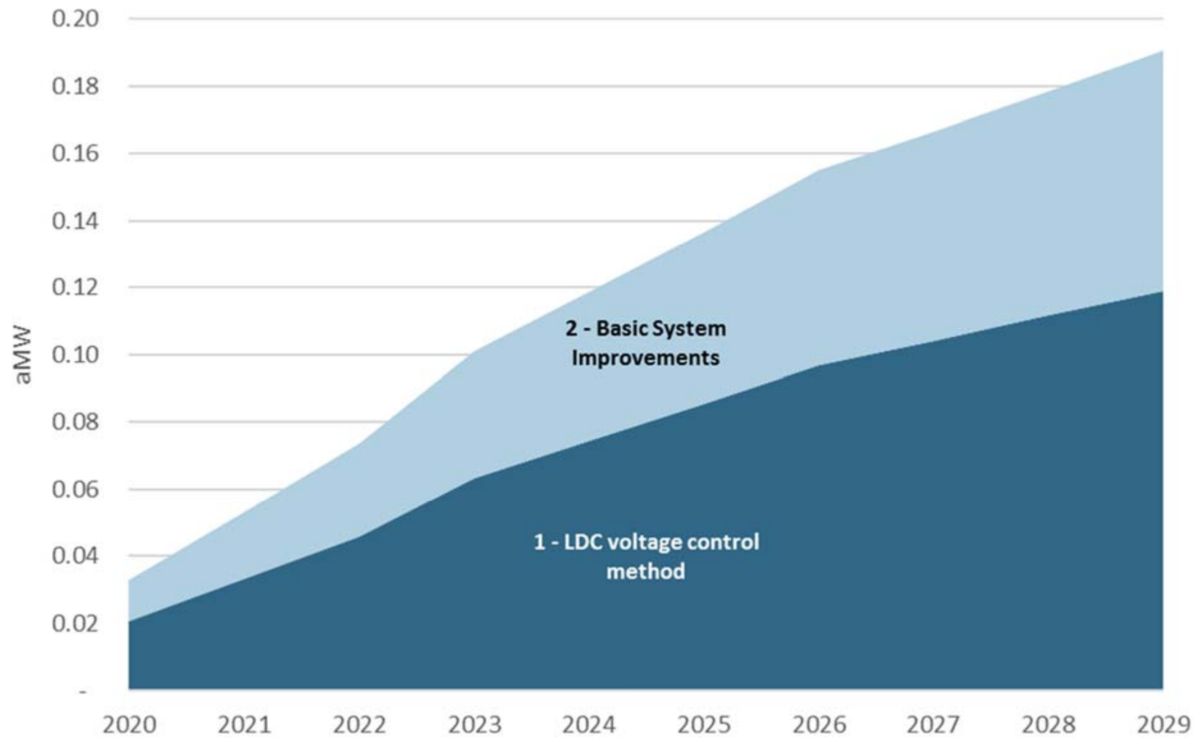


Distribution Efficiency

Distribution system energy efficiency measures regulate voltage and upgrade systems to improve the efficiency of utility distribution systems and reduce line losses. Distribution system potential was estimated using the Council's methodology, which considers five different measures. The Seventh Plan estimates distribution system potential based on end system energy sales.

Distribution system conservation potential is shown in Figure 18. Although five measures were considered in the analysis, only two measures were identified as cost effective. The cost estimates for distribution system potential shown in Table 7, in the next section, are also based on the end-system sales method.

Figure 18
Annual Distribution System Efficiency Potential



Cost

Budget costs can be estimated at a high level based on the incremental cost of the measures (Table 7). The assumptions used to estimate utility costs to acquire the conservation potential presented in this report include: 20% of measure capital cost for administrative expenditures and 35% of the incremental cost for incentives is assumed to be paid by the utility. A 20% allocation of measure costs to administrative expenses is a standard assumption for utility conservation potential assessments. This figure was used in the Council's analysis for the Seventh Power Plan. The 35% incentive cost assumption was not applied to the utility distribution efficiency sector, where incentives are unlikely and the utility is more likely to pay the whole cost of measures. Both the administrative cost allocation and the utility share assumptions are consistent with assumptions used in CPU's 2017 CPA.

This chart shows that CPU can expect to spend approximately $18 million to acquire estimated savings over the next two years. The bottom row of Table 7 shows the cost per MWh of first-year savings.

Table 7 Utility Program Costs (2019$)				
	2-Year	**6-Year**	**10-Year**	**20-Year**
Residential	$8,249,000	$34,775,000	$56,610,000	$69,601,000
Commercial	$7,741,000	$21,974,000	$31,668,000	$43,044,000
Industrial	$2,545,000	$7,658,000	$9,863,000	$10,464,000
Distribution Efficiency	$27,000	$159,000	$372,000	$1,052,000
Total	**$18,562,000**	**$64,566,000**	**$98,513,000**	**$124,161,000**
$/First Year MWh	$236	$260	$269	$255

The cost estimates presented in this report are conservative estimates for future expenditures since they are based on historic values. Future conservation achievement may be more costly than historic conservation achievement since utilities often choose to implement the lowest cost programs first. In addition, as energy efficiency markets become more saturated, it may require more effort from CPU to acquire conservation through its programs. The additional effort may result in increased administrative costs.

Cost Scenarios

To provide a range of program costs over the planning period, EES tested a Low and a High cost scenario relative to the Base Case conservation potential scenario. For the Low scenario, the utility share of measure capital cost is reduced to 30 percent. A situation where the utility is responsible for a lower share of measure capital cost may result from higher conservation achievement through programs for which the customer is responsible for a higher fraction of measure cost. An example of this scenario would be if more conservation were achieved through commercial or industrial custom projects where higher incentives may not be required to gain customer participation. For the High scenario, the utility share of measure costs was increased to 40 percent.

For the High Cost scenario, administrative costs were increased to 30 percent (compared with 20 percent in the Base Case). The High Cost scenario reflects the case where program administration costs may increase for CPU to connect with hard-to-reach customers.

Table 8 shows 2, 6, 10 and 20-year program costs for the Expected (Base Case), High and Low cost scenarios. Table 9 shows the cost per megawatt hour (first year savings) for each of the cost scenarios.

Table 8 Utility Cost Scenarios for Cost-Effective Potential (2019$)				
	2-Year	**6-Year**	**10-Year**	**20-Year**
Expected Case	$18,562,000	$64,566,000	$98,513,000	$124,161,000
Low Cost Case	$16,875,000	$58,696,000	$89,557,000	$112,874,000
High Cost Case	$23,624,000	$82,175,000	$125,380,000	$158,023,000

Table 9 Utility Cost Scenarios for Cost-Effective Potential (2019$/MWh)				
	2-Year	**6-Year**	**10-Year**	**20-Year**
Expected Case	$236	$260	$269	$255
Low Cost Case	$215	$237	$244	$232
High Cost Case	$300	$331	$342	$325

Tables 8 and 9 costs are presented as dollars per first year savings (MWh). These units do not consider the savings over the life of a measure, but they do provide an indication of the program costs per unit of savings that CPU could expect to acquire conservation going forward. Over the next two years, conservation programs are expected to cost between $215 and $342/MWh (first year savings). Overall, CPU can expect the biennium potential estimates presented in this report to cost between $16.9 and $23.6 million for utility incentives and administrative expenditures.

Besides looking at the utility cost, CPU may also wish to consider the total resource cost (TRC) cost of energy efficiency. The total resource cost reflects the cost that the utility and ratepayers will together pay for conservation, similar to how the costs of other power resources are paid. The TRC costs are shown below (Table 10), levelized over the measure life of each measure. Distribution efficiency measures are by far the cheapest resource, with other measures in the neighborhood of three to four cents per kilowatt-hour.

Table 10 TRC Levelized Cost (2019$/kWh)				
	2-Year	**6-Year**	**10-Year**	**20-Year**
Residential	$0.048	$0.052	$0.053	$0.051
Commercial	$0.050	$0.049	$0.049	$0.049
Industrial	$0.041	$0.042	$0.042	$0.042
Distribution Efficiency	$0.007	$0.007	$0.007	$0.007
Total	**$0.046**	**$0.047**	**$0.048**	**$0.046**

Scenarios

The costs and savings discussed throughout the report thus far describe the Base Case avoided cost scenario. Under this scenario, annual potential for the planning period was estimated by applying assumptions that reflect CPU's expected most likely future loads and avoided costs. In addition, the Council's 20-year ramp rates were applied to each measure and then adjusted to accelerate potential to more closely reflect CPU's recent historic conservation achievement.

Additional scenarios were developed to identify a range of possible outcomes that account for uncertainties over the planning period. In addition to the Base Case scenario, this assessment tested Low and High scenarios to test the sensitivity of the results to different future avoided cost values. The avoided cost values in the Low and High scenarios reflect values that are realistic and lower or higher, respectively, than the Base Case assumptions.

To understand the sensitivity of the identified savings potential to avoided cost values alone, all other inputs were held constant while varying avoided cost inputs.

Table 11 summarizes the Base, Low, and High avoided cost input values. Rather than using a single generic risk adder applied to each unit of energy, the Low and High avoided cost values consider lower and higher potential future values for each avoided cost input. These values reflect potential price risks based upon both the energy and capacity value of each measure. The final row tabulates the implied risk adders for the Low and High scenarios by summarizing all additions or subtractions relative to the Base Case values. Risk adders are provided in both energy and demand savings values. The first set of values is the maximum (or minimum in the case of negative values). The second set of risk adder values are the average values in energy terms. Further discussion of these values is provided in Appendix IV.

Table 11 Avoided Cost Assumptions by Scenario, $2012			
	Base	**Low**	**High**
Energy	Market Forecast	-50%-85% Confidence Interval	+50%-85% Confidence Interval
Social Cost of Carbon	California Carbon Market	No Cost	Federal/7th Power Plan Values
Value of REC Compliance	4% Cost Cap	1% Cost Cap	25% RPS
Distribution System Credit, $/kW-year	$6.33	$6.33	$6.33
Transmission System Credit, $/kW-year	$2.85	$2.85	$2.85
Deferred Generation Capacity Credit, $/kW-year	$75.70	$44.44	$115
Implied Risk Adder:	N/A	Up to -$33/MWh -$31/kW-year Average of -$20/MWh -$31/kW-year	Up to $28/MWh $39/kW-year Average of $21/MWh $39/kW-year

**As noted above prediction intervals were used based on the last 10 years of data for high and low estimates.*

Table 12 summarizes results across each avoided input scenario, using Base Case load forecasts and measure acquisition rates.

Table 12 Cost-Effective Potential - Scenario Comparison				
	2-Year	**6-Year**	**10-Year**	**20-Year**
Base Case	9.0	28.3	41.8	55.5
Low Scenario	3.8	11.7	17.5	26.0
High Scenario	12.7	35.9	50.9	72.2

In the table above, the change in cost-effective potential when going from the base to the low case is slightly more than change in potential when going from the base to the high case. This suggests that while there is sensitivity to changes in avoided costs in both directions, the amount of cost-effective potential gained by further increases in avoided costs diminishes.

This result is somewhat evident from the Benefit-Cost Ratio supply curve presented earlier in the report. The supply curve has a steep slope near the threshold of cost-effectiveness, where the BCR equals 1.0, suggesting a sensitivity to any changes in avoided cost parameters, but the steepness begins to decline further to the right.

Accelerated Base Scenario

The Accelerated Base scenario represents a case where CPU very quickly ramps up program savings. In this scenario, a subset of retrofit measures—those measures that are available at any time—were modeled with more aggressive ramp rates, beyond what is presented in the Base Case. The measures chosen were those where it would be possible to quickly ramp up programs. They include:

- Commercial Energy Management
- Commercial Interior Lighting
- Commercial Showerheads
- Industrial Lighting
- Residential Showerheads, Aerators, & Thermostatic Valves
- Residential Weatherization and Wi-Fi Thermostats

Aside from adjusted ramp rates, the assumptions for the Accelerated scenario are identical to the Base Case. The Accelerated Base 2-year potential is approximately 20% higher than the Base Case 2-year potential (Table 13).

Table 13
Cost-Effective Potential - Accelerated Scenario (aMW)

	2-Year	6-Year	10-Year	20-Year
Residential	4.2	12.5	17.8	23.0
Commercial	4.3	11.5	16.1	21.2
Industrial	2.2	5.4	6.8	7.1
Distribution Efficiency	0.1	0.5	1.2	3.4
Total	**10.8**	**29.9**	**41.9**	**54.8**

These savings also bring additional reductions in peak demand. The peak demand savings are summarized in Table 14 below. The accelerated scenario provides an additional 31% in peak demand reductions in the first two years of study period over the base case peak demand savings.

Table 14
Cost-Effective Demand Savings - Accelerated Scenario (MW)

	2-Year	6-Year	10-Year	20-Year
Residential	13.1	39.7	54.4	64.9
Commercial	7.1	19.6	27.1	35.3
Industrial	2.7	6.6	8.2	8.6
Distribution Efficiency	0.1	0.6	1.5	4.2
Total	**23.0**	**66.6**	**91.2**	**113.0**

Table 15 below compares the sector-level achievement of this scenario with recent program achievement. As before, note that 2017 includes a very large industrial project which has been omitted from the averages as it is an anomaly. The table shows that the accelerated case roughly begins near Clark's current level of achievement, although the program history contains high levels of residential lighting while the potential only includes a small amount of lighting in 2020.

Table 15 Comparison of Program Achievement and Accelerated Scenario Potential							
	Program History				Potential		
	2017	2018	2019	Average	2020	2021	2022
Residential	4.4	2.4	2.9	3.2	2.3	2.1	2.2
Commercial	1.9	3.0	2.1	2.3	2.2	2.1	2.0
Industrial	6.8	1.5	1.6	1.5	1.2	1.0	0.9
Distribution Efficiency	-	-	-	-	0.0	0.1	0.1
Total	**13.1**	**6.8**	**6.6**	**7.1**	**5.7**	**5.3**	**5.2**

Scenario Summary

Table 16 compares the Base, High and Low cost cases, and Accelerated scenarios of the 2019 CPA. Table 16 also shows the Base Case potential from CPU's 2017 CPA, which is provided for reference. Potential is compared on a program year basis to provide a better comparison between the 2019 and 2017 potential estimates.

Table 16 Cost-Effective Potential - Scenario Comparison				
	2-Year	6-Year	10-Year	20-Year
2017 Base Case	9.8	28.4	46.5	80.9
2019 Base Case	9.0	28.3	41.8	55.5
Accelerated Base	11.0	30.5	42.7	55.6
Low Scenario	5.4	15.9	23.3	32.8
High Scenario	12.7	35.9	50.9	72.2

In terms of the total 20-year potential, the high case from the 2019 CPA is most similar to the 2017 CPA Base Case. The 2019 high case features somewhat similar avoided costs, especially in terms of the value of capacity, as the 2017 base case. As a result of these higher avoided costs, additional measures are cost-effective. The increase in cost-effective measures in the high case is almost enough to counter the reduction in savings due to the exclusion of lighting measures impacted by the federal standard.

Savings Shape Results

The savings from energy efficiency measures are typically reported on an annual basis. However, savings occur throughout the day and year at different levels. The annual savings for each measure are distributed across the hours of the year, based on the load or savings shape of the measure. The measure load shapes are also used to estimate the economic value of the measure, based on projected time-differentiated savings and the value of the savings at those times. This CPA made use of load shapes developed for the Seventh Plan. They include more granular, hourly detail not present in the load shapes used in previous analyses. The load shapes can be found in the MC and Load Shape file.

Figures 20 and 21 show total monthly energy savings by sector for the 20-year planning period. Figure 20 shows heavy load hour (HLH) savings and Figure 21 shows savings during light load hour (LLH) time periods. Similar to the 2017 CPA, the savings are higher during the winter months due to heating-related measures like weatherization and HVAC equipment, but even lighting and water heating end uses have slightly higher energy use in the winter months due to less sunlight and colder water supplied by municipal water systems, respectively. However, the overall profile is flatter than in the 2017 CPA. This is likely a consequence of the lower values attributed to peak demand savings discussed earlier in the report.

Figure 20
CPU Monthly Energy Efficiency Savings, HLH

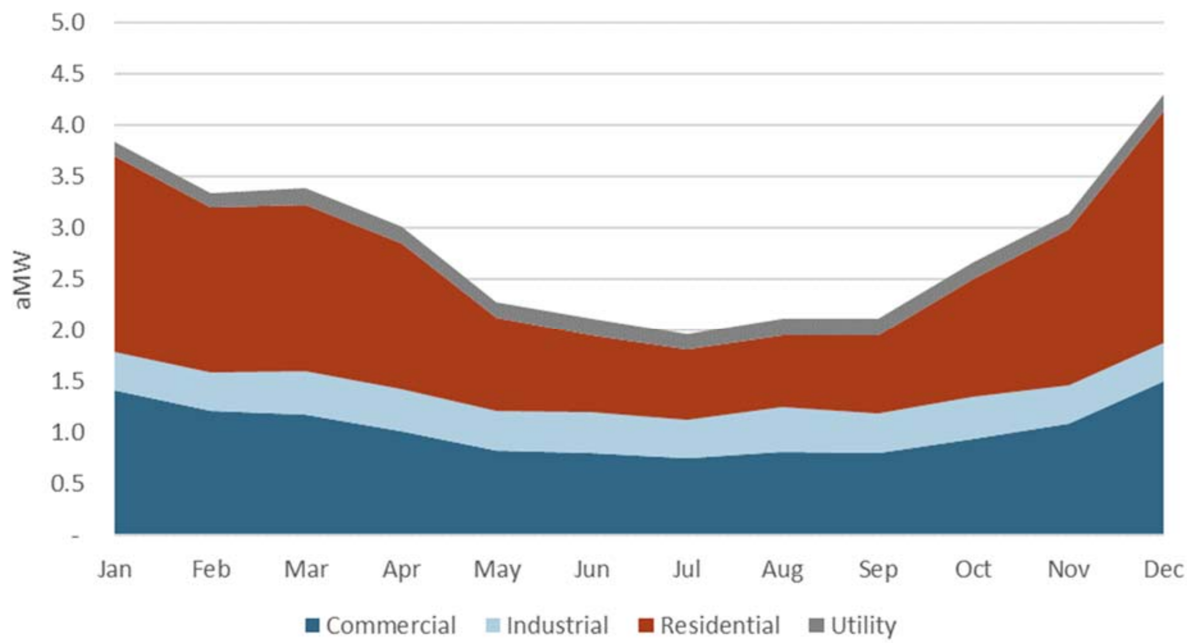


Figure 21
CPU Monthly Energy Efficiency Savings, LLH

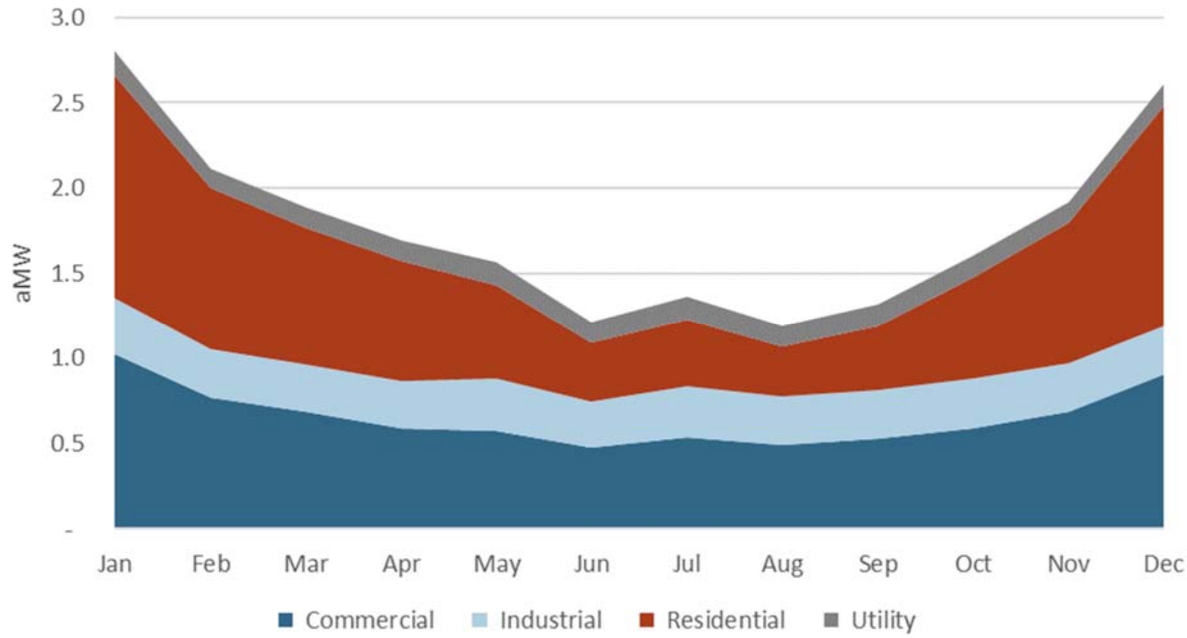
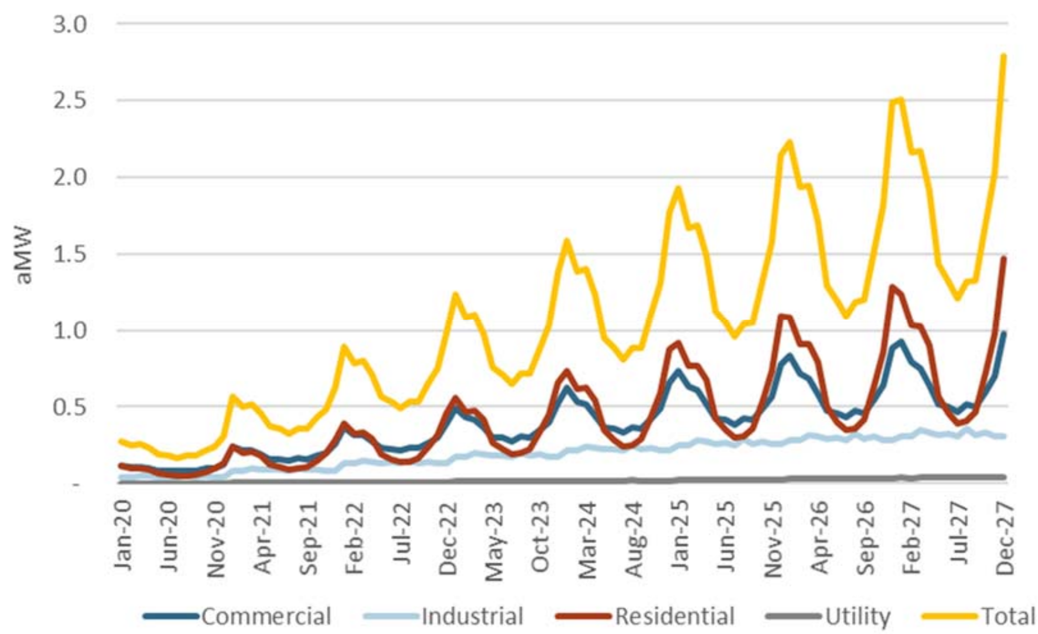


Figure 22 shows the cumulative heavy load hour monthly energy savings over the first eight years of the planning period. The overall shape of the savings is similar to the shape of seasonal utility demand.

Figure 22
CPU Monthly Energy Efficiency Savings, HLH, Cumulative



Peak Demand Savings

To estimate demand savings for this assessment, the hourly load profiles developed for the Seventh Plan were used, in addition to the timing of CPU's distribution system peak for each month. Table 17 below presents the assumed timing of CPU's monthly system peaks. CPU's system peak is most often in the morning during winter and shoulder season months, and in the evening during the summer months.

Table 17
CPU Monthly Peak Occurs at Hour Ending

January	8
February	8
March	8
April	8
May	8
June	18
July	18
August	18
September	18
October	8
November	8
December	8

Figure 23 shows the cumulative peak demand savings by month over the 20-year study period. As with the savings shape above, the peak demand savings are greatest in the winter months. The end uses with the greatest potential peak demand reductions are residential water heating and HVAC. Commercial lighting also contributes to peak demand reductions, though it should be noted that this varies highly with the hours of operation within each business category.

Figure 23
Cumulative Peak Demand Savings by Month

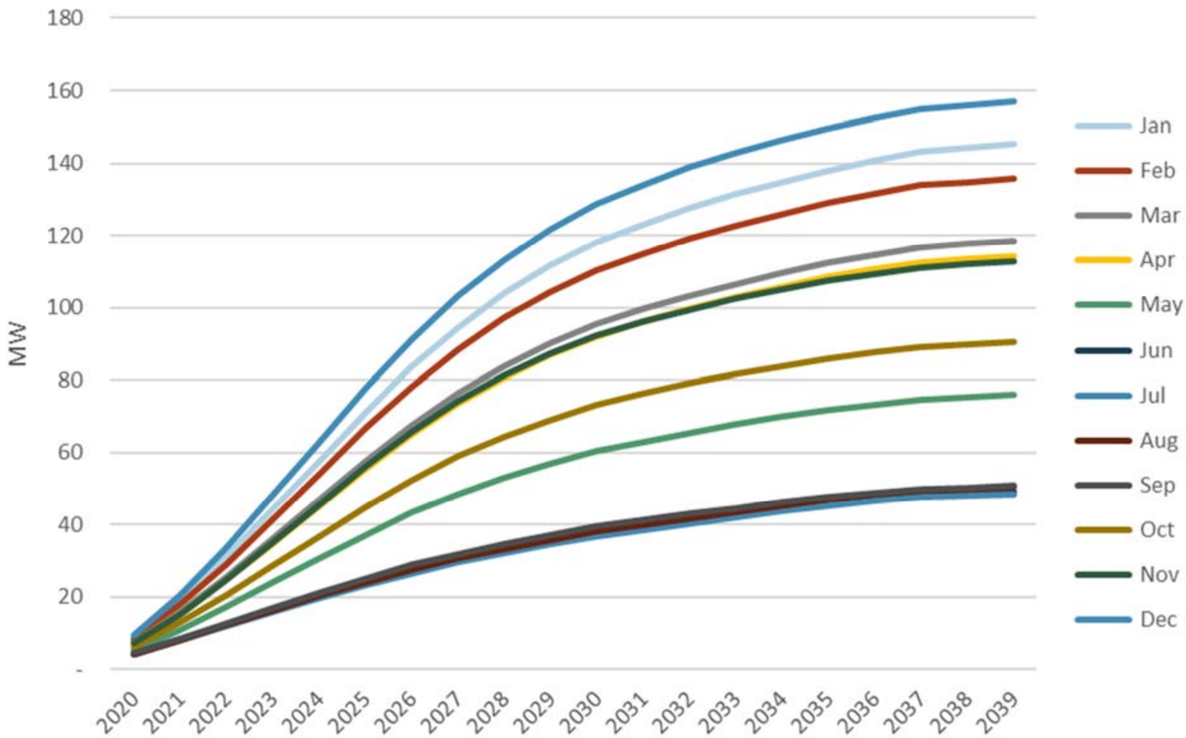


Figure 24 shows cumulative peak demand savings for the 20-year planning period for each month.

Figure 24
Monthly Peak Demand Savings, Cumulative (MW)

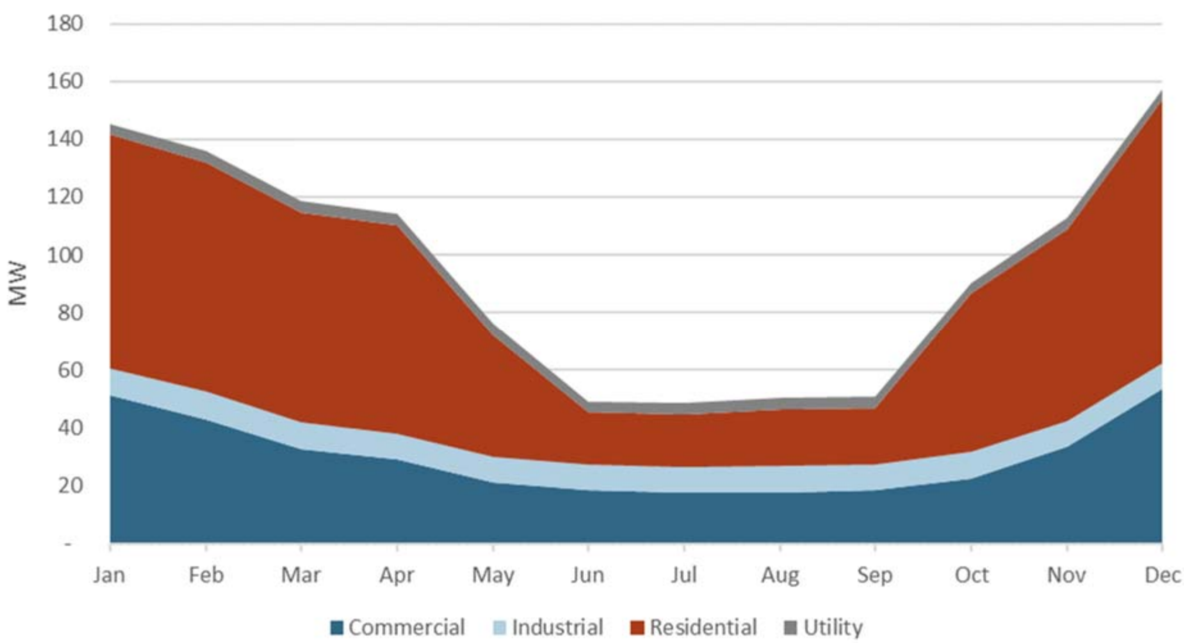


Figure 24 shows that demand savings are highest in December and are lower during the summer months.

Table 18 shows cumulative annual energy savings and peak winter and summer demand savings for the 20-year planning period. Summer and winter peaks were assumed to occur in August and December, respectively, based upon historical data provided by CPU. The costs shown in Table 18 are annual, incremental utility costs (administrative expenditures and incentive costs). The costs were modeled with the Base Case utility program assumptions described above.

Table 18
Cumulative Peak Demand Savings with Associated Energy Savings and Costs

		Energy Savings	Peak Demand Savings (MW)	
Year	Cost	(aMW)	Winter	Summer
2020	$7,514,000	4.48	9	4
2021	$8,334,000	8.97	20	8
2022	$9,285,000	13.81	33	12
2023	$9,976,000	18.84	48	16
2024	$10,125,000	23.77	63	20
2025	$9,632,000	28.33	78	24
2026	$8,796,000	32.43	91	27
2027	$7,792,000	36.02	103	30
2028	$6,698,000	39.16	113	33
2029	$5,570,000	41.83	122	36
2030	$4,637,000	44.18	129	38
2031	$3,722,000	46.13	134	40
2032	$3,088,000	47.85	139	42
2033	$2,680,000	49.45	143	44
2034	$2,417,000	50.99	146	45
2035	$2,175,000	52.44	150	47
2036	$1,579,000	53.55	152	48
2037	$1,307,000	54.53	155	49
2038	$560,000	55.04	156	50
2039	$536,000	55.53	157	50

**Costs may vary slightly from Table 7 above due to rounding.*

The 20-year cumulative peak demand savings estimates for this assessment are 157 MW during CPU's winter peak and 50 MW during the summer peak. As discussed above, the decrease in peak demand savings as well as the exclusion of many residential lighting savings are two drivers of the reduction in peak demand savings relative to the 2017 CPA.

Summary

This report summarizes the results of the 2019 CPA conducted for Clark Public Utilities. The assessment provides estimates of energy savings by sector for the period 2020 to 2039 with a focus on the first 10 years of the planning period, as required by the EIA. The assessment considered a wide range of conservation resources that are reliable, available, and cost effective within the 20-year planning period.

Federal lighting standards impacting many residential lighting measures and new, lower values for capacity savings has resulted in less cost-effective potential than was identified in the 2017 CPA. The cost-effective potential identified in this report remains the lowest cost and lowest risk resource and will serve to keep future electricity costs to a minimum.

Methodology and Compliance with State Mandates

The energy efficiency potential reported in this document is calculated using methodology consistent with the Council's methodology for assessing conservation resources. Appendix III lists each requirement and describes how each item was completed. In addition to using methodology consistent with the Council's Seventh Power Plan, this assessment utilized many of the measure assumptions that the Council developed for the Seventh Regional Power Plan. Additional measure updates subsequent to the Seventh Plan were also incorporated. Utility-specific data regarding customer characteristics, service-area composition, and historic conservation achievements were used, in conjunction with the measures identified by the Council, to determine available energy-efficiency potential. This close connection with the Council methodology enables compliance with the Washington EIA.

Three types of energy-efficiency potential were calculated: technical, achievable, and economic. Most of the results shown in this report are the economic potential, or the potential that is cost effective in the CPU service territory. The economic and achievable potential considers savings that will be captured through utility program efforts, market transformation and implementation of codes and standards. Often, realization of full savings from a measure will require efforts across all three areas. Historic efforts to measure the savings from codes and standards have been limited, but regional efforts to identify and track savings are increasing as they become an important component of the efforts to meet aggressive regional conservation targets.

Conservation Targets

The EIA states that utilities must establish a biennial target that is "no lower than the qualifying utility's pro rata share for that two-year period of its cost-effective conservation potential for the subsequent ten-year period."[3] However, the State Auditor's Office has stated that:

> The term pro-rata can be defined as equal portions but it can also be defined as a proportion of an "exactly calculable factor." For the purposes of the Energy Independence Act, a pro-rata share could be interpreted as an even 20 percent of a utility's 10-year assessment but state law does not require an even 20 percent.[4]

The State Auditor's Office expects that qualifying utilities have analysis to support targets that are more or less than the 20 percent of the 10-year assessments. This document serves as support for the target selected by Clark Public Utilities and approved by its Commission.

Note on Uncertainty

This study shows a range of conservation target scenarios. These scenarios are estimates based on the set of assumptions detailed in this report and supporting documentation and models. Due to the uncertainties discussed in the Introduction section of this report, actual available and cost-effective conservation may vary from the estimates provided in this report.

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[3] RCW 19.285.040 Energy conservation and renewable energy targets.

[4] State Auditor's Office. Energy Independence Act Criteria Analysis. Pro-Rata Definition. CA No. 2011-03. https://www.sao.wa.gov/local/Documents/CA_No_2011_03_pro-rata.pdf

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Appendix I – Acronyms

ALH – Average Load Hours

aMW – Average Megawatt

BCR – Benefit-Cost Ratio

BPA – Bonneville Power Administration

CFL – Compact Fluorescent Light

CPA – Conservation Potential Assessment

CPU – Clark Public Utilities

EIA – Energy Independence Act

EUI – Energy Use Intensity

HLH – Heavy load hour energy

HPWH – Heat Pump Water Heater

HVAC – Heating, ventilation and air-conditioning

IRP – Integrated Resource Plan

kW – kilowatt

kWh – kilowatt-hour

LED – Light-emitting diode

LLH – Light load hour energy

MW – Megawatt

MWh – Megawatt-hour

NEEA – Northwest Energy Efficiency Alliance

NPV – Net Present Value

O&M – Operation and Maintenance

RPS – Renewable Portfolio Standard

RTF – Regional Technical Forum

TRC – Total Resource Cost

UC – Utility Cost

Appendix II – Glossary

7th Power Plan: Seventh Northwest Conservation and Electric Power Plan, Feb 2016. A regional resource plan produced by the Northwest Power and Conservation Council (Council).

Average Megawatt (aMW): Average hourly usage of electricity, as measured in megawatts, across all hours of a given day, month or year.

Avoided Cost: Refers to the cost of the next best alternative. For conservation, avoided costs are usually market prices.

Achievable Potential: Conservation potential that takes into account how many measures will actually be implemented after considering market barriers. For lost-opportunity measures, there is only a certain number of expired units or new construction available in a specified time frame. The Council assumes 85% of all measures are achievable. Sometimes achievable potential is a share of economic potential, and sometimes achievable potential is defined as a share of technical potential.

Cost Effective: A conservation measure is cost effective if the present value of its benefits is greater than the present value of its costs. The primary test is the Total Resource Cost test (TRC), in other words, the present value of all benefits is equal to or greater than the present value of all costs. All benefits and costs for the utility and its customers are included, regardless of who pays the costs or receives the benefits.

Economic Potential: Conservation potential that considers the cost and benefits and passes a cost-effectiveness test.

Levelized Cost: Resource costs are compared on a levelized-cost basis. Levelized cost is a measure of resource costs over the lifetime of the resource. Evaluating costs with consideration of the resource life standardizes costs and allows for a straightforward comparison.

Lost Opportunity: Lost-opportunity measures are those that are only available at a specific time, such as new construction or equipment at the end of its life. Examples include heat-pump upgrades, appliances, or premium HVAC in commercial buildings.

MW (megawatt): 1,000 kilowatts of electricity. The generating capacity of utility plants is expressed in megawatts.

Northwest Energy Efficiency Alliance (NEEA): The alliance is a unique partnership among the Northwest region's utilities, with the mission to drive the development and adoption of energy-efficient products and services.

Northwest Power and Conservation Council "The Council": The Council develops and maintains a regional power plan and a fish and wildlife program to balance the Northwest's environment and energy needs. Their three tasks are to: develop a 20-year electric power plan that will guarantee adequate and reliable energy at the lowest economic and environmental cost to the Northwest; develop a program to protect and rebuild fish and wildlife populations affected by hydropower development in the Columbia River Basin; and educate and involve the public in the Council's decision-making processes.

Regional Technical Forum (RTF): The Regional Technical Forum (RTF) is an advisory committee established in 1999 to develop standards to verify and evaluate conservation savings. Members are appointed by the Council and include individuals experienced in conservation program planning, implementation and evaluation.

Renewable Portfolio Standards: Washington state utilities with more than 25,000 customers are required to meet defined %ages of their load with eligible renewable resources by 2012, 2016, and 2020.

Retrofit (discretionary): Retrofit measures are those that can be replaced at any time during the unit's life. Examples include lighting, shower heads, pre-rinse spray heads, or refrigerator decommissioning.

Technical Potential: Technical potential includes all conservation potential, regardless of cost or achievability. Technical potential is conservation that is technically feasible.

Total Resource Cost Test (TRC): This test is used by the Council and nationally to determine whether or not conservation measures are cost effective. A measure passes the TRC if the ratio of the present value of all benefits (no matter who receives them) to the present value of all costs (no matter who incurs them) is equal to or greater than one.

Appendix III – Documenting Conservation Targets

References:

1) Report – "Clark Public Utilities 2019 Conservation Potential Assessment". Final Report – September 3, 2019.
2) Model – "EES CPA Model-v3.3" and supporting files
   a. MC_and_Loadshape-Clark-Base.xlsm – referred to as "MC and Loadshape file" – contains price and load shape data

WAC 194-37-070 Documenting Development of Conservation Targets; Utility Analysis Option		
NWPCC Methodology	**EES Consulting Procedure**	**Reference**
a) **Technical Potential:** Determine the amount of conservation that is technically feasible, considering measures and the number of these measures that could be physically be installed or implemented, without regard to achievability or cost.	The model includes estimates for stock (e.g. number of homes, square feet of commercial floor area, industrial load) and the number of each measure that can be implemented per unit of stock. The technical potential is further constrained by the amount of stock that has already completed the measure.	Model – the technical potential is calculated as part of the achievable potential, described below.
b) Achievable 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 assessment conducted for Clark Public Utilities used ramp rate curves to identify the amount of achievable potential for each measure. Those assumptions are for the 20-year planning period. An additional factor of 85% was included to account for market barriers in the calculation of achievable potential.	Model – the use of these factors can be found on the sector measure tabs, such as 'Residential Measures'. Additionally, the complete set of ramp rates used can be found on the 'Ramp Rates' tab.
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.	Benefits and costs were evaluated using multiple inputs; benefit was then divided by cost. Measures achieving a benefit-cost ratio greater than one were tallied. These measures are considered achievable and cost-effective (or "economic").	Model – BC Ratios are calculated at the individual level by ProCost and passed up to the model.

WAC 194-37-070 Documenting Development of Conservation Targets; Utility Analysis Option		
NWPCC Methodology	**EES Consulting Procedure**	**Reference**
d) **Total Resource Cost**: In determining economic achievable potential, perform a life-cycle cost analysis of measures or programs	The life-cycle cost analysis was performed using the Council's ProCost model. Incremental costs, savings, and lifetimes for each measure were the basis for this analysis. The Council and RTF assumptions were utilized.	Model – supporting files include all of the ProCost files used in the Seventh Plan. The life-cycle cost calculations and methods are identical to those used by the Council.
e) 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	Cost analysis was conducted per the Council's methodology. Capital cost, administrative cost, annual O&M cost and periodic replacement costs were all considered on the cost side. Energy, non-energy, O&M and all other quantifiable benefits were included on the benefits side. The Total Resource Cost (TRC) benefit cost ratio was used to screen measures for cost-effectiveness (I.e., those greater than one are cost-effective).	Model – the "Measure Info Rollup" files pull in all the results from each avoided cost scenario, including the BC ratios from the ProCost results. These results are then linked to by the Conservation Potential Assessment model. The TRC analysis is done at the lowest level of the model in the ProCost files.
f) Include the incremental savings and incremental costs of measures and replacement measures where resources or measures have different measure lifetimes	Savings, cost, and lifetime assumptions from the Council's 7th Plan and RTF were used.	Model – supporting files include all of the ProCost files used in the Seventh Plan. The life-cycle cost calculations and methods are identical to those used by the Council.
g) Calculate the value of 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 Council's Seventh Plan measure load shapes were used to calculate time of day of savings and measure values were weighted based upon peak and off-peak pricing. This was handled using the Council's ProCost program so it was handled in the same way as the Seventh Power Plan models.	Model – See MC file for load shapes. The ProCost files handle the calculations.
h) Include the increase or decrease in annual or periodic operations and maintenance costs due to conservation measures	Operations and maintenance costs for each measure were accounted for in the total resource cost per the Council's assumptions.	Model – the ProCost files contain the same assumptions for periodic O&M as the Council and RTF.

WAC 194-37-070 Documenting Development of Conservation Targets; Utility Analysis Option		
NWPCC Methodology	**EES Consulting Procedure**	**Reference**
i) Include avoided energy costs equal to a forecast of regional market prices, which represents the cost of the next increment of available and reliable power supply available to the utility for the life of the energy efficiency measures to which it is compared	A regional market price forecast for the planning period was created and provided by EES. A discussion of methodologies used to develop the avoided cost forecast is provided in Appendix IV.	Report –See Appendix IV. Model – See MC File ("TEA Base" worksheet).
j) Include deferred capacity expansion benefits for transmission and distribution systems	Deferred transmission capacity expansion benefits were given a benefit of \$2.85/kW-year in the cost-effectiveness analysis. A distribution system credit of \$6.33/kW-year was also used.	Model – this value can be found on the ProData page of each ProCost file.
k) Include deferred generation benefits consistent with the contribution to system peak capacity of the conservation measure	Deferred generation capacity expansion benefits were given a value of \$75.70/kW-year in the base case cost effectiveness analysis. This is based upon CPU's projected marginal cost for generation capacity. Alternate values were used for the low and high scenarios.	Model – this value can be found on the ProData page of the ProCost Batch Runner file. The generation capacity value was not originally included as part of ProCost during the development of the 7th Plan, so the value has been combined with the distribution capacity benefit, since the timing of CPU's system peak and the regional peak are different.
l) Include the social cost of carbon emissions from avoided non-conservation resources	The avoided cost data include estimates of future high, medium, and low CO_2 costs.	Multiple scenarios were analyzed and these scenarios include different levels of estimated costs and risk.
m) 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	In this analysis, risk was considered by varying avoided cost inputs and analyzing the variation in results. Rather than an individual and non-specific risk adder, our analysis included a range of possible values for each avoided cost input.	The scenarios section of the report documents the inputs used and the results associated.
n) Include all non-energy impacts that a resource or measure may provide that can be quantified and monetized	Quantifiable non-energy benefits were included where appropriate. Assumptions for non-energy benefits are the same as in the Council's Seventh Power Plan. Non-energy benefits include, for example, water savings from clothes washers.	Model – the ProCost files contain the same assumptions for non-power benefits as the Council and RTF. The calculations are handled in by ProCost.

WAC 194-37-070 Documenting Development of Conservation Targets; Utility Analysis Option		
NWPCC Methodology	**EES Consulting Procedure**	**Reference**
o) Include an estimate of program administrative costs	Total costs were tabulated and an estimated 20% of total was assigned as the administrative cost. This value is consistent with regional average and BPA programs. The 20% value was used in the Fifth, Sixth, and Seventh Power plans.	Model – this value can be found on the ProData page of the ProCost Batch Runner file.
p) Include the cost of financing measures using the capital costs of the entity that is expected to pay for the measure	Costs of financing measures were included utilizing the same assumptions from the Seventh Power Plan.	Model – this value can be found on the ProData page of the ProCost Batch Runner file.
q) Discount future costs and benefits at a discount rate equal to the discount rate used by the utility in evaluating non-conservation resources	Discount rates were applied to each measure based upon the Council's methodology. A real discount rate of 4% was used, based on the Council's most recent analyses in support of the Seventh Plan	Model – this value can be found on the ProData page of the ProCost Batch Runner file.
r) 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 was added to all measures in the model parameters per the Conservation Act.	Model – this value can be found on the ProData page of the ProCost Batch Runner file.

Appendix IV – Avoided Cost and Risk Exposure

EES Consulting, Inc. (EES) has conducted a Conservation Potential Assessment (CPA) for Clark Public Utilities (CPU) for the period 2020 through 2039 as required under RCW 19.285 and WAC 194.37. According to WAC 197.37.070, CPU must evaluate the cost-effectiveness of conservation by setting avoided energy costs equal to a forecast of regional market prices. In addition, several other components of the avoided cost of energy efficiency savings must be evaluated, including generation capacity value, transmission and distribution costs, risk, and the social cost of carbon. This appendix describes each of the avoided cost assumptions and provides a range of values that was evaluated in the 2019 CPA. The 2019 CPA considered three avoided cost scenarios: Base, Low, and High. Each of these is discussed below.

Avoided Energy Value

For the purposes of the 2019 CPA, EES has prepared a forecast of market prices for the Mid-Columbia trading hub. This section summarizes the methodology and results of the market price forecast and compares the forecast to the market forecast used for CPU's 2017 CPA.

Methodology

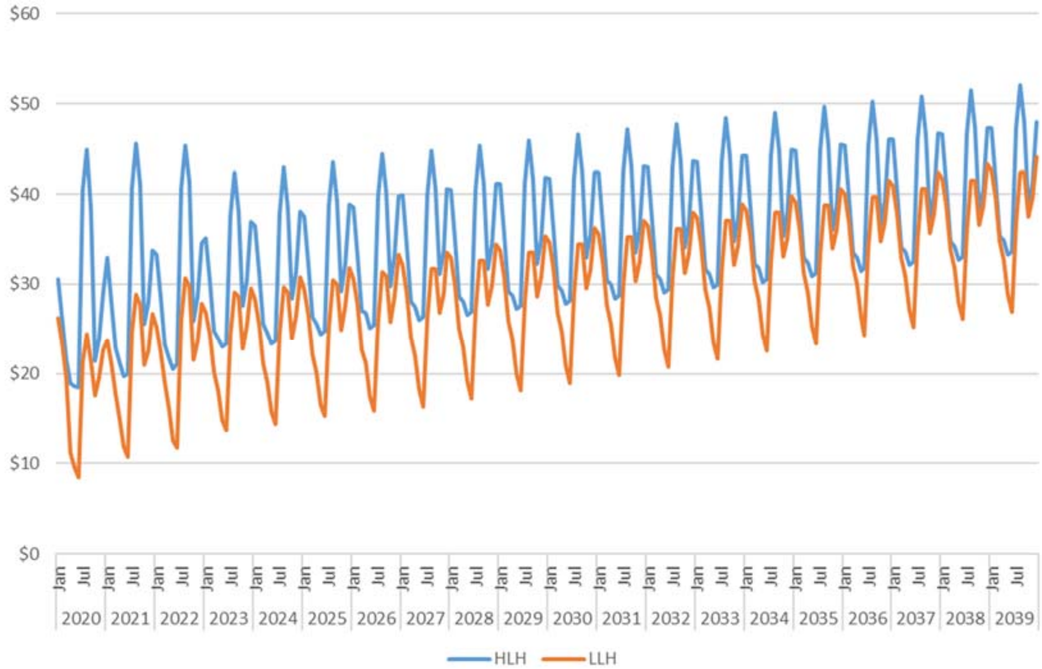
For the period January 2019 through December 2027, projected monthly on- and off-peak market prices were provided by CPU's scheduling agent. CPU's scheduling agent provides CPU with forward price projections on a daily basis. The forward market prices upon which the avoided costs are based were sourced in December 2018.

EES estimated a linear trend for the 9-year period 2019 through 2027 and then escalated rates in years 2028 through 2039 at the estimated trend rate. The estimated annual escalation rate is 1.8 percent.

Results

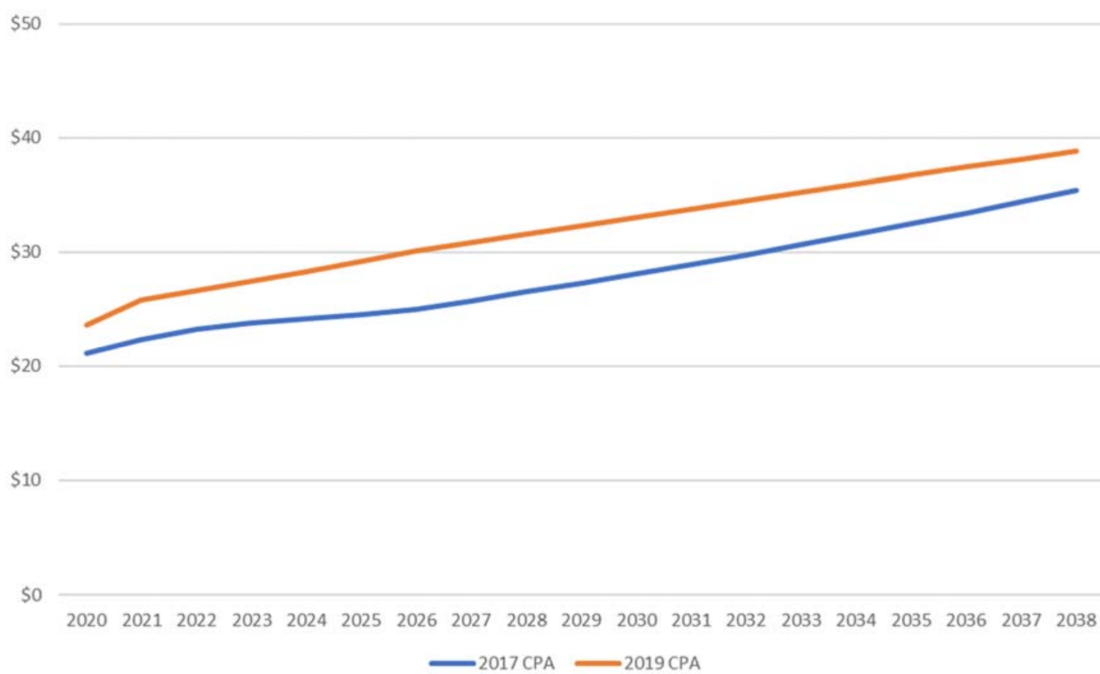
Figure IV-1 illustrates the resulting monthly, diurnal market price forecast. The levelized value of market prices over the study period is $32.36/MWh assuming a 4 percent real discount rate. As noted above, the average annual growth rate beginning in 2027 is 2.1 percent. These prices do not include any potential carbon costs, which are discussed below.

Figure IV-1
Forecast Market Prices (2012$/MWh)



This market price forecast (December 2018) is slightly higher than the market price forecast used in CPU's 2017 CPA. Figure IV-2 compares the two forecasts.

Figure IV-2
Forecast Market Prices in 2017 CPA and 2019 CPA (2012$/MWh)

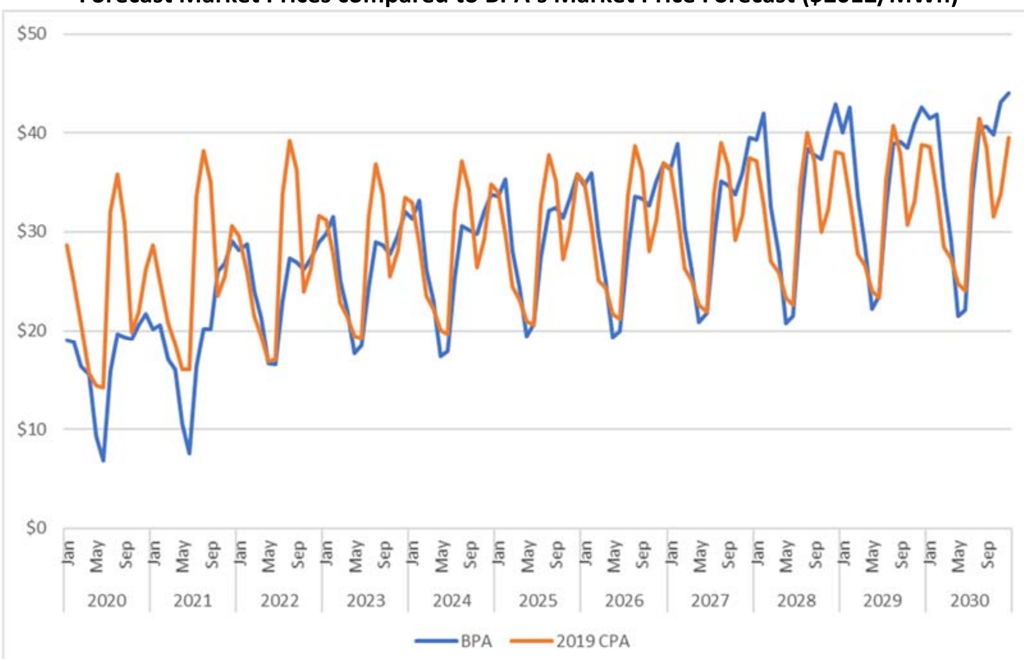


The 2019 CPA market price forecast for the period 2019 through 2039 is on average about $4 higher per month compared with the market price used in the 2017 CPA. This is in part driven by increased market prices in 2018.

Benchmarking

Figure IV-3 compares the 2019 CPA forecast with the forecast included in BPA's Initial Proposal for FY20-21 rates over the years 2020-2030. The monthly shapes differ in the short term as the BPA market price forecast is lower through June 2021. The forecasts are similar from summer 2021 forward, noting the BPA forecast peaks higher in winter months and the CPA forecast dips further in the fall.

Figure IV-3
Forecast Market Prices compared to BPA's Market Price Forecast ($2012/MWh)



**BPA's market price forecast is per the market price forecast included in BPA's 2020 Rate Analysis Model.*

High and Low Scenarios

To reflect a range of possible future outcomes, EES calculated high- and low-case market price forecasts. To do this, EES looked at a history of monthly mid-Columbia energy prices from the past ten years and fit a simple model controlling for monthly variation and a time trend. From this model a prediction interval was calculated moving from a 50% to 85% confidence interval over time to estimate the high and low market price forecasts.

Figures IV-4 and IV-5 compare the resulting price forecasts, for high and low load hours, respectively.

Figure IV-4
High Load Hour Market Price Forecast Comparison (2012$/MWh)

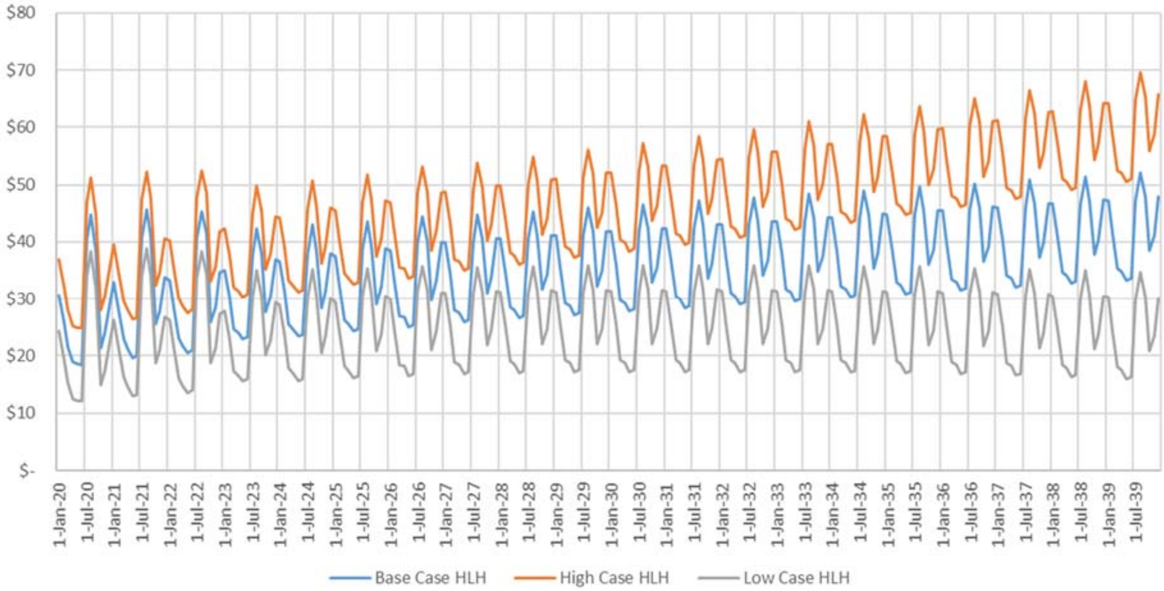
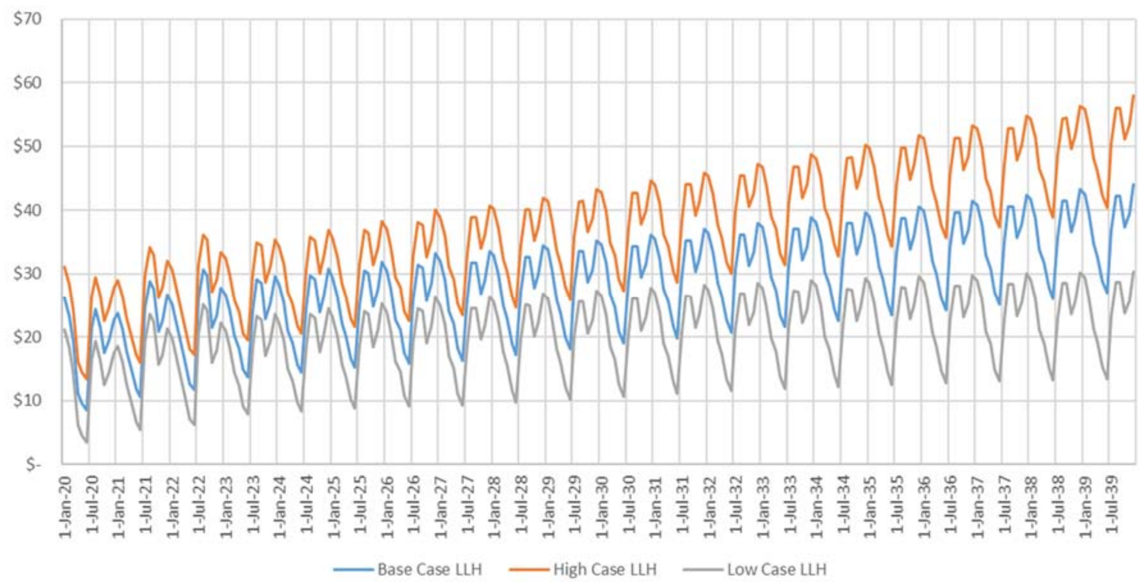


Figure IV-5
Low Load Hour Market Price Forecast Comparison (2012$/MWh)



Avoided Cost Adders and Risk

From a total resource cost perspective, energy efficiency provides multiple benefits beyond the avoided cost of energy. These include deferred capital expenses on generation, transmission, and distribution capacity; as well as the reduction of required renewable energy credit (REC) purchases, avoided social costs of carbon emissions, and the reduction of utility resource portfolio risk exposure. Since energy efficiency measures provide both peak demand (kW) and energy savings (kWh), these other benefits are monetized as value per unit of either kWh or kW savings.

Energy-Based Avoided Cost Adders:

1. Social Cost of Carbon
2. Renewable Energy Credits
3. Risk Reduction Premium

Peak Demand-Based Adders:

1. Generation Capacity Deferral
2. Transmission Capacity Deferral
3. Distribution Capacity Deferral

The estimated values and associated uncertainties for these avoided cost components are provided below. EES evaluated the energy efficiency potential under a range of avoided cost adders and identified the sensitivity of the results to changes in these values.

Social Cost of Carbon

The social cost of carbon is a value that society incurs when fossil fuels are burned to generate electricity. EIA rules require that the social cost of carbon be included in the total resource cost test (TRC). The value of the social cost of carbon is not defined by markets; therefore, the CPA includes the social cost of carbon in an uncertainty analysis through scenario modeling. The scenarios modeled include the value of the social cost of carbon from various resources. California's cap-and-trade carbon market prices were used in the base case, as these represent the closest available analogue to a carbon market and are similar to policies recently considered in Washington. Prices in the California market are currently near $15 per metric ton and are expected to rise to near $16 in 2020. The price floor in California's market is stipulated to rise at 5% plus inflation, so that escalation rate was used.

The Power Council used the federal Interagency Workgroup estimate of a social cost of carbon in scenarios of the Seventh Power Plan. The federal carbon cost estimates range from $46 to $65 (2012$) per metric ton over the 20-year planning period. In addition, a value of zero is included in the low avoided cost scenario analysis. The zero value is consistent with other resource planning done by CPU, in which a social cost of carbon is not considered.

In addition to these carbon costs, the nature of CPU's marginal generation source also needs to be considered. In the spring runoff season, hydropower and wind are the likely the marginal resources, while gas turbines serve as the marginal resource at other times of the year. Accordingly, EES has assumed zero pounds of CO_2 production per kWh in April through July, and 0.84 lbs. of CO_2 per kWh in the other months.

Value of Renewable Energy Credits

Related to the social cost of carbon is the value of renewable energy credits. Washington's Energy Independence Act established a Renewable Portfolio Standard (RPS) for utilities with 25,000 or more customers. Currently, utilities are required to source 9% of all electricity sold to retail customers from renewable energy resources. In 2020, the requirement increases to 15%.

The EIA allows two alternate modes of compliance. Utilities can comply by spending four percent or more of the annual retail revenue requirement on the incremental cost of renewable energy—essentially a four percent cost cap. Utilities with no load growth can also comply by spending one percent or more of the retail revenue requirement.

Accordingly, energy savings from conservation measures can reduce the cost of compliance in two ways:

1. Eliminates CPU's load growth, making the utility eligible for the reduced RPS requirement, and
2. Reducing the net retail revenue requirement.

CPU's 2018 IRP projects a small amount of load growth in the coming years, even after savings from energy efficiency are included. As such, in the base scenario, the first benefit—making the utility eligible for the reduced 1% requirement—is not applicable. Only the second benefit, the reduction in net retail revenue requirement is applicable.

Each unit of energy adds a variety of costs to CPU's revenue requirement, but for simplicity we assume that the cost of energy is the only change to the revenue requirement, as other infrastructure and administrative costs are unlikely to change with small increments of energy efficiency acquired. Therefore, we add 4% of the market price of energy to the avoided cost as energy efficiency's value of reducing CPU's RPS compliance cost. These prices were incorporated into the avoided costs of energy efficiency. With energy prices around $30/MWh, this has the effect of adding approximately $1.20/MWh to the market prices. In the low scenario, we assume that CPU is able to use the 1% compliance path. In the high scenario, a 25% RPS policy was assumed to account for potential increases in the cost of RECs plus potential increases in the stringency of Washington's RPS requirements.

Risk Adder

In general, the risk that any utility faces is that energy efficiency will be undervalued, either in terms of the value per kWh or per kW of savings, leading to an under-investment in energy efficiency and exposure to higher market prices or preventable investments in infrastructure. The converse risk—an over-valuing of energy and subsequent over-investment in energy efficiency—is also possible, albeit less likely. For example, an over-investment would occur if an assumption is made that economies will remain basically the same as they are today and subsequent sector shifts or economic downturns cause large industrial customers to close their operations. Energy efficiency investments in these facilities may not have been in place long enough to provide the anticipated low-cost resource.

In order to address risk, the Council includes a risk adder in its cost-effectiveness analysis of energy efficiency measures. This adder represents the value of energy efficiency savings not explicitly accounted for in the avoided cost parameters. The risk adder is included to ensure an efficient level of investment in energy efficiency resources under current planning conditions. Specifically, in cases where the market price has been low compared to historic levels, the risk adder accounts for the likely possibility that market prices will increase above current forecasts.

The value of the risk adder has varied depending on the avoided cost input values. The adder is the result of stochastic modeling and represents the lower risk nature of energy efficiency resources. In the Sixth Power Plan the risk adder was significant (up to $50/MWh for some measures). In the Seventh Power Plan, no risk adder was needed after the addition of the generation capacity credit. While the Council uses stochastic portfolio modeling to value the risk credit, utilities conduct scenario and uncertainty analysis. The scenarios modeled in CPU's CPA include an inherent value for the risk credit.

For CPU's 2019 CPA, the avoided cost parameters have been estimated explicitly, and, a scenario analysis is performed. Therefore, a risk adder of $0/MWh is recommended for the base case. Variation in other avoided cost inputs covers a range of reasonable outcomes and is sufficient to identify the sensitivity of the cost-effective energy efficiency potential to a range of outcomes. The scenario results present a range of cost-effective energy efficiency potential, and the identification of CPU's biennial target based on the range modeled is effectively selecting the utility's preferred risk strategy and associated risk credit.

Deferred Distribution and Transmission System Investment

Energy efficiency measure savings reduce capacity requirements on both the distribution and transmission system. The Council recently updated the values previously estimated for these capacity savings: $26/kW-year and $31/kW-year for transmission and distribution systems, respectively ($2012). The new values are $3.08/kW-year and $6.85/kW-year (2016$) or $2.85/kW-year and $6.33/kW-year (2012$) for transmission and distribution system deferral. These values are based on input provided to the Council by several regional utilities and will likely be used in the next Power Plan. These values were used in all scenarios of the CPA.

Deferred Investment in Generation Capacity

CPU's 2018 IRP progress report identified that the utility had sufficient resources for average annual energy requirements but showed a need for new resources to meet peak demands. Currently, CPU has a call option for capacity for all months except April, May, and June and expect to renew the contract at a price of $1/kW-month. Higher prices are expected in the future, however, so this CPA assumed a price of $2.50/kW-month for 2020 and then shifted to the charges in BPA's demand rates over the initial 10 years of the study period. BPA's demand charges are based on the cost of a gas plant and reflects that a new resource may need to be built at some point.

EES assumed a monthly shape to the demand savings realized through energy efficiency, recognizing that energy efficiency does not provide equal reductions of capacity in all months. For the base case, it was assumed the cost increase in real terms by 5% annually. Over twenty, years, the resulting cost of avoided capacity is $75.70/kW-year (2012$) in levelized terms. In the low scenario, no cost escalation was assumed, resulting in a 20-year levelized cost of $44.44/kW-yr. In the Council's Seventh Power Plan[5], a generation capacity value of $115/kW-year was explicitly calculated ($2012). This value will be used in the high scenario.

Summary of Scenario Assumptions

Table IV-1 summarizes the recommended scenario assumptions. The Base Case represents the most likely future.

Table IV-1
Avoided Cost Assumptions by Scenario, $2012

	Base	Low	High
Energy	Market Forecast	-50%-85% Confidence Interval*	+50%-85% Confidence Interval*
Social Cost of Carbon	California Carbon Market	No Cost	Federal/7th Power Plan Values
Value of RPS Compliance	4% Cost Cap	1% Cost Cap	25% RPS
Distribution System Credit, $/kW-year	$6.33	$6.33	$6.33
Transmission System Credit, $/kW-year	$2.85	$2.85	$2.85
Deferred Generation Capacity Credit, $/kW-year	$75.70	$44.44	$115
Implied Risk Adder:	N/A	Up to -$33/MWh -$31/kW-year Average of -$20/MWh -$31/kW-year	Up to $28/MWh $39/kW-year Average of $21/MWh $39/kW-year

**As noted above prediction intervals were used based on the last 10 years of data for high and low estimates.*

[5] https://www.nwcouncil.org/energy/powerplan/7/home/

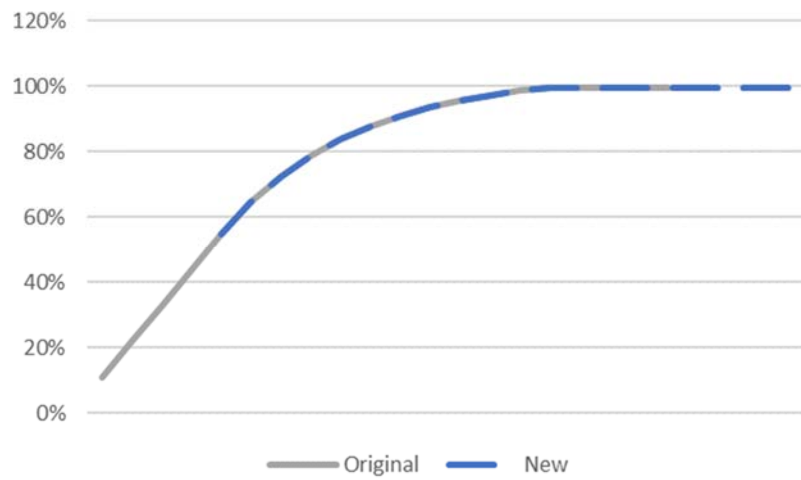
Appendix V – Ramp Rate Documentation

This section is intended to document how ramp rates were adjusted to align near term potential with recent achievements of CPU programs.

Modelling work began with the Seventh Plan ramp rate assignments for each measure. For new measures added to the model, an appropriate ramp rate was selected based on the maturity of each measure. Seventh Plan ramp rates were also adjusted to fit the 2020-2039 timeline of this CPA. The adjustment made to each ramp rate varied depending on the type of ramp rate, since different types of ramp rates are applied to retrofit and lost opportunity measures.

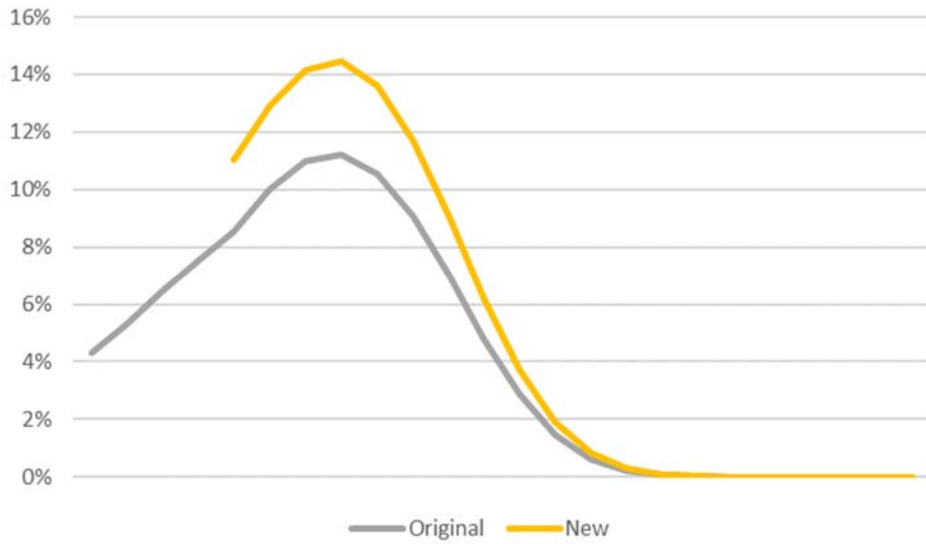
For lost opportunity measures, the ramp rates represent the share of equipment turning over in a given year that is achieved by efficiency programs. For these ramp rates, the only modification necessary was to extrapolate the final years to cover the time period relevant to the 2019 CPA. An example of this is shown in Figure V-1 below.

Figure V-1
Example Lost Opportunity Ramp Rate Modification



For retrofit ramp rates, a different adjustment was necessary. The ramp rates applied to retrofit measures describe the portion of the entire stock that is acquired in a given year. For these ramp rates, new values were calculated based on the original ramp rate values. The new value was set as the original ramp rate value for a given year, divided by the sum of original ramp rate values over the 2020-2039 timeframe. This approach reflects the fact that a portion of the stock has already been acquired and continuing with the pace projected by the Seventh Plan would mean acquiring a larger percentage of a smaller remaining stock. An example of this is shown below.

Figure V-2
Example Retrofit Ramp Rate Modification



With these modified ramp rates, CPU's program achievements from 2017-2018 and estimates for 2019 were compared at a sector level with the first three years of the study period, 2020-2022. Savings from NEEA's market transformation initiatives were allocated to the appropriate sectors. This allowed for the identification of sectors where ramp rate adjustments may be necessary.

Table V-1 below shows the results of the comparison by sector *after* ramp rate adjustments were made. Note that these totals exclude savings from CPU's residential lighting program, since these measures were excluded from the model due to the upcoming implementation of the federal EISA 2020 lighting standard. Further, the 2017 industrial savings includes one very large project. As such, this value was not included in the averages.

Table V-1
Comparison of Sector-Level Program Achievement and Potential (aMW)

	Program History				Potential		
	2017	**2018**	**2019**	**Average**	**2020**	**2021**	**2022**
Residential	2.1	1.2	2.4	1.9	1.5	1.5	1.8
Commercial	1.9	3.0	2.1	2.3	2.1	2.0	2.0
Industrial	6.8	1.5	1.6	1.5	0.9	0.9	0.9
Distribution Efficiency	-	-	-	-	0.0	0.1	0.1
Total	**10.8**	**5.7**	**6.1**	**5.8**	**4.5**	**4.5**	**4.8**

CPU provided measure detail for each sector, allowing for additional comparisons at the end use level, although savings from NEEA could not be allocated to individual measures or end uses.

Table V-2 below shows a comparison of historical accomplishments and future potential for the residential sector, by end use. Additional commentary is provided below.

Table V-2
Comparison of Residential Achievement and Potential (aMW)

	Program History				Potential		
End Use	**2017**	**2018**	**2019**	**Average**	**2020**	**2021**	**2022**
Dryer	-	-	-	-	-	-	-
Electronics	-	0.00	-	0.00	0.02	0.03	0.04
Food Preparation	-	-	-	-	0.01	0.01	0.01
HVAC	0.35	0.35	0.64	0.45	0.52	0.71	0.89
Lighting	2.28	1.11	0.65	1.34	0.37	-	-
Refrigeration	0.06	0.04	0.04	0.04	-	-	-
Water Heating	1.09	0.10	1.05	0.75	0.62	0.76	0.87
Whole Bldg/Meter Level	0.01	0.02	0.02	0.02	-	-	-
NEEA	0.64	0.73	0.71	0.69	-	-	-
Total	**2.15**	**1.24**	**2.44**	**1.95**	**1.53**	**1.51**	**1.82**

HVAC – This category was set to align approximately with the historical savings. Additional savings from NEEA's market transformation may apply here. Less aggressive ramp rates were applied to some measures to align with program potential.

Lighting – Savings in this category were excluded from potential after 2020 due to the upcoming EISA 2020 standard implementation. A small amount of savings here acknowledges that some program transition will occur in 2020.

Water Heating – The potential in this end use was aligned with recent program history by applying slower ramp rates. In this category, NEEA savings also apply due to NEEA's work with heat pump water heaters.

Other Categories – CPU reported savings in other categories (e.g. refrigeration, whole building) but no cost-effective potential was identified.

The commercial sector ramp rate comparisons are shown in Table V-3, with additional commentary below.

Table V-3 Comparison of Commercial Achievement and Potential (aMW)							
	Program History				Potential		
End Use	2017	2018	2019	Average	2020	2021	2022
Compressed Air					0.01	0.01	0.01
Electronics					0.01	0.02	0.03
Food Preparation	-	0.00	0.03	0.01	0.02	0.02	0.03
HVAC	0.36	0.18	0.31	0.28	0.43	0.51	0.57
Lighting	1.27	2.61	1.62	1.83	1.42	1.25	1.14
Motors/Drives					0.02	0.02	0.03
Process Loads					0.05	0.06	0.06
Refrigeration	0.10	0.00	-	0.04	0.06	0.09	0.11
Water Heating					0.04	0.04	0.04
NEEA	0.15	0.17	0.16	0.16	-	-	-
Total	**1.87**	**2.96**	**2.12**	**2.32**	**2.06**	**2.02**	**2.01**

Lighting – Commercial lighting ramp rates were increased above Seventh Plan rates to more closely align with recent levels of program achievement. Ramp rates are

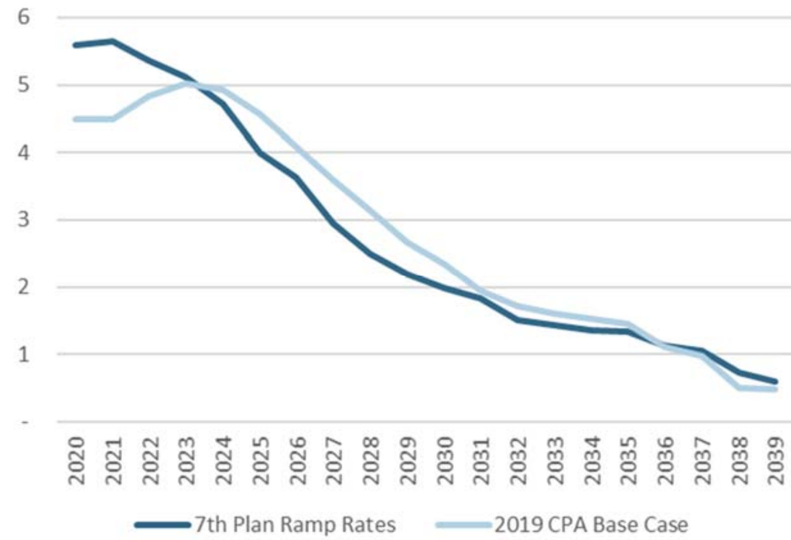
HVAC – Slower ramp rates were applied to several measures in this category to align program history and potential.

In the commercial sector, smaller ramp rate modifications were also made to other smaller end uses, including food preparation, refrigeration, and electronics.

In the industrial sector, EES ramp rates were slowed slightly across a variety of measures to align potential with program history.

Figure V-3 compares the annual acquisition of conservation potential with the ramp rates used in this potential assessment with the acquisition if the Seventh Plan ramp rates, adjusted to the timeline of this CPA, had been used. While the potential acquired under the Seventh Plan ramp rates begins at a higher level, the adjusted ramp rates acquire more potential over many of the subsequent years, resulting in a nearly identical cumulative potential over the 20-year study period.

Figure V-3
Effect of Adjusted Ramp Rates on Acquisition of Potential



Appendix VI – Measure List

This appendix provides a high-level measure list of the energy efficiency measures evaluated in the 2019 CPA. The CPA evaluated thousands of measures; the measure list does not include each individual measure; rather it summarizes the measures at the category level, some of which are repeated across different units of stock, such as single family, multifamily, and manufactured homes. Specifically, utility conservation potential is modeled based on incremental costs and savings of individual measures. Individual measures are then combined into measure categories to more realistically reflect utility-conservation program organization and offerings. For example, single-family attic insulation measures are modeled for a variety of upgrade increments: R-0 to R-38, R-0 to R-49, or R-19 to R-38. The increments make it possible to model measure savings and costs at a more precise level. Each of these individual measures are then bundled across all housing types to result in one measure group: attic insulation.

The measure list used in this CPA was developed based on information from the Regional Technical Forum (RTF) and the Northwest Power and Conservation Council (Council). The RTF and the Council continually maintain and update a list of regional conservation measures based on new data, changing market conditions, regulatory changes, and technological developments. The measure list provided in this appendix includes the most up-to date information available at the time this CPA was developed.

The following tables list the conservation measures (at the category level) that were used to model conservation potential presented in this report. Measure data was sourced from the Council's Seventh Plan workbooks and the RTF's Unit Energy Savings (UES) workbooks. Note that some measures may not be applicable to an individual utility's service territory based on characteristics of the utility's customer sectors.

Table VI-1
Residential End Uses and Measures

End Use	Measures/Categories	Data Source
Dryer	Heat Pump Clothes Dryer	7th Plan
Electronics	Advanced Power Strips	7th Plan, RTF
	Energy Star Computers	7th Plan
	Energy Star Monitors	7th Plan
Food Preparation	Electric Oven	7th Plan
	Microwave	7th Plan
HVAC	Air Source Heat Pump	7th Plan, RTF
	Controls, Commissioning, and Sizing	7th Plan, RTF
	Ductless Heat Pump	7th Plan, RTF
	Ducted Ductless Heat Pump	7th Plan
	Duct Sealing	7th Plan, RTF
	Ground Source Heat Pump	7th Plan, RTF
	Heat Recovery Ventilation	7th Plan
	Attic Insulation	7th Plan, RTF
	Floor Insulation	7th Plan, RTF
	Wall Insulation	7th Plan, RTF
	Windows	7th Plan, RTF
	Wi-Fi Enabled Thermostats	7th Plan
Lighting	Linear Fluorescent Lighting	7th Plan, RTF
	LED General Purpose and Dimmable	7th Plan, RTF
	LED Decorative and Mini-Base	7th Plan, RTF
	LED Globe	7th Plan, RTF
	LED Reflectors and Outdoor	7th Plan, RTF
	LED Three-Way	7th Plan, RTF
Refrigeration	Freezer	7th Plan
	Refrigerator	7th Plan
Water Heating	Aerator	7th Plan
	Behavior Savings	7th Plan
	Clothes Washer	7th Plan
	Dishwasher	7th Plan
	Heat Pump Water Heater	7th Plan, RTF
	Showerheads	7th Plan, RTF
	Solar Water Heater	7th Plan
	Thermostatic Valve	RTF
	Wastewater Heat Recovery	7th Plan
Whole Building	EV Charging Equipment	7th Plan

Table VI-2
Commercial End Uses and Measures

End Use	Measures/Categories	Data Source
Compressed Air	Controls, Equipment, & Demand Reduction	7th Plan
Electronics	Energy Star Computers	7th Plan
	Energy Star Monitors	7th Plan
	Smart Plug Power Strips	7th Plan, RTF
	Data Center Measures	7th Plan
Food Preparation	Combination Ovens	7th Plan, RTF
	Convection Ovens	7th Plan, RTF
	Fryers	7th Plan, RTF
	Hot Food Holding Cabinet	7th Plan, RTF
	Steamer	7th Plan, RTF
	Pre-Rinse Spray Valve	7th Plan, RTF
HVAC	Advanced Rooftop Controller	7th Plan
	Commercial Energy Management	7th Plan
	Demand Control Ventilation	7th Plan
	Ductless Heat Pumps	7th Plan
	Economizers	7th Plan
	Secondary Glazing Systems	7th Plan
	Variable Refrigerant Flow	7th Plan
	Web-Enabled Programmable Thermostat	7th Plan
Lighting	Bi-Level Stairwell Lighting	7th Plan
	Exterior Building Lighting	7th Plan
	Exit Signs	7th Plan
	Lighting Controls	7th Plan
	Linear Fluorescent Lamps	7th Plan
	LED Lighting	7th Plan
	Street Lighting	7th Plan
Motors/Drives	ECM for Variable Air Volume	7th Plan
	Motor Rewinds	7th Plan
Process Loads	Municipal Water Supply	7th Plan
Refrigeration	Grocery Refrigeration Bundle	7th Plan, RTF
	Water Cooler Controls	7th Plan
Water Heating	Commercial Clothes Washer	7th Plan, RTF
	Showerheads	7th Plan
	Tank Water Heaters	7th Plan

Table VI-3 Industrial End Uses and Measures		
End Use	**Measures/Categories**	**Data Source**
Compressed Air	Air Compressor Equipment	7th Plan
	Demand Reduction	7th Plan
Energy Management	Air Compressor Optimization	7th Plan
	Energy Project Management	7th Plan
	Fan Energy Management	7th Plan
	Fan System Optimization	7th Plan
	Cold Storage Tune-up	7th Plan
	Chiller Optimization	7th Plan
	Integrated Plant Energy Management	7th Plan
	Plant Energy Management	7th Plan
	Pump Energy Management	7th Plan
	Pump System Optimization	7th Plan
Fans	Efficient Centrifugal Fan	7th Plan
	Fan Equipment Upgrade	7th Plan
Hi-Tech	Clean Room Filter Strategy	7th Plan
	Clean Room HVAC	7th Plan
	Chip Fab: Eliminate Exhaust	7th Plan
	Chip Fab: Exhaust Injector	7th Plan
	Chip Fab: Reduce Gas Pressure	7th Plan
	Chip Fab: Solid State Chiller	7th Plan
Lighting	Efficient Lighting	7th Plan
	High-Bay Lighting	7th Plan
	Lighting Controls	7th Plan
Low & Medium Temp Refrigeration	Food: Cooling and Storage	7th Plan
	Cold Storage Retrofit	7th Plan
	Grocery Distribution Retrofit	7th Plan
Material Handling	Material Handling Equipment	7th Plan
	Material Handling VFD	7th Plan
Metals	New Arc Furnace	7th Plan
Misc.	Synchronous Belts	7th Plan
	Food Storage: CO2 Scrubber	7th Plan
	Food Storage: Membrane	7th Plan
Motors	Motor Rewinds	7th Plan
Paper	Efficient Pulp Screen	7th Plan
	Material Handling	7th Plan
	Premium Control	7th Plan
	Premium Fan	7th Plan
Process Loads	Municipal Sewage Treatment	7th Plan
Pulp	Efficient Agitator	7th Plan
	Effluent Treatment System	7th Plan
	Premium Process	7th Plan
	Refiner Plate Improvement	7th Plan
	Refiner Replacement	7th Plan
Pumps	Equipment Upgrade	7th Plan
Transformers	New/Retrofit Transformer	7th Plan
Wood	Hydraulic Press	7th Plan
	Pneumatic Conveyor	7th Plan

Table VI-4
Distribution Efficiency End Uses and Measures

End Use	Measures/Categories	Data Source
Distribution Efficiency	LDC Voltage Control	7th Plan
	Light System Improvements	7th Plan
	Major System Improvements	7th Plan
	EOL Voltage Control Method	7th Plan
	SCL Implement EOL w/ Improvements	7th Plan

Appendix VII – Annual Energy Efficiency Economic Potential by End-Use

Residential aMW

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Dryer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Electronics	0.02	0.03	0.04	0.06	0.08	0.09	0.11	0.12	0.12	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Food Preparation	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HVAC	0.52	0.71	0.89	1.03	1.11	1.11	1.04	0.92	0.77	0.62	0.49	0.37	0.29	0.22	0.18	0.15	0.11	0.10	0.00	0.00
Lighting	0.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Heating	0.58	0.71	0.80	0.85	0.86	0.83	0.76	0.67	0.60	0.54	0.51	0.50	0.49	0.49	0.49	0.49	0.37	0.32	0.10	0.08
Whole Bldg/Meter L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**1.49**	**1.46**	**1.74**	**1.96**	**2.06**	**2.04**	**1.92**	**1.73**	**1.50**	**1.21**	**1.02**	**0.88**	**0.78**	**0.72**	**0.68**	**0.65**	**0.49**	**0.43**	**0.11**	**0.09**

Commercial aMW

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Compressed Air	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	-	-	-
Electronics	0.01	0.02	0.03	0.04	0.06	0.08	0.10	0.13	0.15	0.18	0.21	0.04	-	-	-	-	-	-	-	-
Food Preparation	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.09	0.09	0.07	-	-	-	-
HVAC	0.43	0.51	0.57	0.61	0.61	0.58	0.52	0.44	0.35	0.27	0.20	0.15	0.11	0.08	0.07	0.06	0.05	0.04	0.04	0.04
Lighting	1.42	1.25	1.14	1.02	0.83	0.59	0.43	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.34	0.33	0.25	0.10	0.10
Motors/Drives	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Process Loads	0.05	0.06	0.06	0.07	0.06	0.05	0.04	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-	-
Refrigeration	0.06	0.09	0.11	0.12	0.13	0.13	0.12	0.10	0.08	0.07	0.05	0.03	0.02	0.01	0.01	0.01	-	-	-	-
Water Heating	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.02	0.01	0.01	0.00	-	-	-	-
Total	**2.06**	**2.02**	**2.01**	**1.96**	**1.80**	**1.56**	**1.35**	**1.19**	**1.11**	**1.03**	**0.98**	**0.74**	**0.64**	**0.60**	**0.58**	**0.52**	**0.40**	**0.32**	**0.17**	**0.17**

Industrial	aMW																			
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Compressed Air	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-	-
Energy Managemen	0.36	0.38	0.38	0.38	0.35	0.30	0.25	0.19	0.13	0.09	0.07	0.06	0.05	0.05	0.05	0.04	-	-	-	-
Fans	0.05	0.06	0.07	0.07	0.06	0.05	0.04	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-	-
Hi-Tech	0.10	0.11	0.12	0.12	0.11	0.09	0.07	0.05	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	-	-	-	-
Lighting	0.15	0.13	0.11	0.09	0.08	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	-	-	-	-
Low & Med Temp Re	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-	-
Material Handling	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-	-
Metals	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-	-
Misc	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Motors	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-	-
Process Loads	0.14	0.17	0.19	0.20	0.19	0.16	0.13	0.09	0.05	0.03	0.01	0.00	0.00	0.00	0.00	0.00	-	-	-	-
Pulp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Transformers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wood	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-	-
Total	**0.86**	**0.91**	**0.94**	**0.92**	**0.85**	**0.74**	**0.59**	**0.43**	**0.29**	**0.19**	**0.12**	**0.09**	**0.07**	**0.06**	**0.06**	**0.05**	**-**	**-**	**-**	**-**

Distribution Efficienc	aMW																			
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
1 - LDC voltage control n	0.02	0.03	0.05	0.06	0.07	0.09	0.10	0.10	0.11	0.12	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
2 - Light system improve	0.01	0.02	0.03	0.04	0.04	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09
3 - Major system improv	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4 - EOL voltage control n	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A - SCL implement EOL w	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**0.03**	**0.05**	**0.07**	**0.10**	**0.12**	**0.14**	**0.15**	**0.17**	**0.18**	**0.19**	**0.20**	**0.21**	**0.22**	**0.22**	**0.22**	**0.22**	**0.22**	**0.23**	**0.23**	**0.23**

Appendix VIII – Measure Detail

Column Heading Definitions

- Sector – Customer sector: Residential, Commercial, Industrial, or Distribution Efficiency
- End-Use – Highest level measure category
- Measure Name – Measure name as defined by the Seventh Power Plan
- Measure Life – Assumed life of the measure, in years
- Initial Capital Cost – The incremental capital cost of the measure. It is the initial cost associated with the savings value
- TRC Levelized Cost ($/MWh) – Total Resource Cost (TRC) levelized costs include the same components as the TRC benefit-cost ratio. All costs minus all benefits regardless of which sponsor incurs the cost or accrues the benefit. Benefits are subtracted from costs and then levelized over the life of the program.
- Total Sponsor Levelized Cost ($/MWh) – This levelized cost includes the capital, maintenance, and administrative costs of the measure. It does not include any adjustment for benefits. Costs are levelized over the life of the program.
- TRC B/C Ratio – The benefit-cost ratio based on the Total Resource Cost test. It includes the present value of all benefits divided by the present value of all costs.
- Bulk Energy (kWh/unit) – Energy savings of the measure at the bulk system level (busbar), including line losses.
- Wholesale demand (kW) – Measure demand savings coincident with the wholesale power system annual peak

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Commercial	HVAC	Advanced Rooftop Controller-Retro-Assembly	15	$0.18	$0.12	$27.03	2.25	0.75	0.0001
Commercial	HVAC	Advanced Rooftop Controller-Retro-Hospital	15	$0.06	$37.32	$57.70	0.93	0.12	0.0000
Commercial	HVAC	Advanced Rooftop Controller-Retro-Large Off	15	$0.09	$59.90	$80.17	0.68	0.12	0.0000
Commercial	HVAC	Advanced Rooftop Controller-Retro-Large Ret	15	$0.18	-$0.53	$16.95	3.04	1.22	0.0001
Commercial	HVAC	Advanced Rooftop Controller-Retro-Lodging	15	$0.06	$30.73	$57.64	1.06	0.12	0.0000
Commercial	HVAC	Advanced Rooftop Controller-Retro-Medium Off	15	$0.32	$66.54	$86.81	0.62	0.41	0.0000
Commercial	HVAC	Advanced Rooftop Controller-Retro-Medium Ret	15	$0.12	$13.72	$31.20	1.65	0.42	0.0000
Commercial	HVAC	Advanced Rooftop Controller-Retro-MiniMart	15	$0.29	$14.83	$33.75	1.55	0.97	0.0001
Commercial	HVAC	Advanced Rooftop Controller-Retro-Other	15	$0.07	$23.19	$50.10	1.22	0.15	0.0000
Commercial	HVAC	Advanced Rooftop Controller-Retro-Residential Care	15	$0.22	$11.96	$32.34	1.65	0.75	0.0001
Commercial	HVAC	Advanced Rooftop Controller-Retro-Restaurant	15	$0.73	$17.59	$38.74	1.41	2.12	0.0003
Commercial	HVAC	Advanced Rooftop Controller-Retro-School K-12	15	$0.09	$75.83	$94.41	0.57	0.11	0.0000
Commercial	HVAC	Advanced Rooftop Controller-Retro-Small Off	15	$0.20	$59.77	$80.04	0.68	0.28	0.0000
Commercial	HVAC	Advanced Rooftop Controller-Retro-Small Ret	15	$0.02	$66.93	$84.41	0.61	0.03	0.0000
Commercial	HVAC	Advanced Rooftop Controller-Retro-Supermarket	15	$0.29	$14.83	$33.75	1.55	0.97	0.0001
Commercial	HVAC	Advanced Rooftop Controller-Retro-University	15	$0.09	$67.58	$94.49	0.64	0.11	0.0000
Commercial	HVAC	Advanced Rooftop Controller-Retro-Warehouse	15	$0.04	$60.27	$86.19	0.69	0.05	0.0000
Commercial	HVAC	Advanced Rooftop Controller-Retro-Xlarge Ret	15	$0.18	$3.05	$20.53	2.51	0.99	0.0001
Commercial	Lighting	NR_LFStairwell3600_Fix_Repl_from LF_2019 to LF_Bi-Level_Fix	16	$2,033.45	$141.82	$167.67	0.36	1,396.60	0.2494
Commercial	Lighting	NR_LFStairwell8760_Fix_Repl_from LF_2018 to LF_Bi-Level_Fix	16	$2,033.45	$54.25	$80.10	0.75	3,398.40	0.6068
Commercial	Water Heating	Washer	11.3	$399.62	-$106.90	-$78.86	3.04	799.17	0.1377
Commercial	HVAC	Commercial EM-Retro-Assembly	5	$42.30	$23.34	$67.61	1.16	168.74	0.0320
Commercial	HVAC	Commercial EM-Retro-Hospital	5	$237.97	$7.10	$41.35	1.63	1,552.08	0.1882
Commercial	HVAC	Commercial EM-Retro-Large Off	5	$158.12	$31.32	$58.37	1.05	730.71	0.0867
Commercial	HVAC	Commercial EM-Retro-Large Ret	5	$143.75	$132.36	$167.46	0.41	231.55	0.0210
Commercial	HVAC	Commercial EM-Retro-Lodging	5	$19.91	$17.26	$46.19	1.36	116.29	0.0221
Commercial	HVAC	Commercial EM-Retro-Medium Off	5	$23.58	$44.80	$73.58	0.85	86.44	0.0103
Commercial	HVAC	Commercial EM-Retro-Medium Ret	5	$15.38	$86.69	$114.62	0.54	36.19	0.0033
Commercial	HVAC	Commercial EM-Retro-MiniMart	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	HVAC	Commercial EM-Retro-Other	5	$50.32	$15.81	$60.45	1.30	224.55	0.0426
Commercial	HVAC	Commercial EM-Retro-Residential Care	5	$21.26	$12.47	$36.64	1.56	156.49	0.0190
Commercial	HVAC	Commercial EM-Retro-Restaurant	5	$13.12	$41.36	$73.15	0.89	48.38	0.0063
Commercial	HVAC	Commercial EM-Retro-School K-12	5	$82.30	$74.46	$113.83	0.65	195.02	0.0191
Commercial	HVAC	Commercial EM-Retro-Small Off	5	$16.18	$158.70	$186.03	0.33	23.45	0.0028
Commercial	HVAC	Commercial EM-Retro-Small Ret	5	$25.46	$21.78	$46.96	1.26	146.26	0.0133
Commercial	HVAC	Commercial EM-Retro-Supermarket	5	$23.91	$23.45	$57.96	1.17	111.25	0.0118
Commercial	HVAC	Commercial EM-Retro-University	5	$216.82	$30.03	$67.90	1.06	861.32	0.1634
Commercial	HVAC	Commercial EM-Retro-Warehouse	5	$14.59	$64.93	$121.01	0.74	32.53	0.0056
Commercial	HVAC	Commercial EM-Retro-Xlarge Ret	5	$9.83	$45.61	$80.17	0.86	33.07	0.0030
Commercial	Compressed Air	Compressed Air-NR-Assembly	10	$11,453.52	-$1.32	$20.25	2.76	85,548.39	11.3582
Commercial	Compressed Air	Compressed Air-NR-Hospital	10	$692.85	-$1.32	$20.25	2.76	5,175.03	0.6871
Commercial	Compressed Air	Compressed Air-NR-Large Off	10	$147,934.05	-$1.42	$20.25	2.75	1,104,792.94	147.9816
Commercial	Compressed Air	Compressed Air-NR-Large Ret	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Compressed Air	Compressed Air-NR-Lodging	10	$3,784.48	-$1.32	$20.25	2.76	28,266.98	3.7530
Commercial	Compressed Air	Compressed Air-NR-Medium Off	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Compressed Air	Compressed Air-NR-Medium Ret	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Compressed Air	Compressed Air-NR-MiniMart	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Compressed Air	Compressed Air-NR-Other	10	$62,074.28	-$1.32	$20.25	2.76	463,643.76	61.5579
Commercial	Compressed Air	Compressed Air-NR-Residential Care	10	$692.85	-$1.32	$20.25	2.76	5,175.03	0.6871
Commercial	Compressed Air	Compressed Air-NR-Restaurant	10	$1,489.05	-$1.32	$20.25	2.76	11,121.97	1.4767
Commercial	Compressed Air	Compressed Air-NR-School K-12	10	$2,352.20	-$1.32	$20.25	2.76	17,569.02	2.3326
Commercial	Compressed Air	Compressed Air-NR-Small Off	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Compressed Air	Compressed Air-NR-Small Ret	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Compressed Air	Compressed Air-NR-Supermarket	10	$10,295.74	-$1.32	$20.25	2.76	76,900.69	10.2101
Commercial	Compressed Air	Compressed Air-NR-University	10	$2,352.20	-$1.32	$20.25	2.76	17,569.02	2.3326
Commercial	Compressed Air	Compressed Air-NR-Warehouse	10	$328,333.16	-$1.97	$20.25	2.79	2,452,245.33	342.4996
Commercial	Compressed Air	Compressed Air-NR-Xlarge Ret	10	$315,553.24	-$4.16	$20.24	2.91	2,357,517.77	383.6622
Commercial	Compressed Air	Compressed Air-Retro-Assembly	10	$53,876.73	-$8.80	$12.77	4.37	1,329,888.67	176.5690
Commercial	Compressed Air	Compressed Air-Retro-Hospital	10	$3,259.14	-$8.80	$12.77	4.37	80,448.23	10.6811
Commercial	Compressed Air	Compressed Air-Retro-Large Off	10	$695,873.41	-$8.90	$12.78	4.37	17,174,508.47	2,300.4415
Commercial	Compressed Air	Compressed Air-Retro-Large Ret	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Compressed Air	Compressed Air-Retro-Lodging	10	$17,802.00	-$8.80	$12.77	4.37	439,423.10	58.3421
Commercial	Compressed Air	Compressed Air-Retro-Medium Off	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Compressed Air	Compressed Air-Retro-Medium Ret	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Compressed Air	Compressed Air-Retro-MiniMart	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Compressed Air	Compressed Air-Retro-Other	10	$291,993.91	-$8.80	$12.77	4.37	7,207,552.97	956.9452
Commercial	Compressed Air	Compressed Air-Retro-Residential Care	10	$3,259.14	-$8.80	$12.77	4.37	80,448.23	10.6811
Commercial	Compressed Air	Compressed Air-Retro-Restaurant	10	$7,004.40	-$8.80	$12.77	4.37	172,896.09	22.9554
Commercial	Compressed Air	Compressed Air-Retro-School K-12	10	$11,064.63	-$8.80	$12.77	4.37	273,118.36	36.2619
Commercial	Compressed Air	Compressed Air-Retro-Small Off	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Compressed Air	Compressed Air-Retro-Small Ret	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Compressed Air	Compressed Air-Retro-Supermarket	10	$48,430.57	-$8.80	$12.77	4.37	1,195,456.19	158.7204
Commercial	Compressed Air	Compressed Air-Retro-University	10	$11,064.63	-$8.80	$12.77	4.37	273,118.36	36.2619

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Commercial	Compressed Air	Compressed Air-Retro-Warehouse	10	$1,544,460.61	-$9.45	$12.78	4.42	38,121,268.37	5,324.3121
Commercial	Compressed Air	Compressed Air-Retro-Xlarge Ret	10	$1,484,344.62	-$11.63	$12.77	4.62	36,648,685.35	5,964.2027
Commercial	Food Preparation	Combi Oven (Wt Average)	10	$774.33	-$86.33	$24.15	5.99	5,624.30	0.9663
Commercial	Food Preparation	Convection Oven (Wt Average)	10	$482.64	$66.43	$91.69	0.65	865.13	0.1489
Commercial	Food Preparation	Fryers	8	$1,682.07	$205.64	$230.89	0.26	1,779.49	0.3063
Commercial	Food Preparation	HFHC (Wt Average Size)	20	$551.59	-$0.39	$24.87	2.39	2,612.50	0.4497
Commercial	Food Preparation	Steamer (Wt Average Size)	9	-$256.45	-$117.59	-$2.41	9,999.00	18,499.80	3.1816
Commercial	Electronics	Best Practice	5	$30.96	$9,999.00	$9,999.00	-	-	-
Commercial	Electronics	Commercial Technology	7.880681	$43.37	$13.92	$34.75	1.55	218.44	0.0274
Commercial	Electronics	Cutting Edge	6.228585	$6.27	$7.67	$28.50	1.89	51.63	0.0065
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Parking Garage-Retro	15	$0.39	$24.54	$51.45	1.18	0.98	0.0002
Commercial	HVAC	DCV Hood 5 hp	18	$8,305.14	$61.08	$83.75	0.67	9,863.55	1.4412
Commercial	HVAC	DCV Hood w/ MUA 5 hp	18	$8,305.14	$23.85	$46.53	1.21	17,754.39	2.5941
Commercial	HVAC	Demand Control Ventilation-Retro-Assembly	15	$218.76	$338.11	$365.45	0.17	67.20	0.0127
Commercial	HVAC	Demand Control Ventilation-Retro-Hospital	15	$113.97	$1,399.10	$1,422.67	0.04	8.99	0.0011
Commercial	HVAC	Demand Control Ventilation-Retro-Large Off	15	$114.12	$68.64	$89.10	0.61	143.78	0.0171
Commercial	HVAC	Demand Control Ventilation-Retro-Large Ret	15	$368.92	$64.25	$81.90	0.63	505.71	0.0459
Commercial	HVAC	Demand Control Ventilation-Retro-Lodging	15	$113.29	$36.75	$63.81	0.96	199.32	0.0378
Commercial	HVAC	Demand Control Ventilation-Retro-Medium Off	15	$117.16	$105.78	$126.32	0.43	104.12	0.0124
Commercial	HVAC	Demand Control Ventilation-Retro-Medium Ret	15	$270.66	$54.73	$72.31	0.71	420.18	0.0381
Commercial	HVAC	Demand Control Ventilation-Retro-MiniMart	15	$250.75	$11.26	$30.21	1.74	931.67	0.0987
Commercial	HVAC	Demand Control Ventilation-Retro-Other	15	$105.23	$142.85	$170.19	0.36	69.41	0.0132
Commercial	HVAC	Demand Control Ventilation-Retro-Residential Care	15	$101.05	$65.52	$86.11	0.62	131.73	0.0160
Commercial	HVAC	Demand Control Ventilation-Retro-Restaurant	15	$298.98	$53.92	$75.26	0.73	445.97	0.0577
Commercial	HVAC	Demand Control Ventilation-Retro-School K-12	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	HVAC	Demand Control Ventilation-Retro-Small Off	15	$109.31	$105.74	$126.32	0.43	97.15	0.0115
Commercial	HVAC	Demand Control Ventilation-Retro-Small Ret	15	$160.46	$54.65	$72.31	0.71	249.10	0.0226
Commercial	HVAC	Demand Control Ventilation-Retro-Supermarket	15	$495.45	$57.24	$76.20	0.69	729.89	0.0774
Commercial	HVAC	Demand Control Ventilation-Retro-University	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	HVAC	Demand Control Ventilation-Retro-Warehouse	15	$21.79	$563.69	$596.47	0.11	4.10	0.0007
Commercial	HVAC	Demand Control Ventilation-Retro-Xlarge Ret	15	$530.18	$63.18	$80.78	0.64	736.84	0.0669
Commercial	Electronics	ENERGY STAR Desktop	5	$0.00	-$22.77	$0.00	9,999.00	130.74	0.0190
Commercial	HVAC	DHP-NEW-Assembly	20	$3.82	$47.69	$83.98	0.83	4.24	0.0012
Commercial	HVAC	DHP-NEW-Hospital	20	$3.82	$60.72	$84.14	0.66	4.23	0.0006
Commercial	HVAC	DHP-NEW-Large Off	20	$3.82	$49.34	$84.05	0.81	4.24	0.0011
Commercial	HVAC	DHP-NEW-Large Ret	20	$3.82	$30.12	$83.83	1.05	4.25	0.0020
Commercial	HVAC	DHP-NEW-Lodging	20	$3.82	$49.07	$83.99	0.81	4.24	0.0011
Commercial	HVAC	DHP-NEW-Medium Off	20	$3.82	$49.34	$84.05	0.81	4.24	0.0011
Commercial	HVAC	DHP-NEW-Medium Ret	20	$3.82	$30.12	$83.83	1.05	4.25	0.0020
Commercial	HVAC	DHP-NEW-MiniMart	20	$3.82	$45.19	$83.92	0.86	4.24	0.0013
Commercial	HVAC	DHP-NEW-Other	20	$3.82	$47.69	$83.98	0.83	4.24	0.0012
Commercial	HVAC	DHP-NEW-Residential Care	20	$3.82	$60.72	$84.14	0.66	4.23	0.0006
Commercial	HVAC	DHP-NEW-Restaurant	20	$3.82	$13.38	$83.82	1.25	4.25	0.0027
Commercial	HVAC	DHP-NEW-School K-12	20	$3.82	$35.76	$83.78	0.98	4.25	0.0017
Commercial	HVAC	DHP-NEW-Small Off	20	$3.82	$16.91	$83.78	1.21	4.25	0.0025
Commercial	HVAC	DHP-NEW-Small Ret	20	$3.82	$30.12	$83.83	1.05	4.25	0.0020
Commercial	HVAC	DHP-NEW-Supermarket	20	$3.82	$45.19	$83.92	0.86	4.24	0.0013
Commercial	HVAC	DHP-NEW-University	20	$3.82	$55.54	$84.03	0.74	4.24	0.0009
Commercial	HVAC	DHP-NEW-Warehouse	20	$3.82	$58.03	$84.09	0.72	4.23	0.0008
Commercial	HVAC	DHP-NEW-Xlarge Ret	20	$3.82	$30.12	$83.83	1.05	4.25	0.0020
Commercial	HVAC	DHP-Retro-Assembly	20	$3.82	$47.69	$83.98	0.83	4.24	0.0012
Commercial	HVAC	DHP-Retro-Hospital	20	$3.82	$60.72	$84.14	0.66	4.23	0.0006
Commercial	HVAC	DHP-Retro-Large Off	20	$3.82	$49.34	$84.05	0.81	4.24	0.0011
Commercial	HVAC	DHP-Retro-Large Ret	20	$3.82	$30.12	$83.83	1.05	4.25	0.0020
Commercial	HVAC	DHP-Retro-Lodging	20	$3.82	$49.07	$83.99	0.81	4.24	0.0011
Commercial	HVAC	DHP-Retro-Medium Off	20	$3.82	$49.34	$84.05	0.81	4.24	0.0011

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Commercial	HVAC	DHP-Retro-Medium Ret	20	$3.82	$30.12	$83.83	1.05	4.25	0.0020
Commercial	HVAC	DHP-Retro-MiniMart	20	$3.82	$45.19	$83.92	0.86	4.24	0.0013
Commercial	HVAC	DHP-Retro-Other	20	$3.82	$47.69	$83.98	0.83	4.24	0.0012
Commercial	HVAC	DHP-Retro-Residential Care	20	$3.82	$60.72	$84.14	0.66	4.23	0.0006
Commercial	HVAC	DHP-Retro-Restaurant	20	$3.82	$13.38	$83.82	1.25	4.25	0.0027
Commercial	HVAC	DHP-Retro-School K-12	20	$3.82	$35.76	$83.78	0.98	4.25	0.0017
Commercial	HVAC	DHP-Retro-Small Off	20	$3.82	$16.91	$83.78	1.21	4.25	0.0025
Commercial	HVAC	DHP-Retro-Small Ret	20	$3.82	$30.12	$83.83	1.05	4.25	0.0020
Commercial	HVAC	DHP-Retro-Supermarket	20	$3.82	$45.19	$83.92	0.86	4.24	0.0013
Commercial	HVAC	DHP-Retro-University	20	$3.82	$55.54	$84.03	0.74	4.24	0.0009
Commercial	HVAC	DHP-Retro-Warehouse	20	$3.82	$58.03	$84.09	0.72	4.23	0.0008
Commercial	HVAC	DHP-Retro-Xlarge Ret	20	$3.82	$30.12	$83.83	1.05	4.25	0.0020
Commercial	Motors/Drives	ECM-VAV-New-Assembly	18	$0.04	$7.33	$29.11	1.78	0.13	0.0000
Commercial	Motors/Drives	ECM-VAV-New-Hospital	18	$0.08	$12.82	$27.74	1.61	0.29	0.0000
Commercial	Motors/Drives	ECM-VAV-New-Large Off	18	$0.12	$17.35	$34.16	1.44	0.35	0.0000
Commercial	Motors/Drives	ECM-VAV-New-Large Ret	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-New-Lodging	18	$0.01	$14.88	$40.15	1.46	0.02	0.0000
Commercial	Motors/Drives	ECM-VAV-New-Medium Off	18	$0.01	$17.65	$34.60	1.43	0.03	0.0000
Commercial	Motors/Drives	ECM-VAV-New-Medium Ret	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-New-MiniMart	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-New-Other	18	$0.04	$8.45	$30.75	1.72	0.14	0.0000
Commercial	Motors/Drives	ECM-VAV-New-Residential Care	18	$0.01	$19.14	$36.93	1.35	0.02	0.0000
Commercial	Motors/Drives	ECM-VAV-New-Restaurant	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-New-School K-12	18	$0.03	$15.94	$29.28	1.55	0.10	0.0000
Commercial	Motors/Drives	ECM-VAV-New-Small Off	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-New-Small Ret	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-New-Supermarket	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-New-University	18	$0.09	$7.51	$29.52	1.77	0.29	0.0001
Commercial	Motors/Drives	ECM-VAV-New-Warehouse	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-New-Xlarge Ret	18	$0.01	$16.48	$28.41	1.52	0.02	0.0000
Commercial	Motors/Drives	ECM-VAV-NR-Assembly	18	$0.04	$3.93	$26.56	1.98	0.14	0.0000
Commercial	Motors/Drives	ECM-VAV-NR-Hospital	18	$0.08	$3.22	$25.45	2.02	0.31	0.0001
Commercial	Motors/Drives	ECM-VAV-NR-Large Off	18	$0.12	$6.41	$30.46	1.83	0.39	0.0001
Commercial	Motors/Drives	ECM-VAV-NR-Large Ret	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-NR-Lodging	18	$0.01	$9.23	$34.87	1.69	0.02	0.0000
Commercial	Motors/Drives	ECM-VAV-NR-Medium Off	18	$0.01	$6.62	$30.79	1.82	0.03	0.0000
Commercial	Motors/Drives	ECM-VAV-NR-Medium Ret	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-NR-MiniMart	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-NR-Other	18	$0.04	$4.75	$27.85	1.92	0.15	0.0000
Commercial	Motors/Drives	ECM-VAV-NR-Residential Care	18	$0.01	$7.71	$32.50	1.76	0.02	0.0000
Commercial	Motors/Drives	ECM-VAV-NR-Restaurant	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-NR-School K-12	18	$0.03	$4.03	$26.72	1.97	0.11	0.0000
Commercial	Motors/Drives	ECM-VAV-NR-Small Off	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-NR-Small Ret	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-NR-Supermarket	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-NR-University	18	$0.09	$4.13	$26.88	1.96	0.32	0.0001
Commercial	Motors/Drives	ECM-VAV-NR-Warehouse	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Motors/Drives	ECM-VAV-NR-Xlarge Ret	18	$0.01	$3.56	$25.99	2.00	0.03	0.0000
Commercial	HVAC	Economizer-Retro-Assembly	18	$0.22	$35.06	$80.62	0.99	0.33	0.0001
Commercial	HVAC	Economizer-Retro-Hospital	18	$0.30	$82.89	$126.75	0.61	0.28	0.0000
Commercial	HVAC	Economizer-Retro-Large Off	18	$0.18	$28.92	$63.34	1.08	0.46	0.0001
Commercial	HVAC	Economizer-Retro-Large Ret	18	$0.32	$64.66	$89.96	0.66	0.41	0.0000
Commercial	HVAC	Economizer-Retro-Lodging	18	$0.10	-$5.05	$28.28	2.36	0.56	0.0001
Commercial	HVAC	Economizer-Retro-Medium Off	18	$0.18	$24.70	$59.05	1.15	0.40	0.0001
Commercial	HVAC	Economizer-Retro-Medium Ret	18	$0.19	$13.43	$35.75	1.58	0.68	0.0001
Commercial	HVAC	Economizer-Retro-MiniMart	18	$0.18	$24.21	$54.26	1.17	0.43	0.0001
Commercial	HVAC	Economizer-Retro-Other	18	$0.17	$13.72	$54.31	1.37	0.41	0.0001
Commercial	HVAC	Economizer-Retro-Residential Care	18	$0.13	$9.86	$35.52	1.65	0.53	0.0001
Commercial	HVAC	Economizer-Retro-Restaurant	18	$0.25	$40.33	$70.08	0.90	0.43	0.0001
Commercial	HVAC	Economizer-Retro-School K-12	18	$0.20	$38.27	$80.48	0.96	0.32	0.0000
Commercial	HVAC	Economizer-Retro-Small Off	18	$0.13	-$4.76	$40.71	1.96	0.46	0.0001
Commercial	HVAC	Economizer-Retro-Small Ret	18	$0.17	$8.50	$31.23	1.82	0.70	0.0001
Commercial	HVAC	Economizer-Retro-Supermarket	18	$0.26	$71.96	$102.54	0.62	0.31	0.0000
Commercial	HVAC	Economizer-Retro-University	18	$0.21	$33.64	$76.86	1.00	0.34	0.0001
Commercial	HVAC	Economizer-Retro-Warehouse	18	$0.07	-$5.86	$38.31	2.04	0.31	0.0001
Commercial	HVAC	Economizer-Retro-Xlarge Ret	18	$0.29	$54.27	$80.00	0.75	0.42	0.0000
Commercial	Lighting	Exterior Lighting: Façade - HID 150W - New	16.27907	$0.75	-$36.43	-$5.08	61.03	70.71	0.0165
Commercial	Lighting	Exterior Lighting: Façade - HID 400W - New	16.27907	$0.93	-$32.72	-$1.37	20.77	30.51	0.0071
Commercial	Lighting	Exterior Lighting: Parking Lot - HPS 250W - New	11.62791	$14.54	-$20.09	$11.26	4.62	137.55	0.0321
Commercial	Lighting	Exterior Lighting: Parking Lot - MH 1000W - New	11.62791	$1.05	-$11.26	$20.08	2.99	6.60	0.0015
Commercial	Lighting	Exterior Lighting: Parking Lot - MH 400W - New	11.62791	$5.31	-$21.37	$9.98	5.01	54.31	0.0127
Commercial	Lighting	Exterior Lighting: Walkway - CFL 26W - New	6.676279	$0.14	-$59.27	-$27.93	8.78	2.44	0.0006
Commercial	Lighting	Exterior Lighting: Walkway - HID 150W - New	16.27907	$0.69	-$36.17	-$4.82	66.30	70.55	0.0165

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Commercial	Lighting	Exterior Lighting: Walkway - INC 75W - New	6.676279	$0.03	-$147.65	-$116.31	53.56	1.81	0.0004
Commercial	Lighting	Exterior Lighting: Façade - HID 150W - NR	16.27907	$19.27	-$8.61	$22.73	2.38	70.71	0.0165
Commercial	Lighting	Exterior Lighting: Façade - HID 400W - NR	16.27907	$5.97	-$15.17	$16.17	3.24	30.51	0.0071
Commercial	Lighting	Exterior Lighting: Parking Lot - HPS 250W - NR	11.62791	$45.54	$10.30	$41.65	1.47	137.55	0.0321
Commercial	Lighting	Exterior Lighting: Parking Lot - MH 1000W - NR	11.62791	$1.95	$6.99	$38.34	1.61	6.60	0.0015
Commercial	Lighting	Exterior Lighting: Parking Lot - MH 400W - NR	11.62791	$13.39	-$1.31	$30.04	1.99	54.31	0.0127
Commercial	Lighting	Exterior Lighting: Walkway - CFL 26W - NR	6.676279	$0.14	-$59.27	-$27.93	8.78	2.44	0.0006
Commercial	Lighting	Exterior Lighting: Walkway - HID 150W - NR	13.95349	$15.90	-$10.34	$21.00	2.55	69.71	0.0163
Commercial	Lighting	Exterior Lighting: Walkway - INC 75W - NR	6.676279	$0.03	-$147.65	-$116.31	53.56	1.81	0.0004
Commercial	Refrigeration	Anti Sweat Heater Controls	8	$53.04	$8.20	$24.94	1.87	280.03	0.0340
Commercial	Refrigeration	ECM Controllers on Walk-In Evaporator Motors	16	$208.55	$57.00	$77.33	0.69	302.77	0.0367
Commercial	Refrigeration	Floating Head Pressure Control	15	$327.87	$27.28	$47.61	1.12	773.16	0.0938
Commercial	Refrigeration	Grocery Retrocommisioning	15	$0.26	$7.05	$27.37	1.95	1.06	0.0001
Commercial	Refrigeration	LED Case Lighting	5.976291	$21.04	$39.04	$55.75	0.90	73.39	0.0089
Commercial	Refrigeration	LED Motion Sensors on Display Case	8	$3.65	$19.33	$39.65	1.34	16.64	0.0020
Commercial	Refrigeration	Replace Shaded Pole with ECM in Walk-in Cooler	15	$6,748.72	$11.51	$31.83	1.68	23,804.47	2.8867
Commercial	Refrigeration	Strip Curtains: Walk-In Coolers/ Freezers	2	$10.14	$20.50	$40.82	1.31	155.70	0.0189
Commercial	Electronics	ENERGY STAR Laptop	4	$0.00	-$22.77	$0.00	9,999.00	39.02	0.0057
Commercial	Lighting	LEC Exit Sign-Double-New	15	$52.50	-$3.79	$17.04	1.39	63.08	0.0079
Commercial	Lighting	LEC Exit Sign-Single-New	15	$52.50	$13.36	$34.19	1.10	31.44	0.0039
Commercial	Lighting	LEC Exit Sign-Double-NR	15	$52.50	-$3.79	$17.04	1.39	63.08	0.0079
Commercial	Lighting	LEC Exit Sign-Single-NR	15	$52.50	$13.36	$34.19	1.10	31.44	0.0039
Commercial	Lighting	Lighting Controls Interior-New-Assembly-Integrated	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-New-Assembly-Unitary	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-New-Hospital-Integrated	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-New-Hospital-Unitary	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-New-Large Off-Integrated	15	$221.70	$136.36	$148.64	0.37	167.44	0.0289
Commercial	Lighting	Lighting Controls Interior-New-Large Off-Unitary	15	$341.08	$71.41	$91.47	0.61	418.60	0.0722
Commercial	Lighting	Lighting Controls Interior-New-Large Ret-Integrated	15	$221.70	$126.17	$123.91	0.39	200.85	0.0335
Commercial	Lighting	Lighting Controls Interior-New-Large Ret-Unitary	15	$341.08	$62.30	$76.25	0.68	502.13	0.0839
Commercial	Lighting	Lighting Controls Interior-New-Lodging-Integrated	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-New-Lodging-Unitary	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-New-Medium Off-Integrated	15	$221.70	$222.48	$219.13	0.24	113.57	0.0196
Commercial	Lighting	Lighting Controls Interior-New-Medium Off-Unitary	15	$341.08	$121.04	$134.85	0.40	283.94	0.0489
Commercial	Lighting	Lighting Controls Interior-New-Medium Ret-Integrated	15	$221.70	$138.94	$131.95	0.36	188.61	0.0315
Commercial	Lighting	Lighting Controls Interior-New-Medium Ret-Unitary	15	$341.08	$69.14	$81.20	0.63	471.53	0.0787
Commercial	Lighting	Lighting Controls Interior-New-MiniMart-Integrated	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-New-MiniMart-Unitary	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-New-Other-Integrated	15	$221.70	$157.72	$167.72	0.32	148.39	0.0237
Commercial	Lighting	Lighting Controls Interior-New-Other-Unitary	15	$341.08	$84.76	$103.21	0.53	370.98	0.0593
Commercial	Lighting	Lighting Controls Interior-New-Residential Care-Integrated	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-New-Residential Care-Unitary	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-New-Restaurant-Integrated	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-New-Restaurant-Unitary	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-New-School K-12-Integrated	15	$221.70	$255.29	$219.47	0.20	113.40	0.0151
Commercial	Lighting	Lighting Controls Interior-New-School K-12-Unitary	15	$341.08	$136.35	$135.06	0.35	283.51	0.0377
Commercial	Lighting	Lighting Controls Interior-New-Small Off-Integrated	15	$221.70	$219.34	$224.79	0.25	110.72	0.0212
Commercial	Lighting	Lighting Controls Interior-New-Small Off-Unitary	15	$341.08	$119.89	$138.33	0.42	276.79	0.0530
Commercial	Lighting	Lighting Controls Interior-New-Small Ret-Integrated	15	$221.70	$202.41	$183.12	0.26	135.91	0.0227
Commercial	Lighting	Lighting Controls Interior-New-Small Ret-Unitary	15	$341.08	$105.55	$112.69	0.45	339.78	0.0567
Commercial	Lighting	Lighting Controls Interior-New-Supermarket-Integrated	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-New-Supermarket-Unitary	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-New-University-Integrated	15	$221.70	$243.94	$219.93	0.23	113.16	0.0245
Commercial	Lighting	Lighting Controls Interior-New-University-Unitary	15	$341.08	$127.25	$135.34	0.41	282.91	0.0612
Commercial	Lighting	Lighting Controls Interior-New-Warehouse-Integrated	15	$209.58	$391.35	$359.47	0.14	65.45	0.0119
Commercial	Lighting	Lighting Controls Interior-New-Warehouse-Unitary	15	$158.98	$84.11	$90.89	0.55	196.35	0.0356
Commercial	Lighting	Lighting Controls Interior-New-Xlarge Ret-Integrated	15	$221.70	$60.76	$70.22	0.69	354.45	0.0592
Commercial	Lighting	Lighting Controls Interior-New-Xlarge Ret-Unitary	15	$341.08	$24.57	$43.21	1.19	886.13	0.1480
Commercial	Lighting	Lighting Controls Interior-NR-Assembly-Integrated	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-NR-Assembly-Unitary	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-NR-Hospital-Integrated	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-NR-Hospital-Unitary	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-NR-Large Off-Integrated	15	$221.70	$121.64	$135.38	0.40	183.84	0.0317
Commercial	Lighting	Lighting Controls Interior-NR-Large Off-Unitary	15	$341.08	$62.67	$83.31	0.67	459.59	0.0792
Commercial	Lighting	Lighting Controls Interior-NR-Large Ret-Integrated	15	$221.70	$128.01	$123.79	0.38	201.05	0.0336
Commercial	Lighting	Lighting Controls Interior-NR-Large Ret-Unitary	15	$341.08	$63.01	$76.18	0.67	502.63	0.0839
Commercial	Lighting	Lighting Controls Interior-NR-Lodging-Integrated	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-NR-Lodging-Unitary	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-NR-Medium Off-Integrated	15	$221.70	$210.67	$211.79	0.25	117.51	0.0203
Commercial	Lighting	Lighting Controls Interior-NR-Medium Off-Unitary	15	$341.08	$114.74	$130.33	0.42	293.78	0.0506
Commercial	Lighting	Lighting Controls Interior-NR-Medium Ret-Integrated	15	$221.70	$118.89	$116.40	0.41	213.82	0.0357
Commercial	Lighting	Lighting Controls Interior-NR-Medium Ret-Unitary	15	$341.08	$57.77	$71.63	0.71	534.56	0.0893
Commercial	Lighting	Lighting Controls Interior-NR-MiniMart-Integrated	15	$0.00	$9,999.00	$9,999.00	-	-	-

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Commercial	Lighting	Lighting Controls Interior-NR-MiniMart-Unitary	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-NR-Other-Integrated	15	$221.70	$157.96	$165.44	0.32	150.44	0.0240
Commercial	Lighting	Lighting Controls Interior-NR-Other-Unitary	15	$341.08	$84.36	$101.81	0.54	376.09	0.0601
Commercial	Lighting	Lighting Controls Interior-NR-Residential Care-Integrated	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-NR-Residential Care-Unitary	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-NR-Restaurant-Integrated	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-NR-Restaurant-Unitary	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-NR-School K-12-Integrated	15	$221.70	$263.58	$229.84	0.20	108.28	0.0144
Commercial	Lighting	Lighting Controls Interior-NR-School K-12-Unitary	15	$341.08	$141.89	$141.44	0.34	270.71	0.0360
Commercial	Lighting	Lighting Controls Interior-NR-Small Off-Integrated	15	$221.70	$227.49	$225.53	0.24	110.35	0.0211
Commercial	Lighting	Lighting Controls Interior-NR-Small Off-Unitary	15	$341.08	$123.31	$138.79	0.41	275.89	0.0528
Commercial	Lighting	Lighting Controls Interior-NR-Small Ret-Integrated	15	$221.70	$199.66	$180.73	0.26	137.71	0.0230
Commercial	Lighting	Lighting Controls Interior-NR-Small Ret-Unitary	15	$341.08	$103.93	$111.22	0.46	344.26	0.0575
Commercial	Lighting	Lighting Controls Interior-NR-Supermarket-Integrated	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-NR-Supermarket-Unitary	15	$0.00	$9,999.00	$9,999.00	-	-	-
Commercial	Lighting	Lighting Controls Interior-NR-University-Integrated	15	$221.70	$253.81	$229.40	0.22	108.49	0.0235
Commercial	Lighting	Lighting Controls Interior-NR-University-Unitary	15	$341.08	$133.24	$141.17	0.39	271.23	0.0587
Commercial	Lighting	Lighting Controls Interior-NR-Warehouse-Integrated	15	$209.58	$415.91	$358.83	0.14	65.57	0.0119
Commercial	Lighting	Lighting Controls Interior-NR-Warehouse-Unitary	15	$158.98	$92.35	$90.73	0.51	196.70	0.0357
Commercial	Lighting	Lighting Controls Interior-NR-Xlarge Ret-Integrated	15	$221.70	$68.69	$84.10	0.63	295.94	0.0494
Commercial	Lighting	Lighting Controls Interior-NR-Xlarge Ret-Unitary	15	$341.08	$30.73	$51.75	1.06	739.84	0.1236
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	Market Average HP Low Power T8 Shift	6.666667	$0.90	$8.02	$30.17	1.76	6.28	0.0011
Commercial	Lighting	All Btype_New_CAN_FIX_REPL_from CFL to LED_FIX_KIT	13.43071	$39.00	-$31.34	-$10.34	2.62	126.94	0.0205
Commercial	Lighting	All Btype_New_CAN_FIX_REPL_from INC_HAL to LED_FIX_KIT	13.11199	$1.86	-$92.83	-$71.93	24.24	100.00	0.0160
Commercial	Lighting	All Btype_New_DISP_FIX_REPL_from CFL to LED_FIX_KIT	9.401498	$110.78	$142.55	$163.55	0.78	34.55	0.0056
Commercial	Lighting	All Btype_New_DISP_FIX_REPL_from INC_HAL to LED_FIX_KIT	8.328906	$8.77	-$47.16	-$27.87	2.45	29.33	0.0047
Commercial	Lighting	All Btype_New_HIGHBAY_FIX_REPL_from HID to LED_FIX_KIT	20.85597	$24.32	$17.43	$37.57	1.34	49.52	0.0081
Commercial	Lighting	All Btype_New_HIGHBAY_FIX_REPL_from HID to LF2018	20	$2.73	-$2.36	$17.78	2.10	8.83	0.0015
Commercial	Lighting	All Btype_New_HIGHBAY_FIX_REPL_from LF2018 to LED_FIX_KIT	19.55876	$54.26	$28.43	$48.15	1.06	61.11	0.0100
Commercial	Lighting	All Btype_New_LF_FIX_REPL_from LF2018 to LED_FIX_KIT	15.89193	$501.65	$31.71	$52.34	1.03	738.34	0.1199
Commercial	Lighting	All Btype_NR_CAN_FIX_REPL_from CFL to LED_FIX_KIT	13.86169	$23.09	-$30.66	-$9.89	2.59	73.04	0.0118
Commercial	Lighting	All Btype_NR_CAN_FIX_REPL_from INC_HAL to LED_FIX_KIT	12.91756	$1.28	-$92.42	-$71.59	23.81	70.51	0.0113
Commercial	Lighting	All Btype_NR_DISP_FIX_REPL_from CFL to LED_FIX_KIT	9.905444	$65.85	$140.51	$161.62	0.79	19.55	0.0031
Commercial	Lighting	All Btype_NR_DISP_FIX_REPL_from INC_HAL to LED_FIX_KIT	8.627286	$17.07	-$47.65	-$27.92	2.41	53.72	0.0086
Commercial	Lighting	All Btype_NR_HIGHBAY_FIX_REPL_from HID to LED_FIX_KIT	21.25284	$33.81	$18.37	$38.52	1.31	66.34	0.0109
Commercial	Lighting	All Btype_NR_HIGHBAY_FIX_REPL_from HID to LF2018	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Lighting	All Btype_NR_HIGHBAY_FIX_REPL_from LF2018 to LED_FIX_KIT	20.25163	$45.54	$30.30	$49.83	1.04	48.63	0.0080
Commercial	Lighting	All Btype_NR_LF_FIX_REPL_from LF2018 to LED_FIX_KIT	16.125	$259.11	$32.75	$52.74	1.02	372.06	0.0606
Commercial	Lighting	All Btype_NR_LF_FIX_REPL_from LF2018 to LED_FIX_KIT_RDX	16.125	$57.26	-$5.32	$14.67	2.12	198.62	0.0323
Commercial	Lighting	All Btype_NR_LF_FIX_REPL_from LF2018 to LF_FIX_KIT_RDX	20	$27.85	-$9.66	$10.33	2.00	65.88	0.0107
Commercial	Lighting	All Btype_NR_LF_FIX_REPL_from LF2018 to TLED_PIN	13.4375	$26.58	$13.00	$32.99	1.28	45.17	0.0074
Commercial	Lighting	All Btype_NR_LF_FIX_REPL_from LF2018 to TLED_PIN_RDX	13.4375	$17.20	-$15.27	$4.72	2.55	75.91	0.0124
Commercial	Lighting	All Btype_Retro_CAN_FIX_REPL_from CFL to LED_FIX_KIT	13.86169	$81.37	$63.46	$84.23	0.78	73.04	0.0118
Commercial	Lighting	All Btype_Retro_CAN_FIX_REPL_from INC_HAL to LED_FIX_KIT	12.91756	$13.44	-$71.00	-$50.16	4.89	70.51	0.0113
Commercial	Lighting	All Btype_Retro_CAN_LAMP_REPL_from CFL to LED_CAN_LAMP	13.86169	$33.64	-$13.22	$7.55	1.77	69.10	0.0111
Commercial	Lighting	All Btype_Retro_CAN_LAMP_REPL_from INC_HAL to LED_CAN_LAMP	12.91756	$5.56	-$85.56	-$64.72	10.07	69.79	0.0112
Commercial	Lighting	All Btype_Retro_DISP_FIX_REPL_from CFL to LED_FIX_KIT	9.905444	$132.08	$651.82	$672.94	0.40	19.55	0.0031
Commercial	Lighting	All Btype_Retro_DISP_FIX_REPL_from INC_HAL to LED_FIX_KIT	8.627286	$31.68	-$2.03	$17.71	1.35	53.72	0.0086
Commercial	Lighting	All Btype_Retro_DISP_LAMP_REPL_from CFL to LED_PAR_MR	9.905444	$60.26	$79.10	$100.22	0.89	23.13	0.0037
Commercial	Lighting	All Btype_Retro_DISP_LAMP_REPL_from HID_CMH to LED_PAR_MR	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Lighting	All Btype_Retro_DISP_LAMP_REPL_from INC_HAL to HID_CMH	2.957927	$1.78	-$19.32	$0.41	1.66	9.91	0.0016
Commercial	Lighting	All Btype_Retro_DISP_LAMP_REPL_from INC_HAL to LED_PAR_MR	8.627286	$11.56	-$55.16	-$35.43	2.83	43.78	0.0070
Commercial	Lighting	All Btype_Retro_HIGHBAY_FIX_REPL_from HID to LED_FIX_KIT	21.25284	$45.99	$34.95	$55.10	0.99	66.34	0.0109
Commercial	Lighting	All Btype_Retro_HIGHBAY_FIX_REPL_from HID to LF2018	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Lighting	All Btype_Retro_HIGHBAY_FIX_REPL_from LF2018 to LED_FIX_KIT	20.25163	$112.45	$156.93	$176.45	0.44	48.63	0.0080
Commercial	Lighting	All Btype_Retro_LF_FIX_REPL_from LF2018 to LED_FIX_KIT	16.125	$892.21	$171.23	$191.23	0.37	446.47	0.0727

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Commercial	Lighting	All Btype_Retro_LF_FIX_REPL_from LF2018 to LED_FIX_KIT_RDX	16.125	$376.52	$98.45	$118.44	0.54	297.93	0.0485
Commercial	Lighting	All Btype_Retro_LF_FIX_REPL_from LF2018 to LF_FIX_KIT_RDX	20	$80.92	$65.37	$85.36	0.74	65.88	0.0107
Commercial	Lighting	All Btype_Retro_LF_LAMP_REPL_from LF2018 to TLED_PIN	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Lighting	All Btype_Retro_LF_LAMP_REPL_from LF2018 to TLED_PIN_RDX	13.4375	$496.67	$47.83	$67.83	0.86	630.04	0.1026
Commercial	Lighting	All Btype_Retro_OTHER_LAMP_REPL_from CFL to LED_OMNI	7.547368	$47.43	-$22.62	-$2.23	1.56	85.50	0.0131
Commercial	Lighting	All Btype_Retro_OTHER_LAMP_REPL_from EISA_2020 to CFL_OMNI	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Lighting	All Btype_Retro_OTHER_LAMP_REPL_from EISA_2020 to LED_OMNI	7.207131	$12.04	-$23.06	-$2.57	2.05	41.99	0.0064
Commercial	Lighting	All Btype_Retro_OTHER_LAMP_REPL_from HID to LED_OMNI	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Electronics	ENERGY STAR Display	4	$0.00	-$22.77	$0.00	9,999.00	32.45	0.0047
Commercial	Motors/Drives	MotorsRewind-New-Assembly	10	$2.37	$22.49	$45.10	1.25	7.95	0.0011
Commercial	Motors/Drives	MotorsRewind-New-Hospital	10	$0.96	-$7.47	$15.15	3.74	9.56	0.0014
Commercial	Motors/Drives	MotorsRewind-New-Large Off	10	$3.11	$24.37	$46.98	1.20	10.01	0.0014
Commercial	Motors/Drives	MotorsRewind-New-Large Ret	10	$1.66	$8.71	$31.32	1.81	8.01	0.0012
Commercial	Motors/Drives	MotorsRewind-New-Lodging	10	$0.79	-$9.19	$13.42	4.22	8.95	0.0013
Commercial	Motors/Drives	MotorsRewind-New-Medium Off	10	$3.11	$24.37	$46.98	1.20	10.01	0.0014
Commercial	Motors/Drives	MotorsRewind-New-Medium Ret	10	$1.66	$8.71	$31.32	1.81	8.01	0.0012
Commercial	Motors/Drives	MotorsRewind-New-MiniMart	10	$4.42	-$3.82	$18.79	3.01	35.61	0.0051
Commercial	Motors/Drives	MotorsRewind-New-Other	10	$2.00	$14.97	$37.58	1.51	8.06	0.0012
Commercial	Motors/Drives	MotorsRewind-New-Residential Care	10	$0.85	-$9.19	$13.42	4.22	9.56	0.0014
Commercial	Motors/Drives	MotorsRewind-New-Restaurant	10	$5.34	$5.57	$28.19	2.01	28.64	0.0041
Commercial	Motors/Drives	MotorsRewind-New-School K-12	10	$1.24	$24.37	$46.98	1.20	3.98	0.0006
Commercial	Motors/Drives	MotorsRewind-New-Small Off	10	$3.11	$24.37	$46.98	1.20	10.01	0.0014
Commercial	Motors/Drives	MotorsRewind-New-Small Ret	10	$1.66	$8.71	$31.32	1.81	8.01	0.0012
Commercial	Motors/Drives	MotorsRewind-New-Supermarket	10	$4.42	-$3.82	$18.79	3.01	35.61	0.0051
Commercial	Motors/Drives	MotorsRewind-New-University	10	$1.24	$24.37	$46.98	1.20	3.98	0.0006
Commercial	Motors/Drives	MotorsRewind-New-Warehouse	10	$1.18	$24.37	$46.98	1.20	3.78	0.0005
Commercial	Motors/Drives	MotorsRewind-New-Xlarge Ret	10	$1.66	$8.71	$31.32	1.81	8.01	0.0012
Commercial	Motors/Drives	MotorsRewind-NR-Assembly	10	$2.37	$22.49	$45.10	1.25	7.95	0.0011
Commercial	Motors/Drives	MotorsRewind-NR-Hospital	10	$0.96	-$7.47	$15.15	3.74	9.56	0.0014
Commercial	Motors/Drives	MotorsRewind-NR-Large Off	10	$3.11	$24.37	$46.98	1.20	10.01	0.0014
Commercial	Motors/Drives	MotorsRewind-NR-Large Ret	10	$1.66	$8.71	$31.32	1.81	8.01	0.0012
Commercial	Motors/Drives	MotorsRewind-NR-Lodging	10	$0.79	-$9.19	$13.42	4.22	8.95	0.0013
Commercial	Motors/Drives	MotorsRewind-NR-Medium Off	10	$3.11	$24.37	$46.98	1.20	10.01	0.0014
Commercial	Motors/Drives	MotorsRewind-NR-Medium Ret	10	$1.66	$8.71	$31.32	1.81	8.01	0.0012
Commercial	Motors/Drives	MotorsRewind-NR-MiniMart	10	$4.42	-$3.82	$18.79	3.01	35.61	0.0051
Commercial	Motors/Drives	MotorsRewind-NR-Other	10	$2.00	$14.97	$37.58	1.51	8.06	0.0012
Commercial	Motors/Drives	MotorsRewind-NR-Residential Care	10	$0.85	-$9.19	$13.42	4.22	9.56	0.0014
Commercial	Motors/Drives	MotorsRewind-NR-Restaurant	10	$5.34	$5.57	$28.19	2.01	28.64	0.0041
Commercial	Motors/Drives	MotorsRewind-NR-School K-12	10	$1.24	$24.37	$46.98	1.20	3.98	0.0006
Commercial	Motors/Drives	MotorsRewind-NR-Small Off	10	$3.11	$24.37	$46.98	1.20	10.01	0.0014
Commercial	Motors/Drives	MotorsRewind-NR-Small Ret	10	$1.66	$8.71	$31.32	1.81	8.01	0.0012
Commercial	Motors/Drives	MotorsRewind-NR-Supermarket	10	$4.42	-$3.82	$18.79	3.01	35.61	0.0051
Commercial	Motors/Drives	MotorsRewind-NR-University	10	$1.24	$24.37	$46.98	1.20	3.98	0.0006
Commercial	Motors/Drives	MotorsRewind-NR-Warehouse	10	$1.18	$24.37	$46.98	1.20	3.78	0.0005
Commercial	Motors/Drives	MotorsRewind-NR-Xlarge Ret	10	$1.66	$8.71	$31.32	1.81	8.01	0.0012
Commercial	Process Loads	Municipal Water Supply-Retro	12	$13,829.18	$9.99	$33.62	1.72	54,168.45	8.5110
Commercial	Lighting	NR_PARKING_GARAGE_FIX_REPL_from MH to BI-LEVEL_LED_FIX	8.561644	$351.84	$11.73	$32.56	1.57	1,612.49	0.2025
Commercial	HVAC	Premium Fume Hood-NR	18	$7,972.94	$24.76	$51.66	1.18	15,349.29	2.9112
Commercial	Food Preparation	Pre-Rinse Spray Valve_0.61_to_0.8gpm	4	$86.67	-$523.83	$129.75	5.30	219.88	0.0370
Commercial	Food Preparation	Pre-Rinse Spray Valve_0.81_to_1.0gpm	4	$86.67	-$470.63	$212.30	3.38	134.38	0.0226
Commercial	HVAC	SGSWindow-High-rise Office (VAV with Central Chillers / Ele Boilers)-HZ3	30	$34.00	$66.13	$79.17	0.62	32.79	0.0016
Commercial	HVAC	SGSWindow-High-rise Office (VAV with Central Chillers / Ele Boilers)-HZ1	30	$34.00	$98.62	$111.65	0.44	23.25	0.0012
Commercial	HVAC	SGSWindow-High-rise Office (VAV with Central Chillers / Ele Boilers)-HZ2	30	$34.00	$82.66	$95.70	0.51	27.12	0.0014
Commercial	HVAC	SGSWindow-High-rise Office (VAV with Central Chillers / Gas Boilers)-HZ3	30	$34.00	$353.19	$455.89	0.30	5.69	0.0003
Commercial	HVAC	SGSWindow-High-rise Office (VAV with Central Chillers / Gas Boilers)-HZ1	30	$34.00	$631.53	$749.19	0.20	3.46	0.0002
Commercial	HVAC	SGSWindow-High-rise Office (VAV with Central Chillers / Gas Boilers)-HZ2	30	$34.00	$381.79	$469.95	0.26	5.52	0.0003
Commercial	HVAC	SGSWindow-Mid-rise Office (Apackaged VAV with Electric reheat)-HZ3	30	$34.00	$68.10	$81.13	0.60	32.00	0.0016
Commercial	HVAC	SGSWindow-Mid-rise Office (Apackaged VAV with Electric reheat)-HZ1	30	$34.00	$106.93	$119.96	0.41	21.64	0.0011
Commercial	HVAC	SGSWindow-Mid-rise Office (Apackaged VAV with Electric reheat)-HZ2	30	$34.00	$81.03	$94.06	0.52	27.60	0.0014
Commercial	HVAC	SGSWindow-Mid-rise Office (Apackaged VAV with Gas)-HZ3	30	$34.00	$360.75	$455.89	0.29	5.69	0.0003
Commercial	HVAC	SGSWindow-Mid-rise Office (Apackaged VAV with Gas)-HZ1	30	$34.00	$642.92	$749.19	0.19	3.46	0.0002
Commercial	HVAC	SGSWindow-Mid-rise Office (Apackaged VAV with Gas)-HZ2	30	$34.00	$385.89	$469.95	0.26	5.52	0.0003
Commercial	HVAC	SGSWindow-Small Office (AC with Ele Furnace)-HZ3	30	$34.00	$139.42	$152.46	0.32	17.03	0.0009
Commercial	HVAC	SGSWindow-Small Office (AC with Ele Furnace)-HZ1	30	$34.00	$170.25	$183.29	0.27	14.16	0.0007
Commercial	HVAC	SGSWindow-Small Office (AC with Ele Furnace)-HZ2	30	$34.00	$124.04	$137.08	0.36	18.94	0.0009
Commercial	HVAC	SGSWindow-Small Office (AC with Gas Furnace)-HZ3	30	$34.00	$294.78	$324.62	0.20	8.00	0.0004
Commercial	HVAC	SGSWindow-Small Office (AC with Gas Furnace)-HZ1	30	$34.00	$304.84	$326.38	0.18	7.95	0.0004
Commercial	HVAC	SGSWindow-Small Office (AC with Gas Furnace)-HZ2	30	$34.00	$263.41	$293.42	0.22	8.85	0.0004
Commercial	HVAC	SGSWindow-Small Office (Air-source Heat Pump)-HZ3	30	$34.00	$203.35	$216.38	0.23	12.00	0.0006
Commercial	HVAC	SGSWindow-Small Office (Air-source Heat Pump)-HZ1	30	$34.00	$229.88	$242.92	0.20	10.69	0.0005
Commercial	HVAC	SGSWindow-Small Office (Air-source Heat Pump)-HZ2	30	$34.00	$185.25	$198.29	0.25	13.09	0.0007
Commercial	Water Heating	Showerheads-Retro-Assembly	10	$12.58	-$322.72	$12.35	29.85	154.08	0.0266
Commercial	Water Heating	Showerheads-Retro-Hospital	10	$18.31	-$328.05	$26.71	14.53	103.68	0.0154

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Commercial	Water Heating	Showerheads-Retro-Large Off	10	$18.31	-$202.71	$31.47	8.51	88.00	0.0152
Commercial	Water Heating	Showerheads-Retro-Large Ret	0	$12.58	$9,999.00	$9,999.00	-	-	-
Commercial	Water Heating	Showerheads-Retro-Lodging	10	$18.31	-$314.84	$17.98	20.36	154.04	0.0229
Commercial	Water Heating	Showerheads-Retro-Medium Off	10	$18.31	-$202.72	$31.47	8.51	88.00	0.0152
Commercial	Water Heating	Showerheads-Retro-Medium Ret	0	$12.58	$9,999.00	$9,999.00	-	-	-
Commercial	Water Heating	Showerheads-Retro-MiniMart	0	$12.58	$9,999.00	$9,999.00	-	-	-
Commercial	Water Heating	Showerheads-Retro-Other	10	$18.31	-$756.96	$19.61	41.31	141.19	0.0243
Commercial	Water Heating	Showerheads-Retro-Residential Care	10	$18.31	-$339.70	$26.71	14.97	103.68	0.0154
Commercial	Water Heating	Showerheads-Retro-Restaurant	0	$12.58	$9,999.00	$9,999.00	-	-	-
Commercial	Water Heating	Showerheads-Retro-School K-12	10	$18.31	-$253.06	$25.07	12.46	110.44	0.0110
Commercial	Water Heating	Showerheads-Retro-Small Off	10	$18.31	-$202.72	$31.47	8.51	88.00	0.0152
Commercial	Water Heating	Showerheads-Retro-Small Ret	0	$12.58	$9,999.00	$9,999.00	-	-	-
Commercial	Water Heating	Showerheads-Retro-Supermarket	0	$12.58	$9,999.00	$9,999.00	-	-	-
Commercial	Water Heating	Showerheads-Retro-University	10	$18.31	-$269.24	$25.07	13.11	110.44	0.0110
Commercial	Water Heating	Showerheads-Retro-Warehouse	0	$12.58	$9,999.00	$9,999.00	-	-	-
Commercial	Water Heating	Showerheads-Retro-Xlarge Ret	0	$12.58	$9,999.00	$9,999.00	-	-	-
Commercial	Electronics	Smart Plug Power Strips-Retro	4	$40.08	$166.63	$192.37	0.31	68.58	0.0121
Commercial	Lighting	Streetlight - HPS 100W - New	11.62791	-$8.59	-$138.73	-$107.39	9,999.00	322.54	0.0753
Commercial	Lighting	Streetlight - HPS 250W - New	11.62791	$2.01	-$78.81	-$47.46	287.25	704.13	0.1643
Commercial	Lighting	Streetlight - MH 1000W - New	11.62791	$532.07	-$19.24	$12.11	3.18	3,084.55	0.7197
Commercial	Lighting	Streetlight - MH 200W - New	11.62791	$2.01	-$111.31	-$79.96	221.00	417.94	0.0975
Commercial	Lighting	Streetlight - MH 400W - New	11.62791	$134.02	-$44.62	-$13.27	6.12	1,217.46	0.2841
Commercial	Lighting	Streetlight - HPS 100W - NR	11.62791	$113.41	-$87.74	-$56.40	3.51	322.54	0.0753
Commercial	Lighting	Streetlight - HPS 250W - NR	11.62791	$162.01	-$48.18	-$16.83	3.57	704.13	0.1643
Commercial	Lighting	Streetlight - MH 1000W - NR	11.62791	$972.07	-$0.01	$31.34	1.74	3,084.55	0.7197
Commercial	Lighting	Streetlight - MH 200W - NR	11.62791	$162.01	-$59.70	-$28.36	2.74	417.94	0.0975
Commercial	Lighting	Streetlight - MH 400W - NR	11.62791	$324.02	-$23.58	$7.77	2.53	1,217.46	0.2841
Commercial	HVAC	VRF-New-Assembly	20	$2.69	$37.86	$64.77	0.94	3.87	0.0007
Commercial	HVAC	VRF-New-Hospital	20	$4.58	$82.27	$102.65	0.52	4.16	0.0005
Commercial	HVAC	VRF-New-Large Off	20	$3.66	$55.52	$75.79	0.72	4.50	0.0005
Commercial	HVAC	VRF-New-Large Ret	20	$2.95	$108.49	$125.97	0.41	2.18	0.0002
Commercial	HVAC	VRF-New-Lodging	20	$2.77	$42.53	$69.44	0.88	3.72	0.0007
Commercial	HVAC	VRF-New-Medium Off	20	$1.70	$62.14	$82.41	0.66	1.92	0.0002
Commercial	HVAC	VRF-New-Medium Ret	20	$2.72	$98.76	$116.24	0.44	2.18	0.0002
Commercial	HVAC	VRF-New-MiniMart	20	$4.03	$55.10	$74.02	0.71	5.07	0.0005
Commercial	HVAC	VRF-New-Other	20	$2.71	$33.78	$60.68	1.00	4.16	0.0008
Commercial	HVAC	VRF-New-Residential Care	20	$3.27	$64.27	$84.65	0.63	3.60	0.0004
Commercial	HVAC	VRF-New-Restaurant	20	$4.90	$59.41	$80.56	0.68	5.67	0.0007
Commercial	HVAC	VRF-New-School K-12	20	$2.66	$103.63	$122.21	0.44	2.03	0.0002
Commercial	HVAC	VRF-New-Small Off	20	$1.70	$30.82	$51.09	1.06	3.09	0.0004
Commercial	HVAC	VRF-New-Small Ret	20	$2.72	$98.76	$116.24	0.44	2.18	0.0002
Commercial	HVAC	VRF-New-Supermarket	20	$5.09	$61.68	$80.60	0.65	5.88	0.0006
Commercial	HVAC	VRF-New-University	20	$2.68	$93.39	$120.30	0.51	2.07	0.0004
Commercial	HVAC	VRF-New-Warehouse	20	$2.82	$99.12	$125.04	0.48	2.10	0.0004
Commercial	HVAC	VRF-New-Xlarge Ret	20	$2.87	$106.15	$123.63	0.42	2.16	0.0002
Commercial	HVAC	VRF-Retro-Assembly	20	$3.11	$63.40	$90.31	0.67	3.21	0.0006
Commercial	HVAC	VRF-Retro-Hospital	20	$5.29	$98.19	$118.56	0.45	4.16	0.0005
Commercial	HVAC	VRF-Retro-Large Off	20	$4.23	$56.46	$76.73	0.71	5.14	0.0006
Commercial	HVAC	VRF-Retro-Large Ret	20	$3.41	$129.59	$147.07	0.35	2.16	0.0002
Commercial	HVAC	VRF-Retro-Lodging	20	$3.20	$48.86	$75.77	0.80	3.93	0.0007
Commercial	HVAC	VRF-Retro-Medium Off	20	$1.96	$63.16	$83.43	0.65	2.19	0.0003
Commercial	HVAC	VRF-Retro-Medium Ret	20	$3.14	$118.24	$135.72	0.38	2.15	0.0002
Commercial	HVAC	VRF-Retro-MiniMart	20	$4.66	$65.79	$84.70	0.62	5.12	0.0005
Commercial	HVAC	VRF-Retro-Other	20	$3.13	$38.30	$65.21	0.93	4.48	0.0008
Commercial	HVAC	VRF-Retro-Residential Care	20	$3.78	$68.85	$89.23	0.60	3.94	0.0005
Commercial	HVAC	VRF-Retro-Restaurant	20	$5.66	$62.92	$84.07	0.65	6.28	0.0008
Commercial	HVAC	VRF-Retro-School K-12	20	$3.08	$126.76	$145.34	0.37	1.97	0.0002
Commercial	HVAC	VRF-Retro-Small Off	20	$1.96	$31.46	$51.72	1.05	3.53	0.0004
Commercial	HVAC	VRF-Retro-Small Ret	20	$3.14	$118.24	$135.72	0.38	2.15	0.0002
Commercial	HVAC	VRF-Retro-Supermarket	20	$5.88	$73.32	$92.24	0.57	5.93	0.0006
Commercial	HVAC	VRF-Retro-University	20	$3.09	$112.04	$138.95	0.44	2.07	0.0004
Commercial	HVAC	VRF-Retro-Warehouse	20	$3.25	$79.84	$105.75	0.56	2.87	0.0005
Commercial	HVAC	VRF-Retro-Xlarge Ret	20	$3.31	$126.87	$144.35	0.36	2.14	0.0002
Commercial	Refrigeration	Market Average to ES 2.0 Upgrade	6	$35.00	$53.70	$74.53	0.72	108.07	0.0136
Commercial	Refrigeration	Timer on ES 2.0 Cold Only Water Cooler	6	$25.35	$127.39	$157.65	0.39	37.00	0.0085
Commercial	Refrigeration	Timer on ES 2.0 Hot & Cold Water Cooler	6	$25.35	$1.27	$31.53	1.96	185.01	0.0423
Commercial	HVAC	WEPT-Retro-Assembly	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	HVAC	WEPT-Retro-Hospital	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	HVAC	WEPT-Retro-Large Off	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	HVAC	WEPT-Retro-Large Ret	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	HVAC	WEPT-Retro-Lodging	5	$0.14	$38.00	$72.93	0.95	0.35	0.0001
Commercial	HVAC	WEPT-Retro-Medium Off	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	HVAC	WEPT-Retro-Medium Ret	5	$0.14	-$1.57	$52.14	1.46	0.49	0.0002

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Commercial	HVAC	WEPT-Retro-MiniMart	0	$0.14	-$14.77	$23.96	2.35	1.06	0.0003
Commercial	HVAC	WEPT-Retro-Other	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	HVAC	WEPT-Retro-Residential Care	5	$0.14	$49.64	$73.05	0.84	0.35	0.0001
Commercial	HVAC	WEPT-Retro-Restaurant	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	HVAC	WEPT-Retro-School K-12	5	$0.14	$24.73	$72.74	1.09	0.35	0.0001
Commercial	HVAC	WEPT-Retro-Small Off	5	$0.14	$34.02	$100.90	1.00	0.25	0.0002
Commercial	HVAC	WEPT-Retro-Small Ret	5	$0.14	-$1.57	$52.14	1.46	0.49	0.0002
Commercial	HVAC	WEPT-Retro-Supermarket	0	$0.14	-$14.77	$23.96	2.35	1.06	0.0003
Commercial	HVAC	WEPT-Retro-University	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	HVAC	WEPT-Retro-Warehouse	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	HVAC	WEPT-Retro-Xlarge Ret	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Commercial	Water Heating	WHTanks-NR-Assembly	13	$31.28	$36.16	$61.39	0.96	63.28	0.0109
Commercial	Water Heating	WHTanks-NR-Hospital	13	$33.02	$37.66	$62.89	0.93	65.20	0.0112
Commercial	Water Heating	WHTanks-NR-Large Off	13	$27.92	$32.69	$57.93	1.02	59.87	0.0103
Commercial	Water Heating	WHTanks-NR-Large Ret	13	$26.94	$30.91	$56.15	1.05	59.59	0.0103
Commercial	Water Heating	WHTanks-NR-Lodging	13	$31.85	$36.92	$62.16	0.95	63.63	0.0110
Commercial	Water Heating	WHTanks-NR-Medium Off	13	$27.92	$32.69	$57.93	1.02	59.87	0.0103
Commercial	Water Heating	WHTanks-NR-Medium Ret	13	$26.94	$30.91	$56.15	1.05	59.59	0.0103
Commercial	Water Heating	WHTanks-NR-MiniMart	13	$25.85	$29.40	$54.63	1.08	58.75	0.0101
Commercial	Water Heating	WHTanks-NR-Other	13	$27.15	$30.48	$55.71	1.06	60.53	0.0104
Commercial	Water Heating	WHTanks-NR-Residential Care	13	$33.02	$37.66	$62.89	0.93	65.20	0.0112
Commercial	Water Heating	WHTanks-NR-Restaurant	13	$32.55	$38.05	$63.28	0.93	63.87	0.0110
Commercial	Water Heating	WHTanks-NR-School K-12	13	$25.75	$27.02	$52.26	1.13	61.19	0.0105
Commercial	Water Heating	WHTanks-NR-Small Off	13	$27.92	$32.69	$57.93	1.02	59.87	0.0103
Commercial	Water Heating	WHTanks-NR-Small Ret	13	$26.94	$30.91	$56.15	1.05	59.59	0.0103
Commercial	Water Heating	WHTanks-NR-Supermarket	13	$25.85	$29.40	$54.63	1.08	58.75	0.0101
Commercial	Water Heating	WHTanks-NR-University	13	$33.02	$37.66	$62.89	0.93	65.20	0.0112
Commercial	Water Heating	WHTanks-NR-Warehouse	13	$29.66	$33.84	$59.07	1.00	62.37	0.0107
Commercial	Water Heating	WHTanks-NR-Xlarge Ret	13	$26.94	$30.91	$56.15	1.05	59.59	0.0103
Distribution Efficie	Distribution Efficiency	1 - LDC voltage control method	15	$0.16	-$17.31	$5.38	10.47	4.37	0.0006
Distribution Efficie	Distribution Efficiency	2 - Light system improvements	15	$0.23	-$11.83	$10.86	5.18	2.62	0.0004
Distribution Efficie	Distribution Efficiency	3 - Major system improvements	15	$1.78	$45.26	$67.95	0.83	2.87	0.0004
Distribution Efficie	Distribution Efficiency	4 - EOL voltage control method	15	$1.31	$76.58	$99.27	0.57	1.48	0.0002
Distribution Efficie	Distribution Efficiency	A - SCL implement EOL w/ major system improvements	15	$0.35	$310.70	$333.39	0.17	0.11	0.0000
Industrial	Misc	Synchronous Belts	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Industrial	Compressed air	Air Compressor Demand Reduction	10	$4,894,983.53	$18.58	$39.59	1.38	58,090,860.34	7,405.4723
Industrial	Compressed Air	Air Compressor Equipment1	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Industrial	Compressed Air	Air Compressor Equipment2	10	$2,115,724.47	$16.02	$37.04	1.47	31,014,720.11	3,953.7829
Industrial	Energy Management	Air Compressor Optimization	10	$19,676,253.07	-$10.20	$60.88	1.72	90,302,151.09	11,511.7950
Industrial	Energy Management	Energy Project Management	11	$128,973,120.63	$30.84	$51.85	1.05	885,835,292.32	112,927.0361
Industrial	Energy Management	Fan Energy Management	10	$0.00	$10.69	$31.43	1.72	86,115,370.28	10,684.6555
Industrial	Energy Management	Fan System Optimization	10	$35,469,452.64	-$1.22	$59.93	1.57	254,161,358.49	35,332.3597
Industrial	Fans	Efficient Centrifugal Fan	10	$4,543,976.58	$11.65	$31.68	1.67	22,853,824.66	2,684.7256
Industrial	Fans	Fan Equipment Upgrade	10	$22,397,943.95	$25.17	$46.19	1.18	241,302,050.26	30,761.3905
Industrial	Low & Med Temp Ref	Food: Cooling and Storage	10	$47,171,855.74	$35.27	$53.99	0.97	139,203,370.72	14,537.8834
Industrial	Energy Management	Cold Storage Tuneup	3	$2,052,120.93	$15.15	$33.87	1.54	27,980,299.67	2,922.1587
Industrial	Energy Management	Food: Refrig Storage Tuneup	3	$5,503,383.17	$15.15	$33.87	1.54	75,037,639.47	7,836.6526
Industrial	Energy Management	Fruit Storage Tuneup	3	$9,263,486.50	$15.15	$33.87	1.54	126,305,971.99	13,190.9270
Industrial	Energy Management	Groc Dist Tuneup	3	$1,042,365.47	$15.15	$33.87	1.54	14,212,465.65	1,484.2972
Industrial	Low & Med Temp Ref	Cold Storage Retrofit	10	$12,702,023.23	$29.29	$48.01	1.09	42,155,811.74	4,402.5965
Industrial	Low & Med Temp Ref	Fruit Storage Refer Retrofit	10	$99,961,068.06	$22.42	$41.14	1.27	387,136,608.99	40,431.1108
Industrial	Low & Med Temp Ref	Groc Dist Retrofit	10	$3,622,119.39	$31.36	$50.08	1.04	11,523,620.80	1,203.4842
Industrial	Misc	CA Retrofit -- CO2 Scrub	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Industrial	MIsc	CA Retrofit -- Membrane	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Industrial	Energy Management	Clean Room: Chiller Optimize	10	$1,142,990.67	-$5.67	$15.35	3.55	11,866,292.88	1,512.7251
Industrial	Hi-Tech	Clean Room: Change Filter Strategy	1	$208,049.55	-$11.10	$9.92	5.50	27,883,392.65	3,554.5986
Industrial	Hi-Tech	Clean Room: Clean Room HVAC	20	$1,460,366.16	-$2.43	$18.59	2.93	7,533,994.16	960.4400
Industrial	Hi-Tech	Elec Chip Fab: Eliminate Exhaust	10	$427,437.59	$31.05	$52.07	1.05	1,307,967.15	166.7408
Industrial	Hi-Tech	Elec Chip Fab: Exhaust Injector	10	$19,826,163.56	-$91.34	$75.10	2.66	42,060,231.40	5,361.8741
Industrial	Hi-Tech	Elec Chip Fab: Reduce Gas Pressure	10	$0.00	-$36.25	$0.00	9,999.00	10,753,955.98	1,370.9235
Industrial	Hi-Tech	Elec Chip Fab: Solidstate Chiller	10	$25,097,668.17	-$69.28	$84.81	2.21	47,149,204.24	6,010.6206
Industrial	Energy Management	Integrated Plant Energy Management	11	$193,454,247.23	-$14.67	$74.29	1.65	780,283,446.85	99,471.1971
Industrial	Lighting	Efficient Lighting 1 Shift	20.97902	$17,023,461.45	$27.65	$54.70	1.09	21,036,116.31	4,025.0284
Industrial	Lighting	Efficient Lighting 2 Shift	12.27496	$18,650,682.54	$15.51	$41.98	1.30	40,222,733.92	7,451.5074
Industrial	Lighting	Efficient Lighting 3 Shift	8.675799	$22,214,004.58	$3.57	$24.59	1.66	87,406,502.66	11,142.6553
Industrial	Lighting	HighBay Lighting 1 Shift	26.57343	$36,176,265.27	$17.55	$44.60	1.27	48,402,730.16	9,261.3275
Industrial	Lighting	HighBay Lighting 2 Shift	15.54828	$34,861,440.05	$3.80	$30.27	1.63	82,252,259.47	15,237.7340
Industrial	Lighting	HighBay Lighting 3 Shift	8.675799	$42,199,695.58	$2.34	$23.36	1.75	181,605,197.63	23,151.1850
Industrial	Lighting	Lighting Controls	10	$77,919,911.05	$135.99	$157.01	0.38	74,581,257.62	9,507.6821
Industrial	Material Handling	Material Handling VFD1	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Industrial	Material Handling	Material Handling VFD2	10	$77,618,573.25	$29.28	$51.51	1.07	240,089,242.85	33,376.1179
Industrial	Material Handling	Material Handling1	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Industrial	Material Handling	Material Handling2	10	$32,341,072.19	$63.02	$85.25	0.65	60,441,875.57	8,402.3555

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Industrial	Metals	Metal: New Arc Furnace	10	$226,213.72	-$2,099.06	$15.48	138.80	2,328,918.87	296.8926
Industrial	Motors	Motors: Rewind 101-200 HP	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Industrial	Motors	Motors: Rewind 201-500 HP	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Industrial	Motors	Motors: Rewind 20-50 HP	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Industrial	Motors	Motors: Rewind 501-5000 HP	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Industrial	Motors	Motors: Rewind 51-100 HP	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Industrial	Process Loads	Optimize Municipal Sewage ; <1 MGD Design Capacity	12	$50,893.14	$15.35	$38.98	1.28	98,564.44	15.4865
Industrial	Process Loads	Optimize Municipal Sewage ; >10 MGD Design Capacity	12	$8,953.66	-$24.52	-$0.89	3.09	41,928.34	6.5878
Industrial	Process Loads	Optimize Municipal Sewage ; 1 to 10 MGD Design Capacity	12	$47,324.29	$25.64	$49.27	1.11	79,601.54	12.5071
Industrial	Paper	Paper: Efficient Pulp Screen	10	$5,911,525.20	$9.16	$30.18	1.81	31,209,563.69	3,978.6217
Industrial	Paper	Paper: Large Material Handling	10	$14,100,897.33	$173.11	$194.13	0.28	11,572,673.66	1,475.2943
Industrial	Paper	Paper: Material Handling	10	$7,839,206.23	$145.78	$166.80	0.33	7,487,807.43	954.5521
Industrial	Paper	Paper: Premium Control Large Material	10	$15,510,987.07	$61.52	$82.54	0.66	29,940,445.94	3,816.8335
Industrial	Paper	Paper: Premium Fan	10	$7,431,903.08	$9.31	$30.32	1.80	39,049,473.30	4,978.0601
Industrial	Energy Management	Plant Energy Management	10	$10,075,823.31	$12.83	$33.84	1.61	422,179,997.67	53,819.8650
Industrial	Pulp	Kraft: Efficient Agitator	10	$5,162,724.54	-$6.73	$14.29	3.82	57,559,084.03	7,337.6810
Industrial	Pulp	Kraft: Effluent Treatment System	10	$548,217.72	-$8.65	$12.37	4.41	7,059,659.43	899.9714
Industrial	Pulp	Mech Pulp: Premium Process	5	$36,988.43	$13.73	$34.75	1.57	307,270.95	39.1712
Industrial	Pulp	Mech Pulp: Refiner Plate Improvement	1	$49,032.67	$29.52	$50.54	1.08	1,289,621.59	164.4021
Industrial	Pulp	Mech Pulp: Refiner Replacement	12	$12,065,631.31	$21.31	$42.33	1.14	19,538,053.41	2,490.7277
Industrial	Energy Management	Pump Energy Management	10	$0.00	$11.40	$31.43	1.68	127,181,598.48	14,940.5055
Industrial	Energy Management	Pump System Optimization	12	$104,734,384.70	-$29.75	$85.11	1.74	351,468,026.81	43,607.9502
Industrial	Pumps	Pump Equipment Upgrade	10	$47,032,776.18	$33.22	$53.25	0.99	343,391,153.15	40,339.4632
Industrial	Transformers	Transformers-New	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Industrial	Transformers	Transformers-Retrofit	0	$0.00	$9,999.00	$9,999.00	9,999.00	-	-
Industrial	Wood	Panel: Hydraulic Press	10	$1,588,802.03	$11.22	$33.45	1.66	7,567,525.34	1,052.0031
Industrial	Wood	Wood: Replace Pneumatic Conveyor	10	$2,740,983.10	-$83.19	$2.42	49.09	180,551,426.81	25,099.4407
Residential	Electronics	Infrared sensing advanced power strip	5	$35.47	$774.30	$803.47	0.08	10.73	0.0023
Residential	Electronics	Load sensing advanced power strip	5	$39.34	$258.41	$281.62	0.20	33.95	0.0053
Residential	Electronics	Occupancy sensing advanced power strip	5	$20.38	$1,859.36	$1,882.58	0.03	2.63	0.0004
Residential	Electronics	PC-interaction-sensing Home Office APS	5	$19.15	$2,814.90	$2,838.11	0.02	1.64	0.0003
Residential	Electronics	Infrared sensing advanced power strip	5	$35.47	$774.30	$803.47	0.08	10.73	0.0023
Residential	Electronics	Load sensing advanced power strip	5	$39.34	$258.41	$281.62	0.20	33.95	0.0053
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Residential	Electronics	Load sensing advanced power strip	5	$39.34	$258.41	$281.62	0.20	33.95	0.0053
Residential	Electronics	Occupancy sensing advanced power strip	5	$20.38	$1,859.36	$1,882.58	0.03	2.63	0.0004
Residential	Electronics	PC-interaction-sensing Home Office APS	5	$19.15	$2,814.90	$2,838.11	0.02	1.64	0.0003
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Residential	Electronics	Load sensing advanced power strip	5	$39.34	$258.41	$281.62	0.20	33.95	0.0053
Residential	Electronics	Occupancy sensing advanced power strip	5	$20.38	$1,859.36	$1,882.58	0.03	2.63	0.0004
Residential	Electronics	PC-interaction-sensing Home Office APS	5	$19.15	$2,814.90	$2,838.11	0.02	1.64	0.0003
Residential	Water Heating	Manufactured Bathroom Aerator 1.0 GPM AnyWH	15	$4.57	-$146.73	$24.12	8.47	26.50	0.0052
Residential	Water Heating	Multifamily - High Rise Bathroom Aerator 1.0 GPM AnyWH	15	$4.57	-$141.46	$19.46	10.00	32.85	0.0064
Residential	Water Heating	Multifamily - Low Rise Bathroom Aerator 1.0 GPM AnyWH	15	$4.57	-$141.46	$19.46	10.00	32.85	0.0064
Residential	Water Heating	Single Family Bathroom Aerator 1.0 GPM AnyWH	15	$4.57	-$272.59	$47.27	7.48	13.52	0.0026
Residential	Water Heating	Single Family Bathroom Aerator 1.0 GPM HPWH	15	$4.57	-$208.26	$45.40	6.33	14.08	0.0030
Residential	Water Heating	Manufactured Bathroom Aerator 1.0 GPM AnyWH	15	$4.57	-$146.73	$24.12	8.47	26.50	0.0052
Residential	Water Heating	Multifamily - High Rise Bathroom Aerator 1.0 GPM AnyWH	15	$4.57	-$141.46	$19.46	10.00	32.85	0.0064
Residential	Water Heating	Multifamily - Low Rise Bathroom Aerator 1.0 GPM AnyWH	15	$4.57	-$141.46	$19.46	10.00	32.85	0.0064
Residential	Water Heating	Single Family Bathroom Aerator 1.0 GPM AnyWH	15	$4.57	-$272.59	$47.27	7.48	13.52	0.0026
Residential	Water Heating	Single Family Bathroom Aerator 1.0 GPM HPWH	15	$4.57	-$208.26	$45.40	6.33	14.08	0.0030
Residential	HVAC	HVAC Conversion - FAF to ASHP 8.5 HSPF/14SEER + HZ1CZ1	15	$4,632.69	$97.99	$145.16	0.57	3,205.07	1.0727
Residential	HVAC	HVAC Conversion - FAF to ASHP 8.5 HSPF/14SEER + HZ1CZ23	15	$3,914.63	$63.13	$115.48	0.77	3,091.94	1.0727
Residential	HVAC	HVAC Conversion - FAF to ASHP 8.5 HSPF/14SEER + HZ23CZ1	15	$4,748.46	$121.75	$165.96	0.49	2,891.44	0.8647
Residential	HVAC	HVAC Conversion - FAF to ASHP 8.5 HSPF/14SEER + HZ23CZ23	15	$4,018.45	$78.13	$127.25	0.68	2,916.08	0.9031

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Residential	HVAC	HVAC Conversion - FAF w/CAC to ASHP 8.5 HSPF/14SEER + HZ1	15	$3,060.27	$51.83	$88.80	0.80	3,363.96	0.9534
Residential	HVAC	HVAC Conversion - FAF w/CAC to ASHP 8.5 HSPF/14SEER + HZ23	15	$3,122.54	$52.27	$89.25	0.82	3,109.42	0.8813
Residential	HVAC	HVAC Upgrade - Heat Pump Upgrade to 9.0 HSPF/14 SEER + HZ1CZ1	15	$89.69	$56.06	$91.71	0.80	95.70	0.0335
Residential	HVAC	HVAC Upgrade - Heat Pump Upgrade to 9.0 HSPF/14 SEER + HZ1CZ23	15	$89.69	$56.06	$91.71	0.80	95.70	0.0335
Residential	HVAC	HVAC Upgrade - Heat Pump Upgrade to 9.0 HSPF/14 SEER + HZ23CZ1	15	$89.69	$101.72	$127.81	0.58	65.55	0.0229
Residential	HVAC	HVAC Upgrade - Heat Pump Upgrade to 9.0 HSPF/14 SEER + HZ23CZ23	15	$89.69	$93.65	$119.73	0.61	69.41	0.0243
Residential	HVAC	New SF HVAC Upgrade - Central Heat Pump Upgrade to Variable Capacity (	15	$5,377.54	$865.63	$902.86	0.09	621.99	0.1800
Residential	HVAC	New SF HVAC Upgrade - Heat Pump Upgrade to 9.0 HSPF/14 SEER	15	$90.00	$27.44	$70.66	1.08	109.32	0.0383
Residential	HVAC	HVAC Conversion - FAF to ASHP 8.5 HSPF/14SEER + HZ1CZ1	15	$4,632.69	$97.99	$145.16	0.57	3,205.07	1.0727
Residential	HVAC	HVAC Conversion - FAF to ASHP 8.5 HSPF/14SEER + HZ1CZ23	15	$3,914.63	$63.13	$115.48	0.77	3,091.94	1.0727
Residential	HVAC	HVAC Conversion - FAF to ASHP 8.5 HSPF/14SEER + HZ23CZ1	15	$4,748.46	$121.75	$165.96	0.49	2,891.44	0.8647
Residential	HVAC	HVAC Conversion - FAF to ASHP 8.5 HSPF/14SEER + HZ23CZ23	15	$4,018.45	$78.13	$127.25	0.68	2,916.08	0.9031
Residential	HVAC	HVAC Conversion - FAF w/CAC to ASHP 8.5 HSPF/14SEER + HZ1	15	$3,060.27	$51.83	$88.80	0.80	3,363.96	0.9534
Residential	HVAC	HVAC Conversion - FAF w/CAC to ASHP 8.5 HSPF/14SEER + HZ23	15	$3,122.54	$52.27	$89.25	0.82	3,109.42	0.8813
Residential	HVAC	HVAC Upgrade - Heat Pump Upgrade to 9.0 HSPF/14 SEER + HZ1CZ1	15	$89.69	$56.06	$91.71	0.80	95.70	0.0335
Residential	HVAC	HVAC Upgrade - Heat Pump Upgrade to 9.0 HSPF/14 SEER + HZ1CZ23	15	$89.69	$56.06	$91.71	0.80	95.70	0.0335
Residential	HVAC	HVAC Upgrade - Heat Pump Upgrade to 9.0 HSPF/14 SEER + HZ23CZ1	15	$89.69	$101.72	$127.81	0.58	65.55	0.0229
Residential	HVAC	HVAC Upgrade - Heat Pump Upgrade to 9.0 HSPF/14 SEER + HZ23CZ23	15	$89.69	$93.65	$119.73	0.61	69.41	0.0243
Residential	HVAC	Existing Single Family Home HVAC Conversion - Convert FAF w/CAC to Heat	15	$3,531.74	$35.09	$78.28	0.99	3,934.79	1.3756
Residential	HVAC	Existing Single Family Home HVAC Conversion - Convert FAF w/CAC to Heat	15	$3,612.39	$37.25	$80.44	0.97	3,637.06	1.2715
Residential	HVAC	Existing Single Family Home HVAC Conversion - Convert FAF w/o CAC to He	15	$5,487.05	$87.89	$138.06	0.65	3,730.76	1.3756
Residential	HVAC	Existing Single Family Home HVAC Conversion - Convert FAF w/o CAC to He	15	$4,002.29	$29.81	$75.78	1.04	3,851.07	1.3756
Residential	HVAC	Existing Single Family Home HVAC Conversion - Convert FAF w/o CAC to He	15	$5,642.58	$102.49	$153.56	0.62	3,305.19	1.2268
Residential	HVAC	Existing Single Family Home HVAC Conversion - Convert FAF w/o CAC to He	15	$4,433.21	$32.21	$80.44	1.01	3,598.61	1.3076
Residential	HVAC	Existing Single Family Home HVAC Upgrade - Central Heat Pump Upgrade t	15	$5,853.86	$1,378.10	$1,416.55	0.06	431.98	0.1304
Residential	HVAC	Existing Single Family Home HVAC Upgrade - Central Heat Pump Upgrade t	15	$5,853.86	$1,089.31	$1,121.85	0.09	538.32	0.1304
Residential	HVAC	Existing Single Family Home HVAC Upgrade - Central Heat Pump Upgrade t	15	$5,853.86	$875.36	$915.45	0.11	659.70	0.2100
Residential	HVAC	Existing Single Family Home HVAC Upgrade - Central Heat Pump Upgrade t	15	$5,853.86	$858.18	$894.23	0.13	657.46	0.1825
Residential	HVAC	Existing Single Family Home HVAC Upgrade + HZ1	15	$99.08	$30.19	$73.38	1.04	115.73	0.0405
Residential	HVAC	Existing Single Family Home HVAC Upgrade + HZ23	15	$99.08	$60.71	$103.89	0.79	81.74	0.0286
Residential	Water Heating	Controled Optimization Program	5	$32.00	$13.55	$42.74	1.47	181.94	0.0383
Residential	Water Heating	Controled Optimization Program	5	$32.00	$13.55	$42.74	1.47	181.94	0.0383
Residential	Dryer	Heat Pump Dryer	16	$386.45	$50.15	$106.31	0.85	446.44	0.1782
Residential	Dryer	Heat Pump Dryer	16	$386.45	$50.15	$106.31	0.85	446.44	0.1782
Residential	Dryer	Heat Pump Dryer	16	$386.45	$50.15	$106.31	0.85	446.44	0.1782
Residential	Dryer	Heat Pump Dryer	16	$386.45	$50.15	$106.31	0.85	446.44	0.1782
Residential	Dryer	Heat Pump Dryer	16	$386.45	$50.15	$106.31	0.85	446.44	0.1782
Residential	Dryer	Heat Pump Dryer	16	$386.45	$50.15	$106.31	0.85	446.44	0.1782
Residential	Dryer	Heat Pump Dryer	16	$386.45	$50.15	$106.31	0.85	446.44	0.1782
Residential	Dryer	Heat Pump Dryer	16	$386.45	$50.15	$106.31	0.85	446.44	0.1782
Residential	Water Heating	Manufactured CEE Tier 1 Clothes Washer - Any DHW, Any Dryer - 54% ENE	14	$59.53	-$103.64	$45.61	4.01	143.18	0.0209
Residential	Water Heating	Manufactured CEE Tier 2 Clothes Washer - Any DHW, Any Dryer - 54% ENE	14	$0.00	-$23.57	$0.01	9,280.29	17.73	0.0026
Residential	Water Heating	Manufactured CEE Tier 3 Clothes Washer - Any DHW, Any Dryer - 54% ENE	14	$632.94	$45,442.35	$47,527.49	0.04	1.46	0.0002
Residential	Water Heating	Multifamily - High Rise CEE Tier 1 Clothes Washer - Any DHW, Any Dryer - 5	14	$59.53	-$103.64	$45.61	4.01	143.18	0.0209
Residential	Water Heating	Multifamily - High Rise CEE Tier 2 Clothes Washer - Any DHW, Any Dryer - 5	14	$0.00	-$23.57	$0.01	9,280.29	17.73	0.0026
Residential	Water Heating	Multifamily - High Rise CEE Tier 3 Clothes Washer - Any DHW, Any Dryer - 5	14	$632.94	$45,442.35	$47,527.49	0.04	1.46	0.0002
Residential	Water Heating	Multifamily - Low Rise CEE Tier 1 Clothes Washer - Any DHW, Any Dryer - 5	14	$59.53	-$103.64	$45.61	4.01	143.18	0.0209
Residential	Water Heating	Multifamily - Low Rise CEE Tier 2 Clothes Washer - Any DHW, Any Dryer - 5	14	$0.00	-$23.57	$0.01	9,280.29	17.73	0.0026
Residential	Water Heating	Multifamily - Low Rise CEE Tier 3 Clothes Washer - Any DHW, Any Dryer - 5	14	$632.94	$45,442.35	$47,527.49	0.04	1.46	0.0002
Residential	Water Heating	Single Family CEE Tier 1 Clothes Washer - Any DHW, Any Dryer - 54% ENER	14	$59.53	-$103.63	$45.61	4.01	143.18	0.0209
Residential	Water Heating	Single Family CEE Tier 2 Clothes Washer - Any DHW, Any Dryer - 54% ENER	14	$0.00	-$23.56	$0.01	9,280.00	17.73	0.0026
Residential	Water Heating	Single Family CEE Tier 3 Clothes Washer - Any DHW, Any Dryer - 54% ENER	14	$632.94	$45,442.49	$47,527.49	0.04	1.46	0.0002
Residential	Water Heating	Manufactured CEE Tier 1 Clothes Washer - Any DHW, Any Dryer - 54% ENE	14	$59.53	-$103.64	$45.61	4.01	143.18	0.0209
Residential	Water Heating	Manufactured CEE Tier 2 Clothes Washer - Any DHW, Any Dryer - 54% ENE	14	$0.00	-$23.57	$0.01	9,280.29	17.73	0.0026
Residential	Water Heating	Manufactured CEE Tier 3 Clothes Washer - Any DHW, Any Dryer - 54% ENE	14	$632.94	$45,442.35	$47,527.49	0.04	1.46	0.0002
Residential	Water Heating	Multifamily - High Rise CEE Tier 1 Clothes Washer - Any DHW, Any Dryer - 5	14	$59.53	-$103.64	$45.61	4.01	143.18	0.0209
Residential	Water Heating	Multifamily - High Rise CEE Tier 2 Clothes Washer - Any DHW, Any Dryer - 5	14	$0.00	-$23.57	$0.01	9,280.29	17.73	0.0026
Residential	Water Heating	Multifamily - High Rise CEE Tier 3 Clothes Washer - Any DHW, Any Dryer - 5	14	$632.94	$45,442.35	$47,527.49	0.04	1.46	0.0002
Residential	Water Heating	Multifamily - Low Rise CEE Tier 1 Clothes Washer - Any DHW, Any Dryer - 5	14	$59.53	-$103.64	$45.61	4.01	143.18	0.0209
Residential	Water Heating	Multifamily - Low Rise CEE Tier 2 Clothes Washer - Any DHW, Any Dryer - 5	14	$0.00	-$23.57	$0.01	9,280.29	17.73	0.0026
Residential	Water Heating	Multifamily - Low Rise CEE Tier 3 Clothes Washer - Any DHW, Any Dryer - 5	14	$632.94	$45,442.35	$47,527.49	0.04	1.46	0.0002
Residential	Water Heating	Single Family CEE Tier 1 Clothes Washer - Any DHW, Any Dryer - 54% ENER	14	$59.53	-$103.63	$45.61	4.01	143.18	0.0209
Residential	Water Heating	Single Family CEE Tier 2 Clothes Washer - Any DHW, Any Dryer - 54% ENER	14	$0.00	-$23.56	$0.01	9,280.00	17.73	0.0026
Residential	Water Heating	Single Family CEE Tier 3 Clothes Washer - Any DHW, Any Dryer - 54% ENER	14	$632.94	$45,442.49	$47,527.49	0.04	1.46	0.0002
Residential	Electronics	ENERGY STAR Desktops	5	$13.80	$27.50	$49.89	1.11	67.23	0.0098
Residential	Electronics	ENERGY STAR Laptops	4	$55.70	$822.81	$845.20	0.07	19.43	0.0028
Residential	Electronics	ENERGY STAR Desktops	5	$13.80	$27.50	$49.89	1.11	67.23	0.0098
Residential	Electronics	ENERGY STAR Laptops	4	$55.70	$822.81	$845.20	0.07	19.43	0.0028
Residential	Electronics	ENERGY STAR Desktops	5	$13.80	$27.50	$49.89	1.11	67.23	0.0098
Residential	Electronics	ENERGY STAR Laptops	4	$55.70	$822.81	$845.20	0.07	19.43	0.0028
Residential	Electronics	ENERGY STAR Desktops	5	$13.80	$27.50	$49.89	1.11	67.23	0.0098
Residential	Electronics	ENERGY STAR Laptops	4	$55.70	$822.81	$845.20	0.07	19.43	0.0028
Residential	Electronics	ENERGY STAR Desktops	5	$13.80	$27.50	$49.89	1.11	67.23	0.0098

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Residential	Electronics	ENERGY STAR Laptops	4	$55.70	$822.81	$845.20	0.07	19.43	0.0028
Residential	Electronics	ENERGY STAR Desktops	5	$13.80	$27.50	$49.89	1.11	67.23	0.0098
Residential	Electronics	ENERGY STAR Laptops	4	$55.70	$822.81	$845.20	0.07	19.43	0.0028
Residential	Electronics	ENERGY STAR Desktops	5	$13.80	$27.50	$49.89	1.11	67.23	0.0098
Residential	Electronics	ENERGY STAR Laptops	4	$55.70	$822.81	$845.20	0.07	19.43	0.0028
Residential	Electronics	ENERGY STAR Desktops	5	$13.80	$27.50	$49.89	1.11	67.23	0.0098
Residential	Electronics	ENERGY STAR Laptops	4	$55.70	$822.81	$845.20	0.07	19.43	0.0028
Residential	HVAC	MH CC&S + HZ1	15	$568.25	$55.22	$105.93	0.80	568.09	0.1986
Residential	HVAC	MH CC&S + HZ23	15	$568.25	$11.10	$71.37	1.32	843.14	0.2948
Residential	HVAC	SF CC&S + HZ1	15	$568.25	$30.37	$90.07	1.04	668.13	0.2336
Residential	HVAC	SF CC&S + HZ23	15	$568.25	$4.91	$60.67	1.48	991.81	0.3467
Residential	HVAC	MH CC&S + HZ1	15	$568.25	$55.22	$105.93	0.80	568.09	0.1986
Residential	HVAC	MH CC&S + HZ23	15	$568.25	$11.10	$71.37	1.32	843.14	0.2948
Residential	HVAC	SF CC&S + HZ1	15	$568.25	$30.37	$90.07	1.04	668.13	0.2336
Residential	HVAC	SF CC&S + HZ23	15	$568.25	$4.91	$60.67	1.48	991.81	0.3467
Residential	HVAC	New SF Zonal to DHP	15	$3,764.98	$71.96	$137.72	0.72	2,895.05	1.0548
Residential	HVAC	Zonal to DHP No Screen + HZ1CZ1	15	$4,375.97	$131.71	$197.58	0.55	2,117.66	0.7869
Residential	HVAC	Zonal to DHP No Screen + HZ1CZ23	15	$4,037.59	$80.38	$137.63	0.73	2,452.80	0.7887
Residential	HVAC	Zonal to DHP No Screen + HZ23CZ1	15	$4,044.32	$69.83	$137.42	0.83	1,959.56	0.7291
Residential	HVAC	Zonal to DHP No Screen + HZ23CZ23	15	$3,888.66	-$21.69	$38.96	1.32	2,407.45	0.8193
Residential	HVAC	Install Ductless Heat Pump in House with Existing FAF - Manufactured Hom	15	$3,895.16	$64.08	$127.32	0.76	3,239.86	1.1852
Residential	HVAC	Install Ductless Heat Pump in House with Existing FAF - Manufactured Hom	15	$3,895.16	$65.73	$137.64	0.76	2,996.95	0.9555
Residential	HVAC	Install Ductless Heat Pump in House with Existing FAF - Single Family Home	15	$4,039.18	$55.33	$158.13	0.86	2,705.00	0.9896
Residential	HVAC	Install Ductless Heat Pump in House with Existing FAF - Single Family Home	15	$4,039.18	$84.58	$156.87	0.67	2,726.77	0.8694
Residential	Water Heating	Manufactured Energy Star Dishwasher - Any DHW	15.4	$5.28	-$13.34	$159.81	1.29	3.44	0.0007
Residential	Water Heating	Multifamily - High Rise Energy Star Dishwasher - Any DHW	15.4	$5.28	-$13.45	$179.09	1.26	3.07	0.0006
Residential	Water Heating	Multifamily - Low Rise Energy Star Dishwasher - Any DHW	15.4	$5.28	-$13.45	$179.09	1.26	3.07	0.0006
Residential	Water Heating	Single Family Energy Star Dishwasher - Any DHW	15.4	$5.28	-$15.84	$599.36	1.08	0.92	0.0002
Residential	Water Heating	Manufactured Energy Star Dishwasher - Any DHW	15.4	$5.28	-$13.34	$159.81	1.29	3.44	0.0007
Residential	Water Heating	Multifamily - High Rise Energy Star Dishwasher - Any DHW	15.4	$5.28	-$13.45	$179.09	1.26	3.07	0.0006
Residential	Water Heating	Multifamily - Low Rise Energy Star Dishwasher - Any DHW	15.4	$5.28	-$13.45	$179.09	1.26	3.07	0.0006
Residential	Water Heating	Single Family Energy Star Dishwasher - Any DHW	15.4	$5.28	-$15.84	$599.36	1.08	0.92	0.0002
Residential	HVAC	New MH Performance-based Duct Sealing - Heat Pump + HZ1	20	$631.58	$64.48	$107.66	0.72	523.52	0.1830
Residential	HVAC	New MH Performance-based Duct Sealing - Heat Pump + HZ23	20	$631.58	$18.83	$62.02	1.25	908.86	0.3177
Residential	HVAC	New SF Performance-based Duct Sealing - Heat Pump + HZ1	20	$631.58	$86.64	$129.83	0.60	434.15	0.1518
Residential	HVAC	New SF Performance-based Duct Sealing - Heat Pump + HZ23	20	$631.58	$37.16	$80.35	0.96	701.52	0.2452
Residential	HVAC	MH Performance-based Duct Sealing - Heat Pump + HZ1	20	$631.58	$8.82	$52.01	1.49	1,083.79	0.3789
Residential	HVAC	MH Performance-based Duct Sealing - Heat Pump + HZ23	20	$631.58	-$18.50	$24.69	3.14	2,282.91	0.7981
Residential	HVAC	SF Performance-based Duct Sealing - Heat Pump + HZ1	20	$631.58	$19.49	$62.68	1.24	899.23	0.3144
Residential	HVAC	SF Performance-based Duct Sealing - Heat Pump + HZ23	20	$631.58	-$11.47	$31.71	2.44	1,777.26	0.6213
Residential	Food Preparation	Non Self-Cleaning Oven	20	$307.20	$343.98	$406.93	0.24	67.37	0.0385
Residential	Food Preparation	Self-Cleaning Oven	20	$289.22	$412.70	$475.66	0.21	54.26	0.0310
Residential	Food Preparation	Non Self-Cleaning Oven	20	$307.20	$343.98	$406.93	0.24	67.37	0.0385
Residential	Food Preparation	Self-Cleaning Oven	20	$289.22	$412.70	$475.66	0.21	54.26	0.0310
Residential	Food Preparation	Non Self-Cleaning Oven	20	$307.20	$343.98	$406.93	0.24	67.37	0.0385
Residential	Food Preparation	Self-Cleaning Oven	20	$289.22	$412.70	$475.66	0.21	54.26	0.0310
Residential	Food Preparation	Non Self-Cleaning Oven	20	$307.20	$343.98	$406.93	0.24	67.37	0.0385
Residential	Food Preparation	Self-Cleaning Oven	20	$289.22	$412.70	$475.66	0.21	54.26	0.0310
Residential	Food Preparation	Non Self-Cleaning Oven	20	$307.20	$343.98	$406.93	0.24	67.37	0.0385
Residential	Food Preparation	Self-Cleaning Oven	20	$289.22	$412.70	$475.66	0.21	54.26	0.0310
Residential	Food Preparation	Non Self-Cleaning Oven	20	$307.20	$343.98	$406.93	0.24	67.37	0.0385
Residential	Food Preparation	Self-Cleaning Oven	20	$289.22	$412.70	$475.66	0.21	54.26	0.0310
Residential	Food Preparation	Non Self-Cleaning Oven	20	$307.20	$343.98	$406.93	0.24	67.37	0.0385
Residential	Food Preparation	Self-Cleaning Oven	20	$289.22	$412.70	$475.66	0.21	54.26	0.0310
Residential	Food Preparation	Non Self-Cleaning Oven	20	$307.20	$343.98	$406.93	0.24	67.37	0.0385
Residential	Food Preparation	Self-Cleaning Oven	20	$289.22	$412.70	$475.66	0.21	54.26	0.0310
Residential	Whole Bldg/Meter Le	EVSE Level 2	10	$750.00	$825.08	$849.07	0.07	123.53	0.0195
Residential	Refrigeration	Std Size Freezer - ENERGY STAR	21.73469	$45.28	$142.06	$157.60	0.31	24.52	0.0023
Residential	Refrigeration	Std Size Freezer - ENERGY STAR	21.73469	$45.28	$142.06	$157.60	0.31	24.52	0.0023
Residential	Refrigeration	Std Size Freezer - ENERGY STAR	21.73469	$45.28	$142.06	$157.60	0.31	24.52	0.0023
Residential	Refrigeration	Std Size Freezer - ENERGY STAR	21.73469	$45.28	$142.06	$157.60	0.31	24.52	0.0023
Residential	Refrigeration	Std Size Freezer - ENERGY STAR	21.73469	$45.28	$142.06	$157.60	0.31	24.52	0.0023
Residential	Refrigeration	Std Size Freezer - ENERGY STAR	21.73469	$45.28	$142.06	$157.60	0.31	24.52	0.0023
Residential	Refrigeration	Std Size Freezer - ENERGY STAR	21.73469	$45.28	$142.06	$157.60	0.31	24.52	0.0023
Residential	Refrigeration	Std Size Freezer - ENERGY STAR	21.73469	$45.28	$142.06	$157.60	0.31	24.52	0.0023
Residential	HVAC	Ground Source Heat Pump Upgrade from Air Source Heat Pump - With Des	20	$9,375.51	$156.38	$199.56	0.39	4,192.69	1.4657
Residential	HVAC	Ground Source Heat Pump Upgrade from Air Source Heat Pump - With Des	20	$6,731.68	$160.66	$203.85	0.38	2,947.14	1.0303
Residential	HVAC	Ground Source Heat Pump Upgrade from Air Source Heat Pump - With Des	20	$10,628.69	$165.26	$208.45	0.37	4,550.47	1.5908
Residential	HVAC	Ground Source Heat Pump Upgrade from Air Source Heat Pump - With Des	20	$7,227.45	$151.61	$194.80	0.40	3,311.20	1.1576
Residential	HVAC	SF RNC HRV ACH3 HZ1CZ1	20	$1,270.04	$118.61	$162.51	0.48	697.44	0.2489
Residential	HVAC	SF RNC HRV ACH3 HZ1CZ2	20	$1,270.04	$114.48	$157.24	0.49	720.83	0.2489
Residential	HVAC	SF RNC HRV ACH3 HZ1CZ3	20	$1,270.04	$110.11	$151.65	0.50	747.38	0.2489
Residential	HVAC	SF RNC HRV ACH3 HZ2CZ1	20	$1,270.04	$69.13	$112.81	0.69	1,004.73	0.3563

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Residential	HVAC	SF RNC HRV ACH3 HZ2CZ2	20	$1,270.04	$67.35	$110.23	0.70	1,028.25	0.3563
Residential	HVAC	SF RNC HRV ACH3 HZ2CZ3	20	$1,270.04	$65.41	$107.40	0.71	1,055.30	0.3563
Residential	HVAC	SF RNC HRV ACH3 HZ3CZ1	20	$1,270.04	$57.30	$100.96	0.77	1,122.70	0.3979
Residential	HVAC	SF RNC HRV ACH3 HZ3CZ2	20	$1,270.04	$55.94	$98.88	0.78	1,146.24	0.3979
Residential	HVAC	SF RNC HRV ACH3 HZ3CZ3	20	$1,270.04	$54.46	$96.60	0.79	1,173.29	0.3979
Residential	Water Heating	Manufactured Tier1_buffered	13	$629.17	$46.40	$75.85	0.83	964.55	0.2131
Residential	Water Heating	Manufactured Tier1_indor2_efaf	13	$629.17	$99.82	$101.43	0.40	721.34	0.0290
Residential	Water Heating	Manufactured Tier1_indor2_gfac	13	$629.17	$50.63	$63.68	0.79	1,148.88	0.2449
Residential	Water Heating	Manufactured Tier1_indor2_gfnc	13	$629.17	$50.63	$63.68	0.79	1,148.88	0.2449
Residential	Water Heating	Manufactured Tier1_indor2_hp85	13	$629.17	$45.60	$75.28	0.83	971.83	0.2536
Residential	Water Heating	Manufactured Tier1_indor2_zonl	13	$629.17	$91.31	$101.41	0.48	721.50	0.0939
Residential	Water Heating	Manufactured Tier2_buffered	13	$0.00	-$29.45	$0.00	9,999.00	501.94	0.1109
Residential	Water Heating	Manufactured Tier2_indor2_efaf	13	$0.00	$16.56	$0.00	1.73	245.20	(0.0191)
Residential	Water Heating	Manufactured Tier2_indor2_gfac	13	$0.00	-$7.67	$0.00	2.97	482.61	0.1025
Residential	Water Heating	Manufactured Tier2_indor2_gfnc	13	$0.00	-$7.67	$0.00	2.97	482.61	0.1025
Residential	Water Heating	Manufactured Tier2_indor2_hp85	13	$0.00	-$30.32	$0.00	12.76	377.33	0.1079
Residential	Water Heating	Manufactured Tier2_indor2_zonl	13	$0.00	$2.52	$0.00	2.92	245.29	0.0174
Residential	Water Heating	Single Family Tier1_buffered	13	$629.17	$44.51	$73.96	0.85	989.23	0.2186
Residential	Water Heating	Single Family Tier1_indor2_efaf	13	$629.17	$99.82	$101.43	0.40	721.34	0.0290
Residential	Water Heating	Single Family Tier1_indor2_gfac	13	$629.17	$50.63	$63.68	0.79	1,148.88	0.2449
Residential	Water Heating	Single Family Tier1_indor2_gfnc	13	$629.17	$50.63	$63.68	0.79	1,148.88	0.2449
Residential	Water Heating	Single Family Tier1_indor2_hp85	13	$629.17	$45.60	$75.28	0.83	971.83	0.2536
Residential	Water Heating	Single Family Tier1_indor2_zonl	13	$629.17	$91.31	$101.41	0.48	721.50	0.0939
Residential	Water Heating	Single Family Tier2_buffered	13	$0.00	-$29.45	$0.00	9,999.00	484.83	0.1071
Residential	Water Heating	Single Family Tier2_indor2_efaf	13	$0.00	$16.56	$0.00	1.73	245.20	(0.0191)
Residential	Water Heating	Single Family Tier2_indor2_gfac	13	$0.00	-$7.67	$0.00	2.97	482.61	0.1025
Residential	Water Heating	Single Family Tier2_indor2_gfnc	13	$0.00	-$7.67	$0.00	2.97	482.61	0.1025
Residential	Water Heating	Single Family Tier2_indor2_hp85	13	$0.00	-$30.32	$0.00	12.76	377.33	0.1079
Residential	Water Heating	Single Family Tier2_indor2_zonl	13	$0.00	$2.52	$0.00	2.92	245.29	0.0174
Residential	Water Heating	Manufactured Tier1_buffered	13	$629.17	$46.40	$75.85	0.83	964.55	0.2131
Residential	Water Heating	Manufactured Tier1_indor2_efaf	13	$629.17	$99.82	$101.43	0.40	721.34	0.0290
Residential	Water Heating	Manufactured Tier1_indor2_gfac	13	$629.17	$50.63	$63.68	0.79	1,148.88	0.2449
Residential	Water Heating	Manufactured Tier1_indor2_gfnc	13	$629.17	$50.63	$63.68	0.79	1,148.88	0.2449
Residential	Water Heating	Manufactured Tier1_indor2_hp85	13	$629.17	$45.60	$75.28	0.83	971.83	0.2536
Residential	Water Heating	Manufactured Tier1_indor2_zonl	13	$629.17	$91.31	$101.41	0.48	721.50	0.0939
Residential	Water Heating	Manufactured Tier2_buffered	13	$0.00	-$29.45	$0.00	9,999.00	501.94	0.1109
Residential	Water Heating	Manufactured Tier2_indor2_efaf	13	$0.00	$16.56	$0.00	1.73	245.20	(0.0191)
Residential	Water Heating	Manufactured Tier2_indor2_gfac	13	$0.00	-$7.67	$0.00	2.97	482.61	0.1025
Residential	Water Heating	Manufactured Tier2_indor2_gfnc	13	$0.00	-$7.67	$0.00	2.97	482.61	0.1025
Residential	Water Heating	Manufactured Tier2_indor2_hp85	13	$0.00	-$30.32	$0.00	12.76	377.33	0.1079
Residential	Water Heating	Manufactured Tier2_indor2_zonl	13	$0.00	$2.52	$0.00	2.92	245.29	0.0174
Residential	Water Heating	Single Family Tier1_buffered	13	$629.17	$44.51	$73.96	0.85	989.23	0.2186
Residential	Water Heating	Single Family Tier1_indor2_efaf	13	$629.17	$99.82	$101.43	0.40	721.34	0.0290
Residential	Water Heating	Single Family Tier1_indor2_gfac	13	$629.17	$50.63	$63.68	0.79	1,148.88	0.2449
Residential	Water Heating	Single Family Tier1_indor2_gfnc	13	$629.17	$50.63	$63.68	0.79	1,148.88	0.2449
Residential	Water Heating	Single Family Tier1_indor2_hp85	13	$629.17	$45.60	$75.28	0.83	971.83	0.2536
Residential	Water Heating	Single Family Tier1_indor2_zonl	13	$629.17	$91.31	$101.41	0.48	721.50	0.0939
Residential	Water Heating	Single Family Tier2_buffered	13	$0.00	-$29.45	$0.00	9,999.00	484.83	0.1071
Residential	Water Heating	Single Family Tier2_indor2_efaf	13	$0.00	$16.56	$0.00	1.73	245.20	(0.0191)
Residential	Water Heating	Single Family Tier2_indor2_gfac	13	$0.00	-$7.67	$0.00	2.97	482.61	0.1025
Residential	Water Heating	Single Family Tier2_indor2_gfnc	13	$0.00	-$7.67	$0.00	2.97	482.61	0.1025
Residential	Water Heating	Single Family Tier2_indor2_hp85	13	$0.00	-$30.32	$0.00	12.76	377.33	0.1079
Residential	Water Heating	Single Family Tier2_indor2_zonl	13	$0.00	$2.52	$0.00	2.92	245.29	0.0174
Residential	Lighting	All_NR_LF_FIX_REPL_from LF2018 to LED_FIX_KIT	20	$86.12	$608.31	$644.99	0.11	11.92	0.0031
Residential	Lighting	All_NR_LF_FIX_REPL_from T12 to LF_2018	20	$49.93	$137.95	$174.63	0.40	25.52	0.0067
Residential	Lighting	All_NR_LF_FIX_REPL_from LF2018 to LED_FIX_KIT	20	$86.12	$608.31	$644.99	0.11	11.92	0.0031
Residential	Lighting	All_NR_LF_FIX_REPL_from T12 to LF_2018	20	$49.93	$137.95	$174.63	0.40	25.52	0.0067
Residential	Lighting	All_NR_LF_FIX_REPL_from LF2018 to LED_FIX_KIT	20	$86.12	$608.31	$644.99	0.11	11.92	0.0031
Residential	Lighting	All_NR_LF_FIX_REPL_from T12 to LF_2018	20	$49.93	$137.95	$174.63	0.40	25.52	0.0067
Residential	Lighting	All_NR_LF_FIX_REPL_from LF2018 to LED_FIX_KIT	20	$86.12	$608.31	$644.99	0.11	11.92	0.0031
Residential	Lighting	All_NR_LF_FIX_REPL_from T12 to LF_2018	20	$49.93	$137.95	$174.63	0.40	25.52	0.0067
Residential	Lighting	2016 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$23.27	$270.60	$301.02	0.33	7.69	0.0020
Residential	Lighting	2016 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$4.29	-$43.06	-$13.49	3.30	17.17	0.0045
Residential	Lighting	2016 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$8.26	-$36.74	-$6.84	1.92	13.26	0.0035
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$11.03	$58.35	$89.15	0.75	13.18	0.0034
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.81	-$37.39	-$6.72	2.47	2.08	0.0005
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$3.86	$22.92	$53.33	1.16	6.96	0.0018
Residential	Lighting	2016 - LEDGlobe1440 to 2600 lumensANY	12	$7.46	-$131.53	-$100.94	2.98	10.77	0.0028
Residential	Lighting	2016 - LEDGlobe250 to 664 lumensANY	12	$1.75	-$72.96	-$43.62	6.20	12.84	0.0034
Residential	Lighting	2016 - LEDGlobe665 to 1439 lumensANY	12	$0.56	-$171.61	-$142.02	18.70	9.16	0.0024
Residential	Lighting	2016 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$12.55	-$53.73	-$20.86	5.31	75.96	0.0198
Residential	Lighting	2016 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$7.99	-$68.97	-$39.35	2.87	18.33	0.0048
Residential	Lighting	2016 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$4.68	-$111.12	-$80.65	4.58	14.71	0.0038

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Residential	Lighting	2016 - LEDThree-Way1440 to 2600 lumensANY	12	$13.57	-$53.28	-$23.91	3.08	42.26	0.0110
Residential	Lighting	2016 - LEDThree-Way250 to 664 lumensANY	12	$10.12	-$27.31	$1.88	2.88	42.53	0.0111
Residential	Lighting	2016 - LEDThree-Way665 to 1439 lumensANY	12	$4.66	-$43.17	-$13.92	5.67	46.24	0.0121
Residential	Lighting	2017 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$1.89	-$48.98	-$17.65	6.12	16.31	0.0043
Residential	Lighting	2017 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	2017 - LEDGlobe1440 to 2600 lumensANY	12	$4.20	-$35.68	-$4.08	2.96	14.77	0.0039
Residential	Lighting	2017 - LEDGlobe250 to 664 lumensANY	12	$1.93	-$43.70	-$12.50	5.82	16.88	0.0044
Residential	Lighting	2017 - LEDGlobe665 to 1439 lumensANY	12	$2.66	-$50.71	-$19.43	8.74	37.90	0.0099
Residential	Lighting	2017 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$4.16	-$41.10	-$7.91	9.56	61.03	0.0159
Residential	Lighting	2017 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$0.25	-$48.83	-$17.34	15.71	9.51	0.0025
Residential	Lighting	2017 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$0.62	-$42.51	-$10.46	10.01	11.15	0.0029
Residential	Lighting	2017 - LEDThree-Way1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDThree-Way250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDThree-Way665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	2016 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$23.27	$270.60	$301.02	0.33	7.69	0.0020
Residential	Lighting	2016 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$4.29	-$43.06	-$13.49	3.30	17.17	0.0045
Residential	Lighting	2016 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$8.26	-$36.74	-$6.84	1.92	13.26	0.0035
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$11.03	$58.35	$89.15	0.75	13.18	0.0034
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.81	-$37.39	-$6.72	2.47	2.08	0.0005
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$3.86	$22.92	$53.33	1.16	6.96	0.0018
Residential	Lighting	2016 - LEDGlobe1440 to 2600 lumensANY	12	$7.46	-$131.53	-$100.94	2.98	10.77	0.0028
Residential	Lighting	2016 - LEDGlobe250 to 664 lumensANY	12	$1.75	-$72.96	-$43.62	6.20	12.84	0.0034
Residential	Lighting	2016 - LEDGlobe665 to 1439 lumensANY	12	$0.56	-$171.61	-$142.02	18.70	9.16	0.0024
Residential	Lighting	2016 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$12.55	-$53.73	-$20.86	5.31	75.96	0.0198
Residential	Lighting	2016 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$7.99	-$68.97	-$39.35	2.87	18.33	0.0048
Residential	Lighting	2016 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$4.68	-$111.12	-$80.65	4.58	14.71	0.0038
Residential	Lighting	2016 - LEDThree-Way1440 to 2600 lumensANY	12	$13.57	-$53.28	-$23.91	3.08	42.26	0.0110
Residential	Lighting	2016 - LEDThree-Way250 to 664 lumensANY	12	$10.12	-$27.31	$1.88	2.88	42.53	0.0111
Residential	Lighting	2016 - LEDThree-Way665 to 1439 lumensANY	12	$4.66	-$43.17	-$13.92	5.67	46.24	0.0121
Residential	Lighting	2017 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$1.89	-$48.98	-$17.65	6.12	16.31	0.0043
Residential	Lighting	2017 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	2017 - LEDGlobe1440 to 2600 lumensANY	12	$4.20	-$35.68	-$4.08	2.96	14.77	0.0039
Residential	Lighting	2017 - LEDGlobe250 to 664 lumensANY	12	$1.93	-$43.70	-$12.50	5.82	16.88	0.0044
Residential	Lighting	2017 - LEDGlobe665 to 1439 lumensANY	12	$2.66	-$50.71	-$19.43	8.74	37.90	0.0099
Residential	Lighting	2017 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$4.16	-$41.10	-$7.91	9.56	61.03	0.0159
Residential	Lighting	2017 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$0.25	-$48.83	-$17.34	15.71	9.51	0.0025
Residential	Lighting	2017 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$0.62	-$42.51	-$10.46	10.01	11.15	0.0029
Residential	Lighting	2017 - LEDThree-Way1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDThree-Way250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDThree-Way665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	2016 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$23.27	$270.60	$301.02	0.33	7.69	0.0020
Residential	Lighting	2016 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$4.29	-$43.06	-$13.49	3.30	17.17	0.0045
Residential	Lighting	2016 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$8.26	-$36.74	-$6.84	1.92	13.26	0.0035
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$11.03	$58.35	$89.15	0.75	13.18	0.0034
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.81	-$37.39	-$6.72	2.47	2.08	0.0005
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$3.86	$22.92	$53.33	1.16	6.96	0.0018
Residential	Lighting	2016 - LEDGlobe1440 to 2600 lumensANY	12	$7.46	-$131.53	-$100.94	2.98	10.77	0.0028
Residential	Lighting	2016 - LEDGlobe250 to 664 lumensANY	12	$1.75	-$72.96	-$43.62	6.20	12.84	0.0034
Residential	Lighting	2016 - LEDGlobe665 to 1439 lumensANY	12	$0.56	-$171.61	-$142.02	18.70	9.16	0.0024
Residential	Lighting	2016 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$12.55	-$53.73	-$20.86	5.31	75.96	0.0198
Residential	Lighting	2016 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$7.99	-$68.97	-$39.35	2.87	18.33	0.0048
Residential	Lighting	2016 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$4.68	-$111.12	-$80.65	4.58	14.71	0.0038
Residential	Lighting	2016 - LEDThree-Way1440 to 2600 lumensANY	12	$13.57	-$53.28	-$23.91	3.08	42.26	0.0110
Residential	Lighting	2016 - LEDThree-Way250 to 664 lumensANY	12	$10.12	-$27.31	$1.88	2.88	42.53	0.0111
Residential	Lighting	2016 - LEDThree-Way665 to 1439 lumensANY	12	$4.66	-$43.17	-$13.92	5.67	46.24	0.0121
Residential	Lighting	2017 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$1.89	-$48.98	-$17.65	6.12	16.31	0.0043
Residential	Lighting	2017 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	2017 - LEDGlobe1440 to 2600 lumensANY	12	$4.20	-$35.68	-$4.08	2.96	14.77	0.0039
Residential	Lighting	2017 - LEDGlobe250 to 664 lumensANY	12	$1.93	-$43.70	-$12.50	5.82	16.88	0.0044
Residential	Lighting	2017 - LEDGlobe665 to 1439 lumensANY	12	$2.66	-$50.71	-$19.43	8.74	37.90	0.0099
Residential	Lighting	2017 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$4.16	-$41.10	-$7.91	9.56	61.03	0.0159

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Residential	Lighting	2017 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$0.25	-$48.83	-$17.34	15.71	9.51	0.0025
Residential	Lighting	2017 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$0.62	-$42.51	-$10.46	10.01	11.15	0.0029
Residential	Lighting	2017 - LEDThree-Way1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDThree-Way250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDThree-Way665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	2016 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$23.27	$270.60	$301.02	0.33	7.69	0.0020
Residential	Lighting	2016 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$4.29	-$43.06	-$13.49	3.30	17.17	0.0045
Residential	Lighting	2016 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$8.26	-$36.74	-$6.84	1.92	13.26	0.0035
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$11.03	$58.35	$89.15	0.75	13.18	0.0034
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.81	-$37.39	-$6.72	2.47	2.08	0.0005
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$3.86	$22.92	$53.33	1.16	6.96	0.0018
Residential	Lighting	2016 - LEDGlobe1440 to 2600 lumensANY	12	$7.46	-$131.53	-$100.94	2.98	10.77	0.0028
Residential	Lighting	2016 - LEDGlobe250 to 664 lumensANY	12	$1.75	-$72.96	-$43.62	6.20	12.84	0.0034
Residential	Lighting	2016 - LEDGlobe665 to 1439 lumensANY	12	$0.56	-$171.61	-$142.02	18.70	9.16	0.0024
Residential	Lighting	2016 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$12.55	-$53.73	-$20.86	5.31	75.96	0.0198
Residential	Lighting	2016 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$7.99	-$68.97	-$39.35	2.87	18.33	0.0048
Residential	Lighting	2016 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$4.68	-$111.12	-$80.65	4.58	14.71	0.0038
Residential	Lighting	2016 - LEDThree-Way1440 to 2600 lumensANY	12	$13.57	-$53.28	-$23.91	3.08	42.26	0.0110
Residential	Lighting	2016 - LEDThree-Way250 to 664 lumensANY	12	$10.12	-$27.31	$1.88	2.88	42.53	0.0111
Residential	Lighting	2016 - LEDThree-Way665 to 1439 lumensANY	12	$4.66	-$43.17	-$13.92	5.67	46.24	0.0121
Residential	Lighting	2017 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$1.89	-$48.98	-$17.65	6.12	16.31	0.0043
Residential	Lighting	2017 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	2017 - LEDGlobe1440 to 2600 lumensANY	12	$4.20	-$35.68	-$4.08	2.96	14.77	0.0039
Residential	Lighting	2017 - LEDGlobe250 to 664 lumensANY	12	$1.93	-$43.70	-$12.50	5.82	16.88	0.0044
Residential	Lighting	2017 - LEDGlobe665 to 1439 lumensANY	12	$2.66	-$50.71	-$19.43	8.74	37.90	0.0099
Residential	Lighting	2017 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$4.16	-$41.10	-$7.91	9.56	61.03	0.0159
Residential	Lighting	2017 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$0.25	-$48.83	-$17.34	15.71	9.51	0.0025
Residential	Lighting	2017 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$0.62	-$42.51	-$10.46	10.01	11.15	0.0029
Residential	Lighting	2017 - LEDThree-Way1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDThree-Way250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDThree-Way665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	2016 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$23.27	$270.60	$301.02	0.33	7.69	0.0020
Residential	Lighting	2016 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$4.29	-$43.06	-$13.49	3.30	17.17	0.0045
Residential	Lighting	2016 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$8.26	-$36.74	-$6.84	1.92	13.26	0.0035
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$11.03	$58.35	$89.15	0.75	13.18	0.0034
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.81	-$37.39	-$6.72	2.47	2.08	0.0005
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$3.86	$22.92	$53.33	1.16	6.96	0.0018
Residential	Lighting	2016 - LEDGlobe1440 to 2600 lumensANY	12	$7.46	-$131.53	-$100.94	2.98	10.77	0.0028
Residential	Lighting	2016 - LEDGlobe250 to 664 lumensANY	12	$1.75	-$72.96	-$43.62	6.20	12.84	0.0034
Residential	Lighting	2016 - LEDGlobe665 to 1439 lumensANY	12	$0.56	-$171.61	-$142.02	18.70	9.16	0.0024
Residential	Lighting	2016 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$12.55	-$53.73	-$20.86	5.31	75.96	0.0198
Residential	Lighting	2016 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$7.99	-$68.97	-$39.35	2.87	18.33	0.0048
Residential	Lighting	2016 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$4.68	-$111.12	-$80.65	4.58	14.71	0.0038
Residential	Lighting	2016 - LEDThree-Way1440 to 2600 lumensANY	12	$13.57	-$53.28	-$23.91	3.08	42.26	0.0110
Residential	Lighting	2016 - LEDThree-Way250 to 664 lumensANY	12	$10.12	-$27.31	$1.88	2.88	42.53	0.0111
Residential	Lighting	2016 - LEDThree-Way665 to 1439 lumensANY	12	$4.66	-$43.17	-$13.92	5.67	46.24	0.0121
Residential	Lighting	2017 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$1.89	-$48.98	-$17.65	6.12	16.31	0.0043
Residential	Lighting	2017 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	2017 - LEDGlobe1440 to 2600 lumensANY	12	$4.20	-$35.68	-$4.08	2.96	14.77	0.0039
Residential	Lighting	2017 - LEDGlobe250 to 664 lumensANY	12	$1.93	-$43.70	-$12.50	5.82	16.88	0.0044
Residential	Lighting	2017 - LEDGlobe665 to 1439 lumensANY	12	$2.66	-$50.71	-$19.43	8.74	37.90	0.0099
Residential	Lighting	2017 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$4.16	-$41.10	-$7.91	9.56	61.03	0.0159
Residential	Lighting	2017 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$0.25	-$48.83	-$17.34	15.71	9.51	0.0025
Residential	Lighting	2017 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$0.62	-$42.51	-$10.46	10.01	11.15	0.0029
Residential	Lighting	2017 - LEDThree-Way1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDThree-Way250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDThree-Way665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	2016 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$23.27	$270.60	$301.02	0.33	7.69	0.0020
Residential	Lighting	2016 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$4.29	-$43.06	-$13.49	3.30	17.17	0.0045
Residential	Lighting	2016 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$8.26	-$36.74	-$6.84	1.92	13.26	0.0035
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$11.03	$58.35	$89.15	0.75	13.18	0.0034
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.81	-$37.39	-$6.72	2.47	2.08	0.0005
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$3.86	$22.92	$53.33	1.16	6.96	0.0018
Residential	Lighting	2016 - LEDGlobe1440 to 2600 lumensANY	12	$7.46	-$131.53	-$100.94	2.98	10.77	0.0028
Residential	Lighting	2016 - LEDGlobe250 to 664 lumensANY	12	$1.75	-$72.96	-$43.62	6.20	12.84	0.0034

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Residential	Lighting	2016 - LEDGlobe665 to 1439 lumensANY	12	$0.56	-$171.61	-$142.02	18.70	9.16	0.0024
Residential	Lighting	2016 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$12.55	-$53.73	-$20.86	5.31	75.96	0.0198
Residential	Lighting	2016 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$7.99	-$68.97	-$39.35	2.87	18.33	0.0048
Residential	Lighting	2016 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$4.68	-$111.12	-$80.65	4.58	14.71	0.0038
Residential	Lighting	2016 - LEDThree-Way1440 to 2600 lumensANY	12	$13.57	-$53.28	-$23.91	3.08	42.26	0.0110
Residential	Lighting	2016 - LEDThree-Way250 to 664 lumensANY	12	$10.12	-$27.31	$1.88	2.88	42.53	0.0111
Residential	Lighting	2016 - LEDThree-Way665 to 1439 lumensANY	12	$4.66	-$43.17	-$13.92	5.67	46.24	0.0121
Residential	Lighting	2017 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$1.89	-$48.98	-$17.65	6.12	16.31	0.0043
Residential	Lighting	2017 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	2017 - LEDGlobe1440 to 2600 lumensANY	12	$4.20	-$35.68	-$4.08	2.96	14.77	0.0039
Residential	Lighting	2017 - LEDGlobe250 to 664 lumensANY	12	$1.93	-$43.70	-$12.50	5.82	16.88	0.0044
Residential	Lighting	2017 - LEDGlobe665 to 1439 lumensANY	12	$2.66	-$50.71	-$19.43	8.74	37.90	0.0099
Residential	Lighting	2017 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$4.16	-$41.10	-$7.91	9.56	61.03	0.0159
Residential	Lighting	2017 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$0.25	-$48.83	-$17.34	15.71	9.51	0.0025
Residential	Lighting	2017 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$0.62	-$42.51	-$10.46	10.01	11.15	0.0029
Residential	Lighting	2017 - LEDThree-Way1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDThree-Way250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDThree-Way665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	2016 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$23.27	$270.60	$301.02	0.33	7.69	0.0020
Residential	Lighting	2016 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$4.29	-$43.06	-$13.49	3.30	17.17	0.0045
Residential	Lighting	2016 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$8.26	-$36.74	-$6.84	1.92	13.26	0.0035
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$11.03	$58.35	$89.15	0.75	13.18	0.0034
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.81	-$37.39	-$6.72	2.47	2.08	0.0005
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$3.86	$22.92	$53.33	1.16	6.96	0.0018
Residential	Lighting	2016 - LEDGlobe1440 to 2600 lumensANY	12	$7.46	-$131.53	-$100.94	2.98	10.77	0.0028
Residential	Lighting	2016 - LEDGlobe250 to 664 lumensANY	12	$1.75	-$72.96	-$43.62	6.20	12.84	0.0034
Residential	Lighting	2016 - LEDGlobe665 to 1439 lumensANY	12	$0.56	-$171.61	-$142.02	18.70	9.16	0.0024
Residential	Lighting	2016 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$12.55	-$53.73	-$20.86	5.31	75.96	0.0198
Residential	Lighting	2016 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$7.99	-$68.97	-$39.35	2.87	18.33	0.0048
Residential	Lighting	2016 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$4.68	-$111.12	-$80.65	4.58	14.71	0.0038
Residential	Lighting	2016 - LEDThree-Way1440 to 2600 lumensANY	12	$13.57	-$53.28	-$23.91	3.08	42.26	0.0110
Residential	Lighting	2016 - LEDThree-Way250 to 664 lumensANY	12	$10.12	-$27.31	$1.88	2.88	42.53	0.0111
Residential	Lighting	2016 - LEDThree-Way665 to 1439 lumensANY	12	$4.66	-$43.17	-$13.92	5.67	46.24	0.0121
Residential	Lighting	2017 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$1.89	-$48.98	-$17.65	6.12	16.31	0.0043
Residential	Lighting	2017 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	2017 - LEDGlobe1440 to 2600 lumensANY	12	$4.20	-$35.68	-$4.08	2.96	14.77	0.0039
Residential	Lighting	2017 - LEDGlobe250 to 664 lumensANY	12	$1.93	-$43.70	-$12.50	5.82	16.88	0.0044
Residential	Lighting	2017 - LEDGlobe665 to 1439 lumensANY	12	$2.66	-$50.71	-$19.43	8.74	37.90	0.0099
Residential	Lighting	2017 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$4.16	-$41.10	-$7.91	9.56	61.03	0.0159
Residential	Lighting	2017 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$0.25	-$48.83	-$17.34	15.71	9.51	0.0025
Residential	Lighting	2017 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$0.62	-$42.51	-$10.46	10.01	11.15	0.0029
Residential	Lighting	2017 - LEDThree-Way1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDThree-Way250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDThree-Way665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	2016 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$23.27	$270.60	$301.02	0.33	7.69	0.0020
Residential	Lighting	2016 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$4.29	-$43.06	-$13.49	3.30	17.17	0.0045
Residential	Lighting	2016 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$8.26	-$36.74	-$6.84	1.92	13.26	0.0035
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$11.03	$58.35	$89.15	0.75	13.18	0.0034
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.81	-$37.39	-$6.72	2.47	2.08	0.0005
Residential	Lighting	2016 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$3.86	$22.92	$53.33	1.16	6.96	0.0018
Residential	Lighting	2016 - LEDGlobe1440 to 2600 lumensANY	12	$7.46	-$131.53	-$100.94	2.98	10.77	0.0028
Residential	Lighting	2016 - LEDGlobe250 to 664 lumensANY	12	$1.75	-$72.96	-$43.62	6.20	12.84	0.0034
Residential	Lighting	2016 - LEDGlobe665 to 1439 lumensANY	12	$0.56	-$171.61	-$142.02	18.70	9.16	0.0024
Residential	Lighting	2016 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$12.55	-$53.73	-$20.86	5.31	75.96	0.0198
Residential	Lighting	2016 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$7.99	-$68.97	-$39.35	2.87	18.33	0.0048
Residential	Lighting	2016 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$4.68	-$111.12	-$80.65	4.58	14.71	0.0038
Residential	Lighting	2016 - LEDThree-Way1440 to 2600 lumensANY	12	$13.57	-$53.28	-$23.91	3.08	42.26	0.0110
Residential	Lighting	2016 - LEDThree-Way250 to 664 lumensANY	12	$10.12	-$27.31	$1.88	2.88	42.53	0.0111
Residential	Lighting	2016 - LEDThree-Way665 to 1439 lumensANY	12	$4.66	-$43.17	-$13.92	5.67	46.24	0.0121
Residential	Lighting	2017 - LEDDecorative and Mini-Base1440 to 2600 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDDecorative and Mini-Base250 to 664 lumensANY	12	$1.89	-$48.98	-$17.65	6.12	16.31	0.0043
Residential	Lighting	2017 - LEDDecorative and Mini-Base665 to 1439 lumensANY	12	$0.01	$9,999.00	$9,999.00	-	-	-
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDGeneral Purpose and Dimmable665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Residential	Lighting	2017 - LEDGlobe1440 to 2600 lumensANY	12	$4.20	-$35.68	-$4.08	2.96	14.77	0.0039
Residential	Lighting	2017 - LEDGlobe250 to 664 lumensANY	12	$1.93	-$43.70	-$12.50	5.82	16.88	0.0044
Residential	Lighting	2017 - LEDGlobe665 to 1439 lumensANY	12	$2.66	-$50.71	-$19.43	8.74	37.90	0.0099
Residential	Lighting	2017 - LEDReflectors and Outdoor1440 to 2600 lumensANY	12	$4.16	-$41.10	-$7.91	9.56	61.03	0.0159
Residential	Lighting	2017 - LEDReflectors and Outdoor250 to 664 lumensANY	12	$0.25	-$48.83	-$17.34	15.71	9.51	0.0025
Residential	Lighting	2017 - LEDReflectors and Outdoor665 to 1439 lumensANY	12	$0.62	-$42.51	-$10.46	10.01	11.15	0.0029
Residential	Lighting	2017 - LEDThree-Way1440 to 2600 lumensANY	12	$1.64	-$35.05	-$3.37	4.39	10.58	0.0028
Residential	Lighting	2017 - LEDThree-Way250 to 664 lumensANY	12	$0.73	-$41.36	-$9.82	9.69	13.81	0.0036
Residential	Lighting	2017 - LEDThree-Way665 to 1439 lumensANY	12	$4.17	-$34.67	-$2.97	4.88	31.58	0.0083
Residential	Lighting	all45lm/WGeneral Purpose and Dimmable1440 to 2600 lumensANY	7.487903	$0.07	$9,999.00	$9,999.00	2.81	(1.19)	(0.0003)
Residential	Lighting	all45lm/WGeneral Purpose and Dimmable250 to 664 lumensANY	8.539783	$0.05	-$94.60	-$64.31	29.54	10.78	0.0028
Residential	Lighting	all45lm/WGeneral Purpose and Dimmable665 to 1439 lumensANY	7.944554	$0.05	-$75.21	-$44.87	20.17	4.23	0.0011
Residential	Lighting	all45lm/WGeneral Purpose and Dimmable1440 to 2600 lumensANY	7.487903	$0.07	$9,999.00	$9,999.00	2.81	(1.19)	(0.0003)
Residential	Lighting	all45lm/WGeneral Purpose and Dimmable250 to 664 lumensANY	8.539783	$0.05	-$94.60	-$64.31	29.54	10.78	0.0028
Residential	Lighting	all45lm/WGeneral Purpose and Dimmable665 to 1439 lumensANY	7.944554	$0.05	-$75.21	-$44.87	20.17	4.23	0.0011
Residential	Lighting	all45lm/WGeneral Purpose and Dimmable1440 to 2600 lumensANY	7.487903	$0.07	$9,999.00	$9,999.00	2.81	(1.19)	(0.0003)
Residential	Lighting	all45lm/WGeneral Purpose and Dimmable250 to 664 lumensANY	8.539783	$0.05	-$94.60	-$64.31	29.54	10.78	0.0028
Residential	Lighting	all45lm/WGeneral Purpose and Dimmable665 to 1439 lumensANY	7.944554	$0.05	-$75.21	-$44.87	20.17	4.23	0.0011
Residential	Lighting	all45lm/WGeneral Purpose and Dimmable1440 to 2600 lumensANY	7.487903	$0.07	$9,999.00	$9,999.00	2.81	(1.19)	(0.0003)
Residential	Lighting	all45lm/WGeneral Purpose and Dimmable250 to 664 lumensANY	8.539783	$0.05	-$94.60	-$64.31	29.54	10.78	0.0028
Residential	Lighting	all45lm/WGeneral Purpose and Dimmable665 to 1439 lumensANY	7.944554	$0.05	-$75.21	-$44.87	20.17	4.23	0.0011
Residential	Food Preparation	Microwave Top Tier	10.91	$4.51	$2.67	$65.62	1.49	9.02	0.0052
Residential	Food Preparation	Microwave Top Tier	10.91	$4.51	$2.67	$65.62	1.49	9.02	0.0052
Residential	Food Preparation	Microwave Top Tier	10.91	$4.51	$2.67	$65.62	1.49	9.02	0.0052
Residential	Food Preparation	Microwave Top Tier	10.91	$4.51	$2.67	$65.62	1.49	9.02	0.0052
Residential	Food Preparation	Microwave Top Tier	10.91	$4.51	$2.67	$65.62	1.49	9.02	0.0052
Residential	Food Preparation	Microwave Top Tier	10.91	$4.51	$2.67	$65.62	1.49	9.02	0.0052
Residential	Food Preparation	Microwave Top Tier	10.91	$4.51	$2.67	$65.62	1.49	9.02	0.0052
Residential	Food Preparation	Microwave Top Tier	10.91	$4.51	$2.67	$65.62	1.49	9.02	0.0052
Residential	Electronics	ENERGY STAR Monitors	5	$8.00	$33.25	$61.84	1.00	31.44	0.0065
Residential	Electronics	ENERGY STAR Monitors	5	$8.00	$33.25	$61.84	1.00	31.44	0.0065
Residential	Electronics	ENERGY STAR Monitors	5	$8.00	$33.25	$61.84	1.00	31.44	0.0065
Residential	Electronics	ENERGY STAR Monitors	5	$8.00	$33.25	$61.84	1.00	31.44	0.0065
Residential	Electronics	ENERGY STAR Monitors	5	$8.00	$33.25	$61.84	1.00	31.44	0.0065
Residential	Electronics	ENERGY STAR Monitors	5	$8.00	$33.25	$61.84	1.00	31.44	0.0065
Residential	Electronics	ENERGY STAR Monitors	5	$8.00	$33.25	$61.84	1.00	31.44	0.0065
Residential	Electronics	ENERGY STAR Monitors	5	$8.00	$33.25	$61.84	1.00	31.44	0.0065
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 1	15.18	$30.30	$302.12	$318.13	0.16	10.01	0.0011
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 2	15.18	$104.83	$306.33	$322.33	0.16	34.18	0.0038
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 3	15.18	$99.31	$159.12	$175.12	0.29	59.60	0.0067
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 1	15.18	$30.30	$302.12	$318.13	0.16	10.01	0.0011
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 2	15.18	$104.83	$306.33	$322.33	0.16	34.18	0.0038
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 3	15.18	$99.31	$159.12	$175.12	0.29	59.60	0.0067
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 1	15.18	$30.30	$302.12	$318.13	0.16	10.01	0.0011
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 2	15.18	$104.83	$306.33	$322.33	0.16	34.18	0.0038
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 3	15.18	$99.31	$159.12	$175.12	0.29	59.60	0.0067
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 1	15.18	$30.30	$302.12	$318.13	0.16	10.01	0.0011
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 2	15.18	$104.83	$306.33	$322.33	0.16	34.18	0.0038
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 3	15.18	$99.31	$159.12	$175.12	0.29	59.60	0.0067
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 1	15.18	$30.30	$302.12	$318.13	0.16	10.01	0.0011
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Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 1	15.18	$30.30	$302.12	$318.13	0.16	10.01	0.0011
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 2	15.18	$104.83	$306.33	$322.33	0.16	34.18	0.0038
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Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 1	15.18	$30.30	$302.12	$318.13	0.16	10.01	0.0011
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 2	15.18	$104.83	$306.33	$322.33	0.16	34.18	0.0038
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 3	15.18	$99.31	$159.12	$175.12	0.29	59.60	0.0067
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 1	15.18	$30.30	$302.12	$318.13	0.16	10.01	0.0011
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 2	15.18	$104.83	$306.33	$322.33	0.16	34.18	0.0038
Residential	Refrigeration	Std Size Refrig and Refrig-Freezer - CEE Tier 3	15.18	$99.31	$159.12	$175.12	0.29	59.60	0.0067
Residential	HVAC	Attic R0 - R22_Electric FAF	25	$1,102.94	$40.95	$109.02	0.94	804.84	0.4212
Residential	HVAC	Attic R0 - R22_Heat Pump	25	$1,102.94	$57.48	$109.12	0.79	804.11	0.2811
Residential	HVAC	Attic R0 - R30_Electric FAF	25	$1,246.47	$172.95	$241.02	0.42	411.41	0.2153
Residential	HVAC	Attic R0 - R30_Heat Pump	25	$1,246.47	$189.61	$241.24	0.36	411.03	0.1437
Residential	HVAC	Attic R11 - R30_Electric FAF	25	$1,049.12	$734.52	$802.59	0.13	103.99	0.0544
Residential	HVAC	Attic R11 - R30_Heat Pump	25	$1,049.12	$751.69	$803.32	0.11	103.89	0.0363
Residential	HVAC	CFM50 Infiltration Reduction_Electric FAF	25	$938.50	$241.46	$309.53	0.33	321.09	0.1681
Residential	HVAC	CFM50 Infiltration Reduction_Heat Pump	25	$938.50	$258.17	$309.81	0.28	320.80	0.1121
Residential	HVAC	Floor R0 - R22_Electric FAF	25	$1,775.44	$146.93	$214.99	0.47	656.94	0.3438
Residential	HVAC	Floor R0 - R22_Heat Pump	25	$1,775.44	$163.56	$215.19	0.40	656.35	0.2295
Residential	HVAC	Floor R11 - R22_Electric FAF	25	$1,653.13	$414.88	$482.95	0.21	272.30	0.1425
Residential	HVAC	Floor R11 - R22_Heat Pump	25	$1,653.13	$431.76	$483.39	0.18	272.06	0.0951

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Double Pane Base_Electric	25	$3,179.68	$303.10	$371.17	0.27	681.49	0.3567
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Double Pane Base_Heat Pu	25	$3,179.68	$319.87	$371.51	0.23	680.87	0.2380
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Single Pane Base_Electric Fa	25	$3,179.68	$84.35	$152.42	0.67	1,659.55	0.8686
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Single Pane Base_Heat Pum	25	$3,179.68	$100.92	$152.56	0.56	1,658.04	0.5796
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Double Pane Base_Electric	25	$2,849.62	$302.08	$370.15	0.28	612.44	0.3205
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Double Pane Base_Heat Pu	25	$2,849.62	$318.85	$370.48	0.23	611.88	0.2139
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Single Pane Base_Electric Fa	25	$2,849.62	$72.31	$140.38	0.73	1,614.82	0.8452
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Single Pane Base_Heat Pum	25	$2,849.62	$88.88	$140.51	0.61	1,613.36	0.5640
Residential	HVAC	ATTIC R0 - R19_Electric FAF	45	$225.01	-$16.35	$43.27	2.16	330.69	0.1731
Residential	HVAC	ATTIC R0 - R19_Electric Zonal	45	$223.85	-$11.87	$47.76	1.96	298.07	0.1560
Residential	HVAC	ATTIC R0 - R19_Heat Pump	45	$225.01	$53.81	$113.44	0.82	126.15	0.0660
Residential	HVAC	ATTIC R0 - R38_Electric FAF	45	$298.11	-$17.03	$42.60	2.19	445.04	0.2329
Residential	HVAC	ATTIC R0 - R38_Electric Zonal	45	$297.11	-$12.08	$47.55	1.97	397.42	0.2080
Residential	HVAC	ATTIC R0 - R38_Heat Pump	45	$298.11	$52.58	$112.21	0.83	168.97	0.0884
Residential	HVAC	ATTIC R0 - R49_Electric FAF	45	$340.44	-$13.41	$46.22	2.02	468.43	0.2452
Residential	HVAC	ATTIC R0 - R49_Electric Zonal	45	$341.88	-$7.74	$51.89	1.80	419.02	0.2193
Residential	HVAC	ATTIC R0 - R49_Heat Pump	45	$340.44	$62.39	$122.02	0.77	177.44	0.0929
Residential	HVAC	ATTIC R19 - R30_Electric FAF	45	$194.22	$86.43	$146.06	0.64	84.57	0.0443
Residential	HVAC	ATTIC R19 - R30_Electric Zonal	45	$195.36	$100.16	$159.79	0.59	77.76	0.0407
Residential	HVAC	ATTIC R19 - R30_Heat Pump	45	$194.22	$326.07	$385.70	0.24	32.03	0.0168
Residential	HVAC	ATTIC R19 - R38_Electric FAF	45	$225.01	$65.51	$125.14	0.75	114.36	0.0599
Residential	HVAC	ATTIC R19 - R38_Electric Zonal	45	$223.85	$77.69	$137.32	0.68	103.68	0.0543
Residential	HVAC	ATTIC R19 - R38_Heat Pump	45	$225.01	$274.55	$334.18	0.28	42.82	0.0224
Residential	HVAC	ATTIC R19 - R49_Electric FAF	45	$267.33	$63.81	$123.44	0.76	137.74	0.0721
Residential	HVAC	ATTIC R19 - R49_Electric Zonal	45	$268.62	$76.74	$136.37	0.69	125.27	0.0656
Residential	HVAC	ATTIC R19 - R49_Heat Pump	45	$267.33	$271.85	$331.48	0.28	51.29	0.0268
Residential	HVAC	FLOOR R0 - R19_Electric FAF	45	$358.02	-$12.83	$46.80	2.00	486.57	0.2547
Residential	HVAC	FLOOR R0 - R19_Electric Zonal	45	$358.80	-$12.51	$47.12	1.98	484.31	0.2535
Residential	HVAC	FLOOR R0 - R19_Heat Pump	45	$358.02	$75.69	$135.32	0.69	168.26	0.0881
Residential	HVAC	FLOOR R0 - R30_Electric FAF	45	$383.15	-$22.21	$37.42	2.50	651.30	0.3409
Residential	HVAC	FLOOR R0 - R30_Electric Zonal	45	$382.20	-$21.99	$37.64	2.48	645.74	0.3380
Residential	HVAC	FLOOR R0 - R30_Heat Pump	45	$383.15	$49.09	$108.72	0.86	224.15	0.1173
Residential	HVAC	WALL R0 - R11_Electric FAF	45	$504.28	-$34.82	$24.81	3.77	1,292.83	0.6767
Residential	HVAC	WALL R0 - R11_Electric Zonal	45	$506.48	-$31.56	$28.07	3.33	1,147.50	0.6006
Residential	HVAC	WALL R0 - R11_Heat Pump	45	$504.28	$6.28	$65.91	1.42	486.63	0.2547
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Double Pane Base_Electric	45	$3,457.90	$10.33	$69.96	1.34	3,143.57	1.6453
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Double Pane Base_Electric	45	$3,457.38	$19.17	$78.80	1.19	2,790.51	1.4605
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Double Pane Base_Heat Pu	45	$3,457.90	$101.96	$161.58	0.58	1,361.03	0.7123
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Single Pane Base_Electric Fa	45	$3,457.90	-$20.50	$39.13	2.39	5,620.64	2.9418
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Single Pane Base_Electric Zo	45	$3,457.38	-$15.61	$44.02	2.12	4,995.59	2.6146
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Single Pane Base_Heat Pum	45	$3,457.90	$31.68	$91.30	1.02	2,408.66	1.2607
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Double Pane Base_Electric	45	$3,098.96	$17.66	$77.29	1.21	2,550.02	1.3347
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Double Pane Base_Electric	45	$3,098.94	$27.42	$87.05	1.07	2,264.18	1.1850
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Double Pane Base_Heat Pu	45	$3,098.96	$113.03	$172.66	0.54	1,141.50	0.5975
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Single Pane Base_Electric Fa	45	$3,098.96	-$20.42	$39.21	2.38	5,027.09	2.6311
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Single Pane Base_Electric Zo	45	$3,098.94	-$15.53	$44.10	2.12	4,469.25	2.3392
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Single Pane Base_Heat Pum	45	$3,098.96	$30.40	$90.03	1.04	2,189.13	1.1458
Residential	HVAC	ATTIC R0 - R38_DHP	45	$1,557.62	-$41.56	$30.66	3.47	3,230.71	1.6029
Residential	HVAC	ATTIC R0 - R38_Electric FAF	45	$1,557.62	-$41.18	$28.15	3.69	3,519.41	1.6665
Residential	HVAC	ATTIC R0 - R38_Electric Zonal	45	$1,557.62	-$41.56	$30.66	3.47	3,230.71	1.6029
Residential	HVAC	ATTIC R0 - R38_Heat Pump	45	$1,557.62	-$8.53	$49.61	1.89	1,996.69	0.7714
Residential	HVAC	ATTIC R0 - R49_DHP	45	$1,778.78	-$37.70	$34.53	3.08	3,276.16	1.6256
Residential	HVAC	ATTIC R0 - R49_Electric FAF	45	$1,778.78	-$37.65	$31.69	3.28	3,569.47	1.6906
Residential	HVAC	ATTIC R0 - R49_Electric Zonal	45	$1,778.78	-$37.70	$34.53	3.08	3,276.16	1.6256
Residential	HVAC	ATTIC R0 - R49_Heat Pump	45	$1,778.78	-$2.24	$55.94	1.68	2,022.41	0.7818
Residential	HVAC	ATTIC R11 - R38_DHP	45	$1,336.47	$64.51	$137.57	0.78	617.86	0.3106
Residential	HVAC	ATTIC R11 - R38_Electric FAF	45	$1,336.47	$26.08	$98.05	1.08	866.87	0.4284
Residential	HVAC	ATTIC R11 - R38_Electric Zonal	45	$1,336.47	$64.51	$137.57	0.78	617.86	0.3106
Residential	HVAC	ATTIC R11 - R38_Heat Pump	45	$1,336.47	$169.21	$232.04	0.42	366.31	0.1549
Residential	HVAC	ATTIC R11 - R49_DHP	45	$1,557.62	$74.69	$147.76	0.73	670.43	0.3370
Residential	HVAC	ATTIC R11 - R49_Electric FAF	45	$1,557.62	$33.32	$105.30	1.01	940.75	0.4650
Residential	HVAC	ATTIC R11 - R49_Electric Zonal	45	$1,557.62	$74.69	$147.76	0.73	670.43	0.3370
Residential	HVAC	ATTIC R11 - R49_Heat Pump	45	$1,557.62	$186.65	$249.51	0.39	397.03	0.1680
Residential	HVAC	ATTIC R19 - R38_DHP	45	$1,175.63	$160.01	$233.64	0.46	320.03	0.1623
Residential	HVAC	ATTIC R19 - R38_Electric FAF	45	$1,175.63	$142.67	$214.59	0.49	348.43	0.1720
Residential	HVAC	ATTIC R19 - R38_Electric Zonal	45	$1,175.63	$160.01	$233.64	0.46	320.03	0.1623
Residential	HVAC	ATTIC R19 - R38_Heat Pump	45	$1,175.63	$348.82	$413.98	0.24	180.61	0.0797
Residential	HVAC	ATTIC R19 - R49_DHP	45	$1,396.79	$156.72	$230.35	0.47	385.65	0.1956
Residential	HVAC	ATTIC R19 - R49_Electric FAF	45	$1,396.79	$139.60	$211.53	0.50	419.97	0.2074
Residential	HVAC	ATTIC R19 - R49_Electric Zonal	45	$1,396.79	$156.72	$230.35	0.47	385.65	0.1956
Residential	HVAC	ATTIC R19 - R49_Heat Pump	45	$1,396.79	$343.38	$408.57	0.24	217.43	0.0960
Residential	HVAC	CFM50 Infiltration Reduction_DHP	15	$1,470.80	$89.12	$164.45	0.66	947.14	0.4928
Residential	HVAC	CFM50 Infiltration Reduction_Electric FAF	15	$1,470.80	$60.95	$136.09	0.80	1,144.53	0.5938

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Residential	HVAC	CFM50 Infiltration Reduction_Electric Zonal	15	$1,470.80	$89.12	$164.45	0.66	947.14	0.4928
Residential	HVAC	CFM50 Infiltration Reduction_Heat Pump	15	$1,470.80	$232.94	$308.20	0.35	505.38	0.2627
Residential	HVAC	FLOOR R0 - R19_DHP	45	$1,952.17	$11.52	$88.32	1.25	1,405.70	0.7475
Residential	HVAC	FLOOR R0 - R19_Electric FAF	45	$1,952.17	$13.59	$91.59	1.22	1,355.54	0.7336
Residential	HVAC	FLOOR R0 - R19_Electric Zonal	45	$1,952.17	$11.52	$88.32	1.25	1,405.70	0.7475
Residential	HVAC	FLOOR R0 - R19_Heat Pump	45	$1,952.17	$408.04	$504.10	0.25	246.29	0.1680
Residential	HVAC	FLOOR R0 - R25_DHP	45	$2,026.92	$8.86	$85.70	1.29	1,504.30	0.8005
Residential	HVAC	FLOOR R0 - R25_Electric FAF	45	$2,026.92	$10.52	$88.60	1.26	1,454.97	0.7883
Residential	HVAC	FLOOR R0 - R25_Electric Zonal	45	$2,026.92	$8.86	$85.70	1.29	1,504.30	0.8005
Residential	HVAC	FLOOR R0 - R25_Heat Pump	45	$2,026.92	$395.53	$492.70	0.26	261.64	0.1807
Residential	HVAC	FLOOR R0 - R30_DHP	45	$2,089.22	$8.00	$84.87	1.30	1,565.61	0.8334
Residential	HVAC	FLOOR R0 - R30_Electric FAF	45	$2,089.22	$9.45	$87.58	1.28	1,517.15	0.8226
Residential	HVAC	FLOOR R0 - R30_Electric Zonal	45	$2,089.22	$8.00	$84.87	1.30	1,565.61	0.8334
Residential	HVAC	FLOOR R0 - R30_Heat Pump	45	$2,089.22	$392.44	$490.34	0.26	270.98	0.1887
Residential	HVAC	WALL R0 - R11_DHP	45	$2,773.45	-$14.70	$60.30	1.81	2,925.23	1.5147
Residential	HVAC	WALL R0 - R11_Electric FAF	45	$2,773.45	-$33.49	$41.28	2.63	4,272.94	2.2049
Residential	HVAC	WALL R0 - R11_Electric Zonal	45	$2,773.45	-$14.70	$60.30	1.81	2,925.23	1.5147
Residential	HVAC	WALL R0 - R11_Heat Pump	45	$2,773.45	$22.50	$95.63	1.12	1,844.57	0.9281
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Double Pane Base_DHP	45	$4,329.02	$172.60	$244.22	0.43	1,127.36	0.5540
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Double Pane Base_Electric	45	$4,329.02	$155.57	$223.81	0.46	1,230.17	0.5721
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Double Pane Base_Electric	45	$4,329.02	$172.60	$244.22	0.43	1,127.36	0.5540
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Double Pane Base_Heat Pu	45	$4,329.02	$278.02	$336.64	0.28	817.86	0.3190
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Single Pane Base_DHP	45	$4,329.02	$75.42	$149.07	0.72	1,846.96	0.9368
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Single Pane Base_Electric F	45	$4,329.02	$10.73	$84.13	1.28	3,272.55	1.6537
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Single Pane Base_Electric Z	45	$4,329.02	$75.42	$149.07	0.72	1,846.96	0.9368
Residential	HVAC	WINDOW CL22 Prime Window Replacement of Single Pane Base_Heat Pum	45	$4,329.02	$121.35	$189.55	0.54	1,452.54	0.6750
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Double Pane Base_DHP	45	$3,675.82	$170.32	$241.55	0.44	967.82	0.4727
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Double Pane Base_Electric	45	$3,675.82	$152.55	$220.12	0.46	1,062.07	0.4884
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Double Pane Base_Electric	45	$3,675.82	$170.32	$241.55	0.44	967.82	0.4727
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Double Pane Base_Heat Pu	45	$3,675.82	$269.53	$326.76	0.28	715.45	0.2713
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Single Pane Base_DHP	45	$3,675.82	$64.41	$138.04	0.78	1,693.62	0.8587
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Single Pane Base_Electric F	45	$3,675.82	$4.54	$77.92	1.38	3,000.42	1.5155
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Single Pane Base_Electric Z	45	$3,675.82	$64.41	$138.04	0.78	1,693.62	0.8587
Residential	HVAC	WINDOW CL30 Prime Window Replacement of Single Pane Base_Heat Pum	45	$3,675.82	$108.23	$176.27	0.58	1,326.22	0.6147
Residential	Water Heating	MH Showerhead Replace_1_50gpm_Any Shower_ AnyWH	10	$0.00	-$103.33	$0.00	9,999.00	156.14	0.0301
Residential	Water Heating	MH Showerhead Replace_1_50GPM_any shower_HPWH	10	$17.20	-$127.28	$14.18	12.34	169.62	0.0328
Residential	Water Heating	MH Showerhead Replace_1_75gpm_Any Shower_ AnyWH	10	$0.00	-$104.43	$0.00	9,999.00	65.03	0.0125
Residential	Water Heating	MH Showerhead Replace_2_00gpm_Any Shower_ AnyWH	10	$17.20	-$32.16	$25.21	3.61	95.43	0.0184
Residential	Water Heating	MF Showerhead Replace_1_50gpm_Any Shower_ AnyWH	10	$0.00	-$102.76	$0.00	9,999.00	156.37	0.0301
Residential	Water Heating	MF Showerhead Replace_1_75gpm_Any Shower_ AnyWH	10	$0.00	-$103.26	$0.00	9,999.00	65.13	0.0125
Residential	Water Heating	MF Showerhead Replace_2_00gpm_Any Shower_ AnyWH	10	$17.20	-$18.46	$39.25	2.33	61.28	0.0118
Residential	Water Heating	MF Showerhead Replace_1_50gpm_Any Shower_ AnyWH	10	$0.00	-$102.76	$0.00	9,999.00	156.37	0.0301
Residential	Water Heating	MF Showerhead Replace_1_75gpm_Any Shower_ AnyWH	10	$0.00	-$103.26	$0.00	9,999.00	65.13	0.0125
Residential	Water Heating	MF Showerhead Replace_2_00gpm_Any Shower_ AnyWH	10	$17.20	-$18.46	$39.25	2.33	61.28	0.0118
Residential	Water Heating	SF Showerhead Replace_1_50gpm_Any Shower_ AnyWH	10	$0.00	-$45.95	$0.00	9,999.00	155.42	0.0299
Residential	Water Heating	SF Showerhead Replace_1_50GPM_any shower_HPWH	10	$17.20	-$89.64	$8.59	15.34	280.08	0.0587
Residential	Water Heating	SF Showerhead Replace_1_75gpm_Any Shower_ AnyWH	10	$0.00	-$239.41	$0.00	9,999.00	64.73	0.0125
Residential	Water Heating	SF Showerhead Replace_2_00gpm_Any Shower_ AnyWH	10	$17.20	-$30.44	$24.24	3.64	99.24	0.0193
Residential	Water Heating	MH Showerhead Replace_1_50gpm_Any Shower_ AnyWH	10	$0.00	-$103.33	$0.00	9,999.00	156.14	0.0301
Residential	Water Heating	MH Showerhead Replace_1_50GPM_any shower_HPWH	10	$17.20	-$127.28	$14.18	12.34	169.62	0.0328
Residential	Water Heating	MH Showerhead Replace_1_75gpm_Any Shower_ AnyWH	10	$0.00	-$104.43	$0.00	9,999.00	65.03	0.0125
Residential	Water Heating	MH Showerhead Replace_2_00gpm_Any Shower_ AnyWH	10	$17.20	-$32.16	$25.21	3.61	95.43	0.0184
Residential	Water Heating	MF Showerhead Replace_1_50gpm_Any Shower_ AnyWH	10	$0.00	-$102.76	$0.00	9,999.00	156.37	0.0301
Residential	Water Heating	MF Showerhead Replace_1_75gpm_Any Shower_ AnyWH	10	$0.00	-$103.26	$0.00	9,999.00	65.13	0.0125
Residential	Water Heating	MF Showerhead Replace_2_00gpm_Any Shower_ AnyWH	10	$17.20	-$18.46	$39.25	2.33	61.28	0.0118
Residential	Water Heating	MF Showerhead Replace_1_50gpm_Any Shower_ AnyWH	10	$0.00	-$102.76	$0.00	9,999.00	156.37	0.0301
Residential	Water Heating	MF Showerhead Replace_1_75gpm_Any Shower_ AnyWH	10	$0.00	-$103.26	$0.00	9,999.00	65.13	0.0125
Residential	Water Heating	MF Showerhead Replace_2_00gpm_Any Shower_ AnyWH	10	$17.20	-$18.46	$39.25	2.33	61.28	0.0118
Residential	Water Heating	SF Showerhead Replace_1_50gpm_Any Shower_ AnyWH	10	$0.00	-$45.95	$0.00	9,999.00	155.42	0.0299
Residential	Water Heating	SF Showerhead Replace_1_50GPM_any shower_HPWH	10	$17.20	-$89.64	$8.59	15.34	280.08	0.0587
Residential	Water Heating	SF Showerhead Replace_1_75gpm_Any Shower_ AnyWH	10	$0.00	-$239.41	$0.00	9,999.00	64.73	0.0125
Residential	Water Heating	SF Showerhead Replace_2_00gpm_Any Shower_ AnyWH	10	$17.20	-$30.44	$24.24	3.64	99.24	0.0193
Residential	Water Heating	SHW Solar Zone 1	20	$8,617.59	$700.36	$725.29	0.08	1,126.47	0.1877
Residential	Water Heating	SHW Solar Zone 2	20	$8,617.59	$664.10	$689.02	0.08	1,185.76	0.1976
Residential	Water Heating	SHW Solar Zone 3	20	$8,617.59	$616.02	$640.95	0.09	1,274.69	0.2124
Residential	Water Heating	SHW Solar Zone 4	20	$8,617.59	$526.29	$551.22	0.11	1,482.20	0.2470
Residential	Water Heating	SHW Solar Zone 1	20	$8,617.59	$700.36	$725.29	0.08	1,126.47	0.1877
Residential	Water Heating	SHW Solar Zone 2	20	$8,617.59	$664.10	$689.02	0.08	1,185.76	0.1976
Residential	Water Heating	SHW Solar Zone 3	20	$8,617.59	$616.02	$640.95	0.09	1,274.69	0.2124
Residential	Water Heating	SHW Solar Zone 4	20	$8,617.59	$526.29	$551.22	0.11	1,482.20	0.2470
Residential	Water Heating	Multifamily GFHX DHW Preheat, Heat Pump	40	$627.25	$311.30	$340.49	0.18	121.38	0.0256
Residential	Water Heating	Multifamily GFHX DHW & Shower Preheat, Electric Resistance	40	$688.82	$152.20	$179.50	0.34	252.84	0.0489
Residential	Water Heating	Multifamily GFHX DHW & Shower Preheat, Heat Pump	40	$688.82	$344.72	$373.91	0.17	121.38	0.0256

Sector	End Use	Measure Name	Measure Life (Years)	Initial Capital Cost	TRC Levelized Cost ($/MWh)	Total Sponsor Levelized Cost ($/MWh)	TRC B/C Ratio	Bulk Energy (kWh/unit)	Wholesale Demand (kW)
Residential	Water Heating	Multifamily GFHX DHW Preheat, Electric Resistance	40	$627.25	$136.15	$163.46	0.37	252.84	0.0489
Residential	Water Heating	Multifamily GFHX DHW Preheat, Heat Pump	40	$627.25	$311.30	$340.49	0.18	121.38	0.0256
Residential	Water Heating	Multifamily GFHX DHW & Shower Preheat, Electric Resistance	40	$688.82	$152.20	$179.50	0.34	252.84	0.0489
Residential	Water Heating	Multifamily GFHX DHW & Shower Preheat, Heat Pump	40	$688.82	$344.72	$373.91	0.17	121.38	0.0256
Residential	Water Heating	Multifamily GFHX DHW Preheat, Electric Resistance	40	$627.25	$136.15	$163.46	0.37	252.84	0.0489
Residential	Water Heating	Single Family GFHX DHW Preheat, Heat Pump	40	$749.31	$377.56	$406.74	0.15	121.38	0.0256
Residential	Water Heating	Single Family GFHX DHW & Shower Preheat, Electric Resistance	40	$778.53	$175.58	$202.88	0.30	252.84	0.0489
Residential	Water Heating	Single Family GFHX DHW & Shower Preheat, Heat Pump	40	$778.53	$393.42	$422.61	0.15	121.38	0.0256
Residential	Water Heating	Single Family GFHX DHW Preheat, Electric Resistance	40	$749.31	$167.96	$195.27	0.31	252.84	0.0489
Residential	HVAC	Single Family WIFI Enabled Thermostat HZ1	10	$240.35	$28.56	$87.57	1.06	666.99	0.3448
Residential	HVAC	Single Family WIFI Enabled Thermostat HZ2	10	$240.35	$0.12	$58.58	1.58	996.99	0.5099
Residential	HVAC	Single Family WIFI Enabled Thermostat HZ3	10	$240.35	-$9.49	$48.17	1.91	1,212.44	0.6102
Residential	HVAC	Single Family WIFI Enabled Thermostat HZ1	10	$240.35	$28.56	$87.57	1.06	666.99	0.3448
Residential	HVAC	Single Family WIFI Enabled Thermostat HZ2	10	$240.35	$0.12	$58.58	1.58	996.99	0.5099
Residential	HVAC	Single Family WIFI Enabled Thermostat HZ3	10	$240.35	-$9.49	$48.17	1.91	1,212.44	0.6102