Clean Energy Implementation Plan

2022 - 2025

CITY OF ELLENSBURG

Clean Energy Implementation Plan 2022-2025

City of Ellensburg Clean Energy Implementation Plan | December 2021

Contents

Clean Energy Transformation Act, **Clean Energy Implementation Plan**
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Submission: Email this workbook and all supporting documentation to **CETA@commerce.wa.gov**
Questions: Glenn Blackmon, Sarah Vorpahl, Austin Scharff, State Energy Office, **CETA@commerce.wa.gov**

Washington State Department of Commerce

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Do not modify blue-shaded fields.

RCW 19.405.060
Clean energy implementation plan—Compliance criteria—Incremental cost of compliance.

(2)(a) By January 1, 2022, and every four years thereafter, each consumer-owned utility must develop and submit to the department a four-year clean energy implementation plan for the standards established under RCW 19.405.040(1) and 19.405.050(1) that: (i) Proposes interim targets for meeting the standard under RCW 19.405.040(1) during the years prior to 2030 and between 2030 and 2045, as well as specific targets for energy efficiency, demand response, and renewable energy; (ii) Is informed by the consumer-owned utility's clean energy action plan developed under RCW 19.280.030(1) or other ten-year plan developed under RCW 19.280.030(5); (iii) Is consistent with subsection (4) of this section; and (iv) Identifies specific actions to be taken by the consumer-owned utility over the next four years, consistent with the utility's long-range resource plan and resource adequacy requirements, that demonstrate progress towards meeting the standards under RCW 19.405.040(1) and 19.405.050(1) and the interim targets proposed under (a)(i) of this subsection. The specific actions identified must be informed by the consumer-owned utility's historic performance under median water conditions and resource capability and by the consumer-owned utility's participation in centralized markets. In identifying specific actions in its clean energy implementation plan, the consumer-owned utility may also take into consideration any significant and unplanned loss or addition of load it experiences.

(b) The governing body of the consumer-owned utility must, after a public meeting, adopt the consumer-owned utility's clean energy implementation plan. The clean energy implementation plan must be submitted to the department and made available to the public. The governing body may adopt more stringent targets than those proposed by the consumer-owned utility and periodically adjust or expedite timelines if it can be demonstrated that such targets or timelines can be achieved in a manner consistent with the following: (i) Maintaining and protecting the safety, reliable operation, and balancing of the electric system; (ii) Planning to meet the standards at the lowest reasonable cost, considering risk; (iii) Ensuring that all customers are benefiting from the transition to clean energy: Through the equitable distribution of energy and nonenergy benefits and reduction of burdens to vulnerable populations and highly impacted communities; long-term and short-term public health and environmental benefits and reduction of costs and risks; and energy security and resiliency; and (iv) Ensuring that no customer or class of customers is unreasonably harmed by any resulting increases in the cost of utility-supplied electricity as may be necessary to comply with the standards.

(3)(a) An investor-owned utility must be considered to be in compliance with the standards under RCW 19.405.040(1) and 19.405.050(1) if, over the four-year compliance period, the average annual incremental cost of meeting the standards or the interim targets established under subsection (1) of this section equals a two percent increase of the investor-owned utility's weather-adjusted sales revenue to customers for electric operations above the previous year, as reported by the investor-owned utility in its most recent commission basis report. All costs included in the determination of cost impact must be directly attributable to actions necessary to comply with the requirements of RCW 19.405.040 and 19.405.050.

(b) If an investor-owned utility relies on (a) of this subsection as a basis for compliance with the standard under RCW 19.405.040(1), then it must demonstrate that it has maximized investments in renewable resources and nonemitting electric generation prior to using alternative compliance options allowed under RCW 19.405.040(1)(b).

(4)(a) A consumer-owned utility must be considered to be in compliance with the standards under RCW 19.405.040(1) and 19.405.050(1) if, over the four-year compliance period, the average annual incremental cost of meeting the standards or the interim targets established under subsection (2) of this section meets or exceeds a two percent increase of the consumer-owned utility's retail revenue requirement above the previous year. All costs included in the determination of cost impact must be directly attributable to actions necessary to comply with the requirements of RCW 19.405.040 and 19.405.050.

(b) If a consumer-owned utility relies on (a) of this subsection as a basis for compliance with the standard under RCW 19.405.040(1), and it has not met eighty percent of its annual retail electric load using electricity from renewable resources and nonemitting electric generation, then it must demonstrate that it has maximized investments in renewable resources and nonemitting electric generation prior to using alternative compliance options allowed under RCW 19.405.040(1)(b).

(5) The commission, for investor-owned utilities, and the department, for consumer-owned utilities, must adopt rules establishing the methodology for calculating the incremental cost of compliance under this section, as compared to the cost of an alternative lowest reasonable cost portfolio of investments that are reasonably available.

WAC 194-40-200
Clean energy implementation plan.

(1) **Specific actions.** Each utility must identify in each CEIP the specific actions the utility will take during the next interim performance period or GHG neutral compliance period to demonstrate progress toward meeting the standards under RCW 19.405.040(1) and 19.405.050(1) and the interim targets under subsection (2) of this section and the specific tar gets under subsection (3) of this section. Specific actions must be

consistent with the requirements of RCW 19.405.060 (2)(a)(iv).

(2) **Interim target.** The CEIP must establish an interim target for the percentage of retail load to be served using renewable and nonemitting resources during the period covered by the CEIP. The interim target must demonstrate progress toward meeting the standards under RCW 19.405.040(1) and 19.405.050(1), if the utility is not already meeting the relevant standard.

(3) **Specific targets.** The CEIP must establish specific targets, for the interim performance period or GHG neutral compliance period covered by the CEIP, for each of the following categories of resources:

(a) **Energy efficiency.** (i) The CEIP must establish a target for the amount, expressed in megawatt-hours of first-year savings, of energy efficiency resources expected to be acquired during the period. The energy efficiency target must comply with WAC 194-40-330(1). (ii) A utility may update its CEIP to incorporate a revised energy efficiency target to match a biennial conservation target established by the utility under RCW 19.285.040 (1)(b) and WAC 194-37-070.

(b) **Demand response resources.** The CEIP must specify a target for the amount, expressed in megawatts, of demand response resources to be acquired during the period. The demand response target must comply with WAC 194-40-330(2).

(c) **Renewable energy.** The utility's target for renewable energy must identify the quantity in megawatt-hours of renewable electricity to be used in the period.

(4) **Specific actions to ensure equitable transition.** To meet the requirements of RCW 19.405.040(8), the CEIP must, at a minimum:

(a) Identify each highly impacted community, as defined in RCW 19.405.020(23), and its designation as either: (i) A community designated by the department of health based on cumulative impact analyses; or (ii) A community located in census tracts that are at least partially on Indian country.

(b) Identify vulnerable populations based on the adverse socioeconomic factors and sensitivity factors developed through a public process established by the utility and describe and explain any changes from the utility's previous CEIP, if any;

(c) Report the forecasted distribution of energy and nonenergy costs and benefits for the utility's portfolio of specific actions, including impacts resulting from achievement of the specific targets established under subsection (3) of this section. The report must: (i) Include one or more indicators applicable to the utility's service area and associated with energy benefits, nonenergy benefits, reduction of burdens, public health, environment, reduction in cost, energy security, or resiliency developed through a public process as part of the utility's long-term planning, for the provisions in RCW 19.405.040(8); (ii) Identify the expected effect of specific actions on highly impacted communities and vulnerable populations and the general location, if applicable, timing, and estimated cost of each specific action. If applicable, identify whether any resource will be located in highly impacted communities or will be governed by, serve, or otherwise benefit highly impacted communities or vulnerable populations in part or in whole; and (iii) Describe how the specific actions in the CEIP are consistent with, and informed by, the utility's longer-term strategies based on the analysis in RCW 19.280.030 (1)(k) and clean energy action plan in RCW 19.280.030(1)(l) from its most recent integrated resource plan, if applicable.

(d) Describe how the utility intends to reduce risks to highly impacted communities and vulnerable populations associated with the transition to clean energy.

(5) **Use of alternative compliance options.** The CEIP must identify any planned use during the period of alternative compliance options, as provided for in RCW 19.405.040 (1)(b).

(6) The CEIP must be consistent with the most recent integrated resource plan or resource plan, as applicable, prepared by the utility under RCW 19.280.030.

(7) The CEIP must be consistent with the utility's clean energy action plan developed under RCW 19.280.030(1) or other ten-year plan developed under RCW 19.280.030(5).

(8) The CEIP must identify the resource adequacy standard and measurement metrics adopted by the utility under WAC 194-40-210 and used in establishing the targets in its CEIP. (9) If the utility intends to comply using the two percent incremental cost approach specified in WAC 194-40-230, the CEIP must include the information required in WAC 194-40-230(3) and, if applicable, the demonstration required in WAC 194-40-350(2).

(10) Any utility that is not subject to RCW 19.280.030(1) may meet the requirements of this section through a simplified reporting form provided by commerce.

Utility name:	City of Ellensburg
Report date:	12/31/2021
Contact name/Dept:	Buddy Stanavich
Phone:	509-962-7225
Email:	stanavichm@ci.ellensburg.wa.us
Web address of published CEIP:	https://ci.ellensburg.wa.us/
Small utility:	Yes

A small utility is a utility that is not required by RCW 19.280.030(1) to prepare an integrated resource plan.

City of Ellensburg

Interim target: Percentage of retail load to be served using renewable and nonemitting resources (WAC 194-40-200(2))

Resource	2022	2023	2024	2025	4-year Period
Renewable	83%	83%	83%	83%	83%
Nonemitting	11%	11%	11%	11%	11%
Total	95%	95%	95%	95%	95%

[Small utilities may enter a single value in cell G6 and leave the remaining cells blank.]

Describe how the target demonstrates progress toward meeting the 2030 and 2045 CETA standards (WAC 194-40-200(2)). ***This section is not required if the value in cell G6 is 80% or greater*** **:**

N/A

City of Ellensburg
Total Retail Load Forecast
Weather Adjusted History
2021-2025

Fiscal Year	MWh	aMW	Growth	Hydro/Nuclear	Hydro	4yr CEIP
				95%	83%	
2021	212,843	24.30	0.6%			
2022	214,090	24.44	0.6%	203,385	177,694	
2023	214,743	24.51	0.3%	204,005	178,236	
2024	216,063	24.60	0.3%	205,260	179,333	
2025	216,017	24.66	0.3%	205,216	179,294	714,558

Specific targets (WAC 194-40-200(3)):

Resource	Amount	
Energy Efficiency	6,041	MWh to be acquired over the interim performance period (measured in first-year savings)
Renewable energy	714,558	MWh to be used during the interim performance period
Demand response	0	MW to be acquired over the interim performance period

Identify and describe the specific actions the utility will take over the next interim performance period to demonstrate progress toward meeting the utility's interim targets and the 2030 GHG neutral and 2045 clean electricity standard (WAC 194-40-200(1)):

Specific action proposed	Description of how the action demonstrates progress toward meeting interim targets and the standards
BPA's Energy Efficiency Implementation Program	Energy efficiency focuses on reducing the amount of electricity used by increasing the efficiency of energy use. The City of Ellensburg provides incentives to encourage participation in residential and non-residential programs to promote more efficient use of energy.
Receive BPA's Fuel Mix	The City's resource mix from BPA is 83% hydro, 11% Nuclear

City of Ellensburg

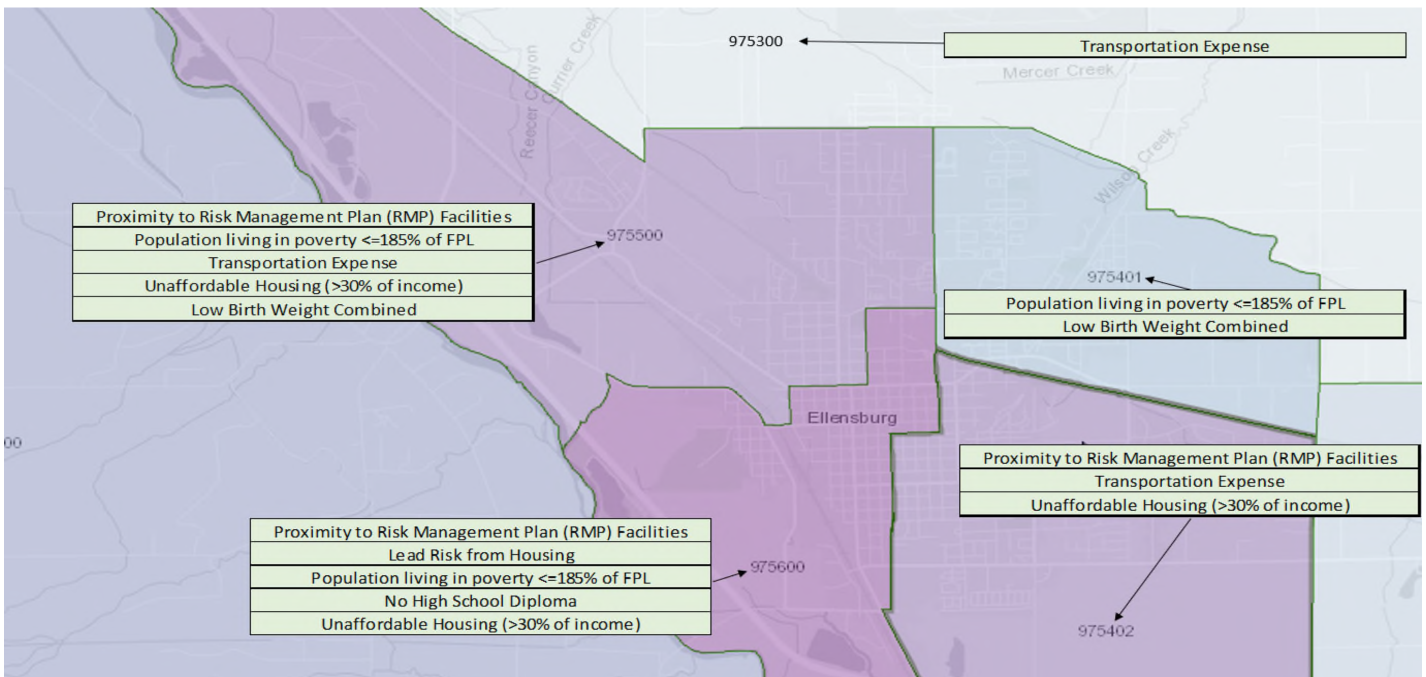
Highly impacted communities (WAC 194-40-200(4))

Report each Highly Impacted Community in the table below.

Highly Impacted Community is defined in RCW 19.405.020(23) as:
(23) "Highly impacted community" means a community designated by the department of health based on cumulative impact analyses in RCW 19.405.140 or a community located in census tracts that are fully or partially on "Indian country" as defined in 18 U.S.C. Sec. 1151.

Department of Health has designated Highly Impacted Communities as those ranking 9 or 10 on the Environmental Health Disparities map. Visit the Department of Health website for instructions on how to identify Highly Impacted Communities:
https://www.doh.wa.gov/DataandStatisticalReports/WashingtonTrackingNetworkWTN/ClimateProjections/CleanEnergyTransformationAct/CETAUtilityInstructions

Census Tract (enter 11 digit FIPS code)	County Name	Tribal Lands (Yes/No)	Environmental Health Disparities Topic Rank
53037975600	Kittitas	N	Lead Risk from Housing
53037975401	Kittitas	N	Low Birth Weight Combined
53037975500	Kittitas	N	Low Birth Weight Combined
53037975600	Kittitas	N	No High School Diploma
53037975401	Kittitas	N	Population living in poverty <=185% of FPL
53037975500	Kittitas	N	Population living in poverty <=185% of FPL
53037975600	Kittitas	N	Population living in poverty <=185% of FPL
53037975402	Kittitas	N	Proximity to Risk Management Plan (RMP) Facilities
53037975500	Kittitas	N	Proximity to Risk Management Plan (RMP) Facilities
53037975600	Kittitas	N	Proximity to Risk Management Plan (RMP) Facilities
53037975300	Kittitas	N	Transportation Expense
53037975402	Kittitas	N	Transportation Expense
53037975500	Kittitas	N	Transportation Expense
53037975402	Kittitas	N	Unaffordable Housing (>30% of income)
53037975500	Kittitas	N	Unaffordable Housing (>30% of income)
53037975600	Kittitas	N	Unaffordable Housing (>30% of income)



City of Ellensburg

Vulnerable populations (WAC 194-40-200(4))

Please list all socioeconomic factors and sensitivity factors developed through a public process and used to identify Vulnerable Populations based on the definition in RCW 19.405.020(40):

(40) "Vulnerable populations" means communities that experience a disproportionate cumulative risk from environmental burdens due to:
(a) Adverse socioeconomic factors, including unemployment, high housing and transportation costs relative to income, access to food and health care, and linguistic isolation; and
(b) Sensitivity factors, such as low birth weight and higher rates of hospitalization

Factors	Details	Caveats	Source	Date Last Updated	Approximate number of households in service territory (if applicable)
Lead Risk from Housing	Homes built before 1980	Washington Tracking Network values have a 90% margin of error; 2016 data estimated 3263 homes in Kittitas County; 2019 data estimated 3601 homes built before 1980 Data adjusted per State: before 1940 = 0.68; 1940 - 1959 = 0.43; 1960 - 1979 = 0.08	2019 ACS 5-year Housing Data	2021	3601 - Kittitas County 1642 - Ellensburg
Low Birth Weight Combined	Ranking of population with low birth weight, < 2500 g (~5.5 pounds)	Multiple births, abortions and fetal deaths are not included	WA Dept of Health Statistics	2021	21 - Kittitas County annual average number of low birth weight 5.2% - Kittitas County annual average percentage of low birth weight 6.3% - Washington State annual average percentage of low birth weight 2003 - 2019
No High School Diploma	Age 25+ and no high school diploma	Washington Tracking Network values shown have a 90% margin of error	2019 ACS 5-year grouping	2021	2392 - Kittitas County 8.6% - Kittitas County 791 - Ellensburg 8.4% - Ellensburg 8.7% - Washington State
Population living in poverty <=185% of FPL	2019 5-year roll-up of estimated number of people living below 185% of Federal Poverty Level, which varies by household size	Washington Tracking Network values shown have a 90% margin of error	WA Dept of Health Population Living in Poverty	2021	13,600 - Kittitas County 30.7% - Kittitas County 8,370 - Ellensburg 44.8% - Ellensburg 21.9% - Washington State

Factors	Details	Caveats	Source	Date Last Updated	Approximate number of households in service territory (if applicable)
Proximity to Risk Management Plan (RMP) Facilities	Facilities with a Risk Management Plan within 5 km of a census tract;	This indicator was developed using nationwide databases and may not reflect the risk of living within close proximity to all RMP facilities in Washington. The 5km buffer size used in this indicator was found to be appropriate for the national indicator. However, a smaller buffer size may be more appropriate for state-specific applications. This measure displays the proximity of facilities with a Risk Management Plan (RMP) by displaying the count of facilities within 5 km of a tract divided by the distance of the facility. If no facility existed within 5km of the tract, the nearest neighbor was used.The data was downloaded from EJSCREEN in 2017.	EPA EJSCREEN map: https://ejscreen.epa.gov/arcgis/rest/services/EMEF/efpoints/MapServer	2017	EF Points: Superfund - 0 Toxic Releases - 2 Water Dischargers - 28 Air Pollution - 1 Hazardous Waste - 43 Brownfields - 8 Toxic Substances Control Act - 0
Transportation Expense	Transportation costs based on percentage of income for the regional moderate household (80% AMI)	The index is intended for use by researchers, developers, planners and policymakers to enhance their understanding of the cost burden of transportation. Indicators that can change more quickly like car ownership can be less accurate inputs than indicators that tend to change slowly like neighborhood block size.	The Housing + Transportation (H+T®) Affordability Index https://www.cnt.org/tools/housing-and-transportation-affordability-index	2008 - 2012	Census Tracts (last 4 digits) 5300 - 35% 5401 - 26% 5402 - 28% 5500 - 28% 5600 - 25%

Factors	Details	Caveats	Source	Date Last Updated	Approximate number of households in service territory (if applicable)
Unaffordable Housing (>30% of income)	Housing burden indicator displays the modeled percent of income spent on housing for a 4-person household making the median household income based on ACS 5-year estimates There are three categories under "Selected Monthly Costs as Percentage of Household Income": households with mortgages, households without mortgages, and rentals. “Unaffordable housing” is defined as households spending great than 30 percent of their income on housing costs.	Washington Tracking Network values shown have a 90% margin of error	2019 ACS 5-year Housing Data	2012 - 2016	6,530 - Kittitas County 37% - Kittitas County 60% of > 30% - Rentals Kittitas County 3,694 - Ellensburg 49% - Ellensburg 82% of > 30% - Rentals Ellensburg 32% - Washington State

*** Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value.*

Describe and explain any changes to the factors from the utility's previous CEIP, if any:

N/A, 2022 is first CEIP

City of Ellensburg

Distribution of energy and non-energy costs and benefits (WAC 194-40-200(4))

Please report one or more indicators, developed through a public process, and used to identify the forecasted distribution of energy and non-energy costs and benefits for the utility's portfolio of specific actions, including impacts resulting from achievement of the specific targets established under WAC 194-40-200(3).

Indicators must be associated with one of the following categories: energy benefits, non-energy benefits, reduction of burdens, public health, environment, reduction in cost, energy security, or resiliency.

Category	Indicator	Details	Source	Date Last Updated
Energy	Renewable Energy Product	Offer a Renewable Energy Product to customers that sign up for it	*Utility Data*	*2021*
	Efficiency Programs	Energy Efficiency, Weatherization, Net-Metering incentives on Low-Income housing	*Energy Efficiency measures*	*2021*
	Resource Adequacy	Planning for future uptake	*Utility Data*	*2021*
Non-Energy	Efficiency Programs	Energy Efficiency, Weatherization, Net-Metering incentives on Low-Income housing	*Energy Efficiency measures*	*2021*
	Supplier Strength	Strength and Health of BPA	*Utility Data*	*2021*
	Communication	Targeted communications, rise in number of outreach and impressions to increase accessability	*Utility Data*	*2021*
Reduction of Burden	Efficiency Programs	Energy Efficiency, Weatherization, Net-Metering incentives on Low-Income housing	*Energy Efficiency measures*	*2021*
	Number of households with high energy burden	Identify energy burdened households	*Utility Data*	*2021*
	Low income rate class	Subsidized by other rate payers, the low income rate classes reduces costs for the customer in the short-term	*Utility data*	*2021*
Public health	Cleaner indoor air	more efficient HVAC units can increase filtering of air inside the home	*Energy Efficiency measures*	*2021*
Environmental	Greenhouse Gas Emissions	Ellensburg GHG emissions	*Utility Data*	*2021*
	Efficiency Programs	Energy Efficiency, Weatherization, Net-Metering incentives on Low-Income housing	*Energy Efficiency measures*	*2021*
Reduction in Cost	Efficiency Programs	Energy Efficiency, Weatherization, Net-Metering incentives on Low-Income housing	*Energy Efficiency measures*	*2021*
	Number of households with high energy burden	Identify energy burdened households	*Utility Data*	*2021*
	Reduced energy burden	Weatherization improvements can reduce energy costs for the customer in the long-term	*Energy Efficiency measures*	
Energy Security	Supplier Generation Location	Generation located in Washington or Connected to BPA Transmission	*Utility Data*	*2021*

Energy Resiliency	Supplier Generation Location	Generation located in Washington or Connected to BPA Transmission	*Utility Data*	*2021*
	Generation	Identify generation capacity that meets the demands of City customers	*Utility Data*	*2021*
	Looping within City distribution system to shorten and reduce outages	The utility's ability to reroute electricity distribution to alternate lines or substations can shorten and reduce outages, both planned and unplanned	*Utility data*	*2021*
	Interlocal agreements with neighboring utilities for outage restoration	The utility's ability to call in neighboring line crews in the event of staffing shortages or widespread system damage can restore power in a more efficient timeframe	*Utility data*	*2021*

Please report the forecasted distribution of energy and non-energy costs and benefits on identified highly impacted communities and vulnerable populations for the utility's portfolio of specific actions, including impacts resulting from achievement of the specific targets established under WAC 194-40-200(3). You must do a separate row for each action and for each population affected.

Identify the expected effect of specific actions on highly impacted communities and vulnerable populations and the general location, if applicable, timing, and estimated cost of each specific action. If applicable, identify whether any resource will be located in highly impacted communities or will be governed by, serve, or otherwise benefit highly impacted communities or vulnerable populations in part or in whole.

Utility Specific Action or (e.g. name of resource or program)	Population(s) Affected	Indicator	Detail (describe distribution of energy and non-energy benefits on named population)	Location of Resource (if applicable)
Ex. Replace substation	*Tribe*	*resiliency*		*substation address*
Dolarway substation relocation & expansion	all	resiliency	Added capacity to carry load	Dolarway Road
Bull Road line extension	all	resiliency	Looping of distribution system to prevent and reduce outages	Bull Road
Energy audits	all	reduced cost burden	Free energy audits for qualifiying low income customers; Subsidized energy audits for the rest	All City customers

Long-term plans (WAC 194-40-200(4)(c)(iii))

Describe how the specific actions in the CEIP are consistent with, and informed by, the utility's longer-term strategies based on the analysis in RCW 19.280.030 (1)(k) and clean energy action plan in RCW 19.280.030 (1)(l) from its most recent integrated resource plan, if applicable:

This report presents the results of the Twenty Year Distribution Study prepared by Electrical Consultants, Inc. (ECI) for the City of Ellensburg (the City). This study evaluates the City's distribution system providing electric service in Central Washington.
Based upon the planning criteria identified in Section 3.0 and pertinent historical trends and load forecasts identified in Section 4.0, distribution system performance was evaluated in order to identify criteria violations for voltage drop, voltage and current imbalance, line and equipment loading, as well as power factor and losses.

System performance was evaluated by first performing load flows for peak loading conditions. A thorough review of the existing system performance with the present, transition (6 year), long range (20 year), long range extreme (20 year extreme) loading was performed. The peak models are represented by the maps located at the end of the report in the Maps Appendix. These maps include voltage levels across the City's distribution system along with projected loads. Results of the load flow analysis are summarized in Section 5.0 along with recommendations for system improvement.

All recommendations were designed to be in general concurrence with planning criteria and to ensure that no adverse impacts to the integrity of the City's system were imposed. The mechanical condition of the City's plant, along with reliability of service to members, was also factored into the recommendations for system improvement. Single contingency outages were investigated through analysis of load flow and voltage drop studies to address system requirements during such operating conditions.

Connection Statistics and Energy Use
The City serves residential, commercial, and industrial customers. In terms of number of accounts, residential is the most profuse, followed by commercial and industrial, respectively. In recent years, industrial/commercial loads have decreased, however there are several proposed projects that could increase these categories.

Historical Demand and Growth Patterns

The City of Ellensburg provides distribution-level voltage through four (4) substations. These include Helena, East Ellensburg, Dolarway #1 and Dolarway #2. The table also shows loads allocated to each substation for the six-year and twenty-year periods.
Figure 4-6-1 shows the historical and forecasted growth characteristics of the City's entire system for the period 2006 through 2037. This forecast gives a base case and an upper confidence bound, the upper confidence bound is a maximum anticipated value.
Having developed a predictor of future growth, growth could then be assigned. This was accomplished through consultation with the City. All areas

with potential new development were identified and a large customer was then assigned. Refer to the Projected Loads Maps in the Appendix for where growth was assigned. Total system kW projections at six-year and twenty year loads were then compared to the projected growth. As can be seen from the trend lines in Figures 4-6-1 through 4-6-4 system growth is negative for the system, according to the linear regression of data provided by the City and BPA reads. The decrease in loads on the system in recent years is due to industrial/commercial loads leaving the city and increased electrical efficiency. Although the load decrease results in a negative trend, it is not an accurate predictor of future growth. Residential loads in the city are anticipated to continue to grow. Projected load growth areas were discussed with City personnel and loads were added to the system based upon the possibility of new subdivisions, industrial/business parks, territory expansion, and the forecast projections. For this reason, projected loads are higher than the linear regression projections would suggest, however, they are in line with City growth projections.
Consumer statistics were analyzed between 2012 and 2017, there were 9,485 customers and 60 MW of non-coincident peak during the 2012 plan, and there was 9,343 customers and 53 MW of non-coincident peak during the 2017 plan. These numbers infer that in 2012 the average kW per customer was 6.326 kW per customer and in 2017 it was 5.672 kW per customer. This analysis does not take into account Twin City Foods load being taken offline for the 2017 plan. Twin City Foods had approximately 4.5 MW of load in the 2012 plan, removing it from the 60 MW load brings the load to 55.5 MW and this changes the average kW per customer to 5.85 kW which is much closer to the current usage per customer. While these numbers show a decrease in usage per customer it is important to note that based upon past experience this decrease is likely due to increased efficiency in homes and businesses. Increased efficiency will initially look like a decrease in loads, however, this decrease cannot maintain into the future and as the population grows loads will continue to increase. For this reason and discussion with City personnel loads are anticipated to begin to increase in the future as the city expands.
Loads were also compared to the BPA load forecast included in the Appendix. The load forecast from BPA shows no growth anticipated, however, as discussed previously residential growth is anticipated to continue within the City and therefore increased load is expected.

Population growth is assumed at 2% year over year with a total population of 32,540 residents by 2037. Growth projections came from a 2016 study by BERK Consulting and the Kittitas County conference of Governments.

In 2021, the Washington Legislature passed the Climate Commitment Act (or CCA) which establishes a comprehensive program to reduce carbon pollution and achieve the greenhouse gas limits set in state law. The program will start Jan. 1, 2023. The deep decarbonization set forth in the CCA and the shift to electrification will increase loads on the system. Further analysis must be done to determine the breadth of capacity requirements this legislation will have on the City's electric system.

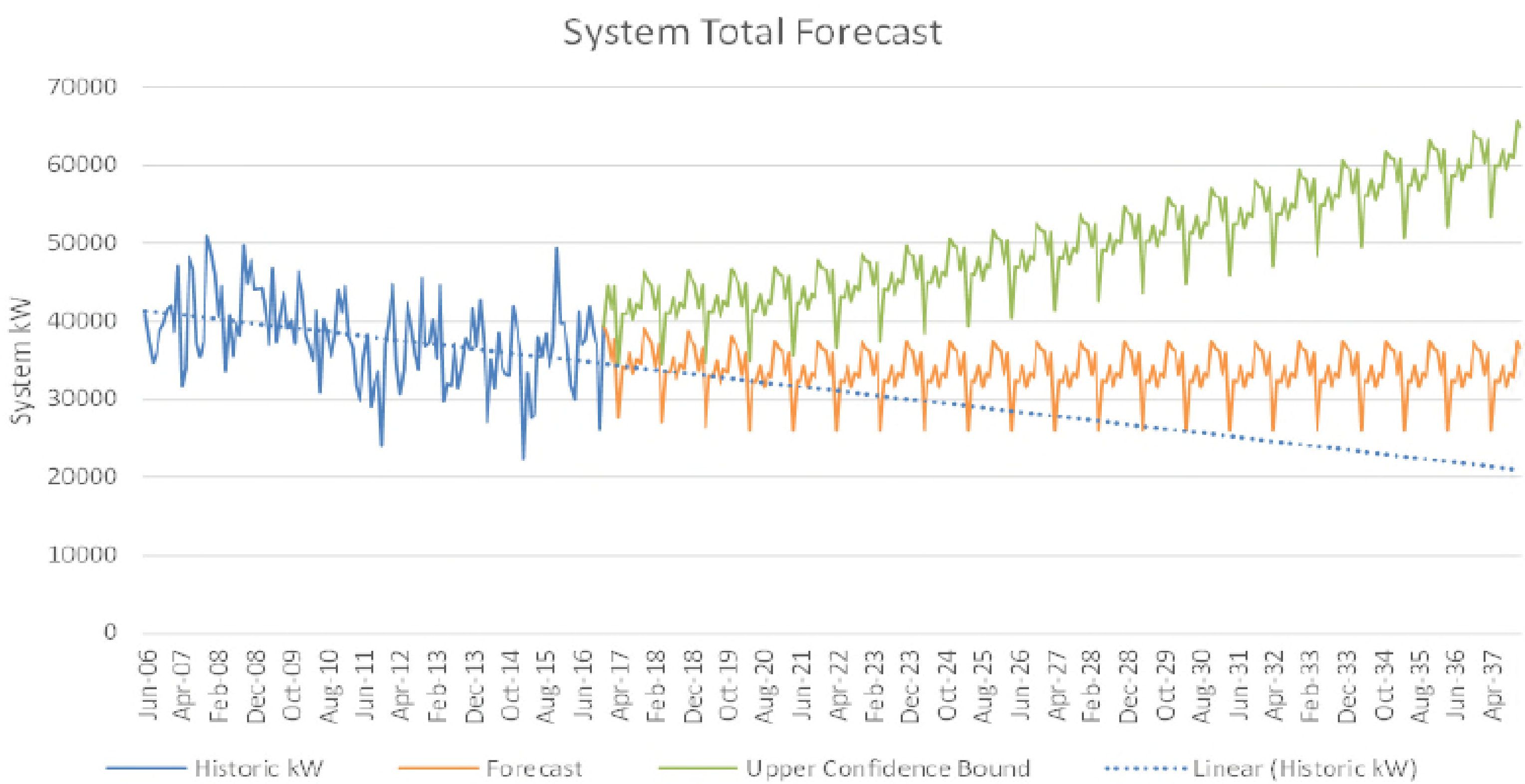

System Total Forecast
70000
60000
50000
40000
30000
20000
10000
0
System kW
Jun-06
Apr-07
Feb-08
Dec-08
Oct-09
Aug-10
Jun-11
Apr-12
Feb-13
Dec-13
Oct-14
Aug-15
Jun-16
Apr-17
Feb-18
Dec-18
Oct-19
Aug-20
Jun-21
Apr-22
Feb-23
Dec-23
Oct-24
Aug-25
Jun-26
Apr-27
Feb-28
Dec-28
Oct-29
Aug-30
Jun-31
Apr-32
Feb-33
Dec-33
Oct-34
Aug-35
Jun-36
Apr-37
Historic kW
Forecast
Upper Confidence Bound
Linear (Historic kW)

Figure 4-6-1

Integrated resource plan compliance (WAC 194-40-200(6))

This CEIP is consistent with the most recent integrated resource plan or resource plan, as applicable, prepared by the utility under RCW 19.280.030. **Select yes or no.**
Yes

Clean energy action plan compliance (WAC 194-40-200(7))

The CEIP is consistent with the utility's clean energy action plan developed under RCW 19.280.030(1) or other ten-year plan developed under RCW 19.280.030(5). **Select yes or no.**
Yes

Risk (WAC 194-40-200(4)(d))

Describe how the utility intends to reduce risks to highly impacted communities and vulnerable populations associated with the transition to clean energy.

Focus on risk reduction through energy security and resiliency. Reduce energy burden on our customers by continuing to provide weatherization improvement rebates to qualifying low-income customers at no cost to low income customers utilizing a variety of funding sources, to include, but not limited to City conservation funds through the BPA program, Department of Commerce, and others.

HopeSource: *"We agree that the biggest risk for vulnerable populations is that the costs increase associated with implementing CETA will lead to higher customer debt and a greater number of disconnections. To reduce risk the goal should be to lower the energy burden of low-income customers both through an energy assistance low-income discount rate program and through a low-income weatherization program."*

The City partners with HopeSource to leverage existing state and federal funds for these programs in order to maximize impact on COE customers.

Public participation (WAC 194-40-200(4), -220(1))

Provide a summary of the public input process conducted in compliance with WAC 194-40-220. Describe how public comments were reflected in the specific actions under WAC 194-40-200(4), including the development of one or more indicators and other elements of the CEIP and the utility's supporting integrated resource plan or resource plans, as applicable.

1.) BeHeardEllensburg (Survey, translation service, website, Social Media, Etc.) - Results shared below
2.) HopeSource - assisted in getting out the survey and feedback from vulnerable populations.
3.) Two public Utility Advisory Committee Meetings where public comment was welcomed.
4.) One City Council Meeting where public comment was welcomed.

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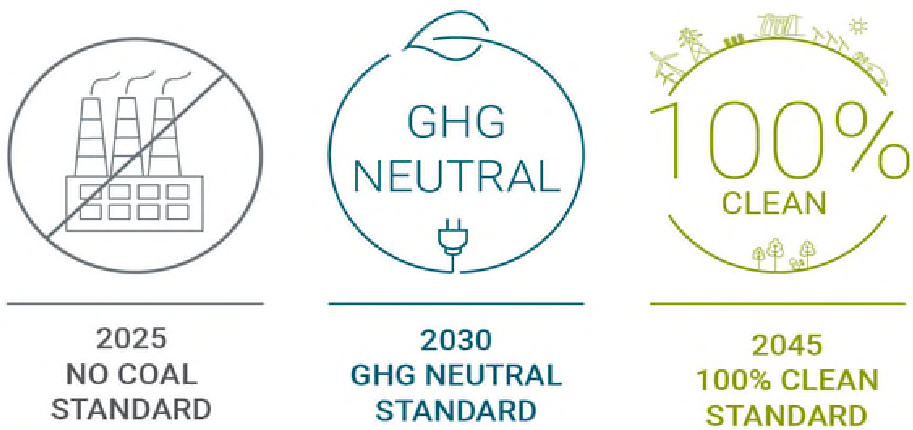
Clean Energy Transformation Act

Clean Energy Transformation Act (CETA)

On May 7, 2019, Governor Jay Inslee signed into law the Clean Energy Transformation Act (CETA), which commits Washington State to achieve an electricity supply that is 100% greenhouse gas emissions free by 2045. As an electric utility, the City of Ellensburg is required to meet these requirements.



Electricity production is the third-largest source of carbon emissions in the state. **The good news is that the City of Ellensburg's electricity fuel mix is 95% carbon free.** The bill aims to curb that by eliminating coal power, including the importation of electricity produced by coal-fired power plants in neighboring states, by 2025. Washington utilities, including the City of Ellensburg, are required by law to transition to a carbon-neutral electricity supply by 2030, before eliminating fossil fuel electricity production completely by 2045.

Clean electricity will allow Washington residents and businesses to power their buildings and homes, vehicles, and appliances with carbon free resources, such as wind and solar. Reductions in fossil fuel use will improve the health of communities, grow the economy, create family-sustaining jobs, and enable the state to achieve its long-term climate goals.

The law provides safeguards to maintain affordable rates and reliable service. It also requires an equitable distribution of the benefits from the transition to clean energy for all utility customers and adds and expands energy assistance programs for low-income customers.

The legislation requires utilities to engage the public to help determine their clean energy transition. Utilities will be required to account for the costs and impacts of carbon pollution when considering energy sources. As part of this requirement, utilities must develop a Clean Energy Implementation Plan (CEIP) that demonstrates how they will work to meet carbon standards at the lowest reasonable cost in the next four years. The City of Ellensburg is currently developing the CEIP, which will be available for review at a future Utility Advisory Committee meeting and will be posted online when complete.

Key milestones for Washington utilities under this law include:

- 2022 – Prepare and publish a clean energy implementation plan with targets for energy efficiency and renewable energy
- 2025 – Eliminate coal-fired electricity from their state portfolios
- 2030 – Achieve greenhouse gas neutrality, may include provisions for offsets
- 2045 – Supply 100% renewable or non-emitting electricity, with no provision for offsets

For more information on CETA, please visit Washington State Department of Commerce's web site here. For a deeper dive into data and visual illustrations on Washington State greenhouse gas emissions, visit the Department of Ecology webpage.

Learn more about the Clean Energy Implementation Plan at the Utility Advisory Commission (UAC) meeting on Thursday, October 21, 2021 at 3:30 p.m. Join virtually or attend in person at City Hall.

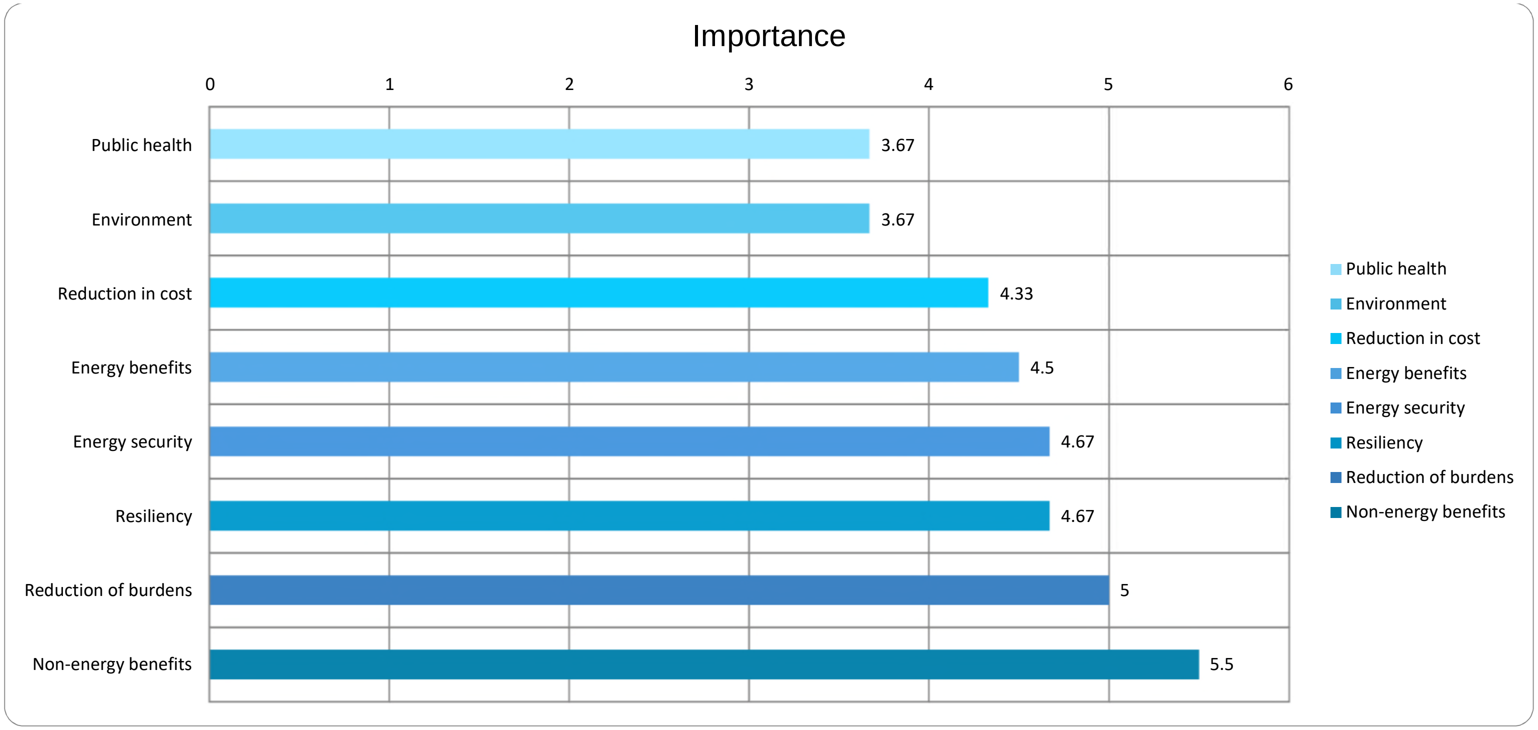
There will be additional meetings for public participation including future UAC and City Council meetings.

Survey Responses from BeHeardEburg Public Outreach

Regarding the City of Ellensburg Electric Utility, please rank the following in order of importance:	Please describe the energy benefits you receive from the City of Ellensburg Electric Utility.	Please describe the non-energy benefits you receive from the City of Ellensburg Electric Utility.	Please describe how the City of Ellensburg Electric Utility can help reduce burdens.
Reduction in cost, Environment, Resiliency, Energy security, Public health, Reduction of burdens, Energy benefits, Non-energy benefits	Electricity	What are non energy benefits?	What burdens would there be?
Public health, Energy security, Resiliency, Environment, Reduction of burdens, Non-energy benefits, Energy benefits, Reduction in cost	None		Help poor people with their electric bills
Public health, Environment, Reduction of burdens, Non-energy benefits, Reduction in cost, Energy benefits, Resiliency, Energy security			
Energy benefits, Public health, Environment, Resiliency, Energy security, Reduction in cost, Reduction of burdens, Non-energy benefits	Electricity	none	Subsidize cooling appliance purchases
Reduction in cost, Energy security, Resiliency, Energy benefits, Reduction of burdens, Non-energy benefits, Public health, Environment	What is an energy benefit?	What is a non-energy benefit?	What do you mean by burdens? Besides the obvious burden of our utilities being over-priced.
Environment, Reduction in cost, Energy security, Public health, Energy benefits, Non-energy benefits, Reduction of burdens, resiliency	NA	N/A	By reducing costs to consumers.
N/A	N/A		*Translated from Spanish* For my children because one of them suffers from asthma and I live in a trailer that's super cold. If they helped me I could turn on the heater. I put it on but for a little while so that I and my children are cold.
Public health, Reduction in cost, Energy benefits, Energy security, Resiliency, Non-energy benefits, Reduction of burdens, Environment	N/Benefit	N/Benefit	Lower costs to seniors

Please describe how the City of Ellensburg Electric Utility impacts public health.	Please describe how the City of Ellensburg Electric Utility impacts the environment.	Please explain the importance of reducing costs for the City of Ellensburg Electric Utility.	Please explain the importance of energy security for the City of Ellensburg Electric Utility.	Please explain the importance of resiliency for the City of Ellensburg Electric Utility.
I don't know, other than if the power goes out Healthcare equipment does not work.	Maybe tell your employees to stop littering. Let's start there.	You really cannot figure out way cutting expenses would be important?	'Murica	Umm because it needs to last in all weather conditions.
Helps people stay warm, cool, and alive with life saving equipment that requires electricity	Hopefully using more solar and wind power	Duh	We need it for our everyday lives	Gotta keep the power on!
Keeps us warm in Winter and cool in Summer	Sells me clean energy, reduces my need for natural gas	Electricity reduces our dependence on expensive fossil fuels	We need to be able to count on electricity in hotter times to come	We need electricity resilience in case of emergencies and rising fossil fuel costs
		As our utilities cost more than most on our side of the Cascades and people's income has declined over the past year, making it more affordable is the most important thing.	What does this mean?	What are you referring to?
People need lights, heat, refridgeration, etc.	I assume they use fossil fuels & produce CO2.	It would help people have more money for other things.	It would be terrible if everyone lost heat in the winter or electricity any time.	I don't know what this question means.
		Translated from Spanish Because right now I am not working and it is difficult for me to pay. In the winter my utility account doubles.		
Keeping seniors warm with lower rates	N/A	For the poor, disabled, seniors, fixed income	N/A	N/A

Regarding the City of Ellensburg Electric Utility, please rank the following in order of importance:	
Public health	3.67
Environment	3.67
Reduction in cost	4.33
Energy benefits	4.5
Energy security	4.67
Resiliency	4.67
Reduction of burdens	5
Non-energy benefits	5.5



Use of alternative compliance options (WAC 194-40-200(5))

Identify any planned use during the period of alternative compliance options, as provided for in RCW 19.405.040(1)(b):

Alternative compliance payments:		Dollars
Unbundled renewable energy credits:		Credits
Credits from energy transformation projects:		MWh
Electricity from the Spokane municipal solid waste to energy facility:		MWh

City of Ellensburg

Resource adequacy standard (WAC 194-40-200(8))

Identify the resource adequacy standard and measurement metrics adopted by the utility under WAC 194-40-210 and used in establishing the targets in the CEIP.

Resource adequacy standard	BPA assures its power supply is available to meet its firm power supply obligation on a long term planning, forecast, basis. As directed by the Pacific Northwest Electric power planning and Conservation Act, a fundamental statutory purpose for BPA is to assure it has an adequate supply of power, which BPA meets through its power planning function as guided by the Northwest power and Conservation Council power Plan. BPA's firm power supply obligation under the Northwest power Act means BPA supplies all the power a customer needs to serve their retail consumer demands on a continuous basis except for reasons of force majeure. This obligation takes into account and is adjusted by the amount of non-federal power/resources the City of Ellensburg uses to serve their load and by the type of product the City of Ellensburg elects to purchase from BPA. BPA's currently effective Regional Dialogue load Following Contracts obligates BPA to supply all the electricity required to meet the second to second variation in the City of Ellensburg's load net of the City of Ellensburg's non-federal resources.
Methods of measurement	BPA uses its Resource Program, which includes a Needs Assessment that examines on a 10-year forecast basis the uncertainty in customer loads, expected water conditions affecting federal hydro production (including Biological Opinion requirements), resource availability, natural gas prices, and electricity market prices to develop a least-cost portfolio of resources that meet Bonneville's obligations. The goal of the Needs Assessment, which is one of the early steps in the Resource Program, is to measure Bonneville's existing system, in relative isolation, against Bonneville's obligations to supply power to show whether any long-term energy and/or capacity shortfalls may occur over the 10-year study horizon. The Needs Assessment forecasts Bonneville's needs for long-term energy and capacity based on resource capabilities and projected obligations to serve power. The Needs Assessment informs later steps of the Resource Program, where resource optimization techniques are used to evaluate and select potential solutions for meeting Bonneville's long-term needs based on cost and risk. The Needs Assessment uses the following four metrics to assess Bonneville's long-term energy and capacity needs: • Annual Energy: Evaluates the annual energy surplus/deficit under 1937 critical water conditions, using forecasted load obligations and expected Columbia Generating Station output. • P10 Heavy Load Hour: Evaluates the 10th percentile (P10) surplus/deficit over heavy load hours, by month, given variability in hydropower generation, load obligations, and Columbia Generating Station output amounts. • P10 Superpeak: Evaluates the P10 surplus/deficit over the six peak load hours per weekday by month, given variability in hydropower generation, load obligations, and Columbia Generating Station output. • 18-Hour Capacity: Evaluates the surplus/deficit over the six peak load hours per day during three-day extreme weather events and assuming median water conditions. Winter and summer extreme weather events, such as cold snaps or heat waves, are analyzed, both of which assume maximum delivery of the Canadian Entitlement outside of the region, zero wind generation, and limited energy market purchases. Winter events assume reduced streamflows due to impacts from ice forming in reservoirs. Summer events assume reduced Columbia Generating Station output due to adverse weather conditions, as the plant must power down during high temperatures for safety reasons.

WAC 194-40-210

Resource adequacy standard.

(1) Each utility that is required to prepare an integrated resource plan under RCW 19.280.030(1) must establish by January 1, 2022, a standard for resource adequacy to be used in resource planning, including assessing the need for and contributions of generating resources, storage resources, demand response resources, and conservation resources. The resource adequacy standard must be consistent with prudent utility practices and relevant regulatory requirements and must include reasonable and nondiscriminatory:

(a) Measures of adequacy, such as peak load standards and loss of load probability or loss of load expectation;

(b) Methods of measurement, such as probabilistic assessments of resource adequacy; and

(c) Measures of resource contribution to resource adequacy, such as effective load carrying capability applicable to all resources available to the utility including, but not limited to, renewable, storage, hybrid, and demand response resources.

(2) Each utility not subject to subsection (1) of this section must identify by January 1, 2022, the resource adequacy standard relied on by the utility in preparing its resource plan and CEIP.

(3) In each CEIP submitted after 2022, each utility must identify and explain any changes to its resource adequacy standard.

[Statutory Authority: RCW 19.405.100 and 19.405.060. WSR 21-02-039, § 194-40-210, filed 12/29/20, effective 1/29/21.]

City of Ellensburg

Annual cost threshold (WAC 194-40-200(9))

Enter information in the blue column only. The rest will pre-populate.

Do not complete this section unless the utility intends to comply using the 2% incremental cost approach specified in WAC 194-40-230.

Year	Retail revenue requirement	Annual amount from revenue increase equal to 2% of prior year revenue requirement	Number of years in effect	Threshold amount over four years	Sum of threshold amounts	Annual threshold amounts
2021						
2022		$	4	$.00	$.00	$.00
2023		$	3	$.00		
2024		$	2	$.00		
2025		$	1	$.00		
Annual threshold ammount as a percentage of average retail revenue requirement						#DIV/0!

Electric Conservation Potential Assessment

This section describes the methodology and results of the City of Ellensburg's (City's) 2016 Electric Conservation Potential Assessment (CPA). This assessment provides estimates of electric energy savings by sector for the period: 2017 to 2036. The assessment considered a wide range of conservation resources that are reliable, available and cost-effective within the 20-year planning period.

Background

The City provides electricity service to nearly 10,000 customers within the City of Ellensburg in central Washington. As noted in the supply-side analysis for the City's 2016 IRP, energy efficiency is the least expensive resource available to the City and is the most attractive resource for serving above-RHWM loads. Therefore, this analysis identifies available conservation potential for the City's service area and applicable programs to assist the utility in strategic conservation program planning. The conservation potential identified in the CPA can be evaluated along with other demand and supply-side resources to inform resource planning for the City's service area over the 20-year planning period. The CPA focuses on available and cost-effective conservation potential for the planning period: 2017 through 2036.

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 the City's service area is similar to that of the region, or that the regional survey data represents the population.
- Measure Data – In particular, savings and cost estimates (when comparing to current market conditions), as prepared by the Northwest Power and Conservation Council (NWPC Council) and Regional Technology Forum (RTF), will vary across the region. In some cases, measure applicability or other attributes have been estimated by the NWPCC 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 are based on the most recent available information but represent a snapshot in time. Given a different snapshot in time, the results of the analysis would vary. However, risk credits are included in the High scenario for this analysis to mitigate the market price risk over the study period.

- Utility System Assumptions – Credits have been included in this analysis to account for the avoided costs of bulk transmission and distribution system expansion and local distribution system expansion. Though potential transmission and distribution system cost savings are dependent on local conditions, the NWPCC considers these credits to be representative estimates of these avoided costs.
- Discount Rate –This study reflects the current borrowing market although changes in borrowing rates will likely vary over the study period.
- Load and Customer Growth Forecasts – The CPA bases the 20-year potential estimates on forecasts of load and customer growth. Each of these forecasts includes a level of uncertainty.
- Load Shape Data – Conservation load shapes are used to value the time value of energy measure savings. Load shapes used in the CPA are taken from the NWPCC and represent estimated regional measure savings shapes. In practice, load shapes will vary by utility based on weather, customer types, and other factors. Finally, peak savings estimates are based on coincident factors and load factors by end-use. In practice, these data will vary by utility since not all utility peaks occur at the same time and not all customer classes contribute to the peak demand in the same way.
- Frozen Efficiency – The CPA assumes that 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, it is recommended that utilities update conservation resource assessments regularly.

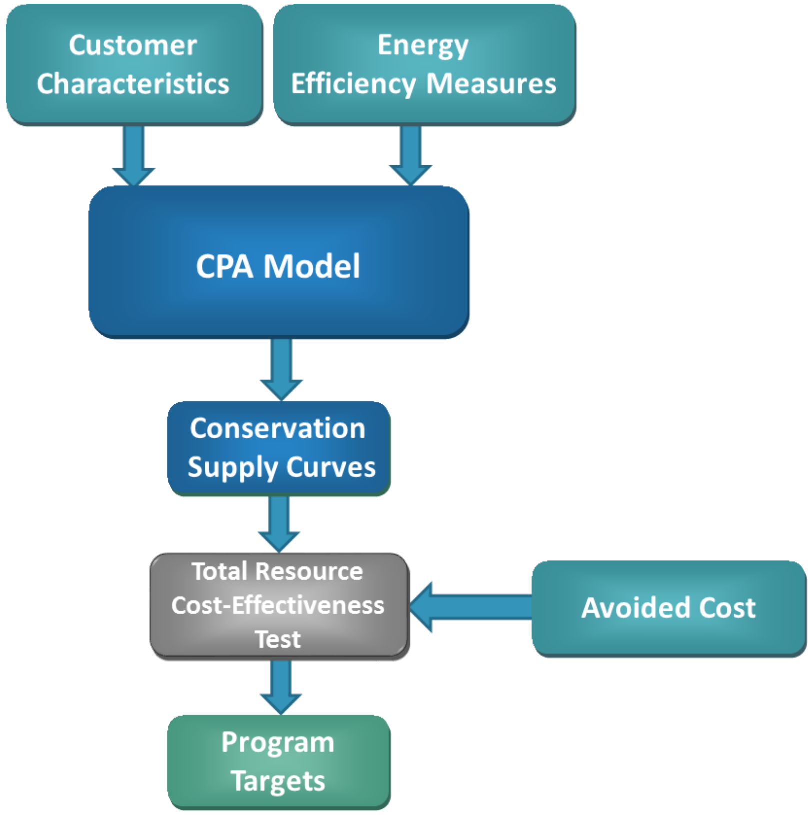
CPA Methodology

This study is a comprehensive assessment of the energy efficiency potential in the City's service area for the period: 2017 to 2036. This section provides an overview of the methodology used to develop the City's estimated conservation potential.

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.

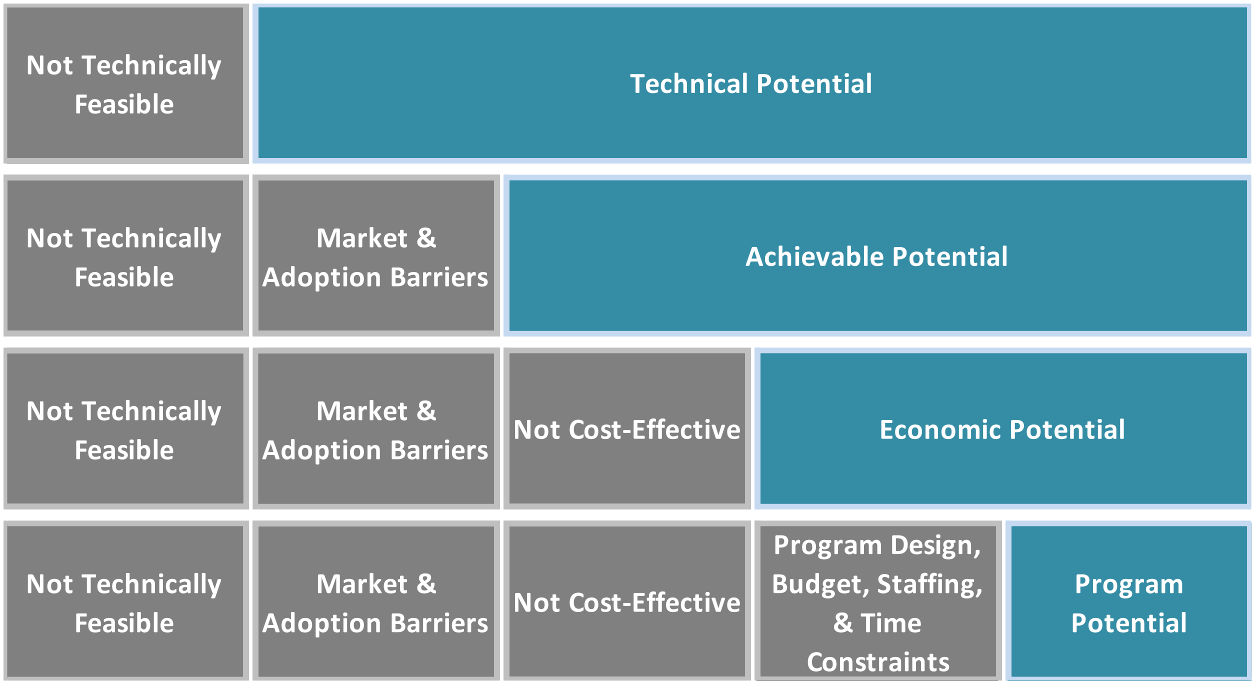
Figure 1
Conservation Potential Assessment Process



Types of Potential

Three types of potential are used in this study: technical, achievable, and economic potential. Technical potential is the theoretical maximum efficiency in the service territory if cost and achievability barriers are excluded. There are physical barriers, market conditions, and other consumer acceptance constraints that 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 technical-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 measures. It represents the theoretical maximum amount of energy efficiency absent these constraints in a utility's service territory.

Estimating the technical potential begins with determining a value for the energy efficiency measure savings. Then, the number of "applicable units" must be estimated. "Applicable units" refers to the number of units that could technically be installed in a service territory. This includes accounting for units that may already be in place. The "applicability" 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, if a home installs insulation and a high-efficiency heat pump, the total savings in the home is less than if each measure were installed individually (interaction). In addition, the measure-by-measure savings depend on which measure is installed first (stacking).

Total technical potential is often significantly more than the amount of economic and achievable potential. The difference between technical potential and economic potential is due to the

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

number of measures in the technical potential that are not cost-effective and the applicability or total amount of savings of those non-cost effective measures.

Achievable – Achievable potential is the amount of potential that can be achieved with a given set of conditions. Achievable potential takes into account many of the realistic barriers to adopting energy efficiency measures. These barriers include market availability of technology, non-measure costs, and physical 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 NWPCC uses achievability rates equal to 85 percent for retrofit measures and 65 percent for lost opportunity measures over the 20-year study period. This CPA follows the NWPCC's methodology, including the achievability rate assumptions. Note that the achievability factors are applied to the technical potential before the economic screening.

Economic – Economic potential is the amount of potential that passes an economic benefit-cost test. This means that the present value of the benefits exceeds the present value of the costs over the lifetime of the measure. This CPA uses a total resource cost test (TRC) is used to determine economic potential. TRC costs include the incremental 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.

For this potential assessment, the NWPCC's ProCost models are 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 time of use energy prices. The version of ProCost used in this CPA evaluates measure savings on a monthly basis and by four time segments. The four segments are defined by the NWPCC and include heavy load hours, shoulder hours, light load hours, and very light load hours (i.e. holidays). These four segments differentiate savings values across these different time periods.

Program – Program potential is the amount of potential that can be achieved through utility administered programs. The program achievable potential excludes savings estimates that are achieved through future code changes and market transformation. The program potential is not the emphasis of this assessment, but understanding the sources of achievement is an important reporting requirement.

Energy Efficiency Measure Data

The characterization of efficiency measures includes measure savings (kWh), demand savings (kW), measure costs ($), and measure life (years). Other features, such as measure load shape, operation and maintenance costs, and non-energy benefits are also important for measure definition. The NWPCC's Seventh Power Plan was finalized in early 2016. The primary sources for conservation measure data are the NWPCC's Seventh Plan supply curve workbooks.

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.

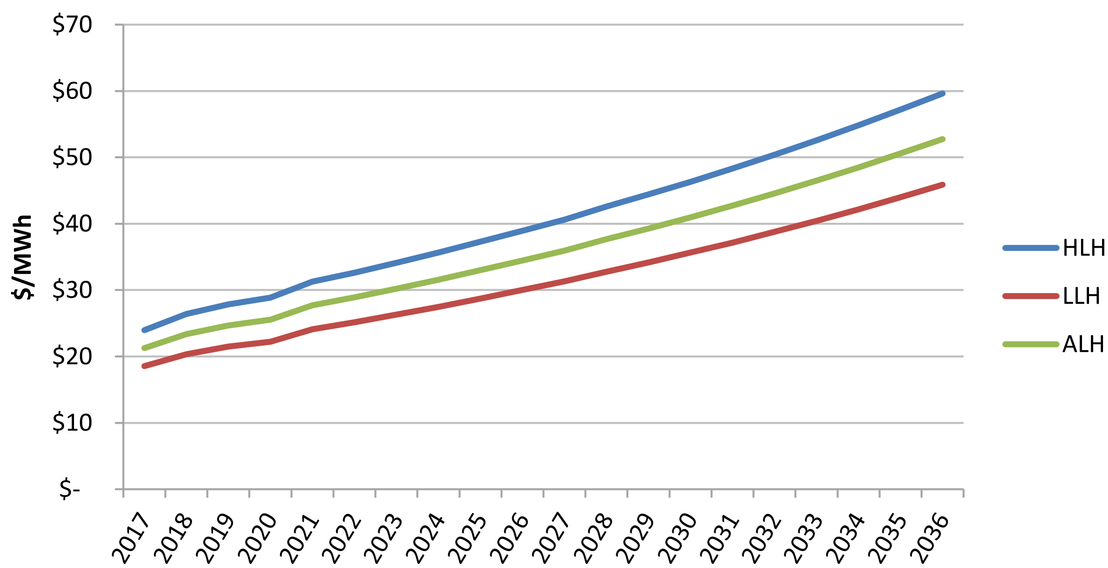
Other financial-related data needed for defining measure costs and benefits include: current and forecasted loads, growth rates, discount rate, avoided costs, line losses, and deferred capacity-expansion benefits.

Avoided Cost

The avoided cost of energy is represented as a dollar value per MWh or dollar per kW-year for conservation savings. Avoided costs are used to value energy and demand savings benefits when conducting cost effectiveness tests and are generally included in the numerator in a benefit-cost test. 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 integrated resource planning process.

Figure 3 shows the price forecast 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). The levelized market price for the planning period is $35.43/MWh.

Figure 3
20-Year Market Price Forecast (Mid-Columbia)



In order to evaluate uncertainty, high and low conservation scenarios were modeled using a range of market price forecasts and growth assumptions. A low and high market price forecast were used along with various growth assumptions to model a range of scenarios.

Discount Rate

The discount rate used to calculate the net present value of costs and benefits is 4 percent. This discount rate is consistent with the rate used in the City's IRP.

Building Characteristic Data

Building characteristics, baseline measure saturation data, and appliance saturation influence the City's total conservation potential. For this analysis, the characterization of the City's baseline was determined using data provided by the utility, County Assessor data and regional data from NEEA's Commercial and Residential Building Stock Assessments. Details of data sources and assumptions are described for each sector later in the report.

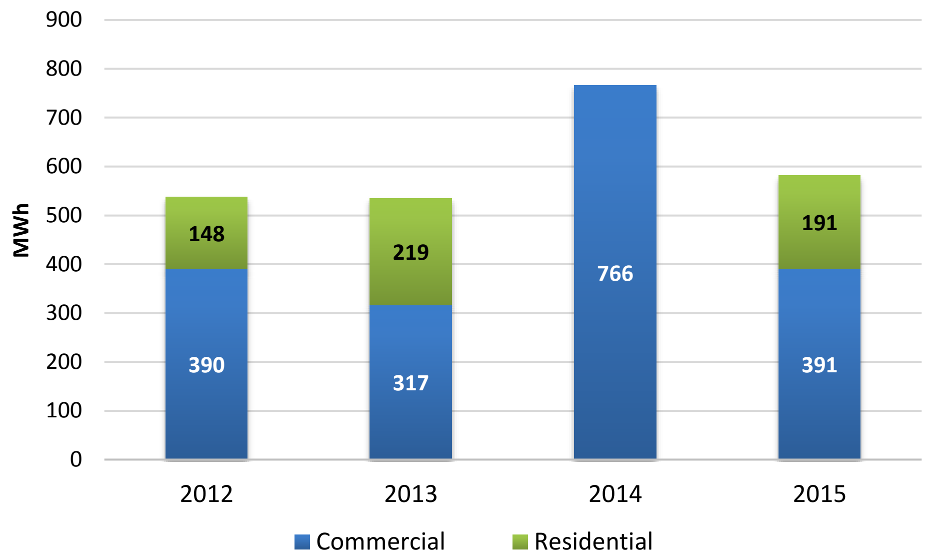
This assessment primarily sourced baseline measure saturation data from the NWPCC's Seventh Plan measure workbooks. The NWPCC's data was developed from NEEA's Building Stock Assessments, studies, market research and other sources, and the NWPCC has updated baselines for regional conservation achievement in preparation for the release of the Seventh Power Plan.

Recent Conservation Achievement

The City has pursued energy efficiency and conservation resources for over 30 years and continues to offer a range of conservation programs for residential and non-residential customers. Figure 4 shows recent energy savings achieved through the City's conservation programs.[2] The City's programs achieved 0.28 aMW (2,421 MWh) of energy savings from 2012 to 2015, with average annual savings of 0.07 aMW (605 MWh). The majority of recent conservation acquisition is due to commercial programs (77 percent), and the remaining achievement is due to residential conservation programs (23 percent). Notably, the City completed nearly 50 commercial energy efficiency projects, which saved customers a total of 0.09 aMW (766 MWh).

[2] Conservation achievement data provided by the City of Ellensburg.

Figure 4
Recent Annual Conservation Achievement by Sector



Current Conservation Programs

The City currently offers incentives for electrically heated residential and commercial customers such as; insulation upgrades and air sealing, commercial energy efficiency projects such as lighting, refrigeration and motor/pump upgrades. The City is offering a limited-time incentive for energy efficiency lighting projects at small commercial facilities, which pays a higher incentive level and is not subject to the standard 70 percent project-cost cap that would normally apply to commercial projects. A summary of the City's current conservation program offerings is provided below.

- *Attic Insulation* – Rebates of up to $0.80 per square foot are available for residential and commercial attic insulation upgrades for electrically-heated homes and facilities.
- *Wall Insulation* – The City currently offers rebates of up to $0.80 per square foot for wall insulation upgrades (R0 to R11) in electrically-heated residential and commercial buildings.
- *Floor Insulation* – The utility offers up to $0.35 per square foot for floor insulation upgrades in electrically-heated residential and commercial buildings.
- *Duct Sealing/Insulation* – Rebates of $1.25 per linear foot are available for duct sealing and insulation projects for electrically-heated residential and commercial buildings. Incentives may not exceed the lower of: the project cost or $250.
- *Commercial Lighting LED Upgrades* – The City currently offers incentives for energy efficient lighting upgrades at commercial facilities. Customers must contact the utility for program details.
- *Commercial Custom Projects* – The City currently offers a range of incentives for custom energy efficiency projects for commercial customers. Eligible projects include upgrades for

compressors, motors, pumps and refrigeration systems. Customers must contact the utility for details on incentives for custom energy efficiency projects.

- *Fuel Switching* – The City is offering a range of incentives to switch from electric appliances to natural gas appliances.

The City does not currently offer incentives for heat pumps as these appliances are a net gain in electric consumption in the climate zone due to cold winter temperatures and the addition of space cooling loads.

Customer Characteristics Data

The City currently serves nearly 10,000 electricity customers located in the City of Ellensburg in Central Washington. A key component of an energy efficiency 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. Tables 1, 2 and 3 show relevant residential data for single-family, multi-family and manufactured homes in the City's service territory. Characteristics for existing homes and new construction are provided separately when applicable. Estimates of the number of residential electric customers served by the City and total population of the City of Ellensburg,[3] are provided as well.

Residential sector characteristics are based on data provided by the City, County Assessor data and Washington State data for single-family, multi-family and manufactured homes. Washington State data points are based on the 2011 Residential Building Stock Assessment (RBSA), developed by NEEA. Regional data for all residential housing characteristics are provided for reference. These data provide an estimate of the current residential characteristics in the City of Ellensburg and are utilized as the residential sector baseline in this study. Average annual net residential growth for the CPA planning period is estimated at 0.3 percent, based on recent single-family, new house construction building permits in the City of Ellensburg[4] and the NWPCC's residential demolition rate assumptions.

[3] 2016 projected.

[4] City-Data. *Single-Family New House Construction Building Permits: Ellensburg, Washington.* April 2016. Retrieved from: http://www.city-data.com/city/Ellensburg-Washington.html.

Table 1
Residential Building Characteristics – Single Family

Heating Zone	Cooling Zone	Solar Zone	Residential Households[1]	Total Population[2]
1	3	3	8,134	18,810

Housing Stock	Existing	New	Regional %	Residential Appliances	Existing	New	Regional %
House Type[3]				Foundation Type[4]			
Single Family	45%	45%	74%	Crawlspace	95%	95%	62%
Multi-Family	51%	51%	17%	Full Basement	2%	2%	28%
Manufactured Homes	4%	4%	8%	Slab on Grade	3%	3%	10%
Housing Vintage[5]				Water Heating[4]			
Pre-1980	67%	N/A	67%	Electric	82%	82%	61%
1980 - 1993	14%	N/A	14%	Natural Gas	18%	18%	37%
Post 1993	19%	N/A	19%				
Heat Fuel Type[4]				Appliance Saturation[5]			
Natural Gas Homes	86%	50%	30%	Refrigerator	129%	129%	129%
Electric Homes	14%	50%	44%	Freezer	53%	53%	53%
Other Fuel Homes	0%	0%	26%	Clothes Washer	99%	99%	99%
Electric Heat System Type[5]				Electric Dryer	98%	98%	98%
Forced Air Furnace	7%	7%	7%	Dishwasher	89%	89%	89%
Heat Pump	21%	21%	21%	Electric Oven	75%	75%	75%
Zonal (Baseboard)	71%	71%	71%	Room AC	14%	14%	14%
Electric Other	1%	1%	1%	Central AC	48%	48%	48%

1. Active residential electric services (December 2015) – Source: City of Ellensburg.
2. 2015 population estimate for the City of Ellensburg – Source: WA Office of Financial Management.
3. Source: City-Data.
4. Provided by City of Ellensburg.
5. Based on the 2011 Residential Building Stock Assessment (NEAA) – Single-Family, Washington State.

Table 2
Residential Building Characteristics – Multi-Family

Housing Stock	Existing	New	Regional %	Residential Appliances	Existing	New	Regional %
Housing Vintage[2]				Water Heating[1]			
Pre-1980	50%	N/A	50%	Electric	90%	90%	77%
1980 - 1993	26%	N/A	26%	Natural Gas	10%	10%	22%
Post 1993	24%	N/A	24%				
Heat Fuel Type[2]				Appliance Saturation[2]			
Natural Gas Homes	8%	8%	8%	Refrigerator	103%	103%	103%
Electric Homes	90%	90%	90%	Freezer	4%	4%	4%
Other Fuel Homes	2%	2%	2%	Clothes Washer	47%	47%	47%
Electric Heat System Type[2]				Electric Dryer	47%	47%	47%
Forced Air Furnace	2%	2%	2%	Dishwasher	78%	78%	78%
Heat Pump	0%	0%	0%	Electric Oven	97%	97%	97%
Zonal (Baseboard)	97%	97%	97%	Room AC	11%	11%	11%
Electric Other	1%	1%	1%	Central AC	2%	2%	2%

1. Provided by City of Ellensburg.
2. Based on the 2011 Residential Building Stock Assessment (NEAA) – Multi-Family, Washington State.

Table 3 Residential Building Characteristics – Manufactured Homes							
Housing Stock	Existing	New	Regional %	**Residential Appliances**	Existing	New	Regional %
Housing Vintage[2]				Water Heating[1]			
Pre-1980	31%	N/A	31%	Electric	72%	62%	83%
1980 - 1993	42%	N/A	42%	Natural Gas	28%	38%	12%
Post 1993	27%	N/A	27%				
Heat Fuel Type[1]				Appliance Saturation[2]			
Natural Gas Homes	0%	0%	6%	Refrigerator	121%	121%	121%
Electric Homes	95%	95%	82%	Freezer	43%	43%	43%
Other Fuel Homes	5%	5%	12%	Clothes Washer	99%	99%	99%
Electric Heat System Type[1]				Electric Dryer	95%	95%	95%
Forced Air Furnace	77%	77%	69%	Dishwasher	77%	77%	77%
Heat Pump	0%	0%	16%	Electric Oven	90%	90%	90%
Zonal (Baseboard)	23%	23%	15%	Room AC	17%	17%	17%
Electric Other	0%	0%	0%	Central AC	26%	26%	26%

1. Provided by City of Ellensburg.
2. Based on the 2011 Residential Building Stock Assessment (NEAA) – Manufactured Homes, Washington State.

Commercial

Building square footage is the key parameter used to determine conservation potential for the commercial sector, as many of the measures are based on savings as a function of building area (kWh per square foot).

For this assessment, the City provided 2015 square footage for all commercial segments (building categories) except University and Hospital. The City sourced commercial building square footage from the Kittitas County Assessor's Office records. The City provided 2015 energy consumption for the University and Hospital segments. These values were converted to square footage based on segment-specific energy use intensity (EUI) estimates.

Regional EUI values by building segment are based on the 2014 Commercial Building Stock Assessment (CBSA), conducted by NEEA. These values are shown in the third column of Table 4. EUI values are often used to derive commercial square footage, if only energy consumption data is available. To determine square footage for the University and Hospital segments, energy consumption for each these segments was divided by the applicable EUI value. Commercial square footage and EUI values by segment are shown in Table 4. Commercial building floor area is estimated at 7.1 million square feet.

Table 4
Commercial Building Square Footage Estimates

Segment	Area (Square Feet)	EUI (kWh/sf)
Large Office	104,985	15.6
Medium Office	66,639	20.2
Small Office	322,273	14.1
Big Box Retail	66,660	13.9
Small Box Retail	878,277	13.0
K-12 Schools[1]	365,585	9.0
University	2,282,708	16.9
Warehouse	848,808	7.3
Supermarket	259,340	53.4
Mini Mart	29,678	80.9
Restaurant	195,567	50.7
Lodging	645,070	14.6
Hospital	132,477	27.4
Other Health Facilities	183,818	14.9
Assembly Hall	70,082	10.5
Other	651,640	12.5
Total	7,103,607	**16.8**

1. Provided by the school district.

The City's goal is to encourage growth in the commercial sector over the planning period. Net annual energy sales growth for the sector may be minimal due to ongoing conservation efforts however, large new commercial project(s) would have an impact on the growth rate for this sector.

Industrial

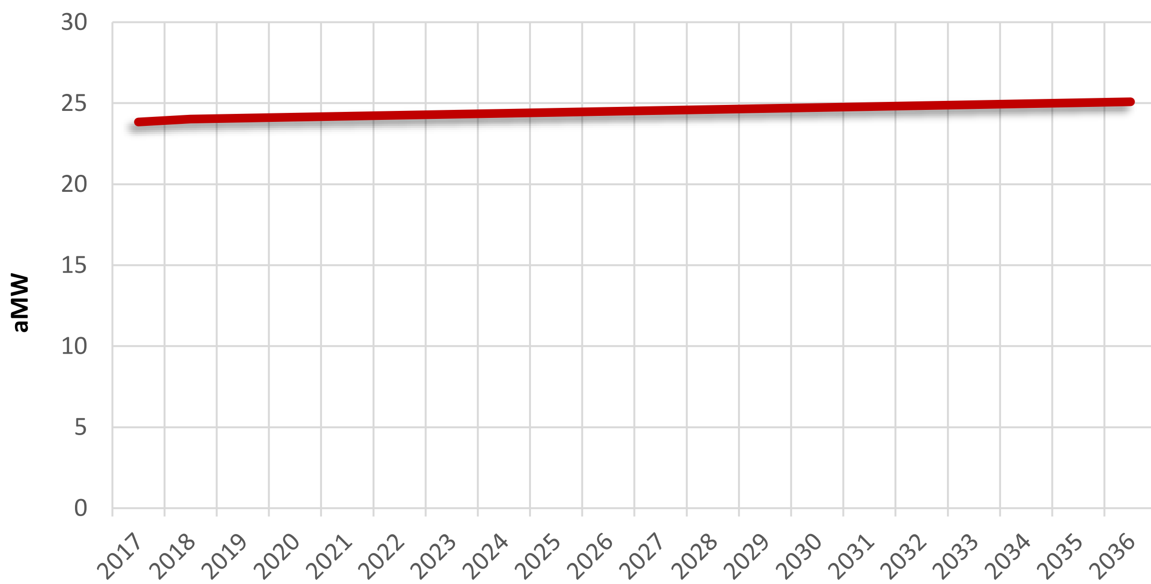
The methodology for estimating industrial potential is different than approaches used for the residential and commercial sectors, primarily because industrial energy efficiency opportunities are based on the distribution of electricity use across processes at industrial facilities. Industrial potential for this assessment was estimated based on the NWPCC'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.

The City provided 2015 energy use for one industrial segment: frozen food annual consumption in 2015 was 6,425 MWh and is expected to grow at a negative 0.5 percent annually. In addition, water and wastewater measures are applied to estimated water and wastewater systems. Municipal wastewater is estimated at 3.95 million gallons of water per day (0.18 MGD per 1,000 population). Water supply measures are applied based on population estimates.

Distribution Efficiency (DEI)

For this analysis, EES developed an estimate of distribution system conservation potential using the NWPCC's Seventh Plan approach. The Seventh Plan estimates distribution potential as a fraction of end system sales (0.12 to 4.4 kWh per MWh depending on measure). Distribution system potential for this assessment is based on BPA's Total Retail Load Forecast (December 2015) for the City of Ellensburg. The Base Case load forecast is graphed in Figure 5 and distribution system conservation potential is discussed in detail in the next section.

Figure 5
20-year End System Load Forecast



Results – Energy Savings and Costs

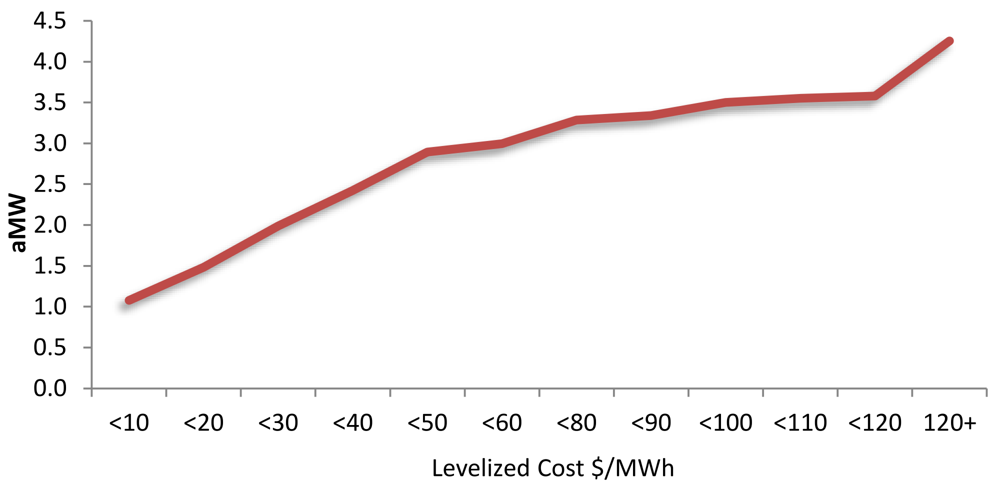
Technical Achievable Conservation Potential

Technical achievable potential is the amount of energy efficiency potential that is available regardless of cost. It represents the theoretical maximum amount of energy efficiency when accounting for achievability. Technical potential has not been screened for cost effectiveness.

Figure 6, below, shows a supply curve of 20-year, technically achievable potential. A supply curve is developed by plotting energy efficiency savings potential at busbar (aMW) against the levelized cost ($/MWh) of the conservation. Costs are standardized (levelized), allowing for the comparison of measures with different life lengths. The cost per MWh of technical potential shown in Figure 6 is based on the estimated costs that the City would incur to acquire the conservation, inclusive of administration costs and incentives paid to customers.[5]

The supply curve facilitates comparison of energy efficiency resources to other demand-side resources and supply-side resources. Figure 6 shows that nearly 2.0 aMW of saving potential is available for $30/MWh or less. Total technical achievable potential is approximately 4.25 aMW over the 20-year study period.

Figure 6
20-Year Technical-Achievable Potential Supply Curve



Economic Achievable Conservation Potential

Economic achievable potential is the amount of achievable potential that passes the Total Resource Cost (TRC) test. This means that the present value of the total benefits attributed to the conservation measure exceeds the present value of the total costs over the measure lifetime.

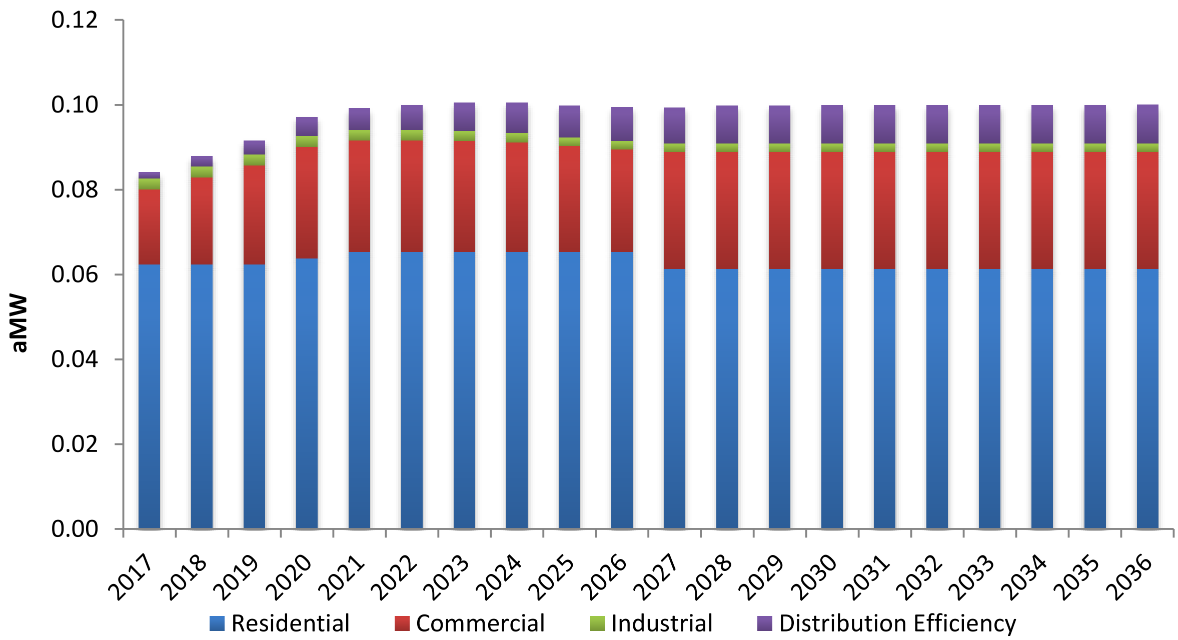
Table 5 shows aMW of economically-achievable (cost-effective) potential by sector in 2, 5, 10 and 20-year increments (savings are measured at busbar). Compared with the technical achievable potential, it shows that 1.96 aMW of the total 4.25 aMW is cost effective for the City.

Table 5 Cost-Effective Achievable Potential (aMW)				
	2 Year	5 Year	10 Year	20 Year
Residential	0.12	0.32	0.64	1.26
Commercial	0.04	0.11	0.24	0.52
Industrial	0.01	0.01	0.02	0.04
Distribution Efficiency	0.00	0.02	0.05	0.14
TOTAL	**0.17**	**0.46**	**0.96**	**1.96**

Sector Summary

Figure 7 shows economic achievable potential by sector on an annual basis.

Figure 7
Annual Economic-Achievable Potential by Sector



Approximately 64 percent of the potential over the 20-year study period is in the residential sector, followed by notable savings potential in the commercial sector. Ramp rates are used to establish reasonable annual conservation achievement levels; which are affected by factors including timing and availability of measure installation (lost opportunity measures), program (technological) maturity, non-programmatic savings, and current utility staffing and funding.

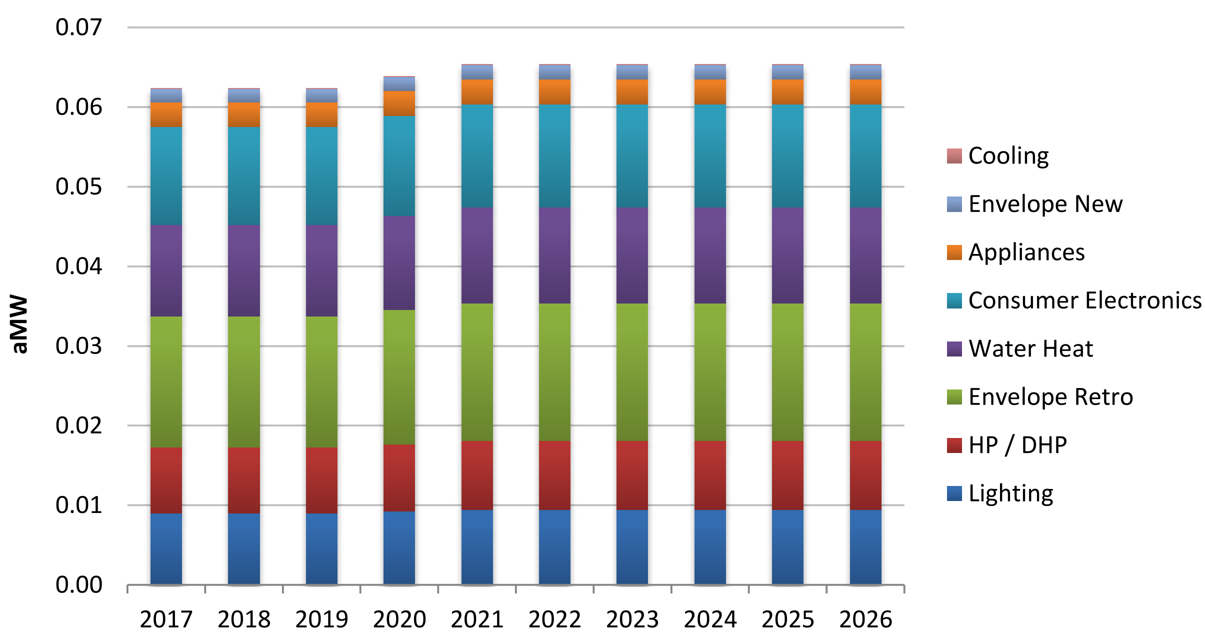
The next sections provide high level overviews of conservation potential by customer sector and measure end-use category. More detailed potential estimates are provided in Appendix III.

Residential

Figure 8 shows the distribution of residential potential savings for the first ten years of the planning period. This assessment also indicates notable potential due to consumer electronics measures, particularly from the installation of new advanced power strips. Weatherization programs for existing buildings have achieved significant savings over program history. Savings potential for envelope measures applied to existing building stock consist primarily of window replacements in multifamily homes.

Sixth Plan residential lighting measures have been replaced due to lighting standards that took effect over the past two years. Whereas previous residential lighting measure sets included CFL measures, the newest measure set is designed solely around LED lighting. Behavioral measures such as turning down water heater temperature, reducing HVAC usage and reducing lighting hours of use were evaluated in this analysis. These measures were not cost-effective.

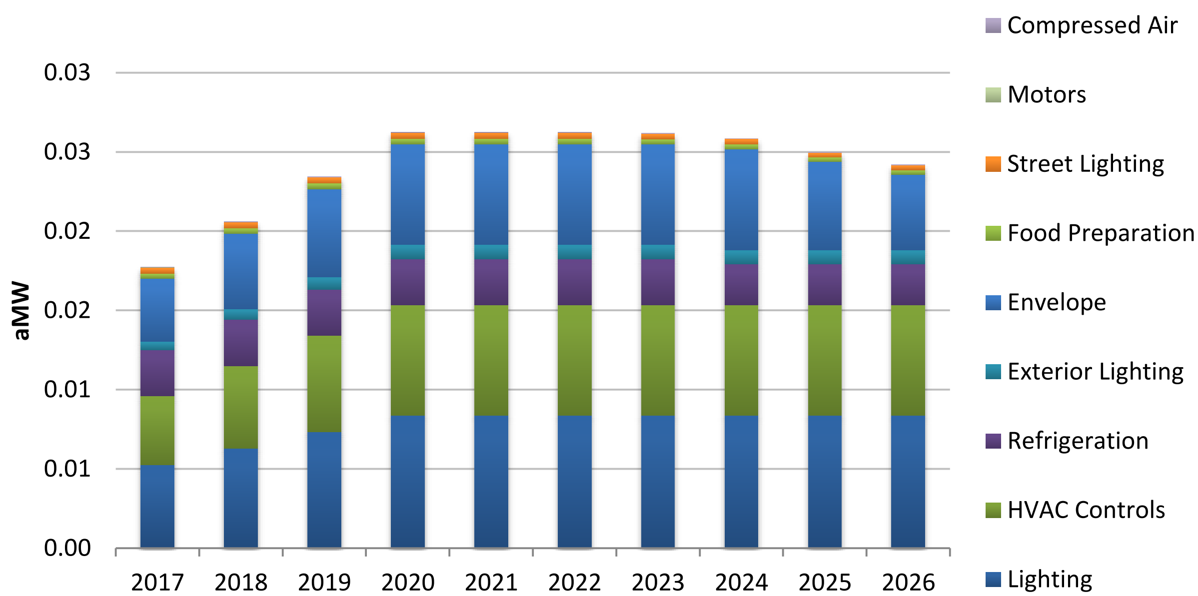
Figure 8
Annual Residential Potential by End-Use



Commercial

Commercial rooftop insulation measures account for the largest single area of potential for this sector. This assessment indicates that commercial lighting potential, particularly lighting power density improvement potential, is also significant. HVAC control measures, including rooftop controller and energy management measures, also account for a substantial part of commercial conservation potential for this assessment. Annual commercial sector potential by measure end-use is shown in Figure 9.

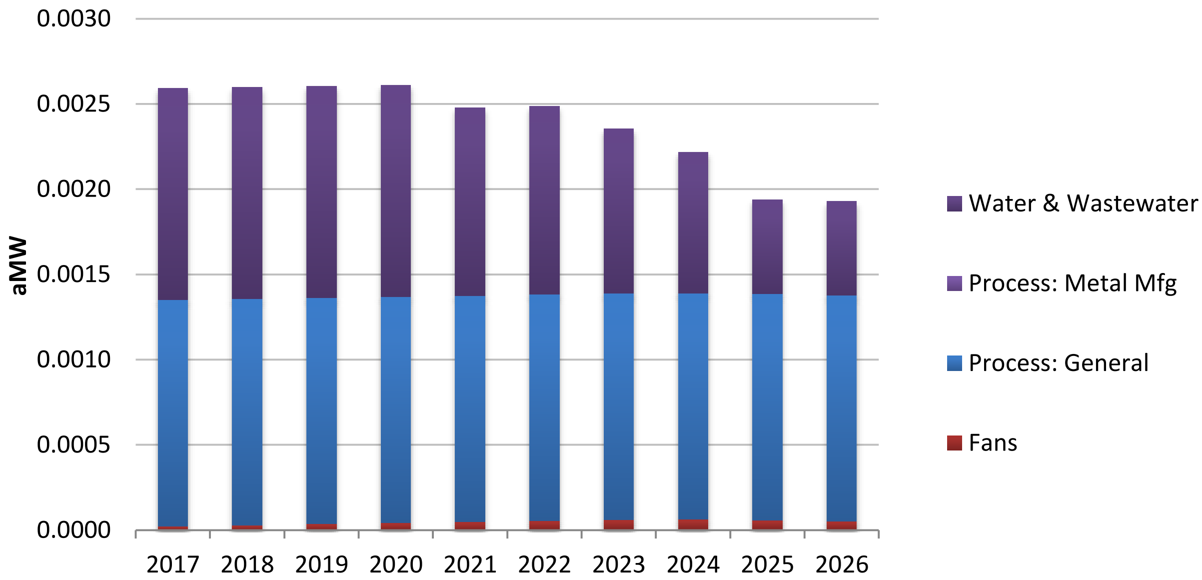
Figure 9
Annual Commercial Potential by End-Use



Industrial

The City's industrial sector includes loads for the frozen food segment only. This customer has moved to limited operations and the City has already pursued several energy efficiency projects at the location. Savings potential is reported below for this industrial customer as well as for water supply and wastewater treatment.

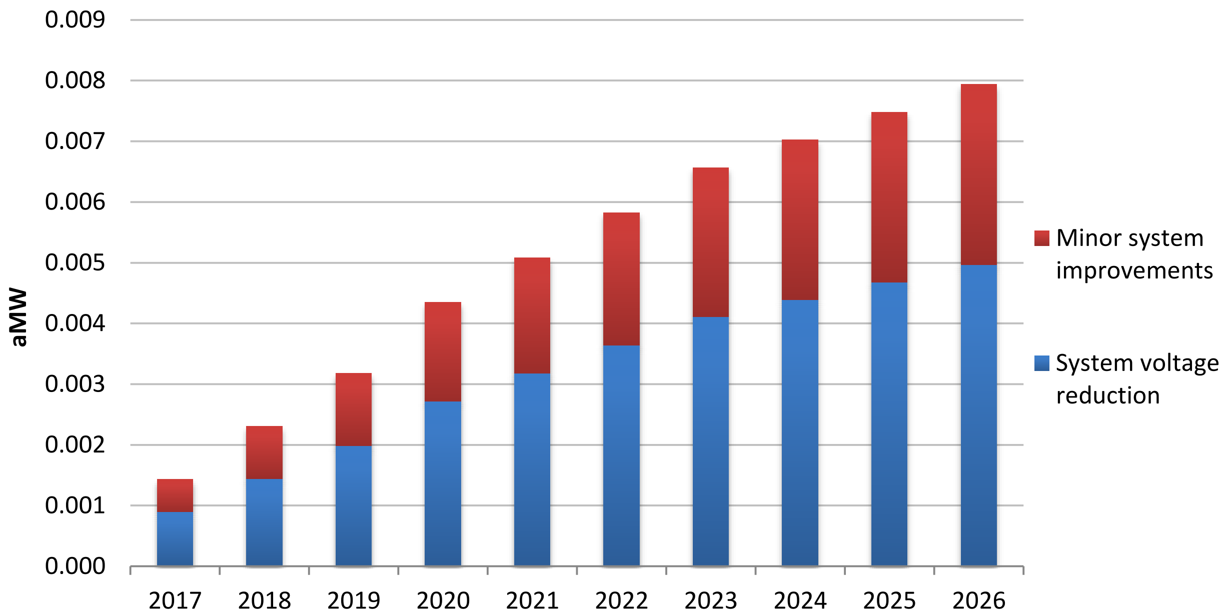
Figure 10
Annual Industrial Potential by End-Use



Distribution Efficiency

Distribution system conservation potential is estimated using the NWPCC's methodology which estimates savings as a fraction of end-system sales (total utility system load less line losses). Minor system improvements include var management, phase load balancing and feeder load balancing. The system voltage reduction potential shown in Figure 11 consists of voltage optimization through line drop compensation (LDC) methods.

Figure 11
Annual Distribution System Efficiency Potential



Cost

Budget costs can be estimated at a high level based on the incremental capital cost of conservation measures. The assumptions in this estimate include: 20 percent of measure capital cost for administrative expenses and 40 percent for incentives. A 20 percent allocation of measure costs to administrative expenses is a standard assumption for utility conservation programs and a 40 percent allocation to measure incentives is commonly used for utility conservation program planning. The incentive includes both funds reimbursed by BPA as well as funds directly from the City.

Given these assumptions, electric conservation potential over the next two years may cost the City and BPA $388,800. The bottom row of Table 6 shows the cost per MWh of first-year savings.

Table 6
Cost for Achievable Conservation Potential (2015$)

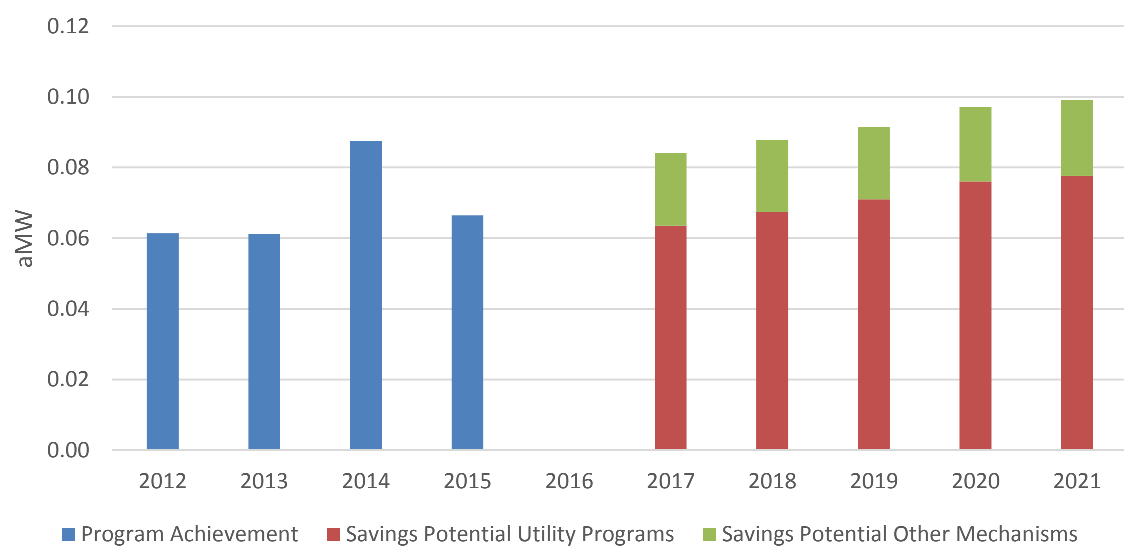
	Utility First Year Cost			
	2 Year	5 Year	10 Year	20 Year
Residential	$322,600	$818,200	$1,663,800	$3,767,400
Commercial	$58,800	$175,300	$370,500	$753,100
Industrial	$6,100	$15,000	$27,600	$51,200
Distribution Efficiency	$1,300	$5,700	$17,700	$48,600
TOTAL	**$388,800**	**$1,014,200**	**$2,079,600**	**$4,620,300**
Unit Cost ($/MWh first year)	$258	$252	$247	$269

Summary

This assessment provides estimates of electricity savings by sector for the period: 2017 to 2036. The assessment considered a wide range of electric conservation resources that are reliable, available, and cost effective within the 20-year planning period. These resources will be achieved through the City's own energy efficiency programs and momentum savings.[6] Figure 12 compares the cost-effective and achievable energy efficiency potential estimated for the City with recent program achievements. Note that data for 2016 is not yet available.

The potential estimate is broken down into savings that are likely to be achieved through utility programs and savings that are likely to be achieved through other efforts. Future changes to codes and standards and market transformation efforts may shift savings from utility program to the other mechanism category. For this analysis, residential heat pumps and consumer electronics are included in potential that is likely to be achieved outside of utility programs. These two measure groups were selected since the City does not currently offer heat pump programs due to the net gain in consumption issue mentioned previously, and consumer electronics savings are likely to be achieved through market transformation.

Figure 12
Comparison of Program Achievement and Program Potential



Based on the above breakdown, future program savings potential is estimated to be at approximately the same level as recent achievement (0.06 aMW/year). This potential may be

[6] Momentum savings refers to energy efficiency that occurs outside of utility programs (direct incentives) regardless of how and why. These savings include state code and federal standard changes, market transformation efforts, and spillover.

achieved at a cost that is similar to what has been experienced in recent program history. While these conservation resources are a valuable part of the City's resource strategy, the potential estimated is not great enough to meet the City's resource needs above BPA Tier 1 power supply.

Demand Response Potential Assessment

This section summarizes the methodology and results of the demand response (DR) potential assessment conducted for the City of Ellensburg (City) for the period: 2017 to 2036. The DR analysis utilized measure assumptions and models developed by the NWPC Council and other stakeholders for estimating regional DR potential for the Seventh Plan. This DR assessment included analysis of four types of DR programs for the residential sector. Specifically, the analysis included two dispatch technologies and a range of seasonal profiles.

Overview of NWPC Council's Approach to DR Analysis

The NWPC Council defines demand response (DR) as, "a voluntary and temporary change in consumers' use of electricity when the power system is stressed."[7] DR programs focus on temporarily reducing demand in response to a price signal or other incentive. The benefits of DR include reducing peak load, which helps to defer building new peaking resources and avoid additional market purchases. Peak load reduction also helps to defer transmission system upgrades and expansion and may improve system reliability. DR also provides ancillary services, including contingency reserves, operating reserves, and transmission and distribution system congestion relief.

Though DR potential for balancing reserves was evaluated in preliminary studies for the Seventh Plan, DR programs evaluated for the Seventh Plan regional portfolio are based solely on demand response for peak load reduction. Therefore, DR potential for this assessment focuses on DR as a peaking resource.

Demand Response Potential Assessment Methodology

Since demand response resources have some characteristics of conservation resources (demand-side), and also share characteristics of generation resources (dispatchable), the methodology used to estimate DR potential for this assessment, and for the Seventh Plan, is based on a hybrid of approaches used to develop conservation and generation resource potentials.

For the Seventh Plan, the NWPC Council commissioned Navigant Consulting to conduct an assessment of regional DR programs and develop methodologies for assessing regional DR potential. Cost and availability assumptions used in the Seventh Plan DR analysis are based on the Navigant study, stakeholder comments and additional data sources.

[7] Northwest Power and Conservation Council. *Seventh Northwest Conservation and Electric Power Plan*. Feb 2016. (pp. 14-2).

Basic Modeling Methodology

Measures are primarily characterized by dispatch technology, load impact (kW/customer), load impact seasonality (% load impact on summer and winter peak demand), enablement costs ($/customer), and implementation costs ($/kW-yr). Additional key parameters used to determine DR program potential include assumptions for measure saturation (availability), participation rates, DR acquisition schedules (ramp rates) and measure turnover.

The key modeling parameter used to estimate DR potential is load impact (kW/customer). The load impact estimate for each DR program was applied to forecasts of eligible residential customers to calculate technical achievable DR potential. DR market potential technical achievable potential) was primarily estimated based on assumptions for program saturation (availability) and program participation. Ramp rates were used to establish reasonable forecasts of available DR potential. Finally, seasonal shapes were used to estimate each DR program's impact on winter and summer peak loads.

The following sections provide details of the key DR modeling inputs and assumptions.

Demand Response Measure Data

Load Impacts

DR load impacts are primarily based on estimates of load reductions at the end-use consumption level. Regional data describing end-use energy distribution for the residential sector provided the initial inputs for estimating DR program load impacts. System peak impacts for the sector's end-use categories were determined, based on end-use load profiles. End-use impacts were then aggregated to estimate DR program potential per customer (kW/customer).

Load Impact Seasonality

DR resources have a range of seasonal shapes, based on the nature of the technology and levels of effectiveness during different seasons. Some resources are only available, or are most effective, during the summer, such as space cooling DR programs, or winter, such as space heating DR programs. Other resources, such as water heating DR programs, are effective year-round. Seasonal peak demand impacts of DR resources are modeled based on assumptions for seasonal peak capacity percentage values for summer and winter. Seasonal profiles for DR measures are discussed in more detail in the residential customer sector results sections of the demand response potential assessment.

Dispatch Technologies

Two DR program dispatch options were considered for this analysis. One option utilizes traditional means for curtailing loads and the second option makes use of advanced, or 'smart' technologies. The DR programs included in this assessment were modeled for both traditional and advanced deployment. A brief overview of these technologies, as they apply to this analysis, is provided below. The results section of the demand response potential assessment provides more detail on dispatch options for specific DR programs.

- Traditional DR Technologies – Includes Direct Load Control (DLC) programs that utilize traditional switch technologies for load curtailment and curtailable/interruptible tariffs. DLC programs allow a utility to remotely interrupt or cycle electrical equipment and appliances at a customer site. This study evaluated traditional DLC program potential for residential space heating, space cooling and water heating. DLC has historically relied on one-way communicating switches for space heating and cooling DR programs, but utilities are increasingly utilizing more advanced technologies, such as programmable communicating thermostats (PCTs) for these applications.

- Advanced DR Technologies – Includes programmable communicating thermostats (PCTs) and automatic water heater controls. PCTs allow utilities to remotely cycle customers' heating and cooling systems to reduce loads during peak events. The two-way communication capabilities of PCTs provide numerous benefits to operators, including providing feedback and data that may be used to improve reliability of load shedding during peak events. Automatic water heater controls allow for this same type of load management with water heating.

Table 7 summarizes the DR programs evaluated for this assessment. More detail on these programs is provided in the residential customer sector section.

Table 7
Programs Included in the City's Demand-Response Potential Assessment

DR Sector	DR Component	DR Technology	Seasonality
Residential	Space Heating	Direct Load Control (DLC) and Programmable Communicating Thermostats (PCT)	Winter Only
	Water Heating	DLC and Automatic Water Heater Controls	Summer and Winter
	Space Cooling – Central Air Conditioning (CAC)	DLC and PCT	Summer Only
	Space Cooling – Room Air Conditioning (CAC)	DLC and PCT	Summer Only

Source: Seventh Northwest Power and Conservation Plan, Table 14-2

Resource Costs

DR resource costs consist of enablement costs and implementation costs. Enablement costs are costs incurred to purchase and install DR technologies. Implementation costs consist of administrative costs and customer incentives, inclusive of costs incurred to market DR programs and research new DR opportunities, pay program support staff and fund customer incentives.

Net levelized implementation cost calculations include a bulk transmission system expansion deferral credit of $26/kw-yr. This value is included to account for upgrades and expansion of the bulk transmission system that can be deferred by reducing peak demand and is consistent with the transmission deferral credit used in the City's CPA cost-effectiveness analysis. Unlike the CPA analysis, however, a distribution system expansion deferral credit is not included in the DR analysis. The NWPC Council's analysis of DR potential assumes that utility distribution systems would need to be sized to serve customers' peak demand when DR resources are not dispatched.

The total resource cost is the sum of the levelized enablement cost and the net levelized implementation cost for each DR resource. A four percent discount rate was used in the levelized cost calculations for DR resources, consistent with the discount rate used throughout this IRP. Levelized costs and program costs are discussed in the 'Levelized Cost' section of the demand response potential analysis.

Customer and Load Forecasts

Residential housing forecasts from the City's Base Case Conservation Potential Assessment were used to estimate eligible populations for DR programs. Table 8 shows residential customer forecasts and average annual growth rates over the 20-year planning period.

Table 8
Residential Customer Forecasts

	20-yr Average Annual Growth Rate	2021	2026	2031	2036
Residential	0.3%	8,236	8,370	8,509	8,607

Estimates of DR load impact, as a percentage of winter and summer peak loads, are based on assumed seasonal peak demands for the City's service area over the planning period. EES calculated load factors for summer and winter peak loads from the City's Customer System Peak and Total Retail Load forecasts from BPA's 2016 TRM Billing Determinants Model. Monthly Total Retail Load forecasts were also used to estimate monthly wholesale energy consumption, based on the retail load forecast used for the City's Base Case CPA analysis and the utility-provided line loss assumption of 3.0 percent. The monthly load factors were applied to monthly wholesale energy forecasts for winter (January) and summer (July) peak months to estimate seasonal peak demands over the planning period. The City's baseline winter peak demand in 2036 was estimated at 45 MW and the baseline summer peak demand was estimated at 40 MW. It should be noted that the City's DR potential is not affected by these data; they are only used to provide a reference for peak load reduction.

Study Uncertainties

- Measure Data – DR program costs, savings, availability, participation, ramp rates and other resource attributes are based on a range of data resources, which inherently carries a level of uncertainty. In some cases, DR resource inputs were estimated based on limited data and/or assumptions based on the professional judgement of Navigant Consulting and other parties. In addition, though the NWPC Council considers the DR resource inputs used in this assessment to be representative of the region and available DR technologies, actual DR program attributes vary depending on service area climate, customer usage patterns, appliance size, etc. Finally, costs and load impacts for each installed DR resource are static over the 20-year planning period and therefore do not account for market availability of new or improved DR technologies.

- Customer Growth Forecasts – This analysis bases DR potential on customer growth forecasts, by sector, for the period: 2017 to 2036. Actual customer growth may differ from these assumptions, particularly in the later years of the planning period.

Demand Response Potential

Table 9 summarizes estimates of the City's technical-achievable DR potential for the 20-year planning period. By 2036, the estimated impact of DR programs is approximately 1.8 MW during the winter and 1.2 MW during the summer. The bottom row of Table 9 shows DR load curtailment as a percentage of estimated summer and winter peak demand for the City's system.

Table 9
Residential Technical-Achievable Load Impact

	2021		2026		2031		2036	
	Winter	**Summer**	**Winter**	**Summer**	**Winter**	**Summer**	**Winter**	**Summer**
Load Impact (kW)	1,489	1,003	1,781	1,200	1,810	1,220	1,831	1,234
Load Impact (%)	3.5%	2.6%	4.1%	3.1%	4.1%	3.1%	4.1%	3.1%

The above estimates consider applicability and participation factors taken from the NWPC Council's analysis.

Advanced DR programs account for approximately 2.0 percent of winter load impacts and 1.3 percent of summer load impacts. Standard technology DR programs account for approximately 2.0 percent of winter load impacts and 1.9 percent of summer load impacts.

Figure 13 shows annual technical-achievable DR potential by program category, inclusive of winter and summer demand impacts. DR acquisition schedules, developed by Navigant for DR resource assessment in the Seventh Plan, assume that potential DR acquisition grows steadily over the first five years of the planning period then reaches a constant state of modest growth through the remaining years.

Figure 13
Annual Technical Achievable DR Potential by Program Category

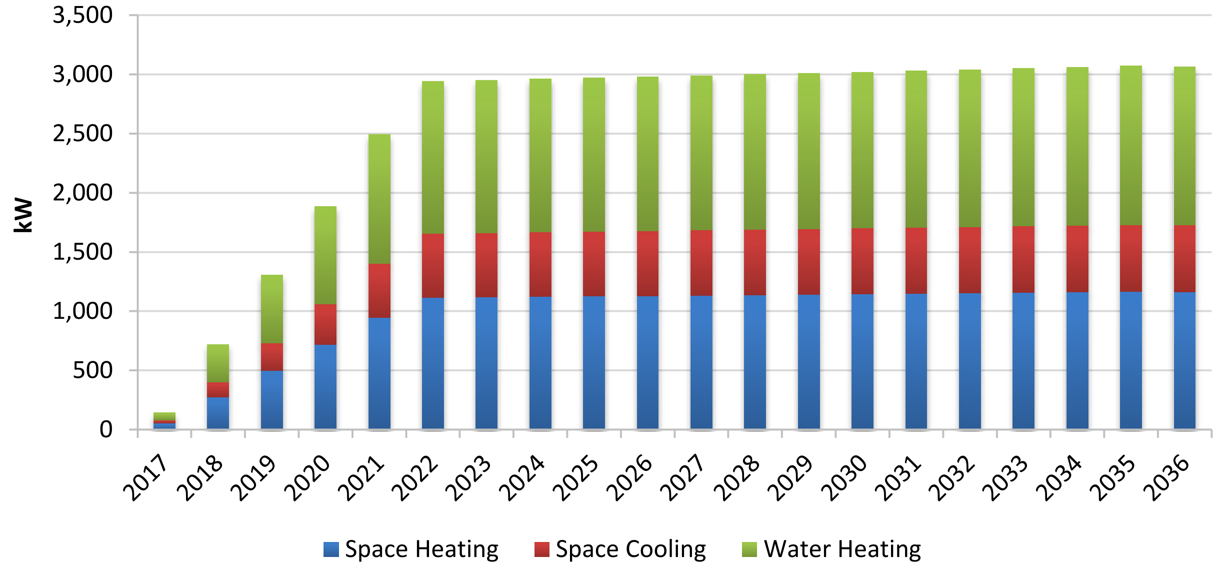


Table 10 shows the residential DR program categories evaluated for this assessment as well as their associated load impacts (kW/customer) and load impact seasonality values (% applicability). As expected, space heating programs impact winter peak loads and space cooling programs impact summer peak loads. Water heating programs are the only residential DR programs evaluated for this assessment that have the potential to reduce loads year-round. As previously noted, space heating DR load impacts per customer are the most significant among the residential DR programs.

Table 10
Residential DR Programs – Load Impact and Seasonality Inputs

DR Component	Load Impact (kW/customer)	Load Impact Seasonality	
		Winter	Summer
Space Heating – DLC	1.74	100%	0%
Space Cooling – CAC DLC	0.60	0%	100%
Space Cooling – RAC DLC	0.27	0%	100%
Water Heating – DLC	0.58	100%	100%

CAC = Central air conditioning; RAC = Room air conditioning

DLC is the most widely deployed type of DR program. Utilities generally use DLC for load shedding during peak events, but may also curtail loads to avoid high on-peak electricity purchases. DLC programs typically limit the number of times or hours that a program participant's appliance, equipment or system can be remotely turned off per year. A fixed monthly incentive is generally offered for participation in DLC programs. Technical-achievable DR program potential for the City's residential sector is shown in Table 11. The DR potential shown in Table 11 includes basic and smart technology deployments.

Table 11 Technical-Achievable Potential – Residential (kW)								
	2021		2026		2031		2036	
	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Space Cooling - CAC DLC	0	346	0	413	0	420	0	425
Space Cooling - RAC DLC	0	114	0	136	0	138	0	140
Space Heating - DLC	945	0	1,130	0	1,149	0	1,162	0
Water Heating - DLC	544	544	651	651	661	661	669	669
Total Load Impact	1,489	1,003	1,781	1,200	1,810	1,220	1,831	1,234

The most significant area of load shedding due to residential DR programs is space heating. This study estimates that 1,162 MW of winter load reduction may be achieved through these programs over the 20-year study period. Residential space heating DR accounts for approximately 64 percent of the sector's winter load impact. Residential space cooling DR accounts for nearly 46 percent of the total summer load impact. Water heating DR potential accounts for 37 percent of the sector's winter potential and 54 percent of residential summer potential. Residential water heating DR programs make up approximately 44 percent of the total annual peak load reduction potential.

DLC programs have traditionally relied on one-way remote switches to shut off or cycle customer equipment but, with the recent market availability of more sophisticated load control technologies, residential DLC programs are trending toward offering programmable communicating thermostats (PCTs) for space heating and cooling DR programs and water heater controls for water heating DR programs. Advanced DR technologies utilize two-way communications, which can increase the reliability of load management during peak events by allowing operators to verify that installed DR technologies are functioning properly and get feedback from DR events to improve predictions of load shedding for future events.

Both standard technology (switch) and smart technology (PCT and water heater controls) deployments were evaluated for each of the DR components shown in Table 12. Figures 14 and Figure 15 show annual residential DR potential load impacts for winter and summer, respectively. Winter potential is split nearly evenly between traditional DR technologies (52 percent) and advanced DR technologies (48 percent). Traditional DR accounts for 60 percent of summer load impacts.

Figure 14
Technical-Achievable Residential DR Potential by Program – Winter

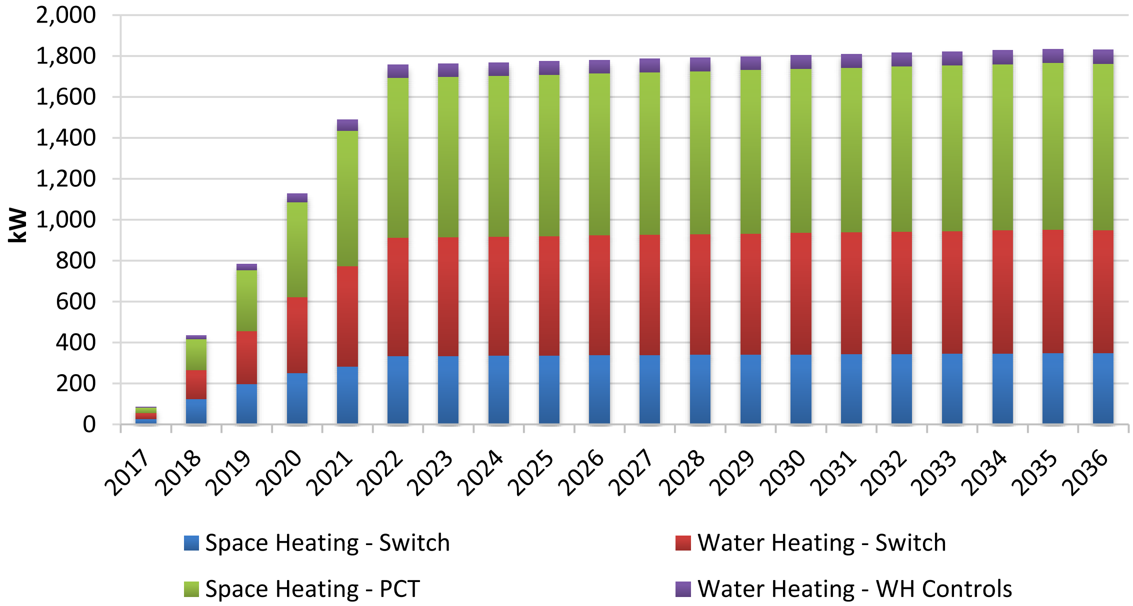
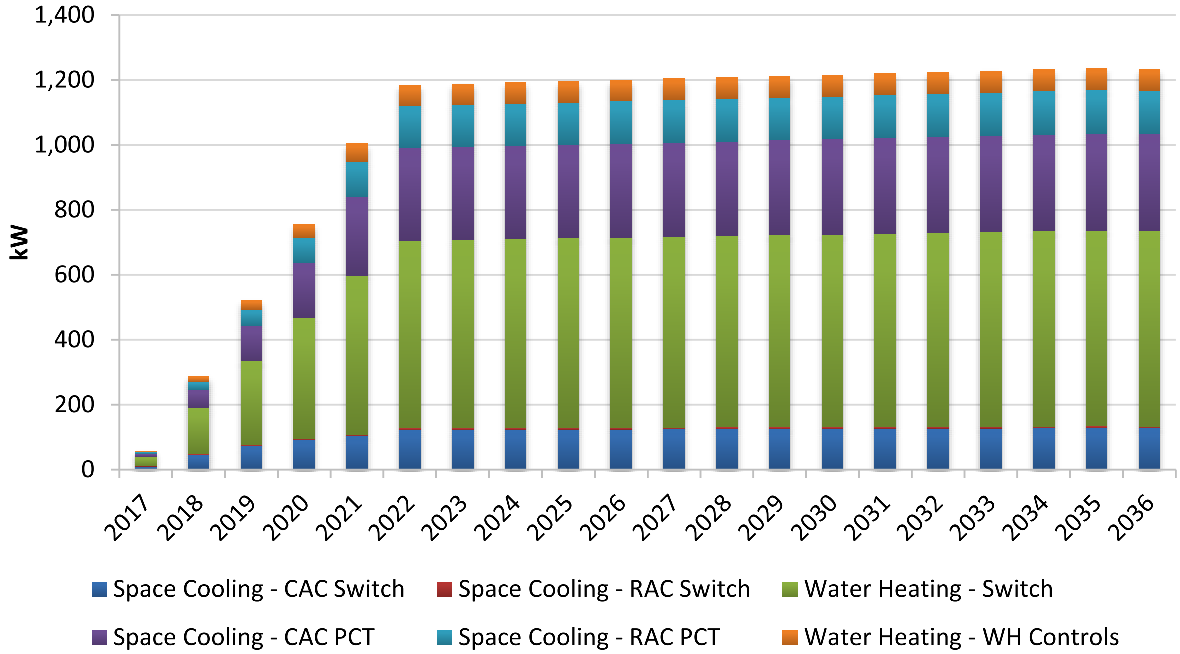


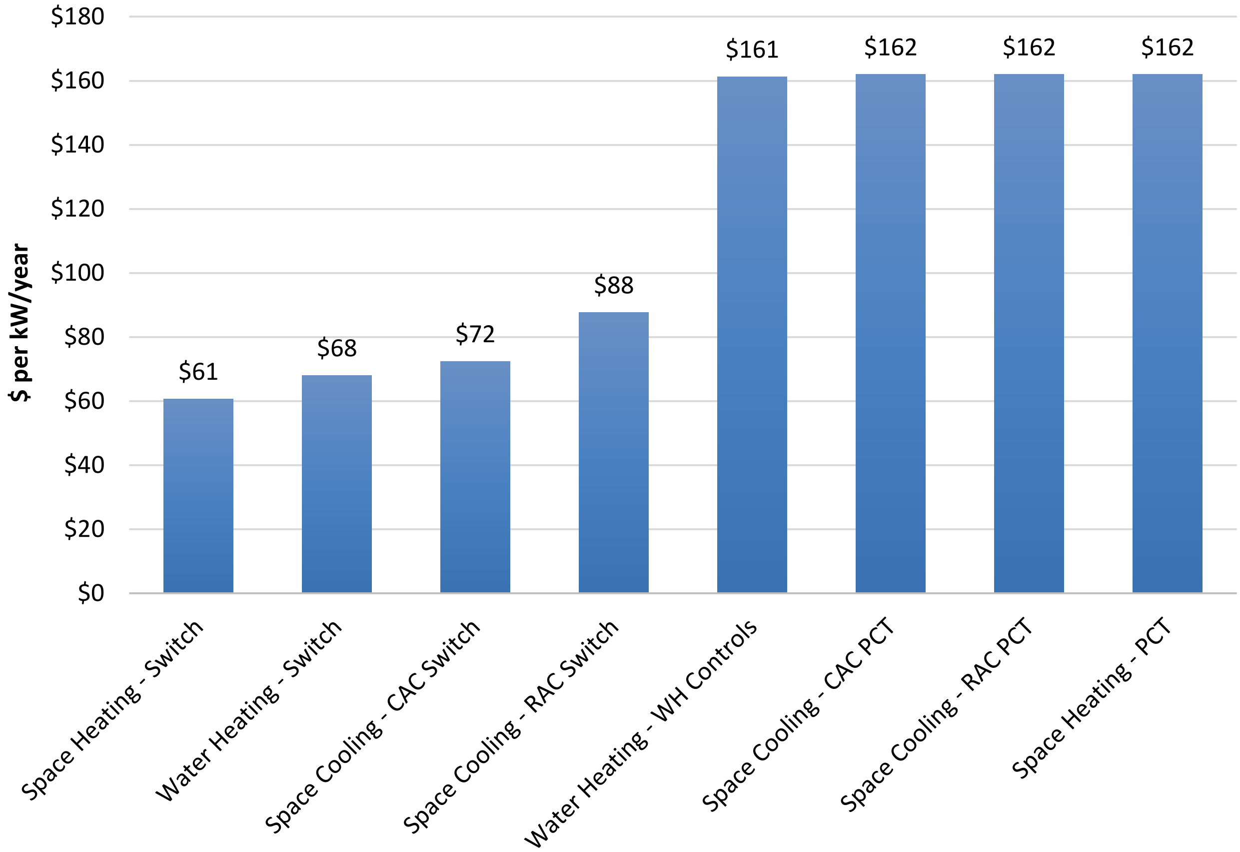
Figure 15
Technical-Achievable Residential DR Potential by Program – Summer



Levelized Costs

Figure 16 shows the 20-year net levelized costs for the DR resources evaluated in this analysis. The costs shown in Figure 16 represent the total resource costs of the DR programs, levelized over the 20-year planning period. The TRC levelized cost includes two primary components: implementation costs and enablement costs. Implementation costs are the costs associated with running a DR program, inclusive of staffing costs, marketing and customer incentives. Enablement costs include the capital costs of DR technologies and installation costs. Implementation costs are applied to all participants and enablement costs apply to new participants only. The net levelized implementation costs include a transmission deferral credit of $26 per kilowatt year to account for the value of transmission system expansions and upgrades that may be deferred by reducing peak demand through DR programs. As shown in Figure 16, smart DR technologies are more expensive than basic technologies.

Figure 16
20-year Net Levelized Costs ($/kW-year)



The TRC levelized costs range from $61 to $162 per kilowatt year. Similar to conservation programs, residential DR programs are generally more expensive than programs in other customer sectors, due to the relatively high recruitment costs and high technology and installation costs, compared with program impact.

Figure 17 shows levelized costs without the transmission deferral credit. Since deferred costs for transmission system expansion and upgrades do not directly benefit the City, the costs shown in Figure 17 represent the City's estimated net program costs for the DR potential results in this assessment.

Figure 17
Total 20-year Levelized Costs (w/o Transmission credit) ($/kW-year)

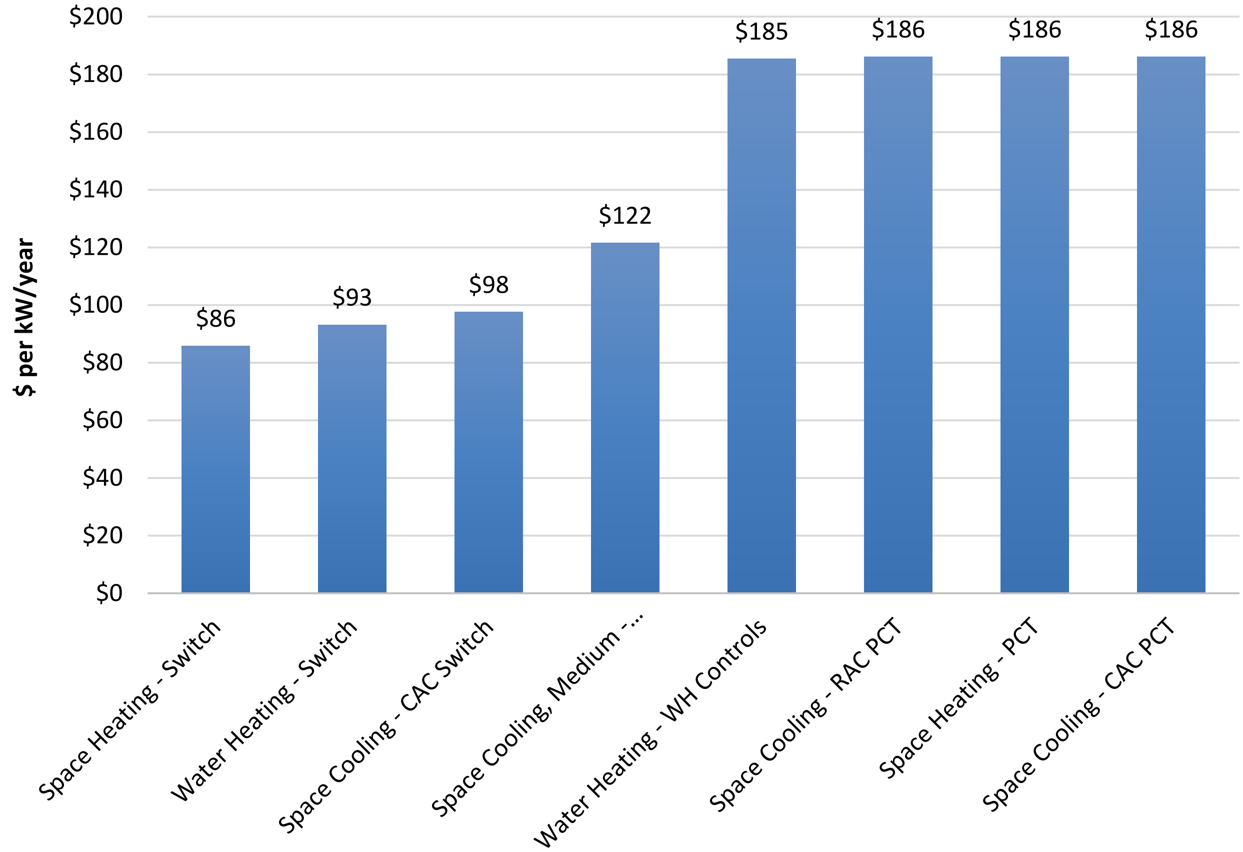


Table 12 shows rounded estimates of program costs by sector for the DR potential estimated in this assessment. The costs in Table 12 do not include the transmission deferral credit. The bottom row of Table 12 shows the total program costs throughout the planning period. The annual average program cost for DR acquisition in this assessment is approximately $42,600.

Table 12
Demand Response Program Costs (2015$)

	2021	2026	2031	2036
Residential				
Enablement Costs	$ 26,201	$ 26,640	$ 27,015	$ 27,015
Implementation Costs	$ 27,241	$ 26,768	$ 22,367	$ 18,597
Total Program Cost	**$ 53,442**	**$ 53,408**	**$ 49,383**	**$ 45,612**

Power Supply Savings

The DR potential and program costs discussed in this study have not yet considered whether the DR programs are cost-effective for the City. In order to evaluate cost-effectiveness, the City's wholesale power supply costs with and without DR programs are estimated and compared with the cost of the programs. For the wholesale power supply cost estimate, a TRM model was developed using monthly forecast of peak demand and energy for the City. The cost-effectiveness analysis assumes that all residential DR potential is achieved by 2018, a time when rates and resources are well-known. Monthly peak demand for November through February is reduced by 1.8 MW and summer peak demand for July through September is reduced by 1.2 aMW. The resulting wholesale power supply costs are provided in Table 13 below.

Table 13
Demand Response Program Impact on Wholesale Power Supply Costs
CY 2018

	No DR Programs	DR Programs	Difference
Breakdown of Power Supply Costs			
BPA Customer Charges	$7,596,633	$7,596,633	$0
Demand - BPA Contracts	$598,759	$487,592	$111,168
Load Shaping, HLH	($332,706)	($332,706)	$0
Load Shaping, LLH	$8,653	$8,653	$0
Tier 2 Purchase (Energy)	$808,321	$808,321	$0
Customer Refund	($307,300)	($307,300)	$0
Break-down of Transmission/Ancillary Costs			
Energy	$153,521	$153,521	$0
Demand	$0	$0	$0
Coincident Transmission Peak-Demand	$845,742	$822,837	$22,904
Total Wholesale Power Supply Costs	**$9,371,622**	**$9,237,551**	**$134,072**

It is estimated that DR program potential may reduce the City's demand and transmission bills by approximately $134,000 per year when full potential is realized (assuming 2018 rates). The analysis above assumed that peak demand would be reduced for 3 summer months and 4 winter months. The 20-year levelized program costs are estimated $56,000 resulting in benefit/cost ratio of 2.4. If the City is only able to reduce peak demand for one winter month and one summer month, the power bill savings total $92,000 per year. In this scenario, the benefit/cost ratio for the program is 1.6.

Summary

This assessment evaluated residential demand response program potential for the City of Ellensburg's service area for the period 2017 to 2036. The residential DR programs evaluated for this analysis are based on DR programs evaluated for the Seventh Power Plan. This assessment estimates that approximately 1,830 kW of winter load shedding and 1,230 kW of summer load shedding may be available from residential DR programs over the 20-year planning period. This potential represents 4.1 percent of the City's estimated winter peak demand and 3.1 percent of summer peak demand and is cost-effective based on the avoided cost of power supply.