CONSERVATION POTENTIAL ASSESSMENT

Report Number 1452

Executive Summary

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Public Utility District #1 of Cowlitz County, Washington

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EXECUTIVE SUMMARY

Public Utility District No. 1 of Cowlitz County, WA (Cowlitz) engaged EnerNOC (formerly Global Energy Partners) to conduct a Conservation Potential Assessment (CPA) study in accordance with Washington Initiative 937 (I-937). The study used 2012 as the base year and then developed potential estimates for the period 2013-2023. This study represents an update to the second CPA conducted by Global Energy Partners for Cowlitz in 2011.

Study Objectives

The key study objectives included:

- Conduct a conservation potential study for electricity for Cowlitz's service territory. The study accounts for:
    1. Impacts of existing Cowlitz DSM programs
    2. Cowlitz's load forecasts
    3. Impacts of codes and standards
    4. Technology developments and innovation
    5. The economy and energy prices
- Assess and analyze cost-effective conservation potential in accordance with the Northwest Power and Conservation Council's (The Council) Sixth Power Plan and Washington I-937 requirements.
- Analyze various market penetration rates associated with technical, economic, and achievable potential estimates.
- Provide Cowlitz's planners with insight into energy use trends and conservation potential to support design and implementation of energy conservation programs in the coming years.

Definitions

In this study, we estimate three types of potential for conservation savings: technical potential, economic potential, and achievable potential. Technical and economic potential are both theoretical limits of conservation savings. Achievable potential embodies a set of assumptions about the decisions consumers make regarding the efficiency of the equipment they purchase, the maintenance activities they undertake, the controls they use for energy-consuming equipment, and the elements of building construction.

- **Technical potential** is a theoretical construct that assumes all feasible measures are adopted by customers, regardless of cost or customer preferences. At the time of equipment failure, customers replace their equipment with the most efficient option commercially available. In new construction, customers and developers also choose the most efficient equipment option. Example of measures that make up the technical potential in the residential sector include:
    - Ductless mini-split air conditions with variable refrigerant flow
    - Ground source (or geothermal heat pumps)
    - LED lighting for screw-in lighting

    Technical potential also assumes the adoption of every available measure, where applicable. For example, it includes installation of high-efficiency windows in all new construction

opportunities and air conditioner maintenance in all existing buildings with central and room air conditioning. The retrofit measures are phased in over a number of years, which is longer for higher-cost measures.

- **Economic potential** is also a theoretical construct that assumes all ***cost-effective*** conservation measures are adopted by customers, regardless of customer preferences. This is a subset of technical potential. In this analysis, the total resource cost (TRC) test, which compares lifetime energy and capacity benefits to the incremental cost of the measure, is applied. Economic potential assumes that all customers purchase the most cost-effective option at the time of equipment failure and also adopt every other cost-effective and applicable non-equipment measure.
- **Achievable Potential** takes into account expected program participation. Participation is based on "ramp rates" developed by the Council, adjusted selectively to reflect Cowlitz's past program experience.

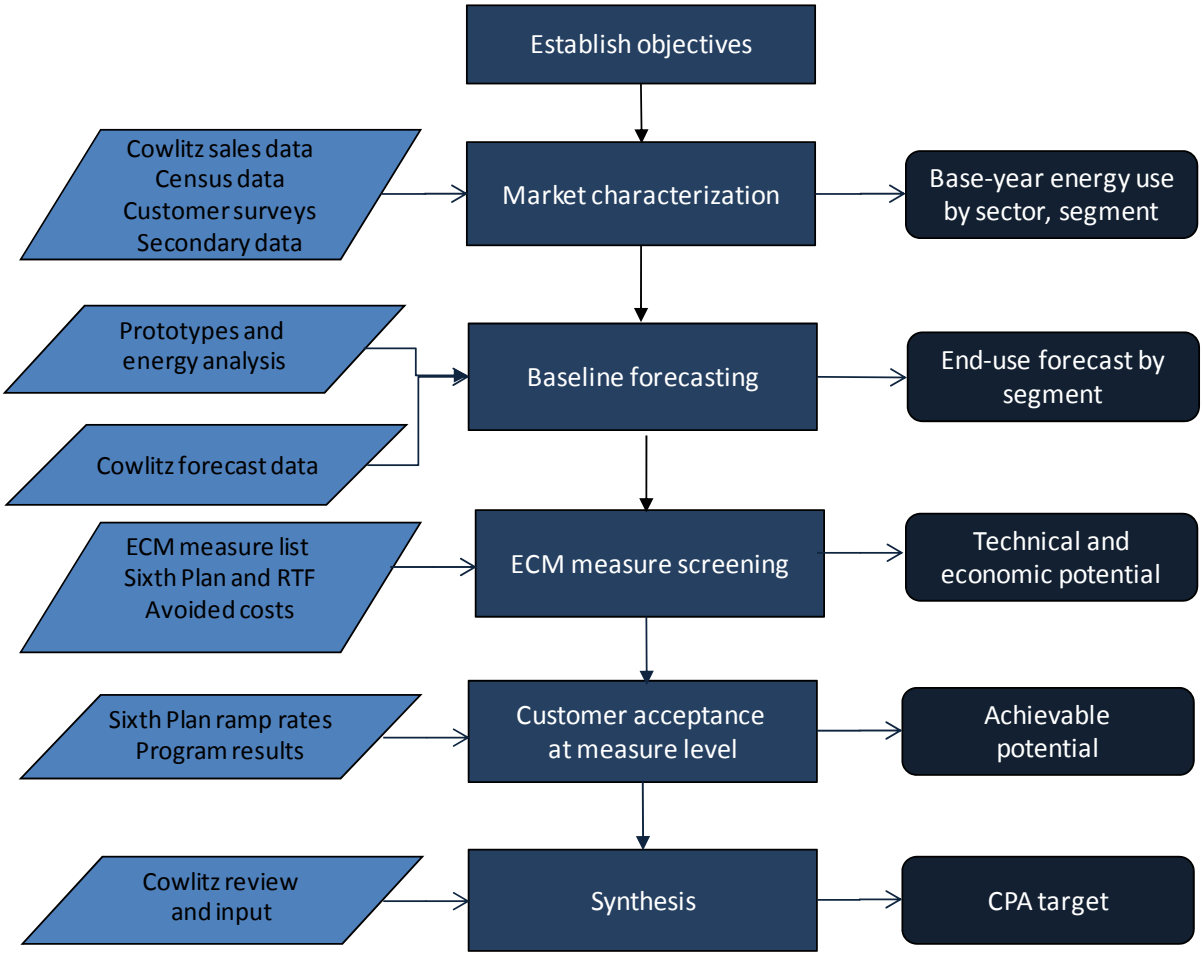
Study Approach

To execute this project, EnerNOC took the following steps, which are also shown in Figure ES-1.

1. Perform a market characterization to describe sector-level electricity use for the residential and commercial sectors for the base year (2012). This included using utility data and secondary data from sources such as the Northwest Energy Efficiency Alliance (NEEA) and the Energy Information Administration (EIA).
2. Utilize primary market research to understand how Cowlitz's customers currently use electricity. For the residential sector, NEAA recently completed a 2011 Residential Building Stock Assessment (RBSA) that oversampled the Cowlitz service territory. For the commercial sector, the NEEA 2009 Commercial Building Stock Assessment was used, along with other secondary research. Combining this information with the market characterization, we developed energy market profiles that describe energy use by segment and end use for the base year, 2012.
3. Develop a baseline electricity forecast by sector, segment, and end use for 2013 through 2023.
4. Identify and analyze energy-efficiency measures appropriate for Cowlitz.
5. Estimate three levels of energy-efficiency potential for the residential and commercial sectors, Technical, Economic, and Achievable.

Because the industrial sector is dominated by a few, very large customers, a different approach was used. In the previous CPA, we conducted onsite interviews with the major customers to identify appropriate measures to conserve energy and take into account actions recently taken. This process identified specific conservation steps that the customer could potentially adopt over the next 10 years. The Cowlitz team then updated the list to indicate the projects already completed, as well as identified new potential opportunities. The Council's ramp rates were then applied to the technical potential to develop achievable potential.

Figure ES-1 Overview of Analysis Approach for the Residential and Commercial Sectors



Market Characterization and Baseline Forecast

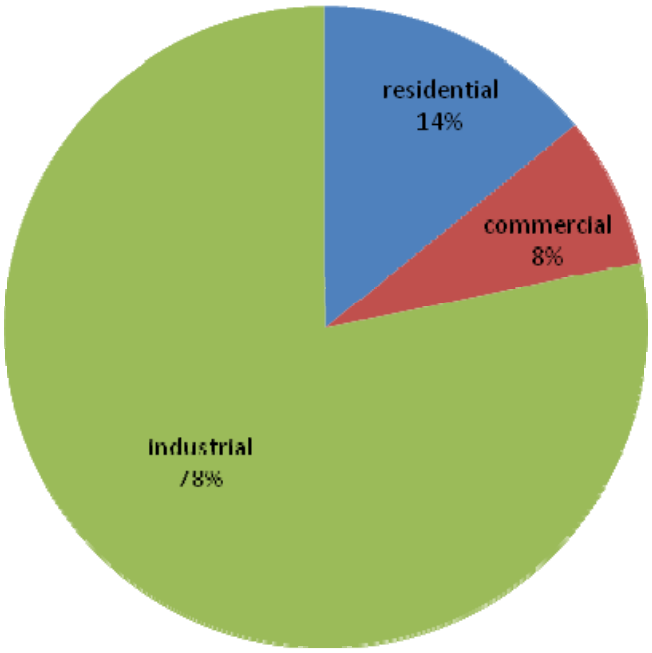
Cowlitz PUD provides electric service to approximately 48,000 accounts in Cowlitz County. Situated in southwestern Washington, Cowlitz serves suburban and rural areas, with its largest population centers in Kelso and Longview.

As a customer of the Bonneville Power Administration (BPA) and as a utility operating in the State of Washington, Cowlitz has a long history of energy conservation activities. Past experience has ranged from customer education to household audits and rebates for a variety of energy efficient equipment to custom projects with the large industrial customers.

While there are several important factors that differentiate Cowlitz from many load-serving entities in the Pacific Northwest, one of the most important features is its customer mix. Almost 80% of Cowlitz's electric sales are supplied to industrial accounts even though the residential sector accounts for approximately 90% of the member accounts.

Total electricity use for the residential, commercial, and industrial sectors in 2012 was 5,122,599 MWh or 585 aMW. As shown in Figure ES-2, the largest sector is industrial, accounting for 4,011,219 MWh. The remaining use is split between residential (14%) and commercial sectors (8%).

Figure ES-2 Sector-Level Electricity Use, MWh, 2012



Residential Sector

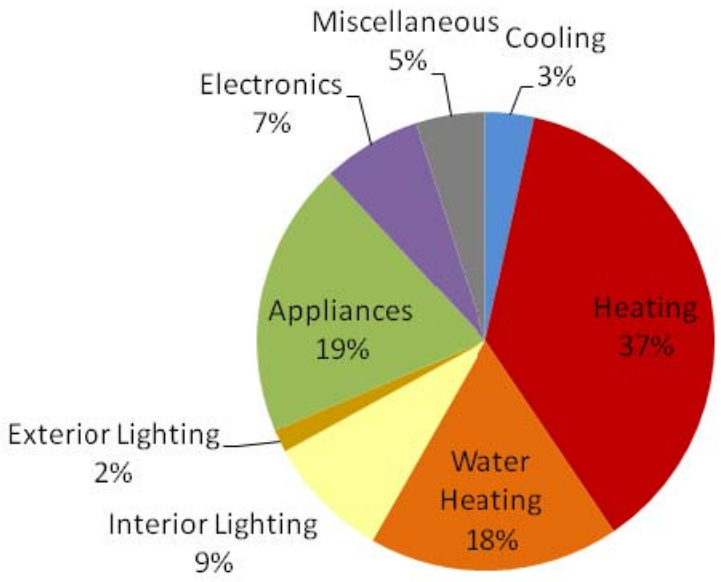
Total residential electricity use in 2012 was 726,620 MWh. This sector was divided into three main segments based on housing type. Information for each customer segment is shown in Table ES-1. The single-family segment used over three-quarters of the total residential sector electricity in 2012. It has the largest number of customers and the highest intensity (average use per customer).

Table ES-1 Residential Sector Electricity Usage and Intensity by Segment Type

Segment	Number of Customers	2012 Electricity Use (MWh)	Avg. Use/Customer (kWh/year)
Single Family	31,677	602,233	19,011
Multifamily	5,443	50,383	9,256
Mobile Home	4,729	74,005	15,648
Total	**41,850**	**726,620**	**17,363**

Figure ES-3 presents the end-use breakout for the residential sector as a whole. Space heating accounts for over one-third of the usage, followed by appliances and water heating. The miscellaneous end use includes such devices as furnace fans and other plug loads (hair dryers, power tools, coffee makers, etc.). The electronics end use, which includes personal computers, TVs, home audio, etc., also contributes significantly to household electricity usage. Additional electricity consumption is allocated among cooling and lighting.

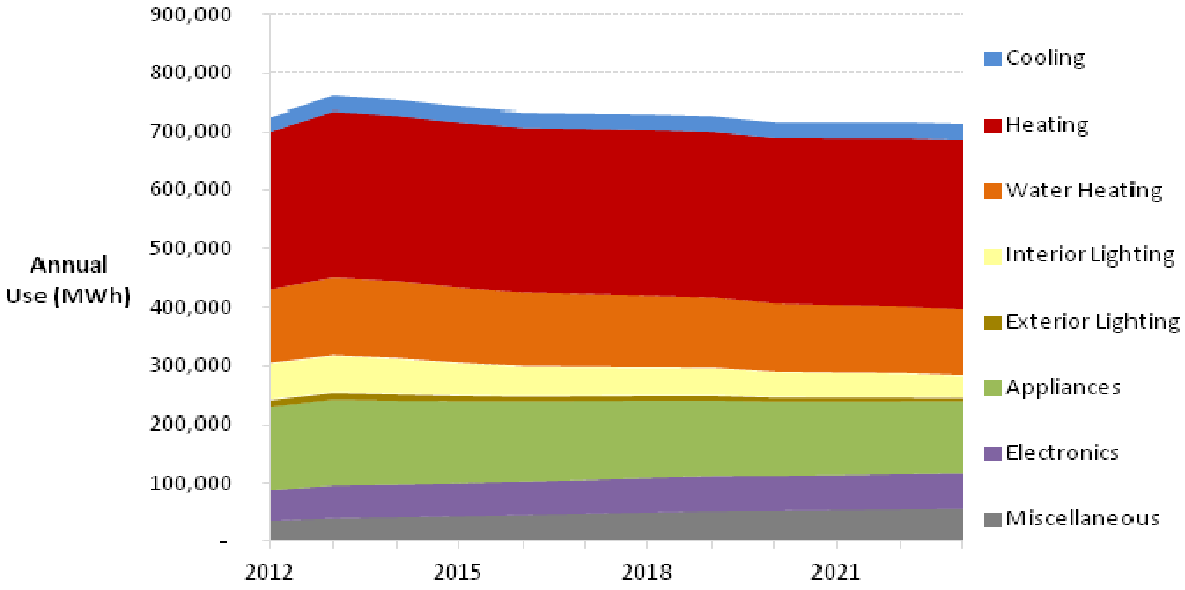
Figure ES-3 Residential Electricity Use by End Use per Household, 2012



The residential baseline forecast incorporates the effects of future customer growth, trends in appliance ownership, building codes, federal appliance standards, and customer response to changes in electricity prices and household income. Overall, use decreases slightly, from 726,620 MWh in 2012 to 715,643 MWh in 2023, a 1.5% decrease.

Figure ES-4 presents the forecast of use per household. Most noticeable is that lighting use decreases significantly after 2012, as the lighting standard from the Energy Independence and Security Act of 2007 (EISA) comes into effect and shifts use to higher efficiency EISA compliant lamps. Appliance use also decreases over the forecast period due to appliance standards. Use in electronics increases over the forecast period, reflecting the increase in saturation of electronic devices in the home.

Figure ES-4 Residential Baseline Forecast by End Use, 2012



Commercial Sector

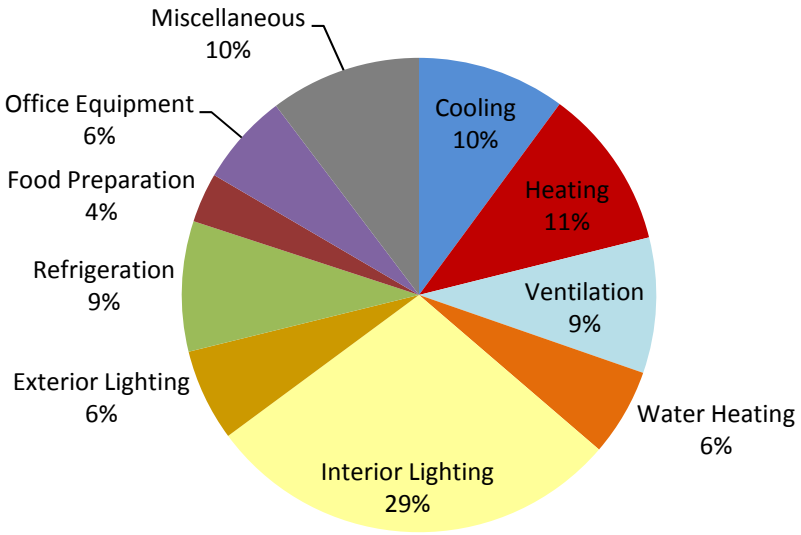
Total electricity use in the commercial sector in 2012 was 384,763 MWh. Using statewide survey data and secondary sources; total commercial floor space is estimated at 23.9 million square feet, implying an average intensity of 16.1 kWh per square foot per year. Information for each customer segment is shown in Table ES-2. The largest segment is warehouses, with almost 8 million square feet, and the largest electricity usage of more than 69,000 MWh. As expected, restaurants and groceries have the highest intensity due to the large amount of cooking and refrigeration. Warehouses, schools, colleges, and the miscellaneous segment have the lowest intensities.

Table ES-2 Commercial Sector Electricity Usage and Intensity by Segment, 2012

Segment	Floor Space (million sq ft)	2012 Electricity Use (GWh)	Avg. Use/sq ft (kWh)
Small Office	1,068	19,612	18.4
Large Office	1,023	22,604	22.1
Restaurant	491	22,851	46.6
Retail	3,455	63,880	18.5
Grocery	690	35,989	52.2
College	62	922	14.8
School	3,235	33,810	10.5
Health	839	25,783	30.7
Lodging	737	14,058	19.1
Warehouse	7,863	69,185	8.8
Miscellaneous	4,476	76,069	17.0
Total	**23,939**	**384,763**	**16.1**

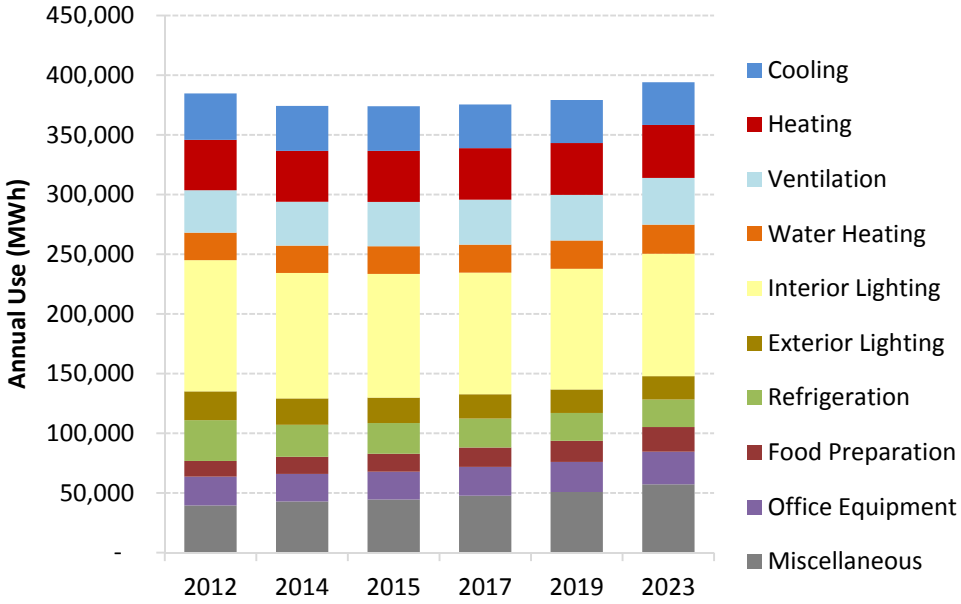
Figure ES-5 shows the breakdown of annual electricity usage by end use. Lighting is the largest single end use in the commercial sector, accounting for more than one-third of total usage. Heating is second, followed by refrigeration, ventilation, cooling, and miscellaneous. Each of the other end uses accounts for less than 8% of total usage.

Figure ES-5 Commercial Electricity Consumption by End Use, 2012



The commercial baseline forecast incorporates the effects of future customer growth, trends in appliance saturation, building codes, federal appliance standards, and customer response to changes in electricity prices. Overall use increases slightly, from 384,763 MWh in 2012, to 394,122 MWh in 2023, a 2% increase. Figure ES-6 presents the baseline forecast at the end-use level for the commercial sector as a whole. Most end uses show modest growth over the forecast period. The exceptions are lighting, which declines due to EISA 2007 lighting standards and refrigeration, which is affected by the EPACT 2005 standards.

Figure ES-6 Commercial Baseline Electricity Forecast by End Use



Overall Conservation Potential

Table ES-3 presents the estimates of achievable potential for all sectors — residential, commercial and industrial. The savings for the residential and commercial sectors are derived from a "bottom-up" analysis approach using EnerNOC's Load Management Analysis and Planning (LoadMAP™) tool. The savings for the industrial sector are based on interviews with Cowlitz staff and the energy managers at the large industrial customers. Based on the ten-year achievable potential of 285,749 MWh, Cowlitz is establishing a biennium target for I-937 of 57,150 MWh or 6.5 aMW.

Table ES-3 Summary of Cowlitz Conservation Potential

	2014	2015	2017	2019	2023
Forecasts (MWh)					
Baseline Forecast	5,158,059	5,208,987	5,308,918	5,346,380	5,323,746
Savings (MWh)					
Achievable Potential	25,903	53,422	107,327	161,759	285,749
Technical Potential	69,241	134,023	245,561	338,867	531,145
Savings (aMW)					
Achievable Potential	3	6	12	18	33
Technical Potential	8	15	28	39	61
Savings (% of Baseline)					
Achievable Potential	0.5%	1.0%	2.0%	3.0%	5.4%
Technical Potential	1.3%	2.6%	4.6%	6.3%	10.0%
Biennium Pro-rata Target Energy (MWh)					**57,150**
Biennium Pro-rata Target (aMW)					**6.5**

Residential Sector Potential

Table ES-4presents estimates for the three types of potential. Figure ES-7 depicts the potential energy savings estimates graphically.

- **Achievable potential** projects 3,275 MWh of energy savings in 2014, 0.4% of the baseline forecast. This increases to 44,511 MWh, 6.2% of the baseline forecast, in 2023. In terms of aMW, projected energy savings are 0.4 aMW in 2014, rising to 5.1 aMW in 2023.
- **Economic potential,** which reflects the savings when all cost-effective measures are taken, is 22,032 MWh in 2014. This represents 2.9% of the baseline energy forecast. By 2023, economic potential reaches 107,149 MWh, 15.0% of the baseline energy forecast. In terms of aMW, projected savings are 2.5 aMW in 2014 with the cumulative savings reaching 12.2 aMW in 2023.
- **Technical potential,** which reflects the adoption of all conservation measures regardless of the cost, is a theoretical upper bound on savings. In 2014, energy savings are 29,103 MWh, or 3.9% of the baseline energy forecast. By 2023, technical potential reaches 143,257 MWh, 20.0% of the baseline energy forecast. In terms of aMW, technical potential is 3.3 aMW in 2014, increasing to 16.4 aMW in 2023.

Table ES-4 Conservation Potential for the Residential Sector

	2014	2015	2017	2019	2023
Baseline Projection(MWh)	754,940	743,571	733,114	728,614	715,643
Cumulative Savings (MWh)					
Achievable Potential	3,275	8,038	16,633	26,188	44,511
Economic Potential	22,032	45,156	74,777	90,494	107,149
Technical Potential	29,103	56,086	93,452	115,683	143,257
Cumulative Savings (aMW)					
Achievable Potential	0.4	0.9	1.9	3.0	5.1
Economic Potential	2.5	5.2	8.5	10.3	12.2
Technical Potential	3.3	6.4	10.7	13.2	16.4
Energy Savings (% of Baseline)					
Achievable Potential	0.4%	1.1%	2.3%	3.6%	6.2%
Economic Potential	2.9%	6.1%	10.2%	12.4%	15.0%
Technical Potential	3.9%	7.5%	12.7%	15.9%	20.0%

Figure ES-7 Residential Conservation Potential Savings

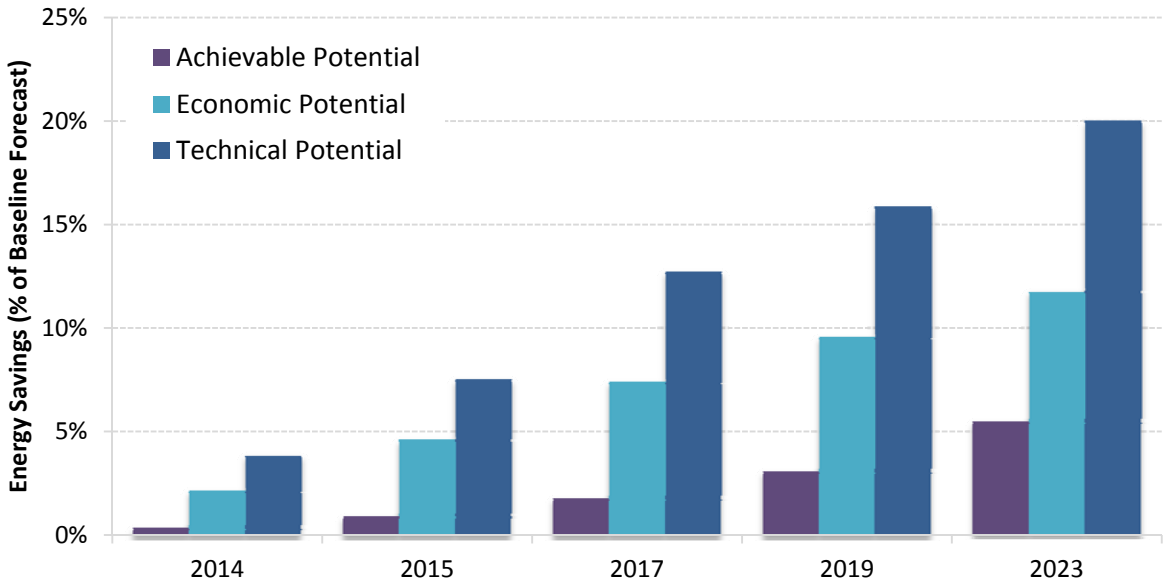


Figure ES-8 shows the forecasts under the three types of potential along with the baseline forecast.

Figure ES-8 Residential Conservation Potential Forecast

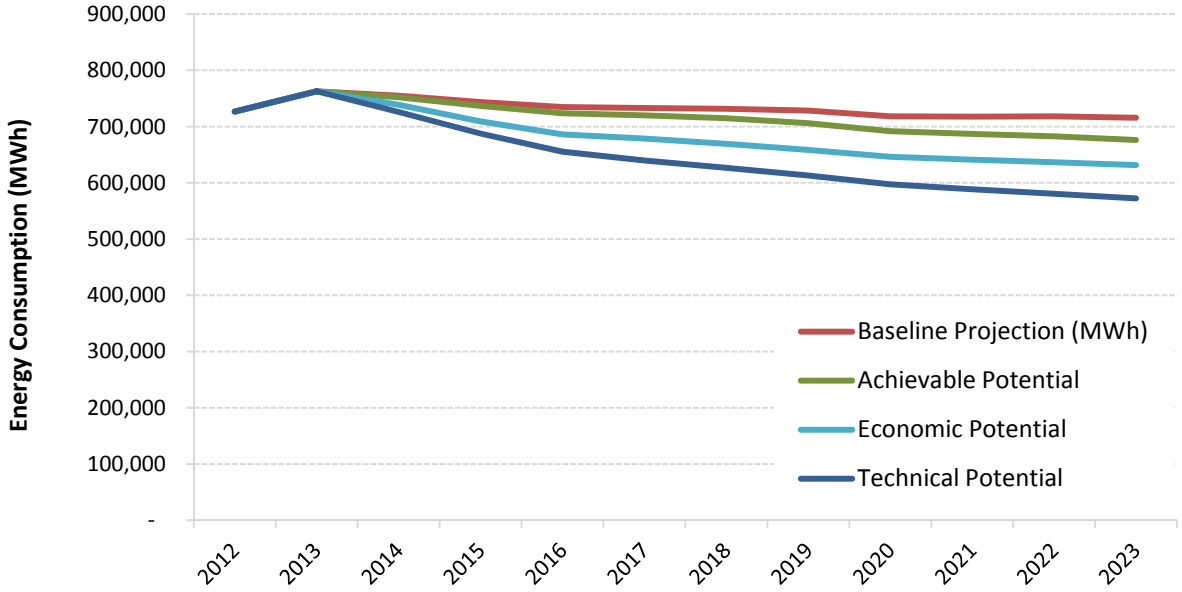


Table ES-5 focuses on the achievable potential by top measures in 2023.

- Ductless heat pumps contribute the largest amount of potential savings, with 27% of the total residential savings.
- Electronics also contribute significantly to the savings by moving to purchases of ENERGY STAR equipment. These savings are captured by the work from NEAA.
- Lighting continues to provide savings through the upgrade from infrared halogen lamps, which become the new baseline in 2014, to CFLs or LED lamps.
- Water heating also accounts for large savings due to purchases of higher efficiency water heaters (heat pumps) and the installation of low-flow showerheads.
- Additional space heating savings come from improvements in shell measures such as duct repair and sealing and wall insulation.

Table ES-5 Residential Achievable Potential by Measure in 2023 (aMW)

Measure	Savings (aMW)	% of Total
Heating Electric Zonal Room Heat (Ductless HP)	1.39	27%
Electronics (NEAA)	1.01	20%
Interior Lighting Screw-in (LED)	1.01	20%
Interior Lighting Specialty (LED)	0.45	9%
Water Heating Water Heater <= 55 gal (HP)	0.31	6%
Exterior Lighting Screw-in (LED)	0.25	5%
Thermostat - Clock/Programmable	0.16	3%
Ducting - Repair and Sealing	0.09	2%
Water Heater - Low-Flow Showerheads	0.08	2%
Appliances Freezer	0.07	1%
Insulation - Ceiling	0.06	1%
Insulation - Infiltration Control	0.06	1%
Water Heater - Faucet Aerators	0.03	0.7%
Appliances Clothes Washer	0.03	0.6%
Refrigerator - Decommissioning and Recycling	0.03	0.5%
ENERGY STAR Home Design	0.02	0.4%
Total	**5.05**	**99.7%**

Commercial Sector Potential

The baseline forecast for the commercial sector remains relatively flat through the forecast period, which reflects the sluggish economy, building codes, and relatively efficient energy-use patterns. Nevertheless, the opportunity for energy-efficiency savings is still significant for the commercial sector.

- **Achievable potential** projects 2,859 MWh of energy savings in 2014 and 43,545 MWh in 2023. This corresponds to 0.8% of the baseline forecast in 2014 and 11% in 2023. In terms of aMW, projected energy savings are 0.3 aMW in 2014, rising to 5.0 aMW in 2023.
- **Economic potential**, which reflects the savings when all cost-effective measures are taken, is 7,659 MWh in 2014. This represents 2.0% of the baseline energy forecast. By 2023, economic potential reaches 61,822 MWh, 15.7% of the baseline energy forecast. In terms of aMW, projected energy savings are 0.9 aMW in 2014, and increasing to 7.1 aMW in 2023.
- **Technical potential,** which reflects the adoption of all conservation measures regardless of cost, is a theoretical upper bound on savings. In 2014, energy savings are 9,248 MWh, or 2.5% of the baseline energy forecast. By 2023, technical potential reaches 78,993 MWh, 20.0% of the baseline energy forecast. In terms of aMW, projected energy savings are 1.1 aMW in 2014, rising to 9.0 aMW in 2023.

Table ES-6 Conservation Potential for the Commercial Sector

	2014	2015	2017	2019	2023
Baseline Forecast (MWh)	374,326	374,018	375,486	379,288	394,122
Cumulative Savings (MWh)					
Achievable Potential	2,859	5,846	11,617	16,956	43,545
Economic Potential	7,659	13,316	22,859	30,052	61,822
Technical Potential	9,248	16,157	28,551	37,847	78,993
Cumulative Savings (aMW)					
Achievable Potential	0.3	0.7	1.3	1.9	5.0
Economic Potential	0.9	1.5	2.6	3.4	7.1
Technical Potential	1.1	1.8	3.3	4.3	9.0
Savings (% of Baseline)					
Achievable Potential	0.8%	1.6%	3.1%	4.5%	11.0%
Economic Potential	2.0%	3.6%	6.1%	7.9%	15.7%
Technical Potential	2.5%	4.3%	7.6%	10.0%	20.0%

Figure ES-9 Commercial Conservation Potential Savings

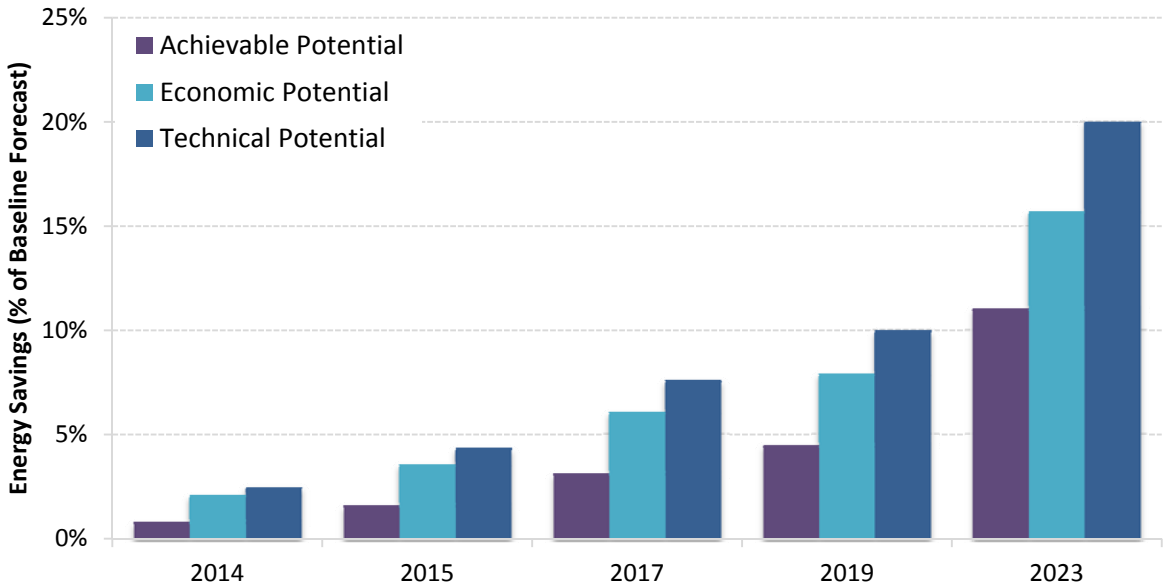


Figure ES-10 shows the forecasts under the three types of potential along with the baseline forecast.

Figure ES-5 focuses on the achievable potential by top measures in 2023. Not surprisingly, lighting delivers the highest achievable savings. Water heating savings come from the installation of heat pump water heaters.

Figure ES-10 Commercial Conservation Potential Forecast

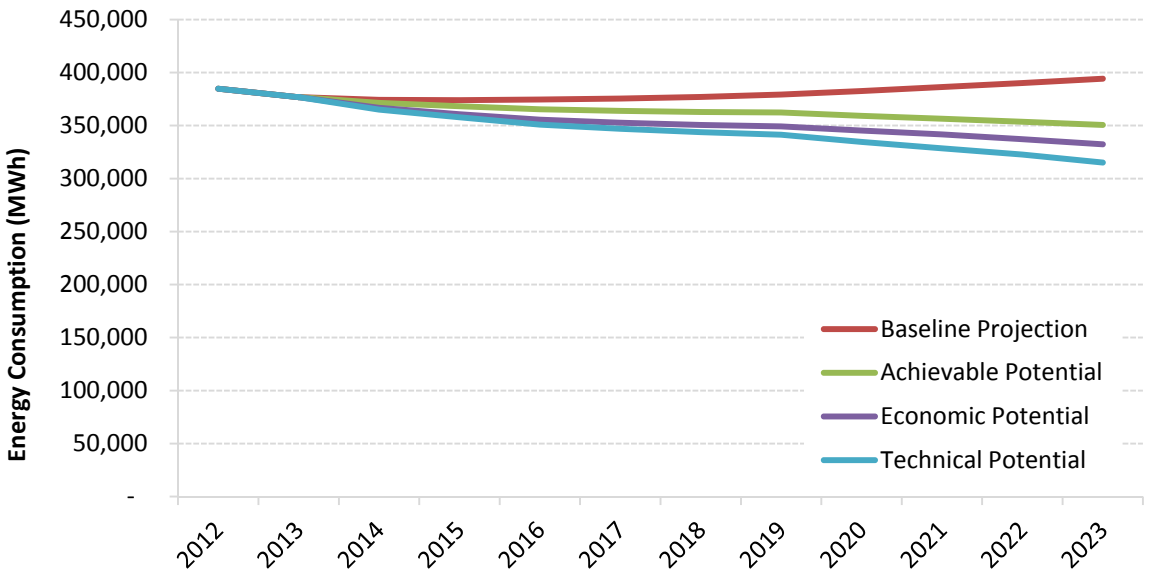


Table ES-7 Commercial Achievable Potential Savings by End Use in 2023 (aMW)

Measure	Savings (aMW)	% of Total
Interior Lighting Linear Fluorescent (LED/ Super T8)	1.29	26%
Ventilation – Variable Air Volume	0.79	16%
Interior Lighting Screw-in (LED)	0.66	13%
Interior Lighting - Occupancy Sensors	0.36	7%
Interior Lighting High-Bay Fixtures (T5/LED)	0.31	6%
Water Heating Equipment (HPWH)	0.30	6%
Exterior Lighting HID (LED)	0.28	6%
Exterior Lighting Screw-in (LED)	0.16	3%
Thermostat - Clock/Programmable	0.11	2%
Interior Lighting - Daylighting Controls	0.09	2%
Exterior Lighting Linear Fluorescent (LED/ Super T8)	0.09	2%
Office Equipment (NEAA)	0.09	2%
Food Preparation Dishwasher	0.07	1%
Refrigeration Walk-in Refrigerator	0.05	1%
Ventilation - Variable Speed Control	0.04	0.8%
Heating Electric Zonal Heat (Ductless Minisplit)	0.03	0.6%
Retrocommissioning	0.02	0.5%
Cooling Rooftop Heat Pump	0.02	0.4%
Exterior Lighting - Daylighting Controls	0.02	0.4%
Total	**4.76**	**95.7%**

Industrial Sector Potential

The industrial sector includes only 27 customers, but accounts for 78% of the electric sales. Within the industrial sector, there are four very large consumers, three of which are pulp and paper mills. Because the four large users have such a large impact, as part of the previous CPA Global Energy Partners (now EnerNOC) conducted onsite interviews with representatives from each of the customers to discuss how the facility uses energy, conservation achievements, any changes on the horizon for the customer, and any plans for conservation in the future. The result was a list of several measures that are technically feasible. For this CPA, the Cowlitz team updated the project list to reflect projects that have been completed or are planned, as well as additional opportunities. These are all considered part of technical potential. In order to estimate Achievable potential, the Council's ramp rates were applied to technical savings. In this case, economic potential was not estimated in the same manner as the other sectors (by applying the TRC test). Instead, only those measures that are approved by the customer and assumed to be cost-effective are included in the analysis.

- **Achievable potential** projects 197,693 MWh, 4.7% of the baseline forecast, in 2023. In terms of aMW, projected energy savings are 22.6 aMW in 2023.
- **Technical potential,** which reflects the adoption of all conservation measures regardless of the cost, is a theoretical upper bound on savings. In 2023, technical potential reaches 308,895 MWh, 7.3% of the baseline energy forecast. In terms of aMW, technical potential is 35.3 aMW in 2023.

Table ES-8 Conservation Potential for the Industrial Sector

	2012	2014	2015	2017	2019	2023
Forecasts (MWh)						
Baseline Forecast	4,011,219	4,028,793	4,091,398	4,200,318	4,238,478	4,213,981
Savings (MWh)						
Achievable Potential		19,769	39,539	79,077	118,616	197,693
Technical Potential		30,889	61,779	123,558	185,337	308,895
Savings (aMW)						
Achievable Potential		2	5	9	14	22.6
Technical Potential		4	7	14	21	35.3
Savings (% of Baseline)						
Achievable Potential		0.5%	1.0%	1.9%	2.8%	4.7%
Technical Potential		0.8%	1.5%	2.9%	4.4%	7.3%

Figure ES-11 Industrial Conservation Potential Savings

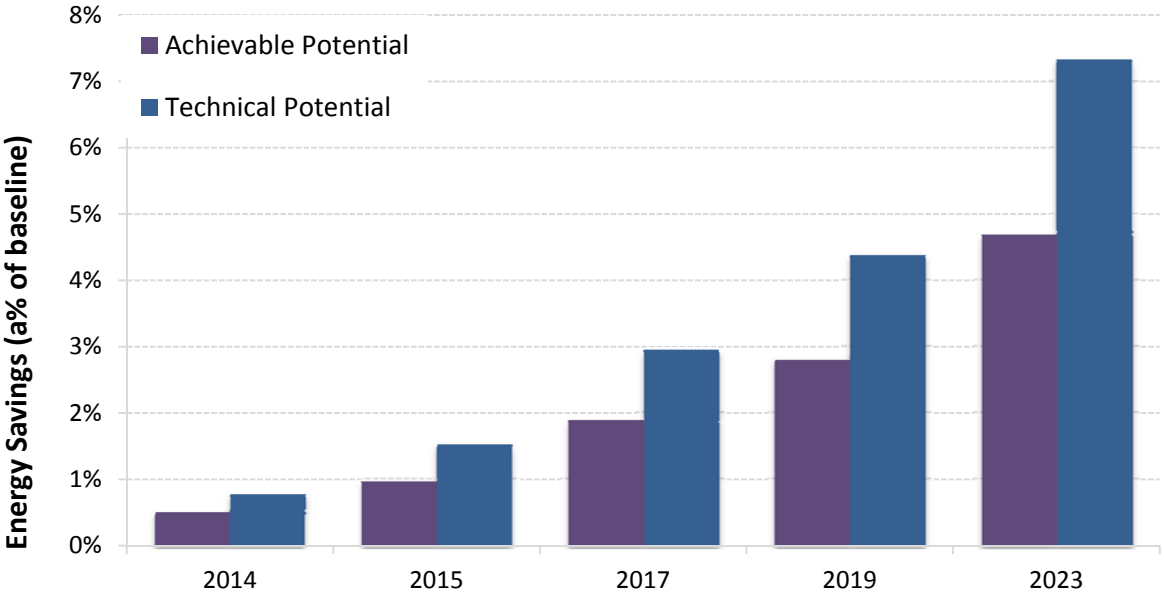
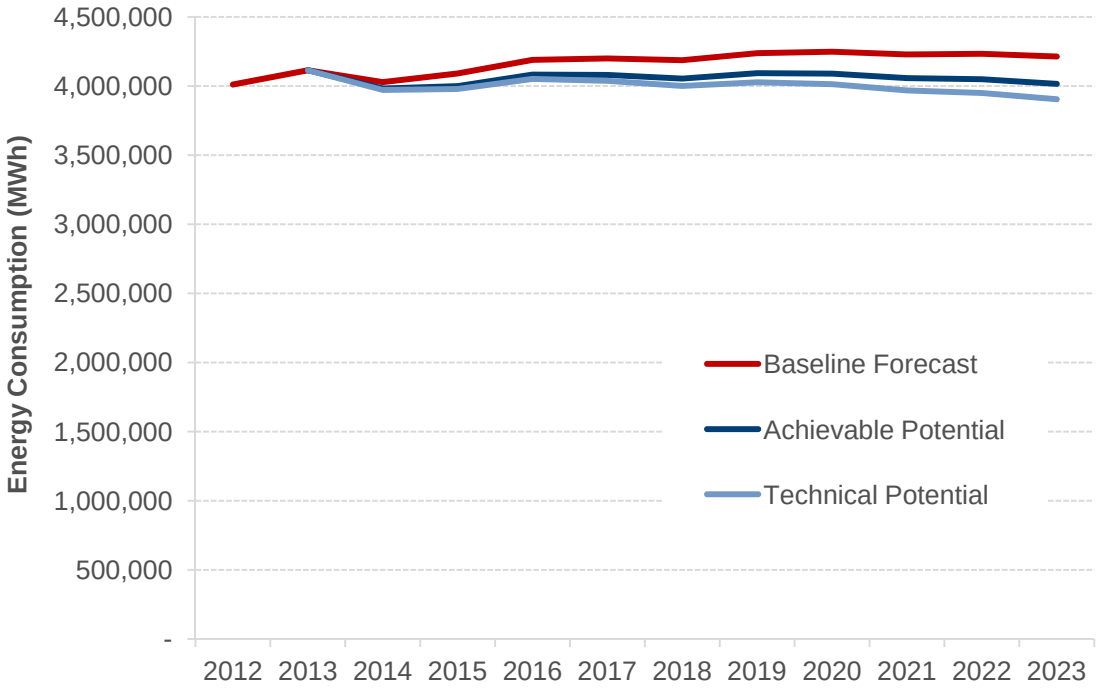


Figure ES-12 shows the forecasts under the two types of potential along with the baseline forecast.

Figure ES-12 Industrial Conservation Potential Forecast



About EnerNOC

EnerNOC's Utility Solutions Consulting team is part of EnerNOC's Utility Solutions, which provides a comprehensive suite of demand-side management (DSM) services to utilities and grid operators worldwide. Hundreds of utilities have leveraged our technology, our people, and our proven processes to make their energy efficiency (EE) and demand response (DR) initiatives a success. Utilities trust EnerNOC to work with them at every stage of the DSM program lifecycle – assessing market potential, designing effective programs, implementing those programs, and measuring program results.

EnerNOC's Utility Solutions deliver value to our utility clients through two separate practice areas – Implementation and Consulting.

- Our Implementation team leverages EnerNOC's deep "behind-the-meter expertise" and world-class technology platform to help utilities create and manage DR and EE programs that deliver reliable and cost-effective energy savings. We focus exclusively on the commercial and industrial (C&I) customer segments, with a track record of successful partnerships that spans more than a decade. Through a focus on high quality, measurable savings, EnerNOC has successfully delivered hundreds of thousands of MWh of energy efficiency for our utility clients, and we have thousands of MW of demand response capacity under management.
- The Consulting team provides expertise and analysis to support a broad range of utility DSM activities, including: potential assessments; end-use forecasts; integrated resource planning; EE, DR, and smart grid pilot and program design and administration; load research; technology assessments and demonstrations; evaluation, measurement and verification; and regulatory support.

The team has decades of combined experience in the utility DSM industry. The staff is comprised of professional electrical, mechanical, chemical, civil, industrial, and environmental engineers as well as economists, business planners, project managers, market researchers, load research professionals, and statisticians. Utilities view EnerNOC's experts as trusted advisors, and we work together collaboratively to make any DSM initiative a success.

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