Lewis County Public Utility District

Lewis County Public Utility District
Conservation Potential Assessment
Final Report

November 16, 2011

Draft

Prepared by:

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EES Consulting

November 16, 2011

Mr. Dave Muller
Lewis County PUD
321 NW Pacific Ave
P.O. Box 330
Chehalis, WA 98532

SUBJECT: 2011 Conservation Potential Assessment – Final Report

Dear Dave:

The Final Report summarizing the 2011 Lewis County Public Utility District Conservation Potential Assessment is attached. This CPA was developed using methodologies consistent with the Fifth Power Plan as required by I-937 Utility Analysis Option, so the results of this analysis could be used for advising or setting I-937 targets.

Very truly yours,

Kevin Smit
Manager, Demand-Side Management

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Executive Summary

This report describes the methodology and results of the Lewis County Public Utility District (Lewis PUD) 2011 Conservation Potential Assessment (CPA). This assessment provides estimates of energy and peak demand savings by sector for the period 2012-2031. The assessment considered a wide range of conservation resources that are reliable, available and cost-effective within the 20 year planning period.

Due to the number of customers served, Washington's Energy Independence Act (often referred to as Initiative 937 (I-937)), effective January 1, 2010, requires that Lewis PUD pursue all cost-effective conservation resources. This is accomplished by setting and then meeting biennial conservation targets. These targets can be set in one of three ways: 1) use the Council's Target Calculator, 2) a modified Target Calculator, or 3) a utility-specific conservation potential assessment.

This report describes the results of an Option 3 – Utility Specific Conservation Potential Assessment. The legislation requires that utilities follow the methodologies used by the Northwest Power and Conservation Council ("Council") for their regional power planning. This CPA is consistent with the Council's methodology, so results of this CPA may be used to advise Lewis PUD on reasonable conservation targets for I-937 compliance. Also, the resulting conservation supply curves can be used as part of the demand-side resources in Lewis PUD's integrated resource plan (IRP).

Developing targets involved analyzing approximately 1,500 energy efficiency measures by applying Lewis' service territory information, such as the number of electrically-heated homes and the saturation from previous conservation programs. The savings from these measures are added together to produce the total conservation potential estimates specifically for Lewis PUD.

Table ES-1 shows the high-level results of this assessment. The economically achievable potential by sector in 2, 5, 10 and 20 year increments is included. The total 20-year energy efficiency potential is just under 20 aMW.

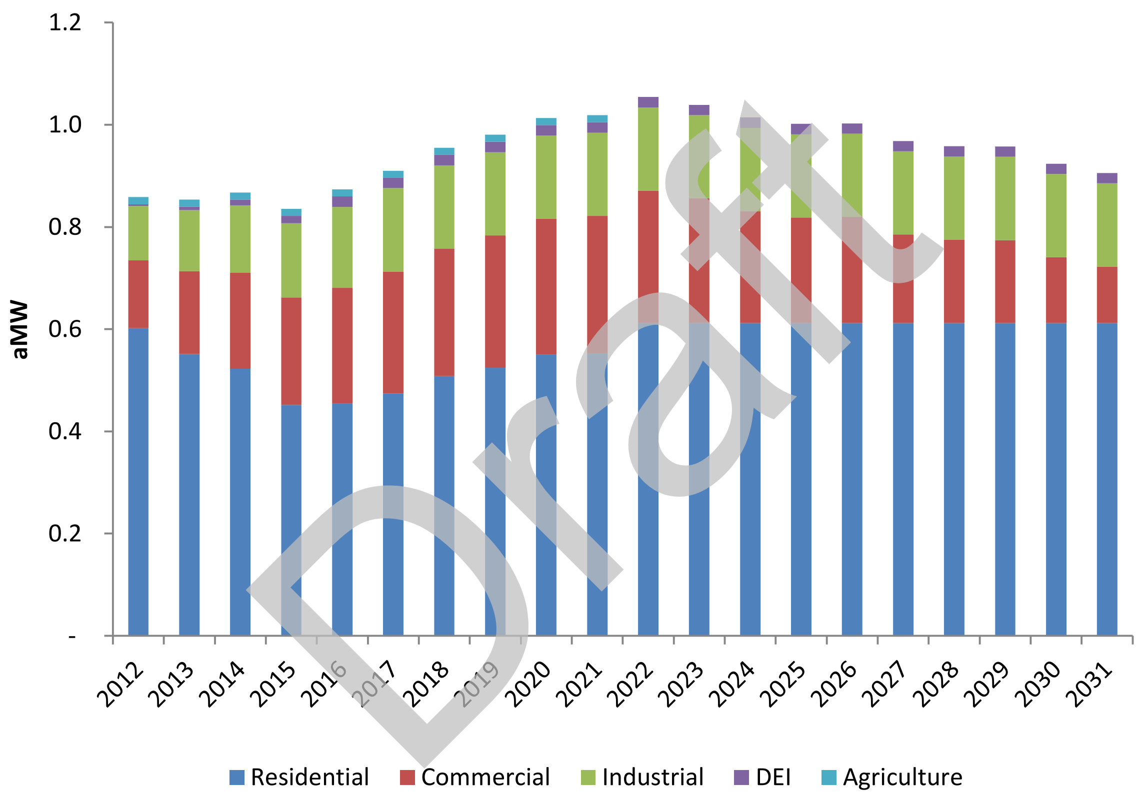
Table ES-1 – Cost-Effective Achievable - aMW

	2 Year	5 Year	10 Year	20 Year
Residential	1.15	2.58	5.19	11.31
Commercial	0.30	0.92	2.20	4.08
Industrial	0.25	0.75	1.73	3.67
Distribution Efficiency	0.01	0.06	0.16	0.36
Agriculture	0.03	0.07	0.14	0.14
TOTAL	**1.74**	**4.38**	**9.42**	**19.56**

These estimates include energy efficiency achieved through Lewis PUD's own utility programs, and also through Lewis PUD's share of the Northwest Energy Efficiency Alliance (NEEA)[1] accomplishments (which is estimated at 10% Lewis PUD's annual potential). In the later years of this plan (e.g., beyond 5 years), a significant portion of the potential could be achieved through codes and standards changes.

This 20-year energy efficiency potential is shown on an annual basis in Figure ES-1. This assessment shows potential starting just under 0.9 aMW in 2012 and ramping upward over the planning period.

Figure ES-1 – Annual Energy Efficiency Potential Estimates

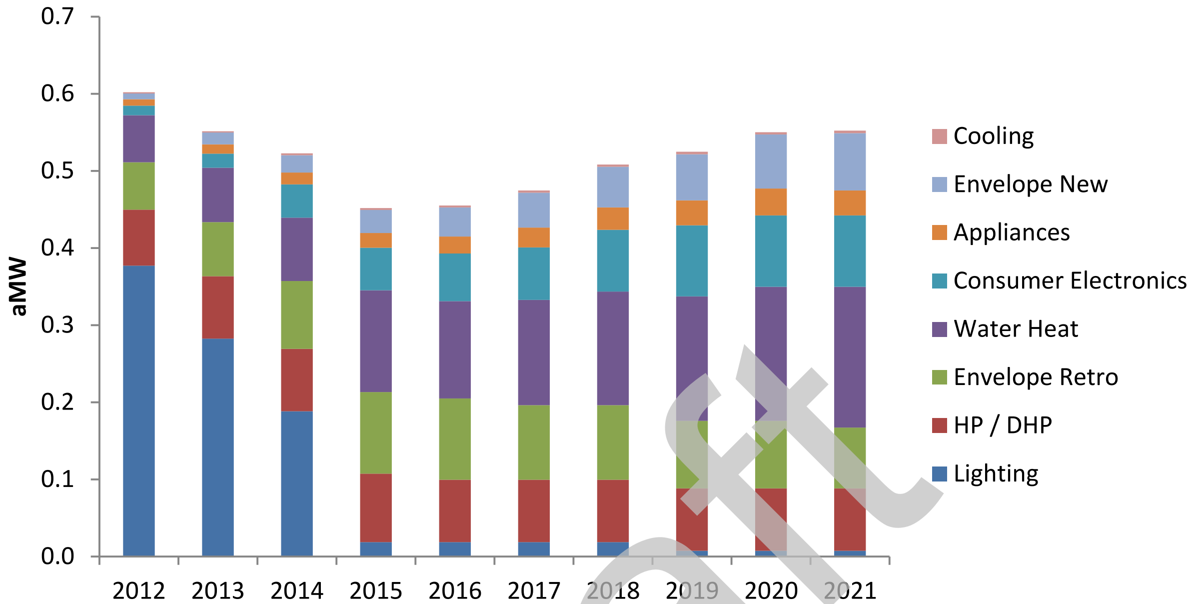


The majority of the potential in this assessment comes from the residential sector, and the breakdown of this potential by end-use is shown in Figure ES-2. On average, this represents approximately 0.5 aMW per year for the next 10 years. Over the next two years there is still some CFL lighting potential, despite Lewis' CFL direct mailer program in 2010 and 2011. Beyond lighting there is large potential in water heating measures including low-flow showerheads and heat pump water heaters. Potential in heat pump water heaters has been shifted away from

[1] NEEA does not provide forecasts of savings for individual utilities. Historic NEEA savings credited to Lewis PUD can be obtained either from your BPA EE or directly from NEEA.

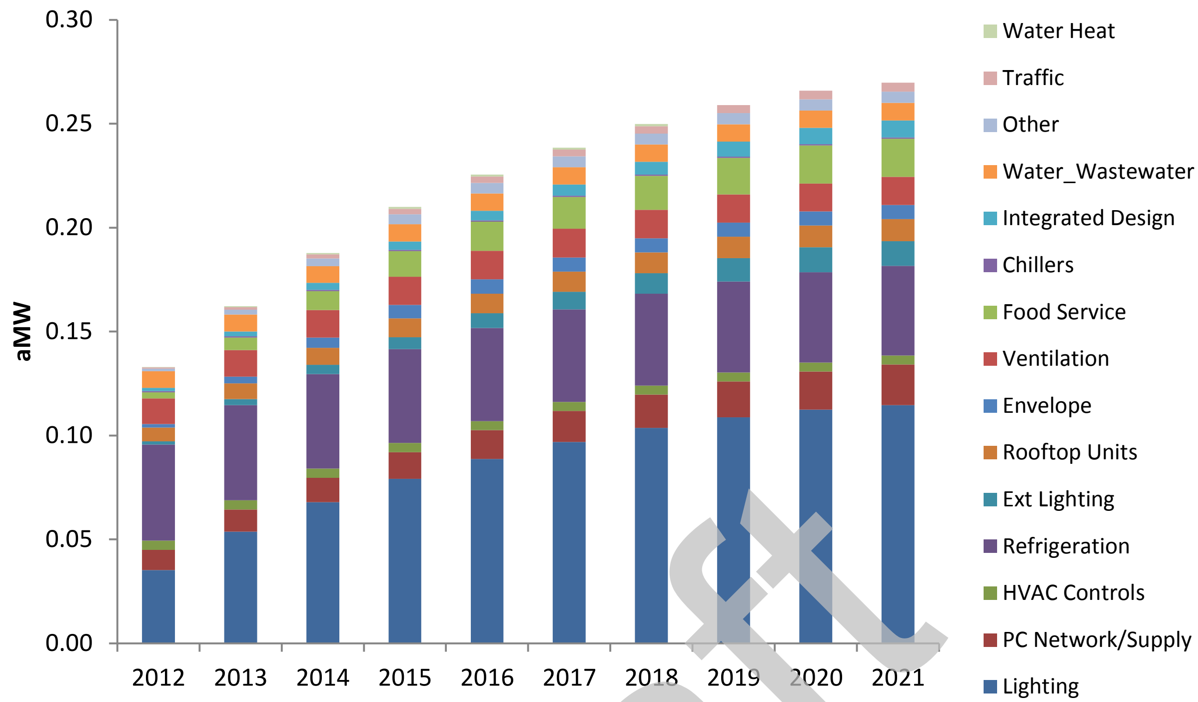
the early years to reflect the market acceptance of this product. Envelope retrofits as well as heat pumps continue to provide opportunities for residential conservation savings.

Figure ES-2 – Annual Residential 10-Year Potential by End-Use



The commercial sector potential in this CPA accounts for approximately one-fifth of Lewis PUD's overall potential. A significant portion of this commercial potential is efficient lighting (see Figure ES-3), which represents close to half of the commercial potential annually. The remainder of the potential is distributed among numerous end use areas that include refrigeration, HVAC controls, rooftop units, and better ventilation control.

Figure ES-3 – Annual Commercial 10-Year Potential by End-Use



In addition to the Residential and Commercial sectors, energy efficiency potential is estimated for the Industrial and Agriculture sectors, as well as the distribution system. These portions are smaller than the residential potential. The agriculture sector is very small accounting for only 0.14 aMW over ten years. Half of this savings is available in dairy farming and the other half will be in irrigation hardware replacements. More efficient water usage lowers electricity consumption by reducing pumping energy. After 10 years, it is assumed this potential will be fully realized. The distribution efficiency potential is 0.36 aMW over the 20-year period and can be achieved by continuing to provide system improvements.

Increased conservation requirements will mean increased investment in conservation and conservation marketing. To meet increasing levels of energy efficiency potential, Lewis PUD will likely need to both expand existing programs and develop new ones. The residential sector holds the greatest potential for conservation. Expanded programs may include CFL promotions or giveaways, window rebates, and insulation rebates. New programs may include low-flow shower head rebates, HVAC rebates, and new home construction energy incentives. In the short term, the five key areas include residential lighting, heat pumps, water heating, commercial lighting, and commercial refrigeration. Custom industrial projects should also remain a priority.

Introduction

Objectives

The objective of this report is to describe the results of the Lewis County Public Utility District (Lewis PUD) 2011 Conservation Potential Assessment (CPA). This assessment provides estimates of energy savings by sector for the period 2012 to 2031, with the primary focus on 2012 to 2021 (10-years). The assessment considered a wide range of conservation resources that are reliable, available, and cost-effective within the 20-year time horizon.

The conservation measures are based on the most recent set of measures approved by the Regional Technical Forum (RTF), and were used in developing the Council's Sixth Power Plan. The results provide energy savings estimates that will assist Lewis PUD in resource and energy efficiency planning.

Background

Lewis PUD provides electricity service to more than 31,000 customers located in Lewis County, Washington excluding Centralia, Washington.

Since the passage of Washington's Energy Independence Act, EIA (also known as Initiative 937, or I-937), effective January 1, 2010, Lewis PUD is required to pursue all cost-effective conservation resources and to meet conservation targets. The legislation requires that utilities follow the methodologies used by the Northwest Power and Conservation Council (Council) for their regional power planning. This CPA is consistent with the Council's methodology, so results of this CPA may be used to advise Lewis PUD on reasonable conservation targets for EIA compliance. Also, the resulting conservation supply curves can be used as part of the demand-side resources in Lewis PUD's integrated resource plan (IRP).

Electric Utility Resource Plan Requirements

According to Chapter 19.280 RCW, utilities with at least 25,000 customers are required to develop integrated resource plans (IRPs) by September 2008 and biennially thereafter. The legislation mandates that these resource plans must include assessments of commercially available conservation and efficiency measures. This CPA is designed to assist in meeting these requirements for conservation analyses.

Energy Independence Act

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

- By January 1, 2010: Identify achievable cost-effective conservation potential through 2019 using methodologies consistent with the Pacific Northwest Power and Conservation Council's (NWPCC) latest power planning document.
- Beginning January 2010, each utility shall establish a biennial acquisition target for cost-effective conservation that is no lower than the utility's pro rata share for the two-year period of the cost effective conservation potential for the subsequent ten years.
- By June 2012, each utility shall submit an annual conservation report to the department. The report shall document the utility's progress in meeting the targets established in RCW 19.285.040.

There are two primary components of the Energy Independence Act related to this study: 1) documenting the development of conservation targets (i.e., setting the targets), and 2) documenting the savings (i.e., demonstrating how the targets are being met). If conservation targets are not met, utilities may be required to pay a $50/MWh (2007 dollars) penalty on the shortfall unless they have documented lack of customer participation despite offering to pay an incentive in an amount equal the utility's full avoided cost over the lifetime of measures. Any such shortfall cannot be automatically deducted from the utility's conservation potential assessment for the subsequent biennium.

Options for Setting Conservation Targets

In order to set the conservation targets, utilities can use one of three options. These options are described below for reference, but the primary focus of this assessment is Option 3 - Utility Analysis. The three options are:

1) The Council's conservation calculator
2) A modified version of the calculator
3) Utilities can perform their own custom analyses

Each of these approaches is further described below.

Option 1: Conservation Calculator

If a utility chooses to calculate conservation potential using the Council's calculator, the biennial target and ten-year potential values from the calculator become the utility targets. In this case, utility is said to have effectively documented the requirement for customer conservation.

The conservation calculator provides an estimate of each utility's share of the regional conservation target based on its share of regional load. The calculator utilizes utility-specific data for the various sectors of retail sales in MWh: residential, commercial, and industrial and irrigated agriculture.

Option 2: Modified Conservation Calculator

This second option allows for the modification of customer base data in order to arrive at targets lower than a utility's share of regional conservation. Modifications that can be made are the following:

- Add or deduct measures as they apply to the service area
- Modify the number or ratio of applicable units (percent of homes with electric heat)
- Increase or reduce per unit incremental resource savings
- Changes in forecasted program costs
- Changes in retail sales growth rates
- Changes in avoided distribution capacity cost savings

Option 3: Utility Analysis

This last option uses the Council's method to establish targets, but allows utilities to calculate the savings, costs, and applicability of measures for their service areas. This is the option used by EES Consulting for this CPS. Detailed below are the requirements of the utility analysis option from RCW 19.285.040:

(i) Analyze a broad range of energy efficiency measures considered technically feasible.
(ii) Perform life-cycle cost analysis of measures or programs, including the incremental savings and incremental costs of measures and replacement measures where resources or measures have different measure lifetimes.
(iii) Set avoided costs equal to a forecast of regional market prices, which represents the cost of the next increment of available and reliable power supply available to the utility for the life of the energy efficiency measures to which it is compared.
(iv) Calculate the value of the energy saved based on when it is saved. In performing this calculation, use time differentiated avoided costs to conduct the analysis that determines the financial value of energy saved through conservation.
(v) Conduct a total resource cost analysis that assesses all costs and all benefits of conservation measures regardless of who pays the costs or receives the benefits. The NWPCC identifies conservation measures that pass the total resource cost test as economically achievable.
(vi) Identify conservation measures that pass the total resource cost test, by having a benefit/cost ratio of one or greater as economically achievable.
(vii) Include the increase or decrease in annual or periodic operations and maintenance costs due to conservation measures.
(viii) Include deferred capacity expansion benefits for transmission and distribution systems in its cost-effectiveness analysis.
(ix) Include all nonpower benefits that a resource or measure may provide that can be quantified and monetized.
(x) Include an estimate of program administrative costs.
(xi) Discount future costs and benefits at a discount rate based on a weighted, after-tax, cost of capital for utilities and their customers for the measure lifetime.

(xii) Include estimates of the achievable customer conservation penetration rates for retrofit measures and for lost-opportunity (long-lived) measures. The NWPCC's twenty-year achievable penetration rates, for use when a utility assesses its twenty-year potential, are eighty-five percent for retrofit measures and sixty-five percent for lost opportunity measures achieved through a mix of utility programs and local, state and federal codes and standards. The NWPCC's ten-year achievable penetration rates, for use when a utility assesses its ten-year potential, are sixty-four percent for non-lost opportunity measures and twenty-three percent for lost-opportunity measures; the weighted average of the two is a forty-six percent ten-year achievable penetration rate

(xiii) Include a ten percent bonus for conservation measures as defined in 16 U.S.C. § 839a of the Pacific Northwest Electric Power Planning and Conservation Act.

(xiv) Analyze the results of multiple scenarios. This includes testing scenarios that accelerate the rate of conservation acquisition in the earlier years.

(xv) Analyze the costs of estimated future environmental externalities in the multiple scenarios that estimate costs and risks.

Lewis PUD may use any of the above options to set their target. This report summarizes the results of a comprehensive CPA which is consistent with Option 3: Utility Analysis. A checklist of how this analysis meets each of these 15 requirements is included in Appendix III.

Report Organization

This report is organized as follows:

- Methodology
- Historic Conservation Achievement
- Assessment Input Data (Assumptions)
- Results – Energy Savings and Costs
    - Residential Savings Potential
    - Commercial Savings Potential
    - Industrial Savings Potential
    - DEI Savings Potential
    - Total Potential

In addition to the main report, the appendices contain supplementary information.

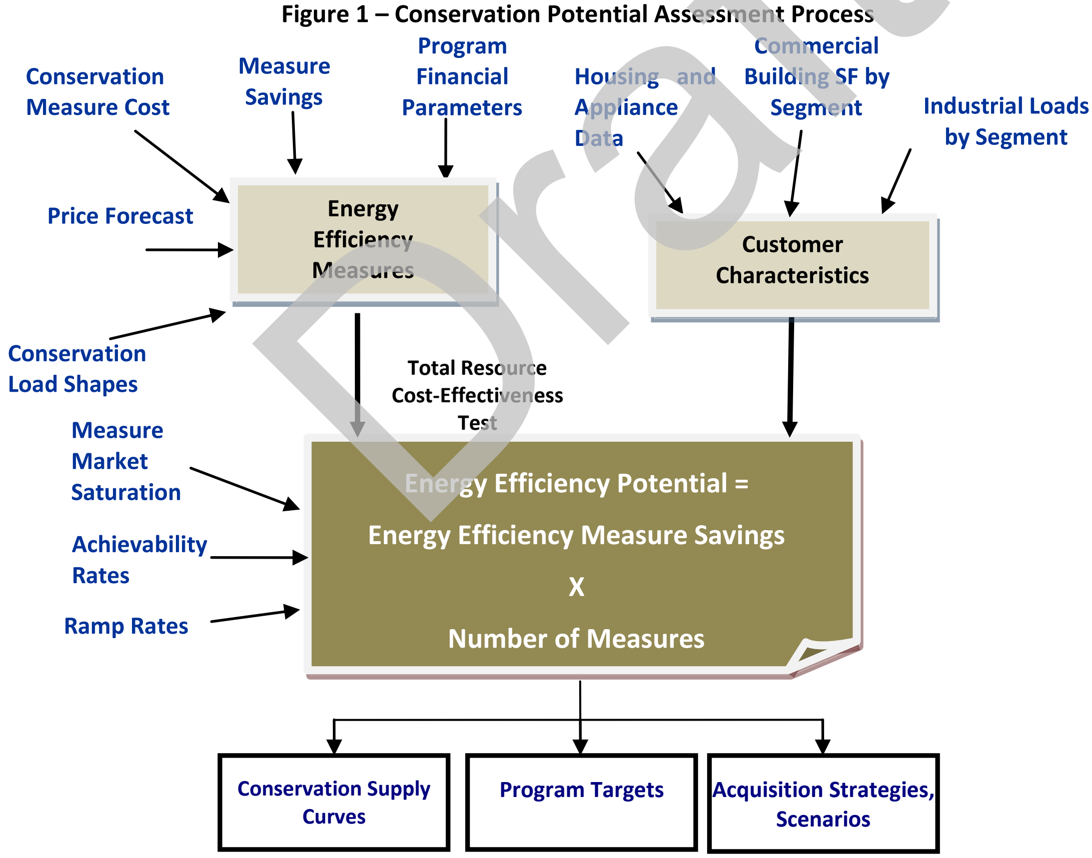
Methodology

This study is a comprehensive analysis that focuses primarily on a "bottom-up approach." Energy efficiency measures are applied to specific end uses, such as number of refrigerators, and assigned a specific savings value in kWh/year. This methodology is consistent with the Council's regional planning methodologies, and is therefore in line with the Utility Analysis Option of WAC 194-37 (Energy Independence Act, Chapter 19.285 RCW).

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 is then aggregated to produce the total potential. The detailed methodology summary that follows the EIA Option 3 requirements is listed in Appendix III.

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.

Technical Potential – Amount of energy efficiency potential that is available regardless of cost or other technological or market constraints, such as 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 (i.e., interaction). In addition, the measure-by-measure savings depend on which measure is installed first (i.e., stacking).

Total technical potential is often significantly more than the amount of economic and achievable potential. The difference between technical potential and achievable and or economic potential is due to 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 – Amount of potential that can be achieved through 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 Council uses achievability rates equal to 85 for retrofit measures and 65 percent for lost opportunity measures over the 20-year study period. This CPA follows the Council's methodology, including the achievability rate assumptions. Note that the achievability factors are applied to the technical potential and before the economic screening.

Economic – Amount of potential that passes an economic benefit-cost test; in Washington State, the total resource cost test (TRC) is used per the Independence Act. This means that the present value of the benefits exceeds the present value of the costs over the lifetime of the measure. TRC costs include the incremental costs and benefits of the measure regardless of who pays for it – the utility or the customer. Costs and benefits include: 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 Council'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 segmented energy prices.

Program Achievable – Amount of potential that can be achieved through utility administered programs. The program achievable excludes potential that is achieved through future code changes and market transformation.

Energy Efficiency Measure Data

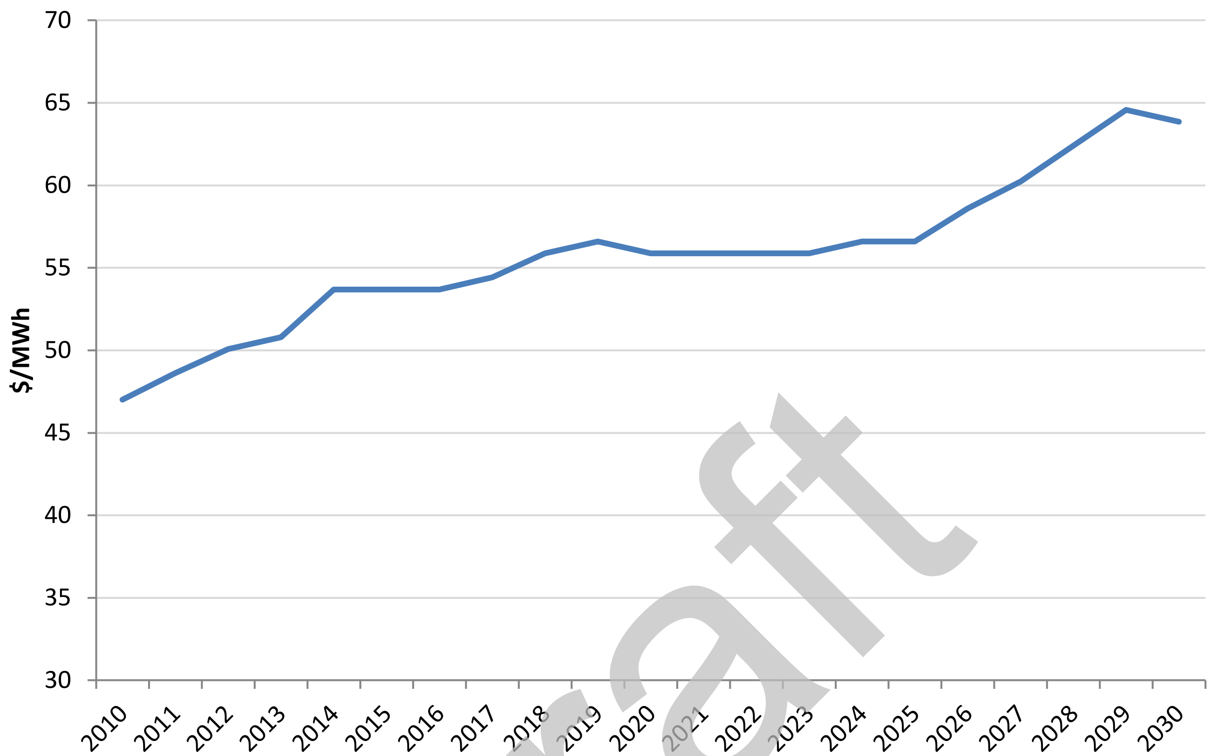
The characterization of efficiency measures includes measure savings (kWh), demand savings (kW), measure costs ($), and measure life (years). Other features, such as measure load shape, operation and maintenance costs, and non-energy benefits, are also important for measure definition. The primary source referenced for conservation measure data is the Council's *6th Power Plan*.

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.

The avoided cost of energy is represented as a dollar value per MWh of conservation. Avoided costs are used to value energy savings benefits when conducting cost effectiveness tests – 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 2 shows the price forecast used for the planning period.

Figure 2 –20-Year Market Price Forecast



Avoided costs for transmission and distribution, as well as peak winter demand, are also valued ($/kW). A local distribution credit value of $23/kW-yr was applied to peak savings from conservation measures. No additional risk credits were included in the avoided cost.

Building Characteristic Data

Building characteristics, baseline saturation data, and appliance saturation influence Lewis PUD's total conservation potential. One of the most accurate methods to obtain these data is through original research, such as end-use surveys. End-use surveys can be designed to provide all the detailed housing and commercial building data requirements. For this analysis, the characterization of Lewis PUD's baseline was determined using data provided by Lewis County records. Details of data sources and assumptions are described for each sector later in the report. Baseline measure saturation data is determined using historic conservation achievements and the results of the customer survey, which is also discussed in detail in the next section. The model also includes regional measure saturations for conservation accomplishments over the past years; these values were used in this model where Lewis PUD-specific information was not available.

Historic Conservation Achievement and Current Programs

Historic and Current Lewis County Conservation

Lewis PUD has pursued conservation and energy efficiency resources since the early 1980s. Currently, the utility offers several rebate programs for both residential and non-residential applications. These include insulation rebates, window rebates, and low-income weatherization. Industrial projects have dominated past conservation with a large portion occurring in the fruit storage sector. Figure 3 shows the distribution of projects over the past five years and shows the large emphasis on industrial projects. These data were used to adjust the saturation of conservation measures already completed (and therefore not available in the future).

Figure 3 –Lewis PUD Conservation History by Sector (MWh)

Current Conservation Programs

Lewis PUD offers a variety of conservation programs to its customers. These programs include several rebates, energy audits, commercial projects, and agricultural projects. The current programs offered by Lewis PUD are described below. Programs began October 1, 2010, however as of August 20, 2011, program budget had been expended and resumption has yet to begin.

Residential

Lewis PUD offers a variety of conservation programs to its customers. Programs include a variety of weatherization upgrades including 50% of the cost of insulation, window and duct sealing projects as well as up to 100% of the cost of low-income weatherization projects. Heat Pumps, both ducted and ductless are eligible for rebates ranging from $470 to $1,900 on eligible units. Energy Star manufactured homes are eligible for an $800 rebate. Energy star appliances and high efficiency water heaters are also eligible for modest rebates.

Commercial & Industrial

Lewis PUD provides incentives in the commercial and industrial sectors. Lewis' commercial lighting program will pay up to 70% of the project cost provided the project produces a 25% reduction in energy. Other commercial programs provided include HVAC upgrades, low flow spray wash valves, as well as grocery store programs.

Industrial programs offered are the lighting retrofit program that covers up to 70% of project cost and the custom industrial project program. Custom projects cover upgrades of larger equipment such as premium efficiency motors, compressed air systems, refrigeration, dryers, VFDs, and pumps.

Agricultural

Lewis PUD offers incentives for sprinkler equipment upgrades, irrigation system high efficiency motors, and variable speed drives for vacuum pumps at dairies and hatcheries.

Loan Program

The LEEP program is a loan program administered by Lewis PUD available to residential and non-residential customers for energy efficiency upgrades. The maximum amount loaned to residential customers is $7,500 and $15,000 for non-residential customers.

Customer Characteristics Data

Lewis PUD serves over 31,000 customers across the County, with a total population of 59,042 (excluding Centralia). A key part of an energy efficiency assessment is to understand the characteristics of these customers primarily the building characteristics.

Customer Characteristics

Residential

For the residential sector, the key characteristics include house type, heat fuel type, and water heating. Table 1 shows relevant data gathered mainly from the 2007 Census[2] and a recent report from the Lewis County Building Department. Residential fuel type was compared with the U.S. Census. The new homes column information was obtained by comparing the 2007 census with the 2000 census and also by using the Building Department's information

Table 1 – Residential Sector Characteristics

Heating Zone	Cooling Zone	Solar Zone	Residential Households	Total Population
1	1	2	22,009	59,042

Housing Stock	Existing	New Homes	Regional %
House Type			
Single Family	77%	66%	72%
Multi-Family	3%	0%	18%
Manufactured Homes	20%	34%	10%
Housing Vintage			
Pre-1980	47%		57%
1980 - 1993	20%		14%
Post 1993	33%		28%
Heat Fuel Type			
Natural Gas Homes	7%	5%	37%
Electric Homes	67%	95%	53%
Other Fuel Homes	26%	0%	10%
Electric Heat System Type			
Forced Air Furnace	31%	31%	34%
Heat Pump	21%	21%	20%
Zonal (Baseboard)	25%	25%	44%
Electric Other	23%	23%	2%
Single Family Foundation Type			
Crawlspace	64%	64%	64%
Full Basement	23%	23%	23%
Slab on Grade	13%	13%	13%

Residential Appliances	Existing	New	Regional %
Water Heating			
Electric	83%	83%	64%
Natural Gas	17%	17%	36%
Appliance Saturation			
Refrigerator	112%	112%	112%
Freezer	57%	57%	57%
Clothes Washer	87%	87%	87%
Electric Dryer	82%	82%	82%
Dishwasher	67%	67%	67%
Electric Oven	82%	82%	82%
Room AC	11%	11%	11%
Central AC	3%	3%	8%

[2] Key data from the 2010 Census are not yet available

Commercial

In determining potential for the commercial sector, building square footage is the key parameter. Many of the measures are based on savings as a function of building square footage (kWh per square foot, kWh/sf). Table 2 shows commercial square footage in each of the Council's 18 building categories. To establish square-footage numbers, a combination of a third party database (Dunn and Bradstreet) and Lewis PUD kWh data were used. The kWh data were associated with council categories and then divided by corresponding EUI values to arrive at total square footage in each category.

The square footage information data by segment (NAICS Code) could be extracted directly from the D&B database. The two data sets compared quite well, but some minor adjustments were needed. Cowlitz Timber Trail was removed because there is no potential. The National Park Service was removed from industrial and added to commercial "other" because of the mixed commercial load. The Green Hill School, Cispus Learning Center, and City of Chehalis were all moved from industrial to commercial because their activities closer matched the commercial building loads rather than industrial processes. As a result, the total commercial square footage used for the potential assessment is just under 10 million square feet.

Table 2 – Commercial Sector Square Footage by Segment

Sub Segment	Square Feet	EUI (kWh/sq ft)	Growth Rate
Large Office	200,000	18.0	1.0%
Medium Office	282,828	16.5	1.0%
Small Office	2,356,898	15.4	1.0%
Big Box Retail	425,000	33.1	0.8%
Small Box Retail	1,537,993	13.8	0.8%
High End Retail	0	16.3	0.8%
Anchor	0	16.2	0.8%
K-12 Schools	466,958	10.0	1.0%
University	132,852	14.0	1.0%
Warehouse	1,409,603	10.0	1.0%
Supermarket	479,886	39.2	0.4%
Mini Mart	84,781	51.7	1.0%
Restaurant	321,354	45.0	1.0%
Lodging	497,016	18.0	0.6%
Hospital	33,356	32.0	1.1%
Other Health Facilities	373,950	20.0	1.0%
Assembly Hall	447,298	14.0	1.0%
Other	746,820	14.0	0.5%
Total	9,796,593		

Industrial

The Industrial sector potential estimates rely primarily on electricity use by major process end-use. Energy conservation measures are applied to the end-use as a percent savings and associated cost. To determine the load attributed to each of the Council's categories, industrial customers were parsed from a list of large customers provided by Lewis PUD and combined with an industrial list also provided by Lewis PUD. Customers were then placed into the Industrial segments based on industry SIC codes. Industrial MWh consumption totaled 227,260. The results are shown in Table 3.

Table 3 – Industrial Sector Load by Segment

Annual Base Load in 2010	MWh	Annual Growth Rate (Regional Average)
Mechanical Pulp		0.8%
Kraft Pulp		1.0%
Paper		0.2%
Foundries		0.6%
Frozen Food		-0.3%
Other Food	41,443	0.4%
Sugar		-0.1%
Lumber		-0.5%
Panel		-0.3%
Wood	115,332	0.6%
Electric Fabrication	65	0.5%
Silicon		-1.0%
Metal Fabrication	8,502	1.0%
Equipment	1,474	-1.9%
Cold Storage		2.1%
Fruit Storage		2.2%
Refinery		-0.9%
Chemical		0.5%
Miscellaneous Manufacturing	60,444	1.0%
Total	227,260	

The methodology for estimating industrial potential is different than that of residential and commercial, primarily because most energy efficiency opportunities are unique to specific industrial segments. This “top-down” methodology starts with the segment annual consumption, disaggregates it by end-use, and then estimates savings for measures applicable to each end-use. A brief example of the potential estimation process and assumptions are described below.

Agriculture

Potential in Lewis County in the Agricultural sector is determined by the number of acres under irrigation. According to the 2007 census of agriculture, there are 28,230 irrigated acres in Lewis County. This is relatively small and yields a small portion of the overall energy efficiency potential.

Distribution Efficiency

The final area where energy efficiency potential is estimated is for the distribution system. There are no customized "inputs" for this section as the results are entirely based on Lewis PUD's share of regional load. The Council's Sixth Plan assumptions are used in estimating distribution efficiency potential. However, a significant amount of distribution efficiency has already been completed by Lewis PUD during normal system upgrades and operations. These accomplishments have been accounted for.

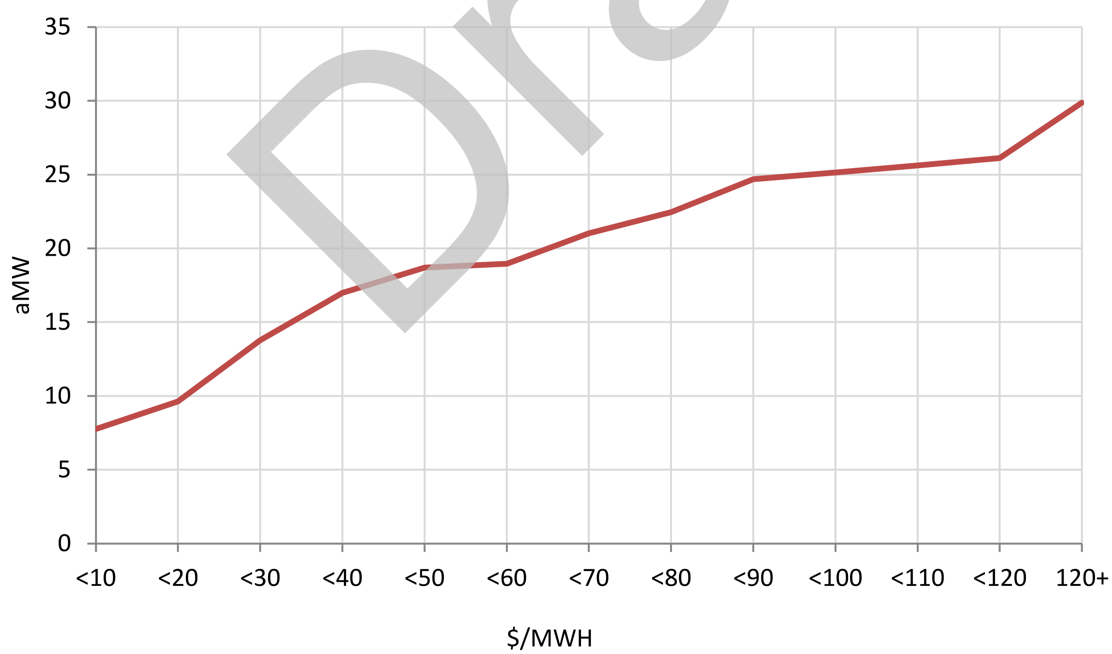
Results– Energy Savings and Costs

Technical Achievable Conservation Potential

Technical achievable potential is the amount of energy efficiency potential that is available regardless of cost or other constraints, such as willingness to adopt measures. It represents the theoretical maximum amount of energy efficiency if these constraints are not considered.

Figure 5, below, shows a supply curve of 20-year, technically achievable potential. A supply curve is energy efficiency savings potential (aMW) plotted against the levelized cost ($/MWh). The technical potential has not been screened for cost effectiveness, but rather it shows the full range of conservation by measure. Costs are standardized (levelized), allowing for the comparison of measures with different lives. The supply curve facilitates comparison of demand-side resources to supply-side resources and is often used in conjunction with integrated resource plans (IRPs). Figure 5 shows close to 15 aMW are available for less than $30/MWh and approximately 22 aMW are available for under $80/MWh. Total technical achievable potential for Lewis PUD is approximately 30 aMW over the 20-year study period.

Figure 5 – 20-Year Technical Potential Supply Curve



Economic Achievable Conservation Potential

Economic potential is the amount of potential that passes an economic cost-benefit test. This generally means that the present value of the benefits exceeds the present value of the measure costs over its lifetime. Often, the levelized cost of an efficiency measure is compared with levelized market prices or an alternative conventional supply-side energy resource (avoided cost).

Table 5 shows aMW of economically achievable potential by sector in 2, 5, 10 and 20-year increments. Compared with the technical potential, it shows that 19.56 aMW of the total 30 aMW is cost effective for Lewis PUD.

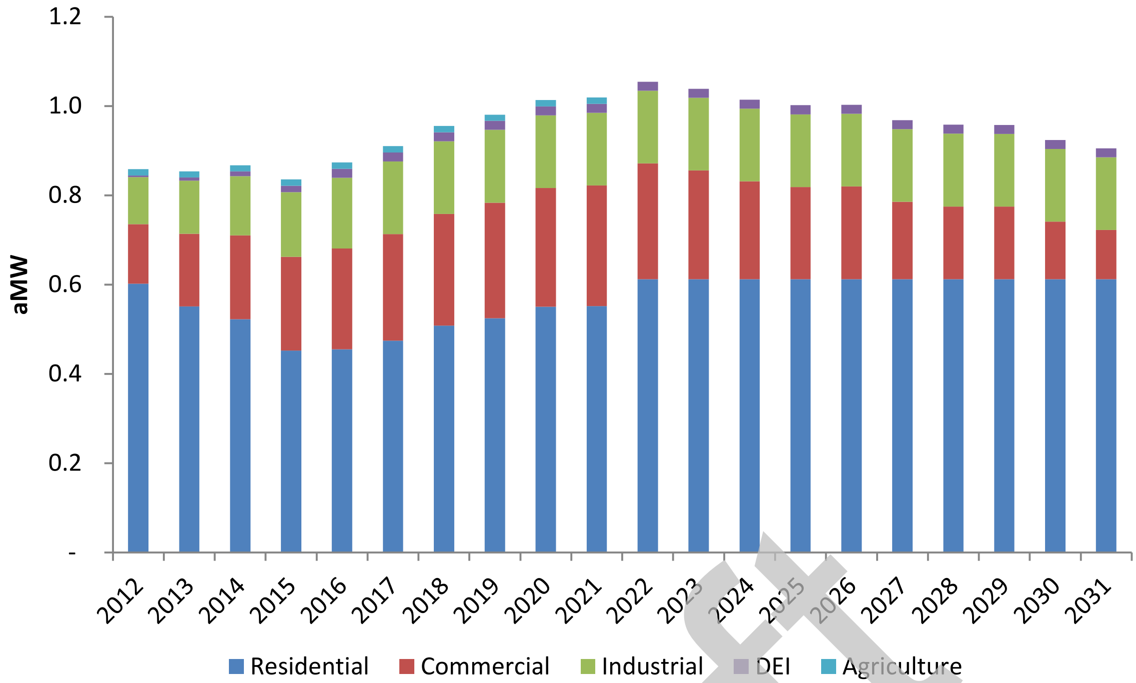
Table 5 – Cost-Effective Achievable Potential- aMW

	2 Year	5 Year	10 Year	20 Year
Residential	1.15	2.58	5.19	11.31
Commercial	0.30	0.92	2.20	4.08
Industrial	0.25	0.75	1.73	3.67
Distribution Efficiency	0.01	0.06	0.16	0.36
Agriculture	0.03	0.07	0.14	0.14
TOTAL	**1.74**	**4.38**	**9.42**	**19.56**

Sector Summary

Figure 6 shows the achievable potential by sector on an annual basis. The potential ramps up from under 0.9 aMW in 2012 to 1.0 aMW in year 2020.

Figure 6 – Annual Achievable Potential by Sector

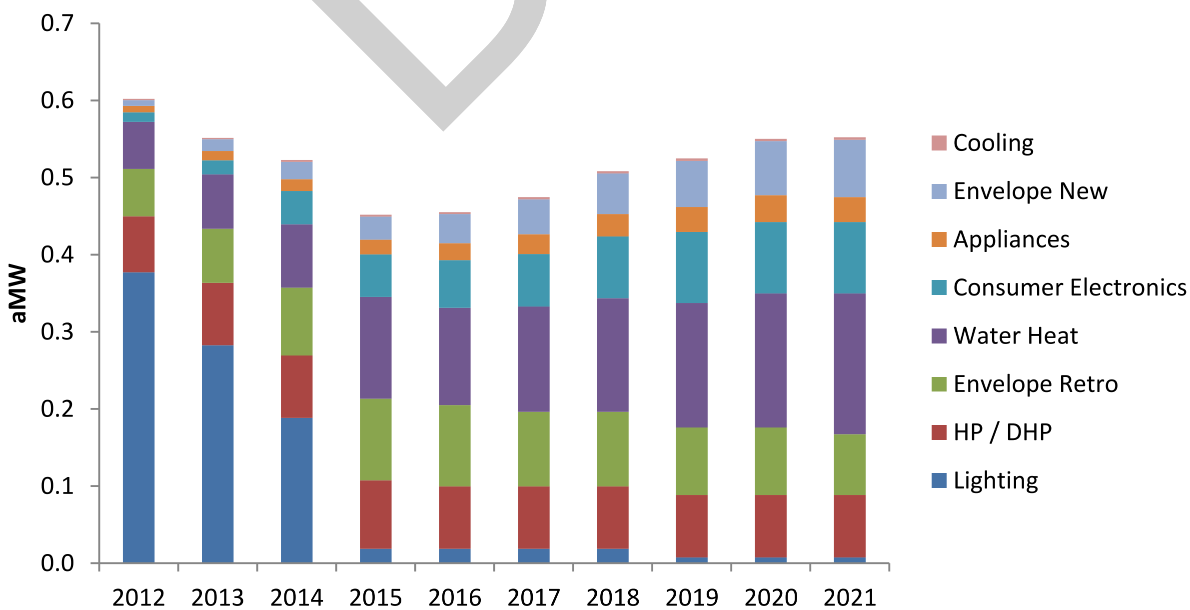


Figures 7 through 9 show the potential by end-use for each sector.

Residential

In the residential sector lighting savings drops off after roughly three years (see Figure 7). This reduction is due to the upcoming changes to lighting codes and standards (2012-2014) which require higher efficiency than most current incandescent bulbs.

Figure 7 – Ten-Year Residential Potential by End-Use

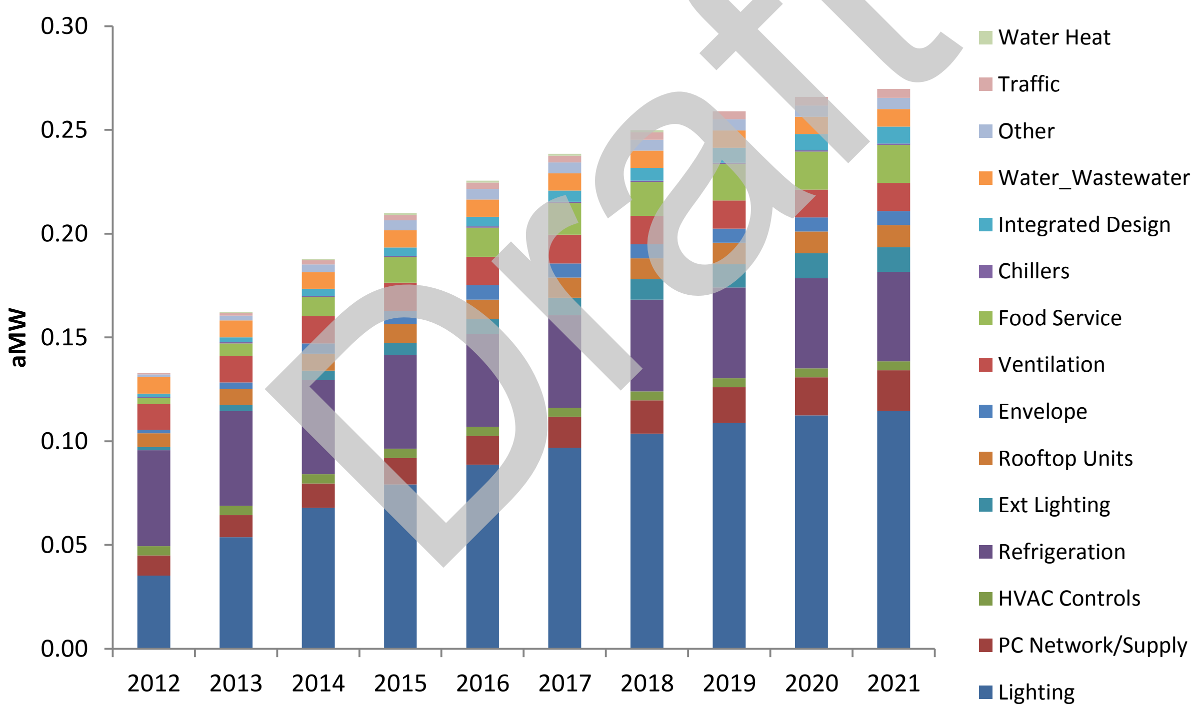


However, there is still lighting potential available in the next biennium. Heat pump measures represent the second largest end-use area of the potential assessment. Water heating is the third largest area of potential in the residential sector. This includes low-flow shower heads in the first several years, and increasing heat pump water heater potential in the latter part of the 10-year period. Consumer electronics (e.g., TVs, Computer monitors) potential is initially low but is ramped up rapidly over the first 10 years. This represents significant potential, but it will likely be achieved either by regional programs (e.g., NEEA) or through codes and standards changes.

Commercial

Commercial savings for the 2012-2021 period are largely dominated by lighting measures (see Figure 8). Refrigeration measures are the next largest components of the commercial potential. Another significant commercial potential is refrigeration, such as grocery stores, convenience stores, etc. The custom nature of commercial building energy efficiency is reflected in the variety of end-uses and corresponding measures.

Figure 8–Ten-Year Commercial Potential by End-Use

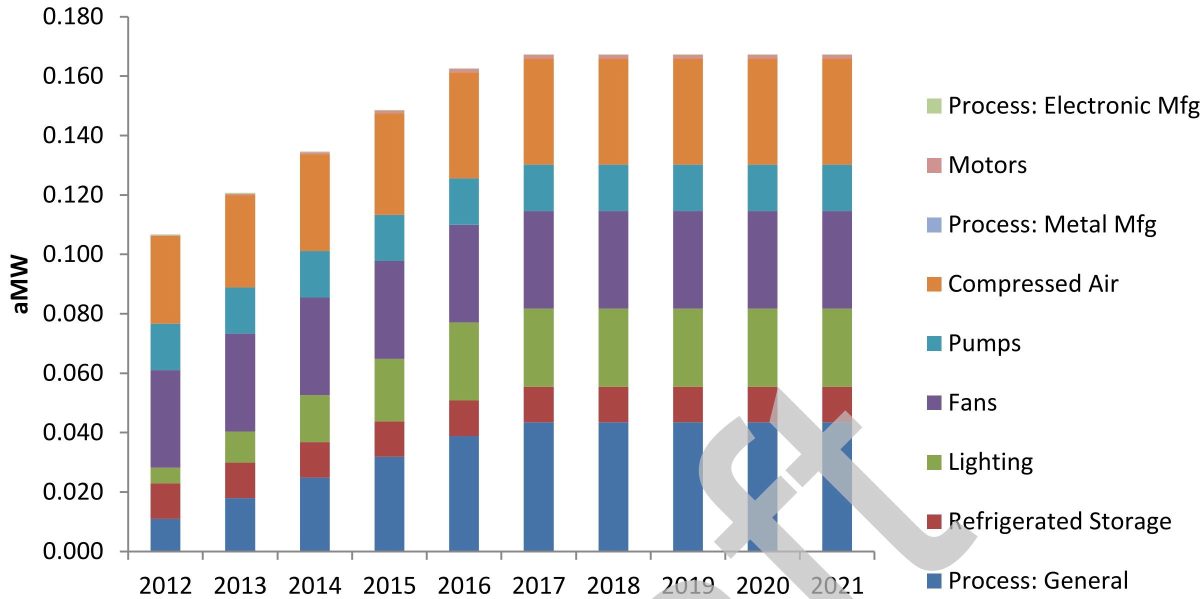


Industrial

In the industrial sector, the methodology differs slightly from the bottom-up approach used in other sectors. A top-down approach is used instead. Because energy efficiency measures are specific to each industrial process, the Council uses a top-down approach to estimate energy efficiency savings for industrial customers. Estimates of energy savings are calculated based on a fractional savings of end-use load. For example, the model assumes that efficient lighting controls in electronic manufacturing facilities can save 28% of lighting energy.

Summing end-use savings across industry types gives total industrial potential. Industrial savings by end-use are shown in Figure 9. The significant conservation efforts done by Lewis in process upgrades and lighting retrofits have been accounted for in the conservation potential.

Figure 9 – Ten-Year Industrial Potential by End-Use



Agriculture

The irrigated agriculture sector is a small portion of Lewis PUD's load and therefore the energy efficiency potential is relatively small. There is some potential in upgrading irrigation hardware, which in turn reduces pumping energy. Some potential can also be realized in dairy production.

DEI Savings Potential

Distribution efficiency measures improve the efficiency of utility distribution systems by operating in the lower end of the acceptable voltage range (120-114 volts). The district operates a highly efficient system already with a >98% power factor throughout the system and continuously monitors and upgrades substation feeders.

Cost

Budget costs can be estimated at a high level based on the incremental cost of the measure (Table 7).The assumptions in this estimate include: 20% of measure cost for administrative cost and 50% of the incremental cost for incentives is assumed to be paid by the utility. This chart shows that if Lewis PUD spends 50% of incremental cost on incentives and has an overall administrative cost of 20% of measure cost, then it will need to spend $3.2 million to acquire the conservation over the next two years. The bottom row of Table 7 shows the cost per aMW. For reference, the overall regional average has been $1.69 million per aMW, for all sectors and $2.35 million per aMW for the residential sector. This average is expected to increase due to the past trend of low cost and high value measures.

Table 7 – Cost for Achievable Conservation Potential				
	Utility First Year Cost ($2011)			
	2 Year	5 Year	10 Year	20 Year
Residential	$2,458,601	$7,182,439	$16,864,245	$40,851,219
Commercial	$515,833	$1,649,360	$4,087,972	$7,666,572
Industrial	$214,816	$623,892	$1,387,610	$2,915,047
Distribution Efficiency	$3,731	$19,439	$54,449	$124,469
Agriculture	$22,388	$55,969	$111,938	$111,938
TOTAL	**$3,215,368**	**$9,531,099**	**$22,506,214**	**$51,669,245**
Total ($/aMW, first year)	$1,852,785	$2,174,842	$2,389,808	$2,641,967

Scenarios

The results of multiple scenarios were analyzed. These scenarios include a "Low" scenario and a "High" scenario; the Low and High terms are relative to the base case. The Low scenario represents even worse economic conditions than currently being experienced. The High scenario represents a quick economic recovery and significant increase market prices and volatility.

Low Scenario:

- Avoided cost reduced by approximately 20%
- Reduced growth rate for residential sector to 0.87% per year
- Reduced industrial growth rates

Table 8 – Cost-Effective Achievable Potential – LOW Scenario (aMW)				
	Cost Effective and Achievable - aMW			
	2 Year	5 Year	10 Year	20 Year
Residential	0.94	1.96	3.87	8.31
Commercial	0.26	0.80	1.90	3.48
Industrial	0.23	0.68	1.56	3.31
Distribution Efficiency	0.01	0.06	0.16	0.36
Agriculture	0.03	0.07	0.14	0.14
TOTAL	**1.47**	**3.57**	**7.63**	**15.60**

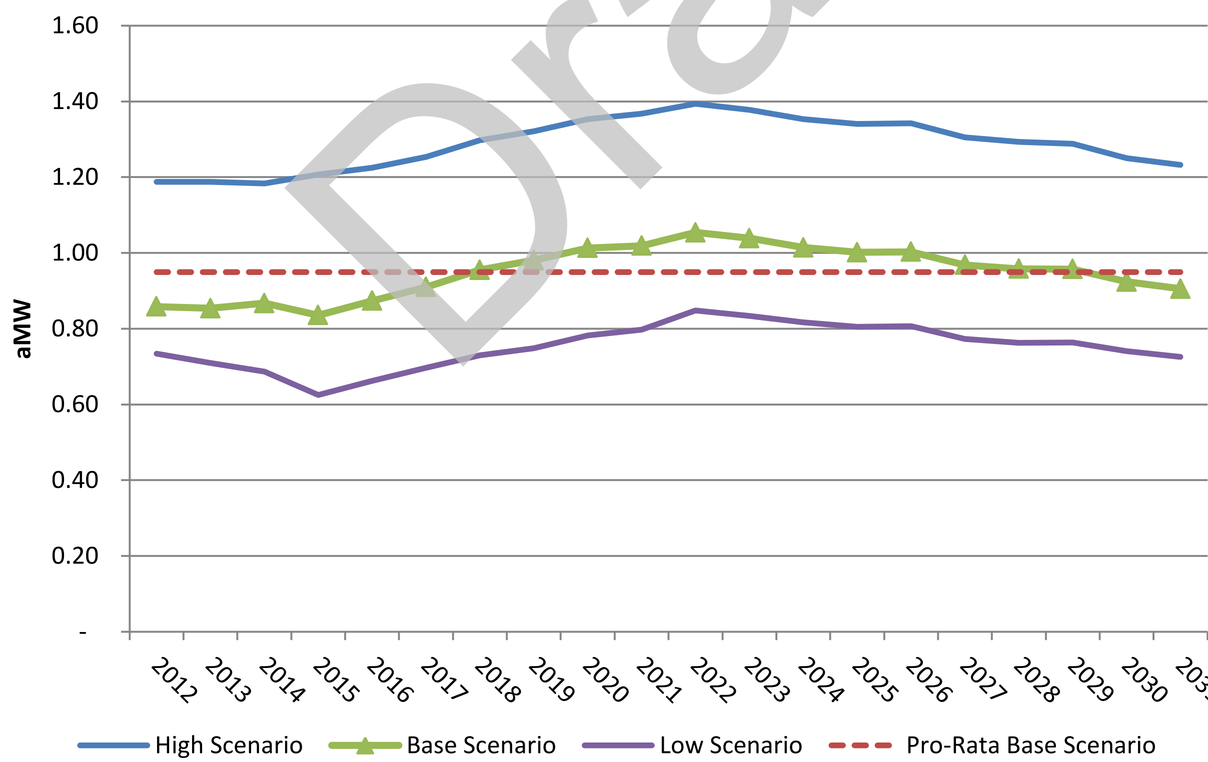
High Scenario

- Avoided cost increased by approximately 43% (risk credit, higher fuel costs)
- Increased residential growth rate to 1.4%
- Increased industrial growth rates to regional averages
- Accelerated some residential measures: Heat pumps, weatherization, electronics, and water heating

Table 9 – Cost-Effective Achievable Potential – HIGH Scenario (aMW)

	Cost Effective and Achievable - aMW			
	2 Year	5 Year	10 Year	20 Year
Residential	1.74	3.99	7.86	16.50
Commercial	0.34	1.03	2.44	4.48
Industrial	0.25	0.77	1.76	3.75
Distribution Efficiency	0.04	0.23	0.64	1.46
Agriculture	0.03	0.07	0.14	0.14
TOTAL	**2.40**	**6.08**	**12.84**	**26.33**

Figure 10 – Lewis PUD Conservation Scenarios – Annual Potential (aMW)



Summary

This report summarizes the results of Lewis PUD's 2011 CPA. The assessment provides estimates of energy savings by sector for the period 2012 to 2031, with a focus on the first 10 years of the planning period, as required by I-937. The assessment considered a wide range of conservation resources that are reliable, available, and cost-effective within the 20-year time horizon.

Methodology and Compliance with State Mandates

Energy efficiency potential is calculated using methodology consistent with the Council's methodology for assessing conservation resources. Appendix III lists each requirement and describes how heat item was completed. In addition to using consistent methodology, Lewis PUD utilized many of the assumptions that the Council developed for the *6th RegionalPower Plan*. Specific utility data about customer characteristics, service-area composition, and historical conservation achievements were used, in conjunction with the measures identified by the Council, to determine the energy-efficiency potential available. Conservation potential was assessed for multiple time horizons: 2 years, 5 years, 10 years, and 20 years. This close connection with the Council methodology enables compliance with the Washington Independence Act.

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

Conservation Target Options

Establishing a conservation target for the 2012-2013 biennium can be done using the results of this assessment. However, as of the writing of this report, there were still ongoing discussions regarding the interpretation of the EIA rules regarding these targets. One of the ambiguous parts is around the use of the term "pro-rata share". One interpretation of this is this represents 20% of the 10-year potential. However, this is in conflict with the "Council Methodology" which uses ramp rates to define when measures are available to be implemented. For example, some measures are not yet available in the first few years of the 10-year period but become available during the plan.

The other point of discussion is whether or not the Fifth Plan Target Calculator can be used for this biennium. If the fifth plan target calculator can be used to set targets, then this option would result in the lowest option for Lewis PUD.

Six options are presented in Table 10. Most likely the first column, 2012+2013 are not acceptable options per the State Auditor. That leaves the possible options of 1.83 aMW based on the results of this CPA, 1.57 aMW based on the Fifth Plan Target Calculator, and 3.87 based on the Sixth Plan Target Calculator.

Table 10 – Target Options for 2012-2013 Biennium (aMW)

Tool	2012+2013	20% of 10-year
CPA (EIA Option 3)	1.71	1.83
5th Plan Target Calculator	1.94	1.57
6th Plan Target Calculator	3.04	3.87

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Appendix I – Acronyms

aMW –Average Megawatt

BPA – Bonneville Power Administration

Btu – British Thermal Unit

C&RD – Conservation and Renewable Discount

CAA – Conservation Augmentation Agreement

CFL – Compact Fluorescent Light Bulb

CPP – Critical Peak Pricing

CRC – Conservation and Renewable Credit

DSM – Demand Side Management

EESC – EES Consulting

GW – Gigawatts. 1,000,000 kW

GWh – Gigawatt-hour

HLH – Heavy load hour energy

HVAC – Heating, ventilation and air-conditioning

I-937 – Washington State Initiative 937

IRR – Internal Rate of Return

kW – kilowatt

kWh – kilowatt-hour

LED – Light-emitting diode

LLH – Light load hour energy

MF –Multi-Family

MH –Manufactured House

MW –Megawatt

MWh –Megawatt-hour

NEEA – Northwest Energy Efficiency Alliance

NPV – Net Present Value

NW – Northwest

O&M – Operation and Maintenance

VFD – Variable Frequency Drive

RIM – Rate Payer Impact

RPS – Renewable Portfolio Standard

RTP – Real Time Pricing

SF – Single Family

SGC – Super Good Cents

UC – Utility Cost

Appendix II – Glossary

6th Power Plan: Sixth Northwest Conservation and Electric Power Plan, Feb 2010. A regional resource plan produced by the Northwest Power and Conservation Council (Council).

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

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

Achievable Potential: Conservation potential that takes into account how many measures will actually be implemented. For lost-opportunity measures, there is only a certain percent of expired units or new construction for a specified time frame. The Council uses 85 and 65 percent achievability rates for retrofit and lost-opportunity measure respectively. Sometimes achievable potential is a percent of economic potential, and sometimes achievable potential is defined as a percent of technical potential.

Conservation Calculator: Refers to Excel program developed by the Council which calculates conservation potential for Northwest utilities based on their share of the regional load.

Cost-Effective: A conservation measure is cost-effective if its present-value benefits are greater than its present-value costs. The primary test is the Total Resource Cost test (TRC), in other words, the present value of all benefits is equal to or greater than the present value of all costs. Benefits and costs are for society as whole.

C&RD and ConAug: Conservation and Renewables Discount and Conservation Augmentation are both conservation programs previously offered by BPA. The C&RD program has been replaced by the Conservation Rate Credit (CRC) program.

CTED (Department of Community Trade and Economic Development): CTED Energy Policy Division helps deliver an economically and environmentally sound energy future to the State of Washington and its citizens. The department provides information, analysis and support and assists in developing energy policies and programs.

DSM (Demand Side Management): Actions to modify consumer demand for energy through various methods such as financial incentives and education.

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

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

Load: The amount of electric power delivered or required at any specific point on a system. Load also refers to the amount of electricity required by a customer or a piece of equipment. When the term refers to the total demand in an electric system it is called system load.

Lost Opportunity: Lost-opportunity measures are those that are installed as new construction or at the end of the life of the unit. Examples include weatherization, heat-pump upgrades, appliances, or premium HVAC in commercial buildings.

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

Non-Lost Opportunity: Measures that can be acquired at any time, such installing low-flow shower heads.

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

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

On-peak Power: Electricity supplied during periods of high system demand.

Off-peak Power: Electricity generated during periods of typically low consumer demand, such as early morning hours, Sundays, and holidays.

Peak: The maximum demand or load that has occurred during a specified period of time. The time period may be 30 minutes or an hour during a day, month, or year. Peak periods fluctuate by season. Peaks usually occur during the morning hours in the winter and in the late afternoon in the summer.

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

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

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

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

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

Appendix III – Documenting Conservation Targets

WAC 194-37-070 Documenting Development of Conservation Targets; Utility Analysis Option		
	NWPCC Procedures	**EES Consulting Methodology**
(i)	Analyze a broad range of energy efficiency measures considered technically feasible.	All of the 1,450 of the Council's current energy efficiency measures (6th Plan measures) were evaluated to determine which had greater benefits than costs.
(ii)	Perform life-cycle cost analysis of measures or programs, including the incremental savings and incremental costs of measures and replacement measures where resources or measures have different measure lifetimes.	The life-cycle cost analysis was performed using the Council's PROCOST model. Incremental costs, savings, and lifetimes for each measure were the basis for this analysis. The Council and RTF assumptions were utilized.
(iii)	Set avoided costs equal to a forecast of regional market prices, which represents the cost of the next increment of available and reliable power supply available to the utility for the life of the energy efficiency measures to which it is compared.	A regional market price forecast for the planning period was created and provided by Lewis PUD consistent with their IRP.
(iv)	Calculate the value of the energy saved based on when it is saved. In performing this calculation, use time differentiated avoided costs to conduct the analysis that determines the financial value of energy saved through conservation.	The Council's default measure load shapes were used to calculate time of day usage and measure values were weighted based upon peak and off-peak pricing. This was handled using the Council's PROCOST program so it was handled in the same way as the Power Plan models.
(v)	Conduct a total resource cost analysis that assesses all costs and all benefits of conservation measures regardless of who pays the costs or receives the benefits. The NWPCC identifies conservation measures that pass the total resource cost test as economically achievable.	Cost analysis was conducted according to the Council's methodology. Capital cost, administrative cost, annual O&M cost and periodic replacement costs were all considered on the cost side. Energy, non-energy, O&M and all other quantifiable benefits were included on the benefits side. The Total Resource Cost (TRC) benefit cost ratio was used to screen measures for cost-effectiveness (I.e., those greater than 1 are cost-effective).
(vi)	Identify conservation measures that pass the total resource cost test, by having a benefit/cost ratio of one or greater as economically achievable.	Benefits and costs were evaluated using multiple inputs; benefit was then divided by cost. Measures achieving a BC ratio of >1 were tallied. These measures are considered achievable and cost-effective (or "economically achievable").
(vii)	Include the increase or decrease in annual or periodic operations and maintenance costs due to conservation measures.	Operations and maintenance costs for each measure were accounted for in the total resource cost according to the Council's assumptions.

(viii) Include deferred capacity expansion benefits for transmission and distribution systems in its cost-effectiveness analysis.	Deferred capacity expansion benefits were given a benefit of $23/kW-yr in the cost-effectiveness analysis. This is the same assumption used by the Council in the Fifth and Sixth Power Plans.
(ix) Include all nonpower benefits that a resource or measure may provide that can be quantified and monetized.	Quantifiable non-energy benefits were included where appropriate. Non-energy benefits include, for example, water savings from clothes washers.
(x) Include an estimate of program administrative costs.	Total costs were tabulated and an estimated 20% of total was assigned as the administrative cost. This value is consistent with regional average and BPA programs. The 20% value was used in both the Fifth and Sixth Power plans.
(xi) Discount future costs and benefits at a discount rate based on a weighted, after-tax, cost of capital for utilities and their customers for the measure lifetime.	Discount rates were applied to each measure based upon the Council's methodology. Real discount rate = 5%.
(xii) Include estimates of the achievable customer conservation penetration rates for retrofit measures and for lost-opportunity (long-lived) measures. The NWPCC's twenty-year achievable penetration rates, for use when a utility assesses its twenty-year potential, are eighty-five percent for retrofit measures and sixty-five percent for lost opportunity measures achieved through a mix of utility programs and local, state and federal codes and standards. The NWPCC's ten-year achievable penetration rates, for use when a utility assesses its ten-year potential, are sixty-four percent for nonlost opportunity measures and twenty-three percent for lost-opportunity measures; the weighted average of the two is a forty-six percent ten-year achievable penetration rate	The assessment conducted for Lewis PUD was for the 20-year planning period, thus 85% for retrofit measures and 65% for lost opportunity measures were used to determine potential. These applicability factors are the same values used in both the Fifth and Sixth Power Plans.
(xiii) Include a ten percent bonus for conservation measures as defined in 16 U.S.C. § 839a of the Pacific Northwest Electric Power Planning and Conservation Act.	A 10% bonus was added to all measures in the model parameters per the Conservation Act.
(xiv) Analyze the results of multiple scenarios. This includes testing scenarios that accelerate the rate of conservation acquisition in the earlier years.	High and low-cost scenarios were run and plotted next to the base-case scenario. Ramp rates were also utilized to adjust for Lewis PUD's programs.
(xv) Analyze the costs of estimated future environmental externalities in the multiple scenarios that estimate costs and risks.	The avoided cost data include estimates of future high, medium, and low CO_2 costs.

Appendix IV – Energy Efficiency Potential by End-Use

Energy Efficiency Potential by End-Use

Residential

aMW

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Lighting	0.38	0.28	0.19	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
HP / DHP	0.07	0.08	0.08	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Envelope Retro	0.06	0.07	0.09	0.11	0.11	0.10	0.10	0.09	0.09	0.08	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Water Heat	0.06	0.07	0.08	0.13	0.13	0.14	0.15	0.16	0.17	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Consumer Electronics	0.01	0.02	0.04	0.06	0.06	0.07	0.08	0.09	0.09	0.09	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Appliances	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Envelope New	0.01	0.02	0.02	0.03	0.04	0.05	0.05	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Cooling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**0.60**	**0.55**	**0.52**	**0.45**	**0.46**	**0.47**	**0.51**	**0.52**	**0.55**	**0.55**	**0.61**	**0.61**	**0.61**	**0.61**	**0.61**	**0.61**	**0.61**	**0.61**	**0.61**	**0.61**

Commercial

aMW

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Lighting	0.04	0.05	0.07	0.08	0.09	0.10	0.10	0.11	0.11	0.11	0.12	0.10	0.08	0.06	0.06	0.06	0.06	0.06	0.04	0.03
PC Network/Supply	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.01	0.01	0.01	0.01	0.01
HVAC Controls	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Refrigeration	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.02	0.01	0.01	0.01	0.01
Ext Lighting	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
Rooftop Units	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Envelope	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Ventilation	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Food Service	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Chillers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Integrated Design	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Water Wastewater	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Other	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Traffic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Water Heat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**0.13**	**0.16**	**0.19**	**0.21**	**0.23**	**0.24**	**0.25**	**0.26**	**0.27**	**0.27**	**0.26**	**0.24**	**0.22**	**0.21**	**0.21**	**0.17**	**0.16**	**0.16**	**0.13**	**0.11**

Industrial

aMW

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Process: General	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Refrigerated Storage	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Lighting	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Fans	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Pumps	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Compressed Air	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Process: Metal Mfg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Motors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Process: Electronic Mfg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**0.11**	**0.12**	**0.13**	**0.15**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**

Agricultural

aMW

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Dairy	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Irrigation Hardware	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Irrigation Scheduling	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	**0.014**	**0.014**	**0.014**	**0.014**	**0.014**	**0.014**	**0.014**	**0.014**	**0.014**	**0.014**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

Distribution Efficiency

aMW

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Reduce system voltage	0.001	0.001	0.002	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Minor system improvements	0.003	0.006	0.009	0.012	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
Major system improvements	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	0.004	0.007	0.011	0.014	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020