Appendix 13

CONSERVATION POTENTIAL ASSESSMENT

SUMMARY

Seattle City Light contracted with Global Energy Partners (Global) to conduct a conservation potential assessment (CPA) to quantify the amount, the timing, and the cost of electric conservation resources available within the City Light service territory. The purpose of this study was to establish cost-effective and achievable energy conservation targets for the 2012–2013 biennial period to meet the legal requirements associated with Washington Initiative 937 (I-937) as well as to support City Light's 2012 Integrated Resource Plan (IRP). In accordance with I-937, this CPA is informed by and uses methodology consistent with the Northwest Power and Planning Council's (NWPCC) Sixth Northwest Conservation and Electric Power Plan report (Sixth Plan). The full Seattle City Light 2012 CPA report can be found at: http://www.seattle.gov/light/conserve/cv5_pub.htm

The CPA's objectives were to:

- Determine the conservation potential for the 10-year period 2012–2021 and the 20-year period 2012–2031 based on Seattle City Light's service territory characteristics;
- Develop energy conservation measure (ECM) data sets for each market sector and each appropriate market segment;
- Categorize the potential by market sector, segment, building type, and ECM;
- Using parameters provided by City Light, calculate the total resource cost (TRC), and measure levelized cost of the ECMs; and
- Provide supply curves of achievable potential.

DEFINITIONS OF POTENTIAL

In this study, the conservation potential estimates represent gross savings[1] developed into three types of potential: technical potential, economic potential, and achievable potential. Technical and economic potential are both theoretical limits to efficiency 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. These levels are described below.

Technical potential is defined as the theoretical upper limit of conservation potential. It assumes that customers adopt all feasible measures regardless of cost. At the time of equipment failure, customers replace equipment with the most efficient option available. In new construction, customers and developers also choose the most efficient equipment option. Examples of measures that make up technical potential in the residential sector include:

- Ductless mini-split heat pumps with variable refrigerant flow
- Heat pump water heaters
- LED lighting

Technical potential also assumes the adoption of every available other measure, where applicable. For example, it includes installation of high-efficiency windows in all new construction opportunities and heat pump maintenance in all existing homes and buildings with heat pump systems. The retrofit measures are phased over a number of years, which is longer for higher-cost measures.

Economic potential represents the adoption of all cost-effective conservation measures. In this analysis, the TRC test, which compares lifetime energy and capacity benefits to the incremental cost of the measure, is applied. Economic potential assumes that customers purchase the most cost-effective option at the time of equipment failure and also adopt every other cost-effective and applicable measure.

Achievable potential takes into account market maturity, customer preferences for energy-efficient technologies, and expected program participation. Achievable potential establishes a realistic target for the conservation savings that a utility can hope to achieve through its programs. It is determined by applying a series of annual factors to the economic potential for each ECM. These factors represent the ramp rates at which technologies will penetrate the market and were based upon the NWPCC ramp rates used in the Sixth Plan. In select cases, these factors were adjusted to account for City Light's past demand side management achievements and program history. Details regarding the ramp rate development appear in Appendix E of the NWPCC report.

[1] Savings in "gross" terms instead of "net" terms means that the baseline forecast does not include naturally occurring efficiency. In other words, the baseline assumes that energy efficiency levels remain fixed as they are today. This rule holds true except in cases where future codes and standards were on the books before June 2011, e.g. the effects of the EISA 2007 lighting efficiency standards.

ANALYSIS APPROACH

To perform the conservation analysis, Global used a bottom-up analysis approach described below.

1. Performed a market characterization to describe sector-level electricity use for the residential, commercial, and industrial sectors for the base year, 2010. This included using utility data and secondary data from sources such as the American Community Survey (ACS), and the Energy Information Administration (EIA).

2. Utilized City Light primary market research, such as the 2009 Residential Customer Characteristics Survey (RCCS) and secondary sources including the NWPCC and the Northwest Energy Efficiency Alliance (NEAA) research to understand how customers in City Light's service territory currently use electricity. Combining this information with the market characterization, Global developed energy market profiles that describe energy use by sector, segment, and end use for 2010.

3. Developed a baseline electricity forecast by sector, segment, and end use for 2012 through 2032. Results presented in this report are through 2031.

4. Identified and analyzed energy conservation measures appropriate for the City Light service territory, including but not limited to measures analyzed in NWPCC's Sixth Plan.

5. Estimated three levels of conservation potential: technical, economic, and achievable.

Overview of Analysis Approach

Energy Conservation Measures

The first step of energy conservation measure analysis is to identify all relevant conservation measures that should be considered. Sources for the measure assumptions were drawn from the NWPCC Sixth Plan and Regional Technical Forum (RTF) databases. To supplement these sources, City Light used Global's building modeling tool, BEST, and other measure databases from previous studies and program work.

The measures were categorized into two types according to the LoadMAP3 taxonomy: equipment measures and non-equipment measures.

Equipment measures, or efficient energy-consuming pieces of equipment, save energy by providing the same service with a lower energy requirement. An example is the replacement of a standard efficiency refrigerator with an ENERGY STAR model. For equipment measures, many efficiency levels are available for a specific technology that range from the baseline unit (often determined by code or standard) up to the most efficient product commercially available. For instance, in the case of central air conditioners, this list begins with the federal standard Seasonal Energy Efficiency Ratio (SEER) 13 unit and spans a broad spectrum of efficiency, with the highest efficiency level represented by a SEER 21 unit.

Non-equipment measures save energy by reducing the need for delivered energy but do not involve replacement or purchase of major end-use equipment (such as a refrigerator or air conditioner). An example would be a programmable thermostat that is pre-set to run the air conditioner only when people are home. Non-equipment measures fall into the following categories:

- Building shell (windows, insulation, roofing material);
- Equipment controls (thermostat, occupancy sensors);
- Equipment maintenance (cleaning filters, changing setpoints);
- Whole-building design (natural ventilation, passive solar lighting);
- Lighting retrofits (included as a non-equipment measure because retrofits are performed prior to the equipment's normal end of life);
- Displacement measures (ceiling fan to reduce use of central air conditioners); and
- Commissioning and retrocommissioning

Table 1 summarizes the number of equipment and non-equipment measures evaluated for each sector.

Table 1: Number of Measures Evaluated

Measures Evaluated	Residential	Commercial	Industrial	Total Number of Measures
Equipment Measures	1,007	3,578	936	5,521
Non-Equipment Measures	302	1,210	190	1,702
Total	1,309	4,788	1,126	7,223

CONSERVATION POTENTIAL RESULTS

Table 2 and Figure 1 summarize the conservation savings for the different levels of potential relative to the baseline forecast. Figure 2 displays the baseline and potential forecasts.

- **Achievable potential** across the residential, commercial, and industrial sectors is 1,013,662 MWh or 115.7 aMW in 2021 and increases to 206.6 aMW by 2031. This represents 9.4 percent of the baseline forecast in 2021 and 14.8 percent in 2031. By 2031, achievable potential offsets 70 percent of the growth in the baseline forecast. This level of savings is consistent with other Global potential studies for utilities with mature conservation programs.
- **Economic potential**, which reflects the savings when all cost-effective measures are taken, is 210.0 aMW in 2021. This represents 17.1 percent of the baseline energy forecast. By 2031, economic potential reaches 289.8 aMW, 20.8 percent of the baseline energy forecast.
- **Technical potential**, which reflects the adoption of all conservation measures regardless of cost-effectiveness, is a theoretical upper bound on savings. In 2021, energy savings are 336.6 aMW, or 27.4 percent of the baseline energy forecast. By 2031, technical potential reaches 449.8 aMW, 32.3 percent of the baseline energy forecast.

Table 2: Summary of Technical Conservation Potential

	2012	2013	2016	2021	2026	2031
Baseline Forecast (MWh)						
	9,595,628	9,797,949	10,239,603	10,751,449	11,286,255	12,198,689
Cumulative Savings (MWh)						
Achievable	69,385	150,028	431,928	1,013,662	1,451,800	1,809,690
Economic	297,923	549,573	1,163,056	1,839,584	2,251,139	2,538,749
Technical	466,261	824,859	1,863,687	2,948,960	3,496,212	3,939,856
Cumulative Savings (aMW)						
Achievable	7.9	17.1	49.3	115.7	165.7	206.6
Economic	34	62.7	132.8	210	257	289.8
Technical	53.2	94.2	212.7	336.6	399.1	449.8
Savings (% of Baseline)						
Achievable	0.70%	1.50%	4.20%	9.40%	12.90%	14.80%
Economic	3.10%	5.60%	11.40%	17.10%	19.90%	20.80%
Technical	4.90%	8.40%	18.20%	27.40%	31.00%	32.30%

Figure 1: Summary of Achievable Potential Energy Savings

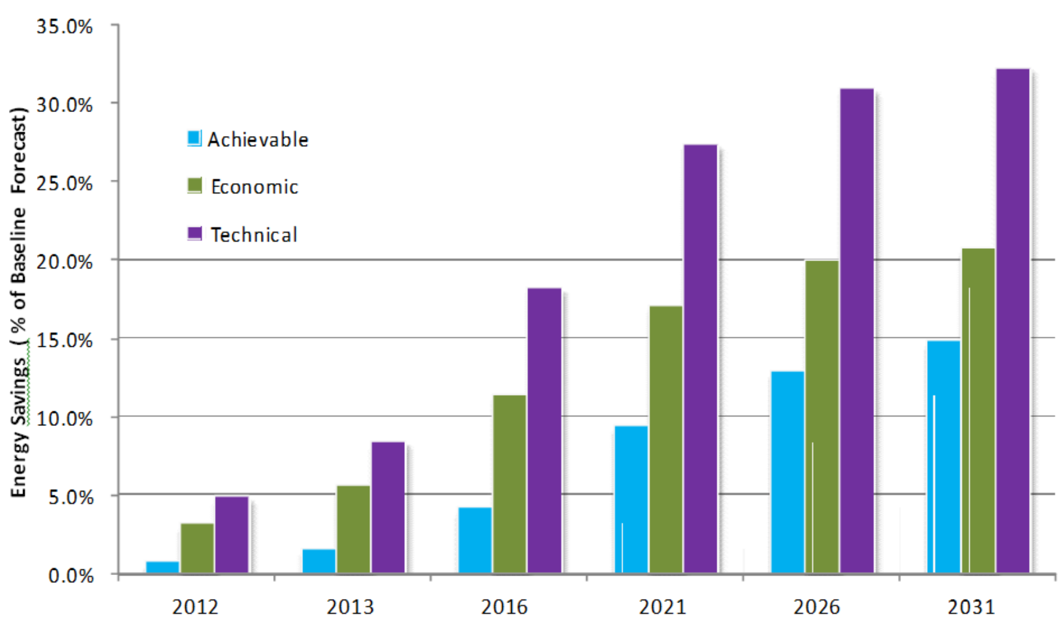

Table 3: Achievable Conservation Potential by Sector

Sector	2012	2013	2016	2021	2026	2031
Achievable Cumulative Savings (MWh						
Residential	16,486	32,363	77,250	192,848	321,315	418,927
Commercial	45,753	103,671	317,714	728,083	1,006,443	1,253,358
Industrial	7,146	13,993	36,964	92,731	124,042	137,405
Subtotal	*69,385*	*150,028*	*431,928*	*1,013,662*	*1,451,800*	*1,809,690*
Outdoor Lighting	3,776	7,551	18,878	37,757		
Total	73,161	157,579	450,806	1,051,419	1,451,800	1,809,690
Achievable Cumulative Savings (aMW)						
Residential	1.9	3.7	8.8	22	36.7	47.8
Commercial	5.2	11.8	36.3	83.1	114.9	143.1
Industrial	0.8	1.6	4.2	10.6	14.2	15.7
Subtotal	*7.9*	*17.1*	*49.3*	*115.7*	*165.7*	*206.6*
Outdoor Lighting	0.4	0.9	2.2	4.3		
Total	8.4	18	51.5	120	165.7	206.6

Table 3 summarizes achievable potential by sector and year. In addition to the residential, commercial, and industrial sector potentials developed by Global and shown in previous results, Table 3 also includes the outdoor lighting (street lighting) potential, which City Light estimated separately as 4.3 aMW by 2021. Based on the total achievable potential of 120.0 aMW in 2011, City Light is establishing a conservation target for the 2012-2013 biennium of 24.0 aMW.

Figure 2: Conservation Potential Energy Forecasts (MWh)

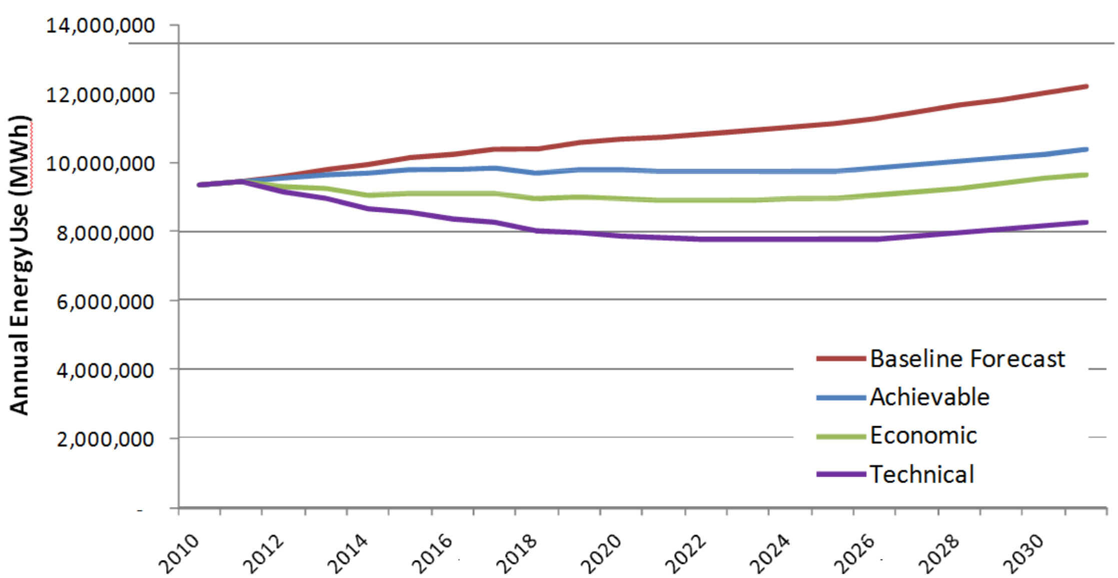

Figure 3: Achievable Conservation Potential by Sector (aMW)

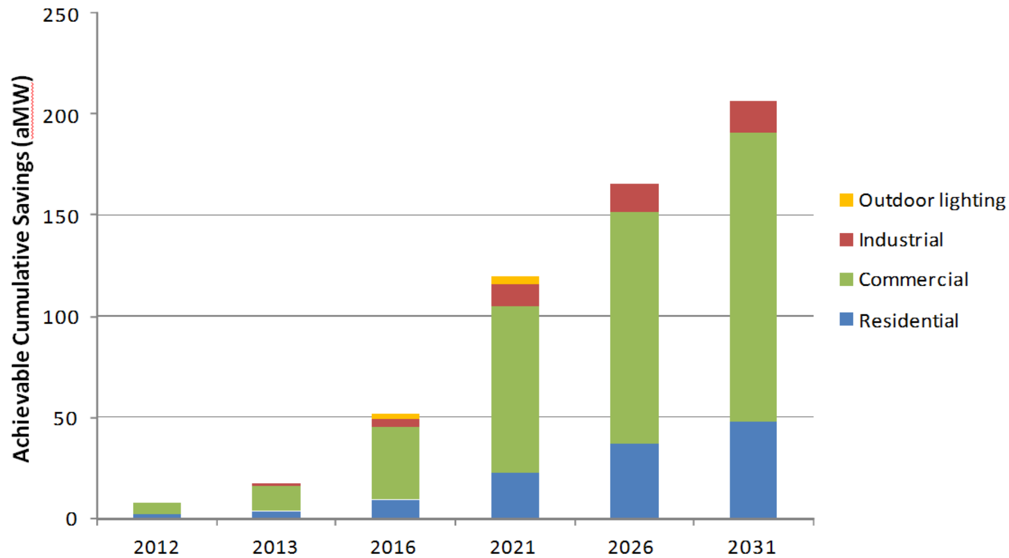

Figure 3 shows that, consistent with its largest proportion of baseline energy use, the commercial sector accounts for the largest portion of the savings, between 65-70 percent of the achievable potential depending on the year, followed by the residential and then the industrial sectors.