BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

PETITION OF PECO ENERGY COMPANY FOR APPROVAL OF ITS ACT 129 ENERGY EFFICIENCY AND CONSERVATION PLAN AND EXPEDITED APPROVAL OF ITS COMPACT FLUORESCENT LAMP PROGRAM	:	DOCKET NO. M-2009-2093215

VOLUME IV OF V

ACT 129 ENERGY EFFICIENCY AND CONSERVATION PLAN

APPENDIX F-1 THROUGH F-8

July 1, 2009

APPENDIX F.

OTHER APPENDICES

APPENDIX F-1.

ENERGY EFFICIENCY POTENTIAL STUDY

Global Energy Partners, LLC
An Employee-Owned Company

Energy Efficiency Potential Study for PECO Energy

APPENDIX F-1 –Energy Efficiency Potential

Global Report Number 1278

May 8, 2009

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The appendix is a corporate document that should be cited in the literature in the following manner:
Energy Efficiency Potential Study for PECO Energy: Appendix A – Energy Efficiency Potential, Global Energy Partners, LLC, Walnut Creek, 2009. Report Number 1278.

SUMMARY AND KEY FINDINGS

This report presents preliminary analysis of the potential for energy efficiency in PECO Energy (PECO) territory which includes the city of Philadelphia surrounding counties of Bucks, Chester, Delaware, Montgomery and York. This report defines three sectors: residential, commercial and industrial. The base year electricity sales[1] are 38,213 GWh, corresponding to PECO's internal forecast.

Table ES-1 presents energy-efficiency potential across all sectors. Across the four-year horizon, this represents an average of 1.8% savings per year. The potential estimates are displayed graphically in Figure ES-1.

Table ES-1
Total Potential Estimates in GWh

	PY 2009	PY 2010	PY 2011	PY 2012
Baseline Electricity Forecast (GWh)	38,215	38,564	39,366	39,828
Energy Savings (GWh)				
Achievable Potential	636	1,578	2,434	3,130
Economic Potential	1,515	3,074	4,474	5,366
Technical Potential	1,992	4,026	5,832	7,086
Energy Savings as % of Baseline				
Achievable Potential	1.7%	3.8%	5.7%	7.2%
Economic Potential	4.0%	8.0%	11.4%	13.5%
Technical Potential	5.2%	10.4%	14.8%	17.8%
Peak Demand Savings (MW)				
Achievable Potential	257	561	831	1,204
Economic Potential	830	1,488	2,023	2,441
Technical Potential	1,001	1,789	2,422	2,913

The achievable potential is 636 GWh in Program Year (PY) 2009 and it increases to 3,130 GWh by PY 2012. This represents 1.7% of the baseline forecast in PY 2009 and 7.2% in PY 2012. Economic potential in PY 2009 is 1,515 GWh, or 4% of the baseline forecast. By PY 2012, it increases to 5,366 or 13.5% of the baseline forecast.

Comparing these estimates with similar studies shows the following:

- The EPRI National Study for the Northeast Region estimated a "maximum" achievable potential of 4.1% in 2010 and 7.5% of baseline in 2020. These values were interpolated to obtain a PY 2012 savings of 5.1%, falls lower than the potentials reported here.
- The primary reason for this discrepancy is that the Energy Security and Independence Act (EISA 2007), which includes an important new standard affecting lighting that becomes effective in 2012-2014, just as the PECO forecast horizon is coming to a close. This standard changes the baseline and reduces the potential estimate for the years 2015-2020, leading to a savings percentage that is low in comparison to the total reported here.

[1] Does not include street lights, railroads and interdepartment

- The Statewide potential study performed for Pennsylvania by ACEEE (April 2009) reports an achievable potential savings of 26% of the electric baseline for residential, commercial and industrial energy efficiency efforts by the year 2025. Assuming a linear trend towards obtaining these savings and interpolating backwards from this number gives a 2013 savings value of between 6-8% of the baseline.

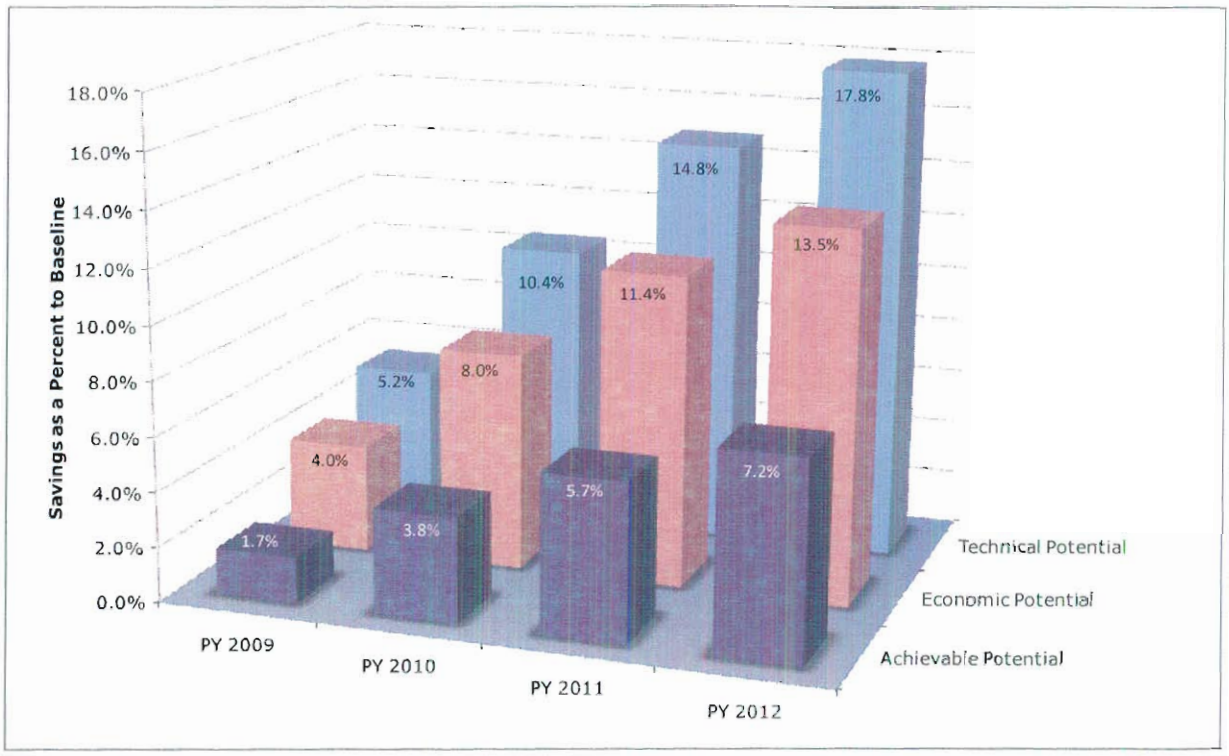

Figure ES-1
Total Energy Efficiency Potential as Percentages of Baseline Forecast

While the potential estimates obtained in this study show that there are ample opportunities for PECO to meet its energy efficiency goals in absolute terms, it should be noted that obtaining these values would require a major shift in energy consumption trends across all customer segments. Figure ES-2 shows the potentials in the context of the baseline forecast. While the baseline rises 4.2% over the forecast horizon, the achievable potential entails a virtual flattening of total energy use, while economic and technical potentials represent steep declines over the same time horizon. Within a period of only three and a half years, the major obstacle to the achievement of the potentials presented here is the ability of PECO to design and implement effective programs that successfully alter the decision-making of customers regarding energy efficiency.

The total baseline forecast climbs at an annual rate of 1.0% throughout the course of the forecast. For comparison, the baseline electric forecast for the Philadelphia area utilized in the ACEEE study rises at an annual growth rate of 1.4%; and the national electric consumption grows at 1.1% according to the baseline forecast utilized in the EPRI National Study.

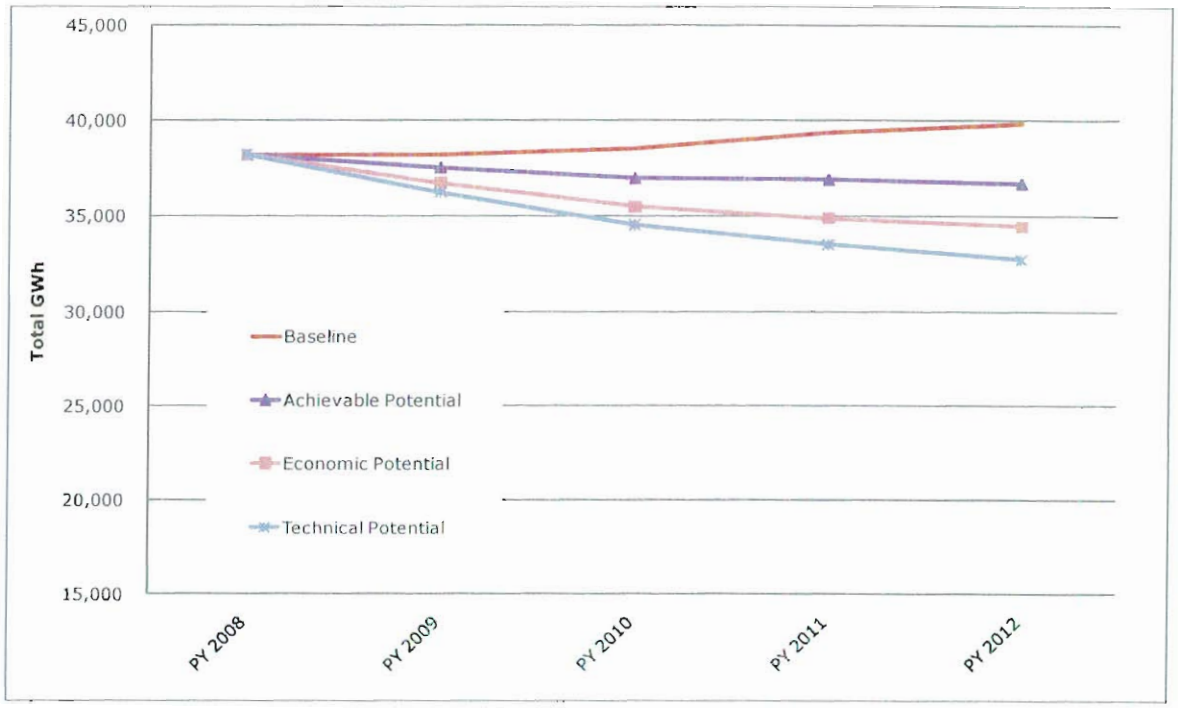

Figure ES-2
Baseline Forecast and Energy Efficiency Potential Estimates

Table ES-2 presents the energy efficiency potential estimates by sector. In PY 2009 through PY 2012, the residential potential roughly equals the total of the commercial and industrial sectors. This is surprising because the residential sector is only half the size of the business market in terms of absolute electric consumption. A large part of the residential savings are attributable to lighting changes from incandescent to Compact Fluorescent Lamps, a key energy efficiency measure with a particularly high applicability in the residential sector.

The majority of the savings making up achievable potential comes from the residential and commercial sectors, with a smaller contribution from the industrial sector. This distribution differs from the savings reported in the ACEEE study for Pennsylvania, under which 21% of the savings are obtained in the industrial sector (compare to 8%) and 18% are obtained through combined heat and power applications, which are not considered under the present study. Between the residential and commercial sectors, the energy efficiency potential for 2030

Table ES-2
Total Sector Potential Estimates in GWh

	PY 2009	PY 2010	PY 2011	PY 2012
Achievable Potential (GWh)				
Residential	334	820	1,282	1,494
Commercial	302	649	975	1,381
Industrial	50	109	178	256
Total	686	1,578	2,435	3,131
Economic Potential (GWh)				
Residential	597	1,360	2,054	2,344
Commercial	806	1,489	2,080	2,566
Industrial	112	224	340	456
Total	1,515	3,073	4,474	5,366
Technical Potential (GWh)				
Residential	787	1,773	2,648	3,102
Commercial	1,035	1,911	2,667	3,288
Industrial	170	342	518	696
Total	1,992	4,026	5,833	7,086

An important subtlety behind the potentials analysis is the existence of two types of energy efficiency measures: equipment measures (chiller systems, room air conditioners, clothes washers, water heaters, etc) and non-equipment measures (controls, shell measures, equipment maintenance, and retrofit projects). While both types of measures contribute to the potentials, they do so in different ways:

- Equipment measures are limited by stock turnover as driven by the useful lifetime of each technology. For example, a central air conditioner in an existing home has a "window" in which it can be upgraded to a SEER 15 or SEER 16 system, depending on when the unit in place quits working and needs to be replaced
- Non-equipment measures can be implemented at any time, although sometimes only cost-effective during new construction or major renovations. An example of a measure in this category is the programmable thermostat.

Because of the short time horizon under consideration, the relative breakout between the two types of energy efficiency measures differs from that of longer studies. With the large savings from equipment replacement measures requiring several years to diffuse into the market, non-equipment measures such as thermostats present a greater-than-usual opportunity for PECO to meet its goals in the near term. Figure ES-3 shows a comparison of the savings as a percent for equipment and **non**-equipment measures. In the beginning of PY 2010 the equipment measures account for a **small** portion of the total savings compared to PY 2012 while non-equipment measures display the opposite characteristics. This is because non-equipment measures such as controls and shell measures are faster to implement compared to equipment measures. Savings in equipment measures rely on stock turnover and decisions variables which has a slower ramp up than non-equipment measures.

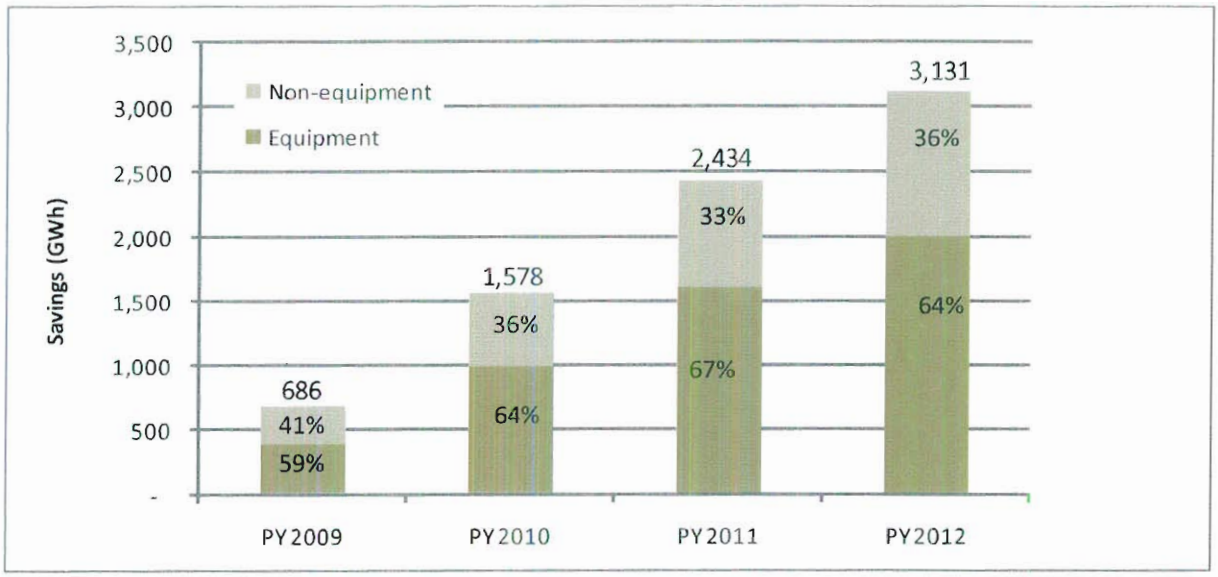

Figure ES-3
Total Energy Efficiency Potential by Equipment and Non-equipment measures

CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER | 1

INTRODUCTION

1.1 BACKGROUND

The state of Pennsylvania has passed a new law that mandates the reduction of energy consumption and demand. Called ACT 129, this new law requires PECO and other distribution companies operating in Pennsylvania to reduce electricity consumption and demand by 1% by 2011 and by 3% by 2013. PECO currently provides electricity and gas services to Pennsylvania customers in 5 counties in and around the city of Philadelphia. As a result of ACT 129, PECO is required to submit to the Public Utilities Commission (PUC) a plan that provides details on new energy-efficiency and demand response programs that PECO will offer to its customers during the 2009-2013 timeframe to achieve the energy savings goals. The plan also outlines funding and other resources that PECO will require to achieve the goals. To this end, PECO has retained Global Energy Partners (Global) to conduct a market assessment of the energy-efficiency and demand response potential and to design programs that will be offered during the 2009-2013 timeframe to support PECO's submission of the plan to the PUC. This appendix covers the energy efficiency potential analysis specifically.

1.2 OBJECTIVES

The overall goal of the energy efficiency potential study is to provide a comprehensive and realistic analysis of the available energy and demand savings that can be obtained from viable energy efficiency measures over the next 10 years. The main objectives for this study include:

- Isolate and evaluate specific end-use energy consumption encompassing electric (both energy and demand) and natural gas by service class, customer type, building category and business segment;
- Develop baseline energy profiles for each market segment;
- Estimate the technical, economic and achievable potentials by passing all measures through a screening process to determine their viability in the market; and
- Administer Total Resource Cost (TRC), a key cost effectiveness test to determine cost benefit of energy efficiency measures throughout their lifecycle.

Specific objectives for the analysis of potential energy savings include considering impacts from:

- Natural turnover of equipment or market availability (including existing saturation data) and early and other discretionary retrofits decisions;
- Anticipated changes to federal minimum efficiency ratings addressing equipment (e.g. The Energy Independence and Security Act of 2007) and state and local building codes and standards;
- Customer growth, equipment adoption rates and applicability;
- New construction market (estimated by segment).

Specific objectives for the research approach include:

- Utilize existing customer and market from PECO Energy;
- Conduct extensive primary market research through online surveys with PECO Energy residential customers,

- Benchmark for similarly situated market segments and buildings across the United States and draw comparisons with recently completed engineering and parametric analyses; and
- Leverage a national study undertaken by the Electric Power Research Institute, (hereafter) referred to as the EPRI National Potential Study.
- Compare with the Pennsylvania Statewide Energy Efficiency Potential Study recently completed by ACEEE.

1.3 APPENDIX ORGANIZATION

This appendix describes the methodology and results associated with estimating the energy efficiency potential. The appendix is organized into the following chapters:

- *Chapter 2 – Study Approach* describes the overall approach and the analysis steps followed to conduct the study.
- *Chapter 3 – Customer Surveys* discusses the primary market research conducted among residential customers and the incorporation of these findings into the analysis.
- *Chapter 4 – Baseline Forecast* describes the development of the baseline forecast and presents the forecast results for the residential and commercial sectors over a 4-year planning horizon.
- *Chapter 5 – Energy Efficiency Measures* describes the process employed to identify and screen energy efficiency measures. This process involves identifying the applicable energy efficiency measures; determining the savings, costs, and lifetimes of the measures; and conducting an economic screening of the measures.
- *Chapter 6 – Energy Efficiency Potential* describes the approach taken to develop the technical, economic, and achievable potentials and provides detailed results for each of the potentials.

STUDY APPROACH

A depiction of the analysis approach carried out in this study is presented in Figure 2-1. Execution of this approach involves four steps:

1. Develop a market research and data development plan for the residential, commercial and industrial sectors
2. Develop base-year energy market profiles and a baseline energy forecast
3. Identify and analyze energy efficiency measures appropriate for PECO Energy's service area
4. Estimate the energy efficiency potential

The methodology used to carry out these steps is described in further detail in the following subsections.

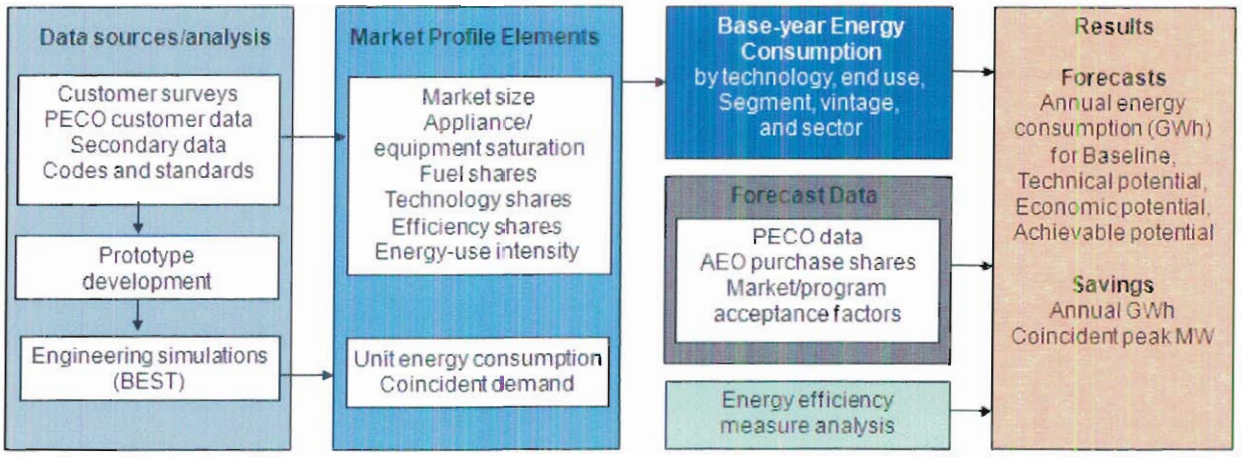

Figure 2-1
Depiction of Analysis Framework

2.1 CUSTOMER SURVEYS

A key objective of this study was to utilize existing customer and business data available from PECO and to supplement with primary market research (residential only). Billing data, end-use and volumetric electricity forecast data, and data from ongoing saturation surveys provided most of the data needed for the study

For the residential sector, an online survey of 1,504 customers was conducted from February 27, 2009 through March 12, 2009. The respondents to the survey were recruited from online panel members of a third-party market research firm, e-Rewards. Once the data was reviewed, a total of 1,481 responses were used for the analysis.

The details about the customer survey approach are presented in Chapter 3.

2.2 BASELINE ENERGY USE

Determining the baseline for energy use is a crucial step in order to understand the current energy use characteristics as well as to project future energy use trends in the absence of new utility demand-side management (DSM) programs. The baseline energy use is often developed in two parts. The first, referred to as *base-year market profiles*, represents the current situation; the second, *the baseline forecast*, represents the future.

For this study, the base-year market profiles were defined for 2009 and the baseline forecast was developed by market segment through May of 2013. The base-year market profiles, baseline forecast, and modeling approach are discussed next.

2.2.1 Base-Year Market Profiles

Market profiles characterize energy use in terms of sector, customer segment, fuel or energy (electricity), and end-use. The elements in a market profile include the market size, annual energy use, equipment saturations, fuel shares, technology shares, and end-use consumption estimates. The end-use consumption estimates are typically defined using values of Unit Energy Consumption (UEC) and Energy Utilization Index (EUI).

For this study, the market profiles for four segments in PECO Energy's service territory were developed for the base year of 2008-2009 (two residential segments and two commercial segments:

- Residential
    - Residential (excluding low-income)
    - Low-income
- Commercial
    - Commercial (excluding government)
    - Government

2.2.2 Baseline Forecast

Once the base year market profiles are defined, the next step is to develop a baseline forecast of annual energy use by customer segment, fuel, and end-use. Several factors are taken into consideration in the baseline forecast:

- Current economic growth forecast
- Energy price forecasts
- Appliance, equipment, and building codes and standards already on the books;
- Naturally-occurring conservation

- Existing utility programs (no new utility programs)

It is important to emphasize that only existing utility programs are included in the baseline forecast; the potential impacts of new utility programs are excluded in the baseline. As a result, this baseline forecast is the metric against which energy savings associated with new programs are compared.

The baseline forecast for this study was developed through May 31, 2013 for the two residential and two commercial segments identified previously. Chapter 4 describes the baseline energy use in greater detail.

2.2.3 Modeling Approach

A comprehensive microeconomic model was used to establish the baseline forecast, as well as forecasts representing the technical, economic, and achievable potentials. The model, referred to as *Load Management Analysis and Planning* (or *LoadMAP™*), was developed in 2007 and employed in the EPRI National Potential Study. Built in Excel, the LoadMAP framework is both accessible and transparent. The LoadMAP model provides forecasts of baseline energy use by sector, segment, end-use and technology for existing and new buildings. It also provides forecasts of total energy use and energy efficiency savings associated with the technical, economic and achievable potentials. In addition, the model may be employed to develop alternative scenarios at the same level of detail.

There are several key features of the model:

- **Simple and robust:** LoadMAP embodies the basic principles of rigorous end-use models (such as EPRI's REEPS and COMMEND) but in a more simplified, accessible form.
- **Capable of stock accounting:** It includes stock-accounting algorithms that treat older, less efficient appliance/equipment stock separately from newer, more efficient equipment. Equipment is replaced according to the measure life defined by the user.
- **Allows for varying degrees of data availability:** To balance the competing desires of simplicity and robustness, the model treats end-uses separately to account for varying importance and availability of data resources. It incorporates important modeling details where market data are available, and allows for simplified estimations where appropriate.
- **Able to discern by building/equipment vintage:** It isolates new construction from existing buildings and systems. It treats purchasing decisions for new construction, replacement upon failure, and non-owner acquisition separately.
- **Employs flexible decision logic:** The model uses a simple, yet flexible logic for appliance and equipment decisions. Some models embody decision tools based on efficiency choice algorithms or diffusion models. While these have some merit, the model parameters are difficult to estimate or observe and sometimes produce anomalous results that require calibration or even overriding. LoadMAP allows the user to drive appliance and equipment choices year by year directly in the model. This flexible approach enables users to import the results from diffusion models, or to input individual assumptions. The framework also facilitates sensitivity analysis.
- **Contains logic customized by end-use:** It includes appliance and equipment models that are customized by end-use. For example, the logic for lighting equipment is distinct from the logic for refrigerators and freezers.
- **Accommodates different degrees of segmentation:** The model can accommodate various levels of segmentation. That is, the analysis can be performed at the sector level (e.g., total residential sector) or for customized segments within sectors (e.g., housing type or income level).

Table 2-1 summarizes the LoadMAP datasets. These datasets are compiled for each applicable segment and vintage. In this study, datasets were developed for the residential (excluding low-

income), low-income, commercial (excluding government), and government segments as well as for new and existing construction.

The quality of data inputs is critical to the outcome of the LoadMAP modeling process. To ensure the best results, the following course of action was adhered to during the data development process.

1. Data obtained through primary research conducted as part of this study and/or provided by relevant parties (e.g., PECO Energy) were relied on to the extent possible.
2. Secondary data sources provided by PECO Energy and Pennsylvania Technical Reference Manual were incorporated to supplement and corroborate the primary research results.
3. Regional data obtained as part of the EPRI National Potential Study and other regional sources were compared and cross-checked with data from Steps 1 and 2.
4. Data were calibrated to ensure segment totals matched up to prior billing data.
5. PECO Energy staff members were consulted with to compare the data and modeling results against their knowledge and experience.

Table 2-1
Data Needs for Forecasting with LoadMAP

Dataset	Description	Key Sources
Study Inputs	Household and floorspace forecasts, electricity price forecast, avoided cost forecast	Billing data, primary research, population forecast, PECO Energy price forecast
Applicability Shares	Percentage of households/floorspace utilizing a given end-use	Primary research for residential, secondary data for C&I
Technology Shares	Percentage of households/floorspace utilizing a given technology	Primary research for residential, secondary data for C&I
Baseline Purchase Shares	Percentage of units purchased for a given efficiency level	Shipments data, AEO forecast assumptions, future codes and standards analysis
Economic Potential Purchase Shares	Percentage of units purchased for a given efficiency level	Output of economic screen module
Technical Potential Purchase Shares	Percentage of units purchased for a given efficiency level	100% of purchases are most efficient available option
Vintage Data	Base year distribution of equipment ages and efficiency levels	Primary research, analysis of past codes and standards, DOE appliance data
Efficiency Definitions	Set of available efficiency levels and base year annual energy consumption for a given technology	Engineering analysis, prototype simulations
UEC/EUI	Energy consumption forecast for a given efficiency level	Output of usage module
Measure List	Non-equipment measures with percentage energy savings, base year saturation, applicability, and penetration rate	Prototype simulations, engineering analysis, primary research
Usage Module	Projection of future usage by efficiency level through application of elasticity's	Price forecast, elasticity assumptions
Economic Screen Module	Calculation of net present value of lifetime energy savings for a given technology or measure and comparison of benefit to cost	Cost data, retail price or avoided cost forecast, assumed discount rate

2.3 ENERGY EFFICIENCY MEASURES ANALYSIS

The framework for assessing savings, costs, and other attributes of energy efficiency measures involves identifying the list of measures to include in the analysis, fully characterizing each measure, and performing cost-effectiveness screening.

Various sources were used to compile a list of energy efficiency measures for each customer sector assess in this study:

- Global's list of universal measures (details in chapter 5).
- EPRI's National Potential Study
- Technical Reference Manual (TRM)
- PECO staff input

The measures identified cover all major types of end-use equipment, as well as devices and actions to reduce energy consumption.

Each measure was characterized in terms of typical savings, incremental cost, and lifetime. An economic screening of the measures was then conducted to screen out the energy efficiency measures that were uneconomical.

Chapter 5 more fully the describes analysis of the energy efficiency measures.

2.4 ASSESSMENT OF ENERGY EFFICIENCY POTENTIAL

A key objective of this study is to estimate the potential for energy savings through energy efficiency activities in PECO Energy's service territory. The potential impact of energy efficiency activities is the cumulative total of many installations, including replacing a unit that has failed with a more efficient unit, improving the building envelope, and applying controls to optimize energy use.

In order to express the potential for energy efficiency in terms that are meaningful to a wide audience, this study followed the convention outlined in the NAPEE Guide for Conducting Potential Studies (November 2007). Specifically, three types of potentials were reported:

- **Technical potential**: The technical potential is calculated by applying the most efficient option commercially available in each purchase decision, regardless of cost. Thus, technical potential represents a maximum or upper limit of the savings that could be attained using existing technologies. While cost is not considered in the decision to purchase efficient equipment, the replacements are limited by the turnover of stock and the penetration of efficiency measures.
- **Economic potential:** Economic potential results from the purchase of the most efficient *cost-effective* option available for a given decision. Cost-effectiveness is determined by applying an economic test. The economic test used in this study is the Total Resource Cost (TRC) test.
- **Achievable potential:** Achievable potential is a subset of the economic potentiall that takes into consideration factors such as market acceptance and customer attitudes toward energy efficiency. This potential can be thought of as an upper bound on the savingsthat could be achieved through the energy efficiency promotional efforts of PECO Energy and other entities. Chapter 6 describes our methodology for achievable potential in more detail.

CHAPTER | 3

CUSTOMER SURVEYS

A key objective of this study was to supplement existing appliance saturation data available for the PECO service territory with primary market research. This chapter describes the residential research.

3.1 RESIDENTIAL SECTOR

For the residential sector, an online survey of residential customers was conducted using a third-party market research panel. In this chapter we cover the sample design, data collection and survey analysis.

3.1.1 Sample Design

To develop the sample, the following steps were taken:

- **Identified the sampling unit**. The sampling unit for the residential sector is an account which represents a household.
- **Developed the stratification approach**. The purpose of the study was to determine energy efficiency programs for the residential population as a whole and for low-income households. Low-income is defined as households with less than 150% of the median household income for the PECO service territory. Since this distinction is based on household size, we used annual household income of less than $25,000 as a proxy for low-income households.
- **Allocated the sample**. A total sample target of 1,500 responses was allocated throughout the PECO territory. The low-income segment was over-sampled since the response rate to online surveys for low-income households is typically lower than the rest of the population. A minimum target of 100 low-income responses was set. In addition, a quota of at least 250 responses for each county was set so that comparisons could be made among the counties.

There are 1,412,469 households in the PECO service territory in 2009. It is estimated that 250,000 of those customers are considered low-income. These households make up the Low Income segment, referred to throughout this report. The Residential Segment is considered all households that are not counted as low-income. Therefore the residential segment includes 1,162,463 households.

In order to obtain results with +/- 5% error of the mean, with a 95% confidence level, we decided to collect 1,500 responses with at least 100 responses from low-income customers. E-Rewards used recruited respondents by

3.1.2 Questionnaire Design

A questionnaire was developed to capture the most important information necessary for the development of accurate estimates of baseline energy use and energy efficiency potential. The survey focused on detailed equipment data along with information about energy efficiency measures already taken. The final questionnaire is presented in Appendix X.

3.1.3 Online Survey

An online survey approach was used for the residential sector. e-Rewards, a third-party online market research company, recruited participants to the survey. e-Rewards maintains a panel of respondents that agree to participate in online surveys. In return for participating, panel members earn points that can be exchanged for various rewards.

e-Rewards invited panel members located in zip codes within the PECO service territory to participate in the survey. Screening questions were setup to ensure that they were PECO customers. Quotas were also set based on income and county.

Since it was anticipated that the low-income segment would be difficult to reach, e-Rewards sent invitations to lower income households more frequently. A minimum quota of 100 low-income responses was set to ensure enough responses to characterize the segment. Quotas were also set so that a minimum of 250 responses were received from each county.

A total of 1,504 responses were collected. After the data were cleaned and validated a total of 1,481 responses were used to develop expansion weights.

To determine the expansion weights, we needed to segment the population by county. There are 1,412,449 residential customers in the PECO service territory. It is estimated that 250,000 of those customers are considered low-income. These households make up the Low Income segment, referred to throughout this report. The Residential Segment is considered all households that are not counted as low-income. Therefore the Residential Segment includes 1,162,463 households.

Assumptions were used to calculate the breakdown of customers into county by segment. The percent of all residential customers by county was provided by PECO. The percent of low-income customers by county was based on the percent of persons below poverty in 2007 from the U.S. Census Bureau[2]. The percentages used to develop the weights are shown in Table 3-1.

Table 3-1
Assumptions for Expansion Weights

	% of all customers	% low-income
Philadelphia	39.6%	24%
Bucks	13.9%	5%
Chester	12.7%	6%
Delaware	16.5%	10%
Montgomery	17.4%	5%

[2] U.S. Census data by county from the U.S. Census Bureau's State & County QuickFacts, http://quickfacts.census.gov/qfd/states/42/42101.html

The breakdown of responses by county and mean-per unit weights is shown in Table 3-2.

Table 3-2
Final Residential Sample

Survey Responses			
	Residential	Low Income	Total
Philadelphia	265	55	320
Bucks	303	8	311
Chester	258	9	267
Delaware	241	16	257
Montgomery	310	16	326
Total	1,377	104	1,481

Mean-Per-Unit Expansion Weights		
	Residential	Low Income
Philadelphia	1,443.30	3,203.58
Bucks	604.52	1,610.19
Chester	638.75	1,567.33
Delaware	842.23	1,919.30
Montgomery	738.81	1,006.68

3.1.4 Data Analysis

The final survey dataset was used to develop the key data elements needed for estimation of the baseline forecast and energy efficiency potential. The results are presented in the market profiles in Section 4. Crosstabs of the survey data, as well as the final SPSS dataset, were provided to PECO separately.

CHAPTER | 4

BASELINE ENERGY USE CHARACTERISTICS

The purpose of the baseline assessment is to portray the way customers of PECO Energy use energy today, and how this energy use projects forward into the future. This section describes energy use in both electricity consumption and peak demand for each sector by segment, end-use, and technology. The baseline forecast serves as the reference case against which energy efficiency potentials and program impacts are measured. This chapter describes how the baselines were determined for the residential, commercial, and industrial sectors.

4.1 OVERVIEW

PECO Energy analysis is performed on a "program year" calendar which begins June 1 and ends May 31 of the following year. Throughout this section, we describe baseline usage for the time period spanning 2008-2009; the 2009-2010 year is the first period considered for energy efficiency potentials and programs, followed by the remaining years, with the termination of the forecast at the end of May 2013.

PECO customers consume 38,213 GWh per year. The summary of present-day electric consumption is illustrated in Figure 4-1 below, with a breakout among the three market sectors. The customers served by PECO are characteristic of other areas in the Mid-Atlantic region, with nearly half of the energy usage in the commercial sector and a relatively small industrial contribution.

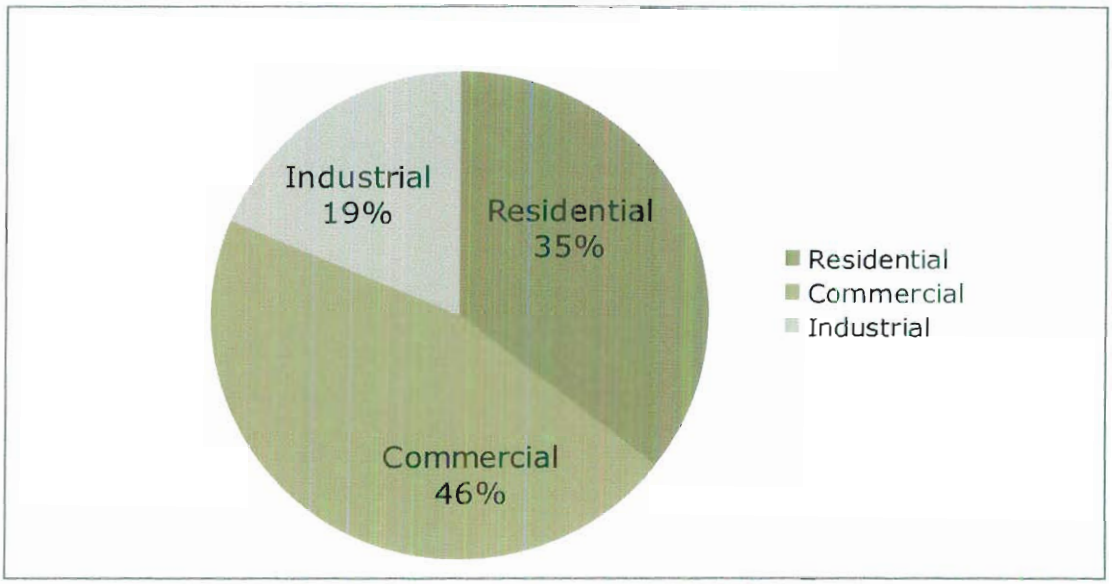

Figure 4-1
Total Electricity Use by Customer Sector, Base Year

4.2 RESIDENTIAL SECTOR

PECO provides electricity to over 1.4 million individual residences, representing total estimated sales in the base year of 13.6 terawatt-hours (TWh). From apartments and condominiums in

inner-city Philadelphia to more suburban settings in the surrounding counties, this group is diverse and varied in the way they consume energy.

4.2.1 Market Segmentation

In order to categorize the energy consumption and peak demand of PECO Energy's residential customer base accurately, the residential sector was divided into two segments:

- Residential buildings, excluding low-income units
- Low-income units

Low income is defined as those households that make 80% of the Area Median Income (AMI), and corresponds to the energy efficiency programs targeting this group. Both the low income and residential segments span all types of dwellings, from single family homes to duplexes and row houses, to large multi-family apartment buildings.

Further distinctions were made to characterize different vintages in the building stock:

- **Existing homes:** Existing homes were defined as those constructed before this study's commencement in 2009. The existing buildings were considered to have building shell characteristics represented by existing stock levels for weather conditions in PECO Energy's territory and installed equipment was considered to adhere to existing stock efficiency levels. Equipment stock levels were determined using survey data described in Chapter 3.
- **New construction**: New construction encompassed homes and dwellings constructed recently. Buildings in this vintage category were considered to have air conditioning and space heating equipment meeting current minimum efficiency standards and baseline building shell characteristics (e.g. wall insulation, window type) adhering to current known energy codes and construction practices in PECO Energy's territory.

In addition to the breakout between low income households and the remainder of the market and the distinction between existing and new construction, the residential sector was further segmented by end-use and technology as shown in Table 4-1.

Table 4-1
Residential End-Uses and Technologies

End-Use	Technology
Cooling	Central Air Conditioning (AC)
	Room AC
Heating	Electric Resistance
	Heat Pump
	Furnace
Water Heating	Water Heater
Interior and Exterior Lighting	Linear Fluorescent
	Screw in
Appliances	Refrigerator
	Second Refrigerator
	Freezer
	Clothes Washer
	Clothes Dryer
	Combined Washer-Dryer
	Dishwasher
	Cooking
Electronics	PC
	Color TV
	Other Electronics
Miscellaneous	Furnace Fan
	Pool Pump
	Other Miscellaneous

4.2.2 Control Totals

With market segments defined, PECO provided control totals for baseline usage from which the analysis was created. The total estimated energy consumption by PECO residential customers for the base year is 13,585 GWh. The control totals for the residential sector and corresponding segments are provided in Table 4-2. As illustrated in Figure 4-2, households classified as low income make up 14% of the total residential consumption.

Table 4-2
Residential Electricity Use in Base Year

Housing Type	Base Year Electricity Use (GWh)
Residential	11,625
Low Income	1,961
Total	**13,585**

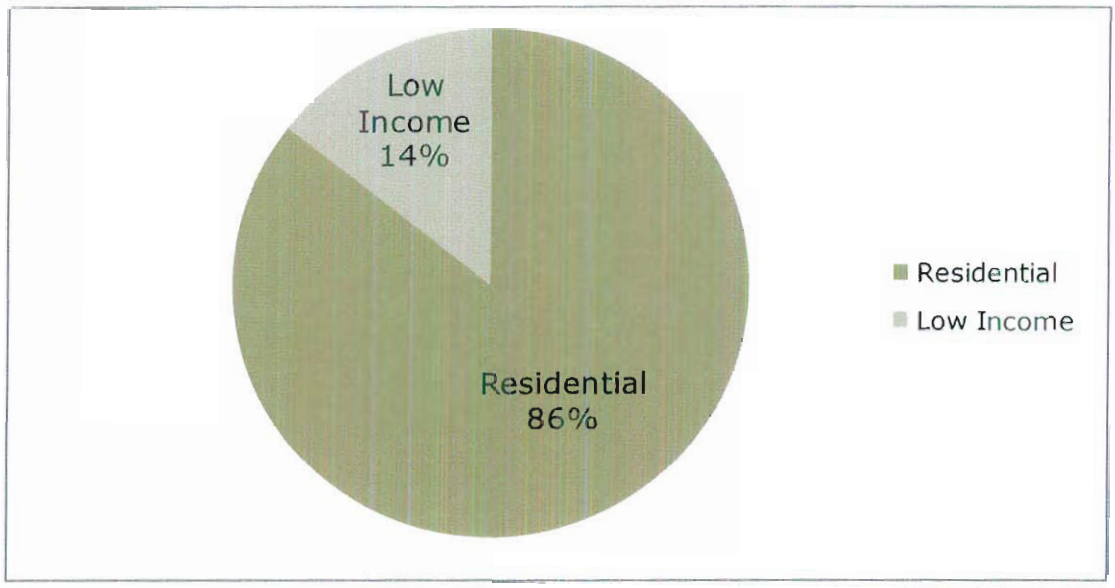

Figure 4-2
Residential Electricity Use by Customer Segment, Base Year

4.2.3 Prototype Modeling

As an analytical backbone for both the baseline analysis and the energy efficiency potential modeling, building prototypes were examined to characterize the energy usage and peak demand by the various end uses. The results from the prototype modeling fed into the baseline analysis as well as the measure characterization and potential assessment.

The prototype approach required the specification of typical building parameters (such as square footage, base equipment types and efficiencies, and shell levels) for each of the segments and considered the specific weather conditions and standard building construction practices in the area. Each prototype was designed to correspond to a typical building of its type and incorporated the major components affecting energy use in each segment of the residential sector, including:

- Air conditioners and auxiliary cooling (e.g. ceiling fans)
- Heating equipment
- Lighting
- Refrigerators and freezers
- Water heaters
- Miscellaneous equipment such as home electronics, small devices, laundry and cooking appliances

The prototypes utilized reflect conditions of PECO Energy's territory in terms of national, state and regional building construction practices and weather. Specific characteristics evaluated include:

- Average home size
- Lighting density and schedule
- Behavioral patterns
- HVAC systems and efficiency levels
- Home construction and insulation levels
- Operating controls

The survey data (see Chapter 3) were used to customize previously-developed prototypes for PECO Energy's service territory. The previously-developed prototypes were originally produced for the Northeast region as a whole during EPRI's National Potential study.

Once the prototype parameters were defined, a DOE-2 simulation tool was developed and adapted for use in this study.[3] The tool, a Global-owned software application called the *Building Energy Simulation Tool (BEST)*, estimates baseline energy usage by end-use for various building prototypes. For this study, the values produced by use of BEST served as key inputs for the residential baseline model and were applied in two ways:

1. To compare and combine with other data sources to define base-year energy use characteristics by end-use and technology; and
2. To analyze efficiency measures to determine their energy savings and demand reduction impacts.

4.2.4 Base-Year Market Profiles

The formulation of the residential baseline forecast required definition of base-year energy use characteristics and equipment holdings. This objective was achieved by developing a Market Profile that described energy use by end-use for each segment. The following parameters were used to create the market profiles.

- **Market size:** Market size represents the number of households in the segment. This number was derived from billing data.
- **Fuel share:** Fuel share embodies the saturation of appliances or equipment as well as the share of homes using a given type of fuel (e.g., homes with electric space heating).
- **Unit energy consumption:** Unit energy consumption (UEC) describes the annual amount of electricity consumed by a specific technology in homes that utilize the technology. These numbers come from DOE-2 simulation tool, and secondary research.
- **Intensity:** Intensity represents the average energy use for the technology or end-use across all homes. It is the product of fuel share multiplied UEC. As an example, 93% of PECO's existing residential segment has cooling. Of this 93%, 48% have Central AC, which means that Central AC represents a fuel share equaling 45%. Once we have determined the fuel share we then multiply it and UEC to come up with the average intensity in kWh per household for the entire sector.
- **Use:** Use is measured in GWh and is the total energy used by a technology or end-use in the segment. It is the product of the number of households and intensity.

With the exception of the UEC values, the market profile elements were developed primarily from the survey data and substantiated and verified against various secondary sources.

Figure 4-2 presents this end-use breakout for the residential sector. Dominated by lighting (combining interior and exterior applications), significant contributions to residential consumption also come from cooling, home electronics (televisions, computers, video game consoles, home audio equipment) and refrigeration (including refrigerators and freezers). Space heating has a relatively small piece of the total due to the high saturation of natural gas and fuel oil in the residential sector. The miscellaneous category represents all plug loads not accounted for in electronics or other appliance categories. Hair dryers, garage door openers, "countertop" kitchen appliances and alarm clocks are all examples of what you would find in the miscellaneous category.

[3] DOE -2 is an energy simulation tool designed by the Department of Energy (DOE). DOE-2 is used across the country to derive estimated energy consumption for new projects and to estimate energy savings based on a change in building characteristics.

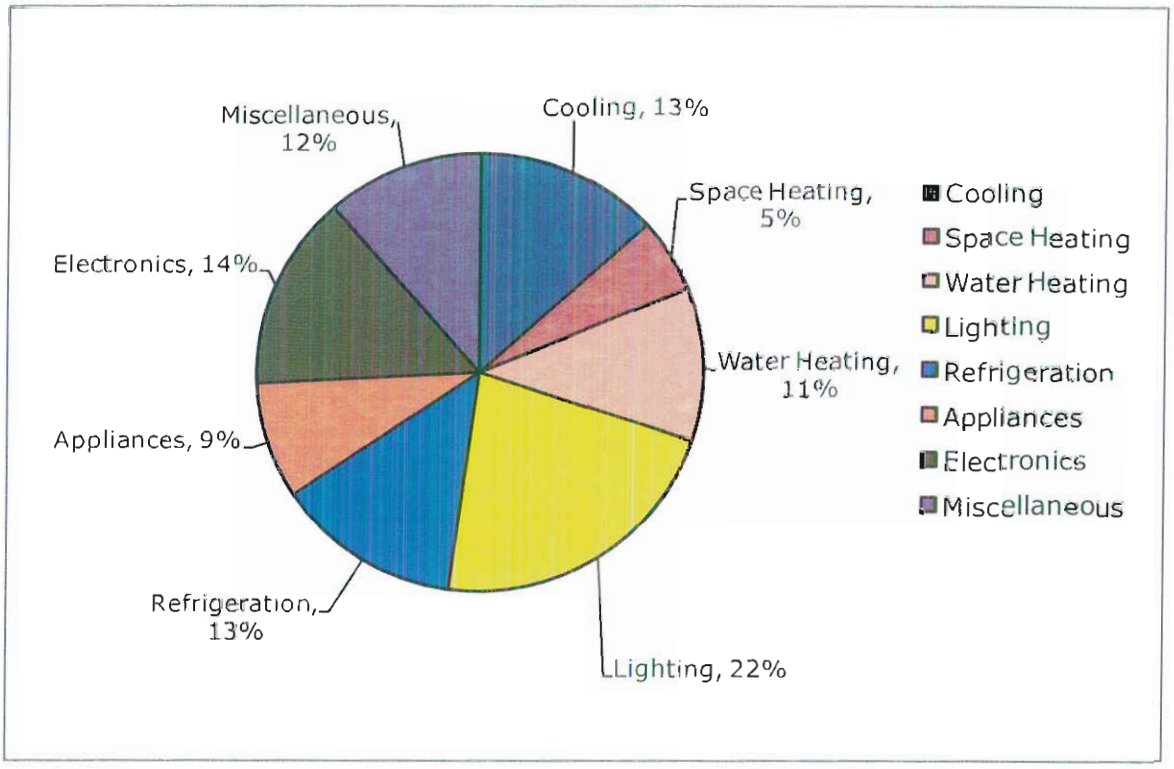

Figure 4-3
Residential Electricity Consumption by End-Use, Base Year

This distribution of electric usage is similar to the findings for the Northeast region reported in the EPRI National Study, with lighting as the predominant end use and relatively small contributions from cooling (less cooling degree days than other parts of the country) and space heating (low saturation of electric heating). One unique feature of the PECO baseline characterization is a large contribution from electronics (14% compared to the EPRI National Study value of 10%), representing the findings of the market research that electronic devices are increasingly prevalent and energy-intensive.

Figure 4-4 displays the end-use shares of total electricity use for each housing type. The relative consumption by cooling and refrigeration is higher for the low income homes than for other residential households, while lighting and electronics make up a relatively smaller usage percentage.

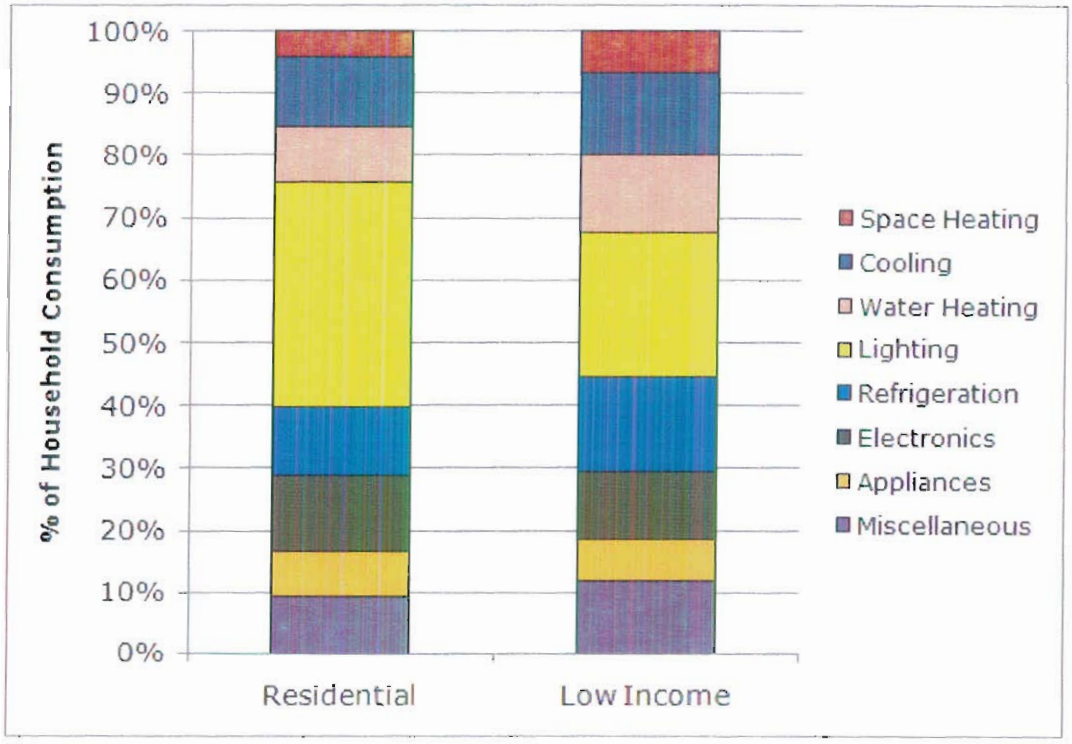

Figure 4-4
End-Use Shares of Total Electricity Use by Housing Type, Base Year

Table 4-3 and Table 4-4 present the detailed market profiles for the Residential and Low-income market segments, respectively, while Table 4-5 presents an aggregated market profile for the whole residential sector.

Table 4-3
Residential Segment (excluding low income) Market Profile

Electric End Use	Technology	Fuel Share	UEC (kWh)	Intensity	Use GWH
Total				10,002	11,626
Cooling	Central AC	45%	1,547	692	805
Cooling	Room AC	49%	1,315	643	747
Space Heating	Electric Resistance	6%	6,715	391	455
Space Heating	Heat Pump	4%	3,510	136	158
Space Heating	Furnace	0%	3,853	-	-
Water Heating	Water Heater	31%	3,510	1,104	1,283
Interior Lighting	Screw-in	89%	2,158	1,912	2,223
Interior Lighting	Linear Fluorescent	7%	425	29	34
Exterior Lighting	Screw-in	83%	305	253	294
Exterior Lighting	Linear Fluorescent	0%	25	-	-
Appliances	Refrigerator	100%	943	943	1,096
Appliances	Freezer	27%	716	194	226
Appliances	Second Refrigerator	25%	721	182	211
Appliances	Clothes Washer	94%	158	149	173
Appliances	Clothes Dryer	62%	625	388	450
Appliances	Combined Washer-Dryer	0%	587	-	-
Appliances	Dishwasher	82%	125	102	118
Appliances	Cooking	56%	450	251	291
Electronics	Personal Computer	199%	180	359	417
Electronics	Color TV	304%	208	631	734
Electronics	Other Electronics	100%	498	498	579
Miscellaneous	Pool Pump	5%	3,144	157	183
Miscellaneous	Furnace Fan	57%	177	101	117
Miscellaneous	Other Miscellaneous	100%	889	889	1,033

Table 4-4
Low Income Segment Market Profile

Electric End Use	Technology	Fuel Share	UEC (kWh)	Intensity	Use GWH
Total				7,842	1,961
Cooling	Central AC	60%	1,354	806	202
Cooling	Room AC	22%	1,008	220.3	55
Space Heating	Electric Resistance	10%	4,405	422.3	106
Space Heating	Heat Pump	2%	5,103	97.8	24
Space Heating	Furnace	0%	5,025	-	-
Water Heating	Water Heater	26%	3,780	991.6	248
Interior Lighting	Screw-in	93%	1,700	1,582.7	396
Interior Lighting	Linear Fluorescent	11%	617	70.3	18
Exterior Lighting	Screw-in	48%	324	156.3	39
Exterior Lighting	Linear Fluorescent	0%	10	-	-
Appliances	Refrigerator	100%	900	900.0	225
Appliances	Freezer	20%	906	183.1	46
Appliances	Second Refrigerator	12%	850	97.8	24
Appliances	Clothes Washer	70%	124	86.8	22
Appliances	Clothes Dryer	45%	524	235.8	59
Appliances	Combined Washer-Dryer	1%	530	4.8	1
Appliances	Dishwasher	35%	143	49.5	12
Appliances	Cooking	34%	437	148.7	37
Electronics	Personal Computer	182%	148	268.8	67
Electronics	Color TV	230%	190	436.0	109
Electronics	Other Electronics	100%	150	150.0	38
Miscellaneous	Pool Pump	1%	2,083	20.8	5
Miscellaneous	Furnace Fan	73%	227	166.8	42
Miscellaneous	Other Miscellaneous	100%	746	746.0	187

Table 4-5
Total Residential Sector Market Profile

Electric End Use	Technology	Fuel Share	UEC (kWh)	Intensity	Use GWH
Total				9,620	13,585
Cooling	Central AC	47%	1,465	713	1,006
Cooling	Room AC	44%	924	567.8	802
Space Heating	Electric Resistance	6%	3,975	396.6	560
Space Heating	Heat Pump	4%	2,603	129.5	183
Space Heating	Furnace	0%	3,975	-	-
Water Heating	Water Heater	31%	2,084	1,083.7	1,531
Interior Lighting	Screw-in	89%	1,786	1,853.7	2,618
Interior Lighting	Linear Fluorescent	8%	422	36.6	52
Exterior Lighting	Screw-in	77%	318	235.5	333
Exterior Lighting	Linear Fluorescent	0%	7	-	-
Appliances	Refrigerator	100%	978	935.4	1,321
Appliances	Freezer	26%	798	192.2	271
Appliances	Second Refrigerator	23%	1,249	166.8	236
Appliances	Clothes Washer	90%	134	137.6	194
Appliances	Clothes Dryer	59%	561	360.6	509
Appliances	Combined Washer-Dryer	0%	529	0.8	1
Appliances	Dishwasher	73%	93	92.6	131
Appliances	Cooking	52%	277	232.6	329
Electronics	Personal Computer	196%	170	342.8	484
Electronics	Color TV	291%	218	596.7	843
Electronics	Other Electronics	100%	526	436.2	616
Miscellaneous	Pool Pump	4%	2,959	133.1	188
Miscellaneous	Furnace Fan	60%	198	112.5	159
Miscellaneous	Other Miscellaneous	100%	1,835	863.7	1,220

4.2.5 Residential Baseline Forecast

Once the base-year market profiles were developed, a process was then implemented to develop a forecast of annual energy use by customer segment, fuel, and end-use. This forecast represents expected annual energy consumption and peak demand taking the following general factors into consideration:

- Current economic growth forecast
- Energy price forecasts
- Appliance, equipment, and building codes and standards already on the books
- Technology trends

- Naturally-occurring conservation (some customers will buy more efficient equipment regardless of a utility program)
- Existing utility programs (no new utility programs)

Specifically, the baseline forecast was developed using the following data elements:

- Base-year market profiles (see Section 4.2.4)
- Purchase shares (EIA Annual Energy Outlook AEO, 2008);
- Forecast results from PECO Energy
- Northeast Census Region forecasts from the EPRI National Potentials Study (EPRI, 2008)
- Forecasts of local economic growth (population, employees, GDP, new construction, etc.) (Economy.com forecast data provided by PECO)
- Local electricity price forecast from PECO Energy
- Avoided cost data from PECO Energy

LoadMAP, a detailed microeconomic model, was adapted and applied to develop the load forecast. This model calculates energy consumption and demand at the lowest end-use level, and then aggregates the results up across all end-uses, vintages, and building types to derive the annual energy consumption and peak demand for the tracked end-uses in the residential sector. Annual energy use and peak demand values are calculated as the product of the number of end-use devices and the average annual energy contribution per device. The number of devices is the product of the number of households and the device saturation, where the device saturation is defined as the average number of devices per household.

Table 4-6 presents forecast data on changes in the number of households for each of the two residential customer segments.

Table 4-6
Forecast of Household Growth

Forecast Driver	PY 2008	PY 2010	PY 2012	% Change PY 2008-'12
Residential	1,162,443	1,170,638	1,178,832	1.4%
Low Income	250,006	251,768	253,531	1.4%
Total Households	1,412,449	1,422,406	1,432,363	1.4%

The main end-use assumptions used in the development of the residential baseline forecast are summarized below.

- For space heating, the technology share is assumed to shift from electric resistance heating to either a heat pump or gas furnace over the forecast period.
- In 2006, a new Federal standard for central air conditioners went into effect, requiring all newly manufactured air conditioners to meet SEER 13 or better, so we have assumed that all new AC units are SEER 13 or better.
- Federal efficiency standards for residential appliances, including refrigerators, clothes washers, and dishwashers, are scheduled to be revised over the coming years. The PECO Energy forecast takes into account the most recent refrigeration standards (from 2007).
- The success of the ENERGY STAR program over the years has led to an increase in ENERGY STAR designated appliances, specifically refrigerators, which is expected to continue through the forecast horizon.
- Residential lighting is affected by the passage of the Energy Independence and Security Act (EISA) in 2007, which mandates higher efficacies for lighting technologies in 2012 and 2013.

Compact fluorescent lamps (CFLs) meet this standard, as well as a new incandescent technology under development by several leading manufacturers of light bulbs. In addition, Light-emitting Diode technologies were considered; however, their relatively high cost as a general service lighting technology relegates them to a minor piece of the baseline forecast over the next four years.

Table 4-7 and Figure 4-5 present the electricity use baseline forecast results for each of the segments considered in the residential sector analysis as well as for the sector in its entirety. The 5.5% growth is driven by the portion of the market not classified as low income, and represents an annualized growth rate of 1.1%.

Table 4-7
Residential Electricity Consumption by Segment (GWh)

Sector	PY 2008	PY 2010	PY 2012	% Change PY 2008-'12
Residential	11,626	11,883	12,296	5.8%
Low Income	1,960	1956	2,030	3.6%
Total	13,585	13,840	14,326	5.5%

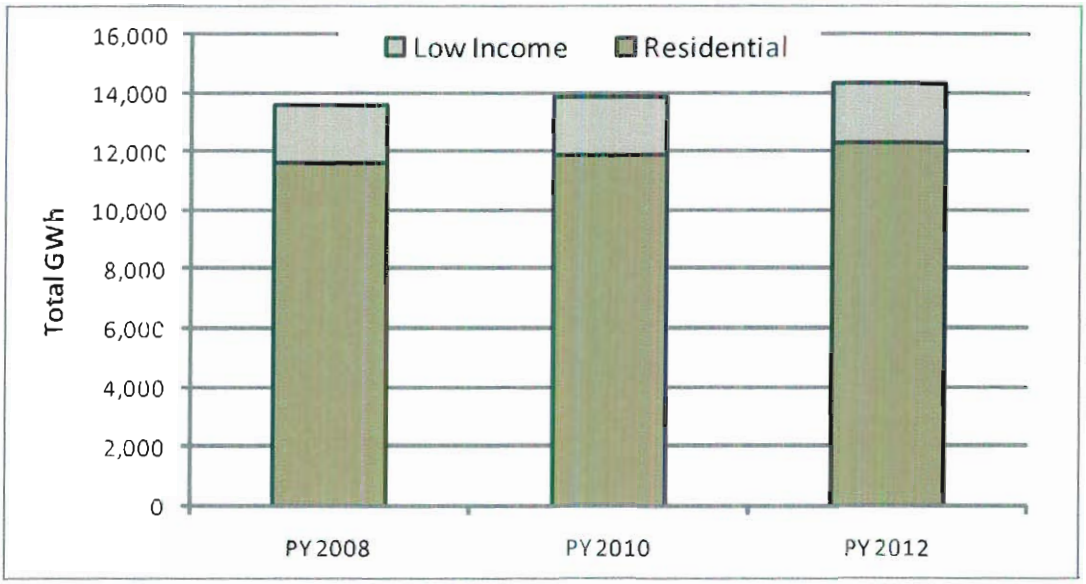

Figure 4-5
Residential Baseline Electricity Forecast by Segment

Table 4-8 and Figure 4-6 present the baseline forecast at the end-use level for the residential sector, while Table 4-9 presents the change in end-use consumption in kWh for an average residential household:

Table 4-8
Residential Baseline Electricity Forecast by End Use (GWh)

End Use	Technology	PY 2008	PY 2010	PY 2012	Change in Usage PY 2008 - 12
Air Conditioner	Central AC	1,006	1,064	1,111	10.4%
Air Conditioner	Room AC	802	745	705	-12.0%
Space Heating	Electric Resistance	560	580	599	6.9%
Space Heating	Heat Pump	183	189	195	6.6%
Space Heating	Furnace	-	-	-	-
Water Heating	Water Heater	1,531	1,504	1,504	-1.7%
Lighting	Screw-in	2,951	2,902	2,584	-12.4%
Lighting	Linear Fluorescent	52	46	44	-15.2%
Refrigeration	Refrigerator	1,321	1,248	1,203	-9.0%
Refrigeration	Second Refrigerator	236	231	229	-2.8%
Refrigeration	Freezer	271	266	264	-2.9%
Other appliances	Clothes Washer	194	191	190	-2.0%
Other appliances	Clothes Dryer	509	495	487	-4.3%
Other appliances	Combined Washer-Dryer	1	1	1	8.1%
Other appliances	Dishwasher	131	132	135	3.2%
Other appliances	Cooking	329	302	283	-14.0%
Electronics	Personal Computer	484	492	521	7.6%
Electronics	Color TV	843	871	902	7.1%
Electronics	Other Electronics	616	663	698	13.2%
Miscellaneous	Furnace Fan	159	159	160	0.5%
Miscellaneous	Pool Pump	188	187	187	-0.6%
Miscellaneous	Other Miscellaneous	1,218	1,571	2,324	90.8%
Total		13,585	13,840	14,326	5.5%

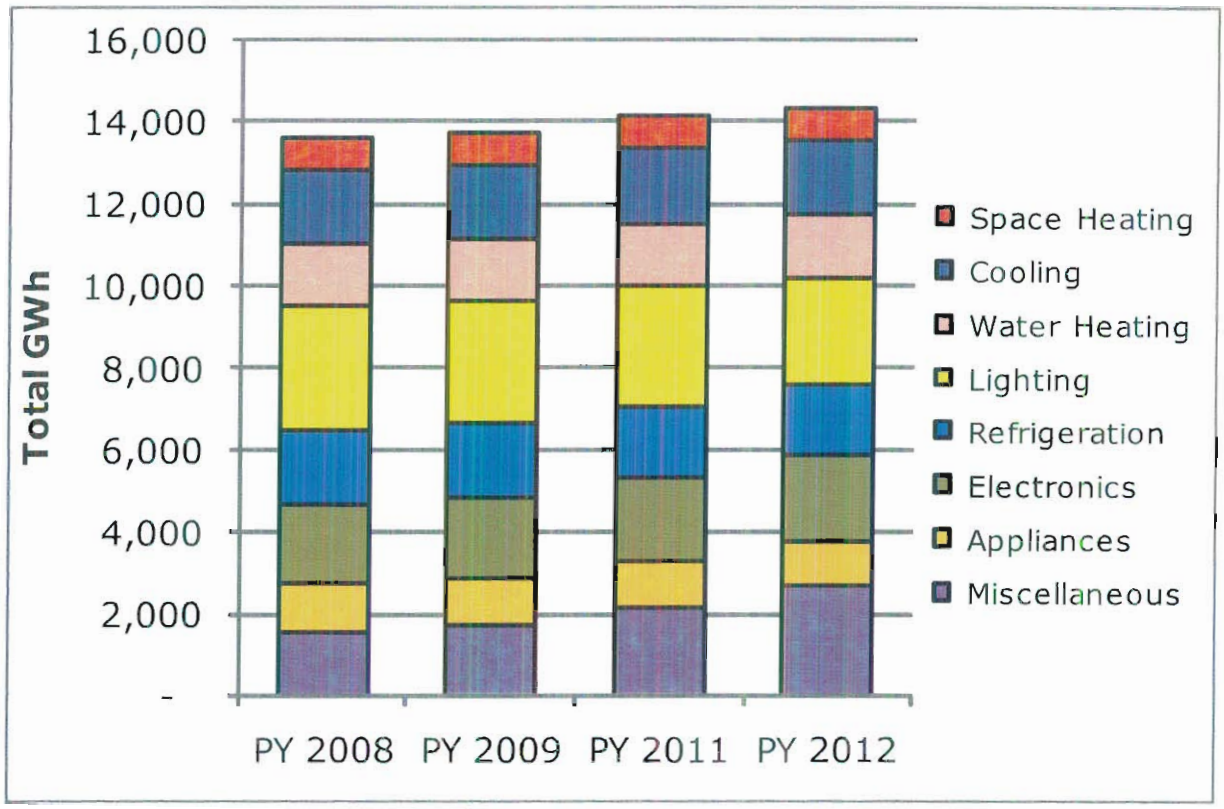

Figure 4-6
Residential Baseline Electricity Forecast by End-Use

The following trends in residential baseline energy usage are evident in both Table 4-8 and Table 4-9:

- Increasing role of central air conditioning systems, both in low income and remaining residential households. This can be seen in the increasing usage attributable to Central AC and a decrease in Room AC
- Decline in appliance usage due to penetration of higher standards relating to energy consumption, such as the federal National Appliance Energy Conservation Act (NAECA) standards. This effect is partially offset by increasing saturation of appliances
- Miscellaneous consumption nearly doubles over the forecast horizon. This is the result of a need to calibrate the end use forecast to the PECO econometric forecast, where significant growth is projected beyond what is predicted within the various end use models.

Table 4-9
Residential Electricity Consumption per Household (kWh/household)

End Use	Technology	PY 2008	PY 2010	PY 2012	Change in Usage PY 2008 - 12
Air Conditioner	Central AC	713	748	776	8.9%
Air Conditioner	Room AC	568	524	492	-13.3%
Space Heating	Electric Resistance	397	408	418	5.4%
Space Heating	Heat Pump	129	133	136	5.1%
Water Heating	Water Heater	1,084	1,058	1,050	-3.1%
Lighting	Screw-in	2,089	2,040	1,804	-13.6%
Lighting	Linear Fluorescent	37	32	31	-16.3%
Refrigeration	Refrigerator	935	877	840	-10.2%
Refrigeration	Second Refrigerator	167	163	160	-4.1%
Refrigeration	Freezer	192	187	184	-4.3%
Other appliances	Clothes Washer	138	135	133	-3.4%
Other appliances	Clothes Dryer	361	348	340	-5.7%
Other appliances	Combined Washer-Dryer	1	1	1	6.6%
Other appliances	Dishwasher	93	93	94	1.8%
Other appliances	Cooking	233	212	197	-15.2%
Electronics	Personal Computer	343	346	364	6.1%
Electronics	Color TV	597	612	630	5.6%
Electronics	Other Electronics	436	466	487	11.6%
Miscellaneous	Furnace Fan	112	112	112	-0.9%
Miscellaneous	Pool Pump	133	132	130	-2.0%
Miscellaneous	Other Miscellaneous	862	1,104	1,622	88.2%
Total		9,618	9,730	10,002	4.0%

General observations about the residential baseline forecast include the following:

- The baseline forecast increases 5.4% over the 4 year forecast horizon, partially due to a 1.4% increase in households and more so related to a projected recovery in the economy in 2010. While the economy starts its recovery in 2010 energy consumption does not pick up until 2011.
- Lighting usage decreases by 9% which is caused by naturally occurring efficiency. Lighting is unique because of its shorter life cycles and relatively low saturation of efficient lamps in households.

- Growth in electricity use in electronics is the second highest of all segments, at an average of greater than 10% over the forecast horizon. This reflects an increase in the saturation of electronics and the trend toward higher-powered computers and larger televisions.
- Growth in miscellaneous use is also substantial. This has been a long-term trend and assumptions have been made about growth in this end-use that is consistent with the Energy Information Administration's (EIA's) Annual Energy Outlook. The miscellaneous end use contains furnace fans, pool pumps and other miscellaneous energy-consuming equipment. The other miscellaneous end use encompasses all technologies that do not pose a substantial energy consumption on their own, but when aggregated can be measured. An example would be a hair dryer, garage door opener, and cell phone chargers.

4.3 COMMERCIAL SECTOR

PECO provides electricity for over 1,170,609,807 square feet of commercial buildings, representing total estimated sales in 2008-2009 of 17.5 terawatt-hours (TWh). Similar to the residential sector, the commercial sector was treated as a whole for modeling purposes after splitting off a segment to represent government buildings.

4.3.1 Market Segmentation

In order to categorize the energy consumption and peak demand of PECO Energy's commercial customer, distinctions were made to characterize different vintages in the building stock:

- **Existing buildings:** Existing buildings were defined as those constructed before the first year of the study. The existing buildings were considered to have building shell characteristics represented by existing stock levels for weather conditions in PECO Energy's territory and installed equipment was considered to adhere to existing stock efficiency levels. All Data was developed from secondary source.
- **New construction**: New construction includes buildings constructed during the study's time horizon as well as major renovations to existing buildings. Buildings in this vintage category were considered to have heating, ventilation and air-conditioning (HVAC) equipment meeting current minimum efficiency standards and baseline building shell characteristics adhering to current known energy codes and construction practices in PECO Energy's territory.

4.3.2 Control Totals

With market vintages defined, PECO provided control building intensities for baseline usage from which the analysis was created. The total estimated energy consumption by PECO commercial customers for the base year is 17,486 GWh with an average intensity of 14.9 kWh per square foot. As shown in Table 4-10 and Figure 4-4, the government segment rmakes up a little more than a fourth of the commercial consumption.

Table 4-10
Commercial Electric Consumption by Segment, Base Year

Segment	Electricity Use (GWh)
Commercial	12,623
Government	4,863
Total	**17,486**

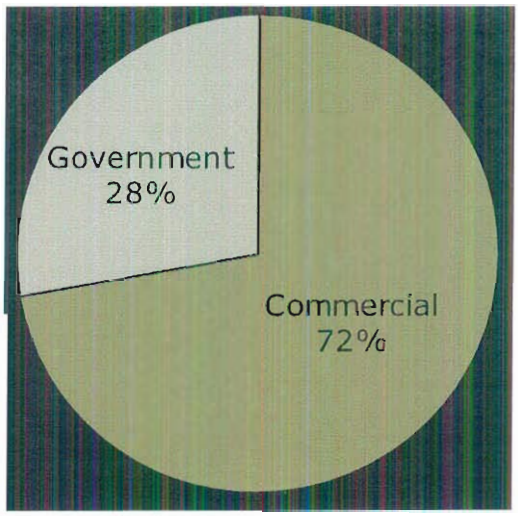

Figure 4-7
Commercial Electric Consumption by Segment, Base Year

Table 4-11
Commercial End-Uses and Technologies

End-Use	Technology
Cooling	Central Chiller
	Package AC
	Room AC
Heating	Electric Resistance
	Heat Pump
Ventilation	Ventilation
Water Heating	Water Heater
Interior Lighting	Interior Lighting
Exterior Lighting	Exterior Lighting
Office equipment	PC
	Server
	Monitor
	Printer/Copier
Refrigeration	Walk-in Refrigerator
	Reach-in Refrigerator
Miscellaneous	Food Service
	Miscellaneous

4.3.3 Prototype Modeling

For the commercial sector, a prototype model originally produced for the Northeast region during EPRI's National Potential study (EPRI, 2008) was used based to characterize the energy usage. The results from the prototype modeling fed into the baseline analysis as well as the measure characterization and potential assessment.

The prototype approach required the specification of typical building parameters (such as square footage, base equipment types and efficiencies, and shell levels) and also considered the specific weather conditions and standard building construction practices in the area. The prototype was designed to correspond to a typical building of its type and incorporated the major components affecting energy use including:

- Heating, Ventilation and Air Conditioning (HVAC) equipment
- Interior and exterior lighting
- Refrigeration equipment
- Water heating equipment;
- HVAC motors
- Office equipment
- Miscellaneous equipment such as laundry and food service appliances

The Northeast regional prototype reflects the conditions of PECO Energy's territory. Specific characteristics evaluated include:

- Floor area and number of floors
- Lighting and equipment densities
- Operating hours
- HVAC systems and efficiency levels
- Building construction and insulation levels
- Occupancy levels
- Operating controls

As in the residential analysis, the prototype models were examined using Global's *Building Energy Simulation Tool (BEST)*, which estimates baseline energy usage by end-use for various building prototypes.

4.3.4 Base Year Market Profiles

As in the residential analysis, the commercial baseline forecast begins with base-year energy use characteristics and equipment holdings, presented in the form of a Market Profile. The following parameters were used to create the market profiles.

- **Market size:** Market size represents the number of square footage in the segment. This number was derived from billing data along with energy intensity data for the region.
- **Fuel share:** Fuel share embodies the saturation of equipment as well as the share of using a given type of fuel (e.g., commercial spaces with electric space heating).
- **Energy utilization index:** Akin to the Unit energy consumption value from the residential sector, the energy utilization index (EUI) describes the annual amount of electricity consumed by a specific technology normalized to the square feet of floor space that utilize the technology. These indices are developed with BEST model and secondary research.
- **Intensity:** Intensity represents the average energy use for the technology or end-use across all commercial spaces. It is the product of fuel share multiplied UEC. As an example, 50% of PECO's existing commercial segment has cooling. Of this 55%, 19% have central chillers, which means Central Chiller represents a fuel share equaling 10%. Once we have determined the fuel share we then multiply it and UEC to come up with the intensity.
- **Use:** Use is measured in GWh and is the total energy used by a technology or end-use in the segment. It is the product of the number of households and intensity.

The base year electric consumption for the PECO commercial sector is summarized in Figure 4-7. Compared to the national baseline usage reported in the EPRI National Study, PECO commercial customers use energy in a comparable manner, with a few key differences:

- Heating, Ventilation and Air Conditioning (HVAC) makes up 27% of PECO commercial consumption, compares to only 17% for the U.S. as a whole. This can be attributed to a higher incidence of office buildings and other building types with high HVAC demands
- Lighting makes up a slightly larger piece of electricity consumption (28% versus 25% in the EPRI National Study).
- Refrigeration and food service are broken out in greater detail, reducing the remaining miscellaneous category to only 7.5%, compared to 34% in the EPRI study.

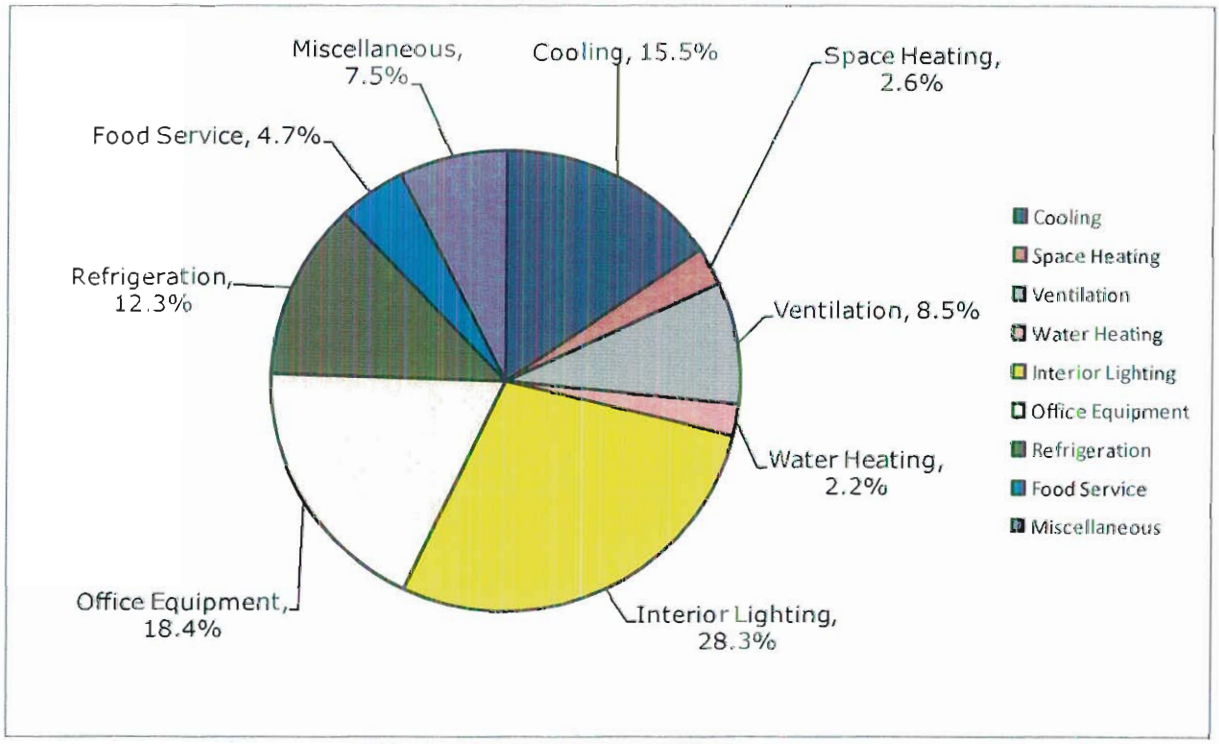

Figure 4-8
Commercial Electricity Consumption by End-Use, Base Year

Table 4-11 through Table 4-13 present the detailed market profiles for the Commercial Sector.

Table 4-12
Total Commercial Segment Market Profile

Electric End Use	Technology	Fuel Share	EUI	Intensity	Use GWh
Total				14.9	12,623
Cooling	Central Chiller	11%	4.2	0.5	384
Cooling	Packaged AC	43%	4.2	1.8	1,541
Cooling	Room AC	1%	5.2	0.03	28
Space Heating	Electric Resistance	0%	6.2	-	-
Space Heating	Heat Pump	11%	3.4	0.4	330
Ventilation	Ventilation	100%	1.3	1.3	1,075
Water Heating	Water Heater	16%	2.0	0.3	276
Interior Lighting	Interior Lighting	100%	4.0	4.0	3,371
Exterior Lighting	Exterior Lighting	77%	0.2	0.2	130
Office Equipment	PC	100%	0.7	0.7	591
Office Equipment	Server	100%	0.9	0.9	794
Office Equipment	Monitor	100%	0.7	0.7	596
Office Equipment	Printer/Copier	100%	0.2	0.2	180
Refrigeration	Walk-in Refrigeration	4%	16.0	0.6	539
Refrigeration	Reach-in Refrigeration	40%	3.0	1.2	1,011
Miscellaneous	Food Service	25%	2.8	0.7	593
Miscellaneous	Miscellaneous	100%	1.4	1.4	1,183

Table 4-13
Total Government Segment Market Profile

Electric End Use	Technology	Fuel Share	EUI	Intensity	Use GWh
Total				14.9	4,863
Cooling	Central Chiller	11%	4.2	0.5	148
Cooling	Packaged AC	43%	4.2	1.8	593
Cooling	Room AC	1%	5.2	0.0	11
Space Heating	Electric Resistance	0%	6.2	-	-
Space Heating	Heat Pump	11%	3.4	0.4	127
Ventilation	Ventilation	100%	1.3	1.3	414
Water Heating	Water Heater	16%	2.0	0.3	106
Interior Lighting	Interior Lighting	100%	4.0	4.0	1,297
Exterior Lighting	Exterior Lighting	77%	0.6	0.5	153
Office Equipment	PC	100%	1.4	1.4	455
Office Equipment	Server	100%	0.9	0.9	305
Office Equipment	Monitor	100%	0.7	0.7	229
Office Equipment	Printer/Copier	100%	0.2	0.2	69
Refrigeration	Walk-in Refrigeration	4%	16.0	0.6	208
Refrigeration	Reach-in Refrigeration	40%	3.0	1.2	389
Miscellaneous	Food Service	25%	2.8	0.7	228
Miscellaneous	Miscellaneous	100%	0.4	0.4	130

Table 4-14
Total Commercial Sector Market Profile

Electric End Use	Technology	Fuel Share	EUI	Intensity	Use GWh
Total				14.9	17,486
Cooling	Central Chiller	11%	4.17	0.45	532
Cooling	Packaged AC	43%	4.20	1.82	2,134
Cooling	Room AC	1%	5.22	0.03	39
Space Heating	Electric Resistance	0%	6.23	-	-
Space Heating	Heat Pump	11%	3.43	0.39	457
Ventilation	Ventilation	100%	1.27	1.27	1,488
Water Heating	Water Heater	16%	2.00	0.33	382
Interior Lighting	Interior Lighting	100%	3.99	3.99	4,669
Exterior Lighting	Exterior Lighting	77%	0.31	0.24	283
Office Equipment	PC	100%	0.89	0.89	1,047
Office Equipment	Server	100%	0.94	0.94	1,099
Office Equipment	Monitor	100%	0.71	0.71	825
Office Equipment	Printer/Copier	100%	0.21	0.21	249
Refrigeration	Walk-in Refrigeration	4%	16.00	0.64	747
Refrigeration	Reach-in Refrigeration	40%	3.00	1.20	1,401
Miscellaneous	Food Service	25%	2.81	0.70	821
Miscellaneous	Miscellaneous	100%	1.12	1.12	1,313

4.3.5 Commercial Baseline Forecast

Between June 1 2009 and June 1 2013, the PECO commercial baseline grows from 17,486 GWh to 18,106 GWh, or 3.5%. While smaller than the residential sector, this increase is healthy for commercial usage and reflects an anticipated economic recovery beginning in 2010.

Figure 4-9 presents a summary of the evolution of energy use within each of the commercial end uses over the course of the baseline forecast. With the exception of lighting and electric space heating, which remain relatively flat over the four years, the growth in the commercial usage is spread fairly evenly over all end uses.

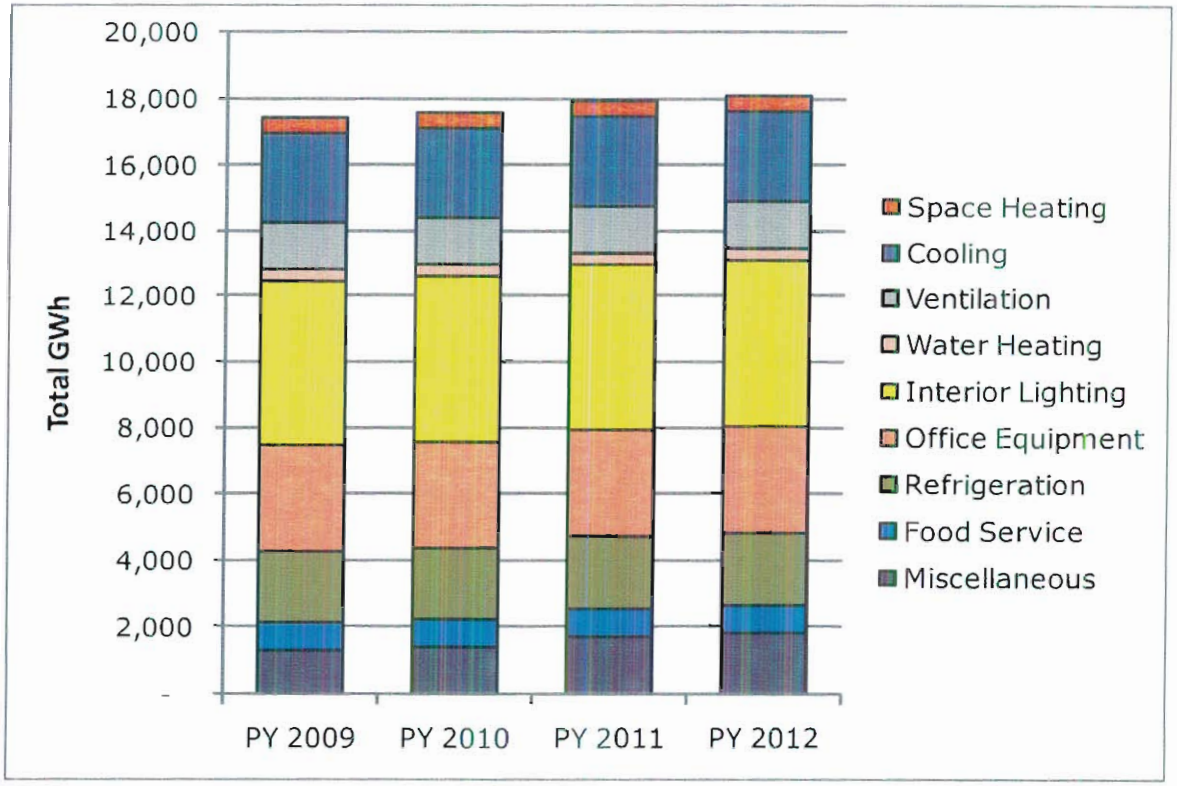

Figure 4-9
Commercial Baseline Forecast, Electric Consumption by End-Use

Table 4-15
Commercial Baseline Electricity Forecast by End Use (GWh)

End Use	Technology	PY 2008	PY 2010	PY 2012	Change in Usage PY 2008 - 12
Cooling	Central Chiller	532	522	519	-2.4%
Cooling	Package AC	2,134	2,123	2,137	0.1%
Cooling	Room AC	39	38	37	-4.2%
Space Heating	Electric Resistance	-	-	-	-
Space Heating	Heat Pump	457	464	476	4.1%
Ventilation	Ventilation	1,488	1,470	1,475	-0.9%
Water Heating	Water Heater	382	360	343	-10.3%
Interior Lighting	Interior lighting	4,669	4,708	4,774	2.3%
Exterior Lighting	Exterior Lighting	283	286	290	2.3%
Office Equipment	PC	1,047	1,056	1,074	2.6%
Office Equipment	Server	1,099	1,091	1,092	-0.7%
Office Equipment	Monitor	825	820	821	-0.5%
Office Equipment	Printer/Copier	249	248	248	-0.5%
Refrigeration	Walk-in Refrigeration	747	740	744	-0.4%
Refrigeration	Reach-in Refrigeration	1,401	1,411	1,441	2.9%
Miscellaneous	Food Service	821	819	823	0.2%
Miscellaneous	Miscellaneous	1,313	1,400	1,814	38.1%
Total		17,486	17,554	18,106	3.5%

4.4 INDUSTRIAL SECTOR

Because very little information was available about the energy use in the PECO industrial sector, the baseline industrial profiles for the Northeast region from the EPRI National Study were adapted and applied for this analysis. The regional data were scaled and adapted to be consistent with PECO's total industrial sales of 7,142 GWh in the base year. The breakdown by end use in the base year is depicted in Figure 4-10, while Table 4-16 provides the evolution of energy consumption be end use over the baseline forecast. Machine drive is the dominant end use, comprised of small, medium and large motors applied in myriad settings throughout industrial facilities. In addition, the lighting and cooling technologies familiar from the commercial sector make up over 20% of industrial usage.

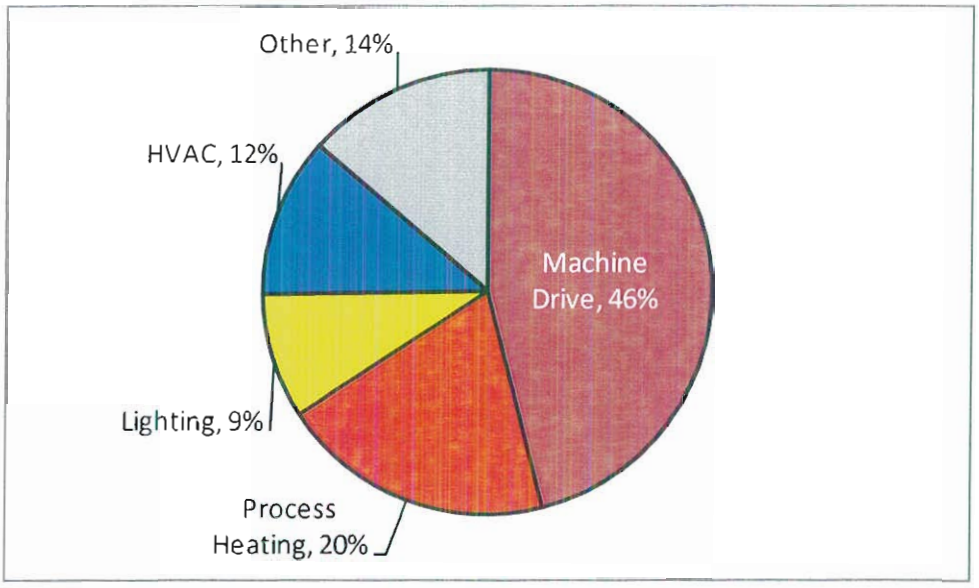

Figure 4-10
Industrial Electricity Consumption by End-Use, PY 2008

Table 4-16
Industrial Baseline Electricity Forecast by End Use (GWh)

End Use	PY 2008	PY 2010	PY 2012
Machine Drive	3,285	3,624	4,092
Process Heating	1,408	1,490	1,617
Lighting	650	852	1,091
HVAC	827	871	943
Other	972	1,031	1,121

ENERGY EFFICIENCY MEASURES

This section describes the framework used to assess the savings, costs, and other attributes of energy efficiency measures. These results are needed to support measure-level cost-effectiveness analyses as well as measure-level impacts. For all measures, information was assembled to reflect equipment performance, incremental costs, and equipment lifetimes. This information, along with the avoided costs, was employed in the economic screen to determine economically feasible measures. The framework that was followed is outlined in Figure 5-1.

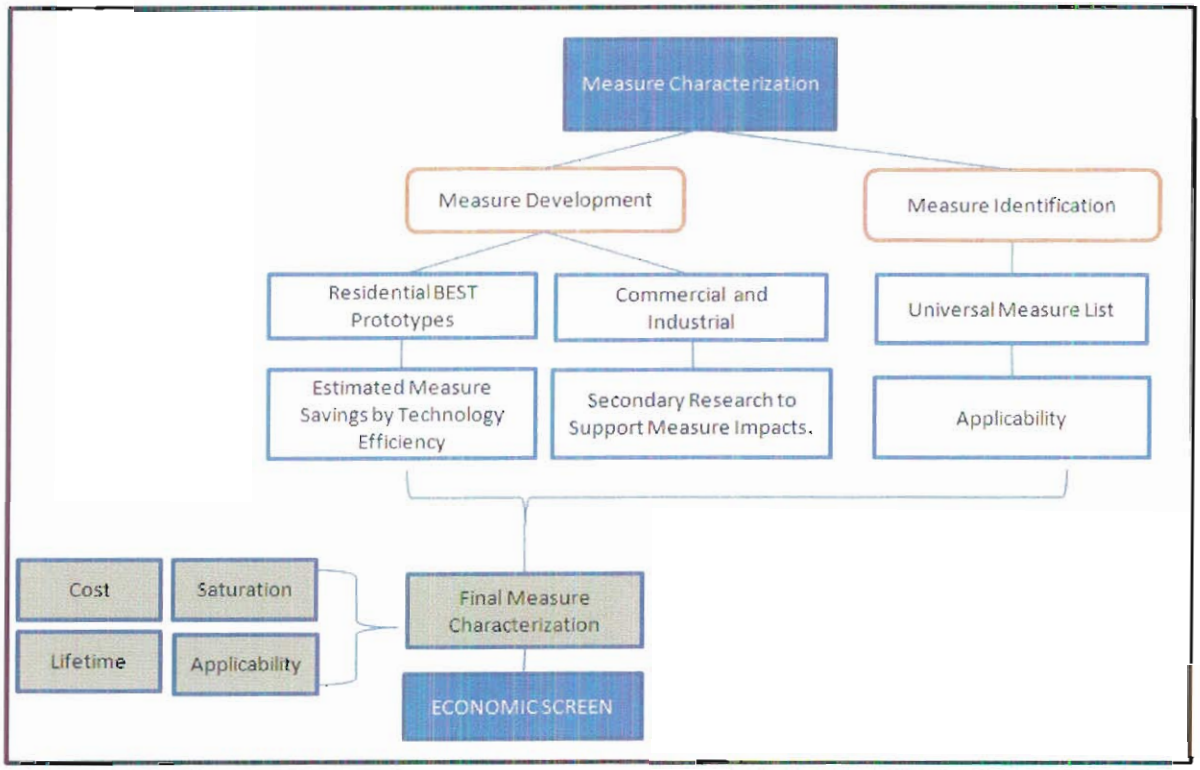

Figure 5-1
Approach for Measure Assessment

The analytical framework for developing the measure savings assessment for all sectors closely follows the frameworks described for the baseline development. The BEST model was used to develop "change cases" relative to the baseline prototypes. For the energy efficiency measures, these change cases reflected increasing levels of energy efficiency escalating to maximum efficiency levels.

5.1 LIST OF ENERGY EFFICIENCY MEASURES

The first step is to identify the list of relevant energy-efficiency measures. Several sources of information were consulted to develop the list for the PECO study, including the EPRI National Potential Study and Global Energy Partner's Database of Energy Efficiency Measures (DEEM).

All measures are categorized into one of two types for calculation of energy savings: equipment measures and non-equipment measures.

The key differences between the equipment and non-equipment measures are:

- **Equipment measures**, or efficient energy-consuming equipment, save energy by providing the same service with a lower energy requirement. An example of an equipment measure 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 (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 SEER 13 unit and spans a broad spectrum of efficiency, with the highest efficiency level represented by a ductless mini-split system with variable refrigerant flow.
- **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 of this group of measures would be a programmable thermostat that is pre-set, for example, to run the air conditioner only when people are home. Non-equipment measures fall into one of 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)
    - Displacement measures (ceiling fan instead of central air conditioner)

Non-equipment measures can apply to more than one end use. For example, insulation levels will affect both space heating and cooling energy consumption.

5.1.1 Residential Measures

The residential measures span all end uses and vary significantly in the manner in which they impact energy consumption. Table 5-1 presents a list of the residential measures considered in the potential analysis.

Table 5-1
Summary of Residential Energy-efficiency Measures

Cooling	Low-Flow Showerheads
High-efficiency Central AC	Pipe Insulation
High-efficiency Room AC	**Lighting**
AC Maintenance	Advanced Incandescent Lamps - Interior
Attic Fan	Compact Fluorescent Lamps (CFLs) - Interior
Ceiling Fan	High Intensity Discharge Lamps (HID) - Interior
Ceiling Insulation	White LED Lamps
Dehumidifier	Occupancy Sensor
Duct Insulation	Lighting Timer
Duct Repair	Advanced Incandescent Lamps - Exterior
External Shades	Compact Fluorescent Lamps (CFLs) - Exterior
Foundation Insulation	High Intensity Discharge Lamps (HID) - Exterior
High-efficiency Windows	Efficient Linear Fluorescent Lamps (T8, T5)
Infiltration Control	Motion Detectors
Programmable Thermostat	Photosensors
Radiant Barrier	**Appliances**
Reflective Roof	Energy Star Refrigerators
Storm Doors	Advanced Energy Star Refrigerators
Wall Insulation	Multiple Drawer Refrigerators
Whole-House Fan	Energy Star Freezer
Space Heating	Compact Freezer
High-efficiency Heat Pumps	Energy Star Dishwasher
Ceiling Insulation	Horizontal Axis Clothes Washer
Duct Insulation	Inverter-drive Clothes Washer
Duct Repair	Combo Washer/Dryer
Foundation Insulation	Moisture Sensor Clothes Dryer
High Efficiency Windows	Heat Pump Clothes Dryer
HP Maintenance	Efficient Oven and Range
Infiltration Control	**Electronics**
Programmable Thermostat	Energy Star Color TV
Storm Doors	Energy Star PC
Wall Insulation	ClimateSavers PC
Water Heating	Efficient Home Electronics
High-efficiency Water Heaters	SmartPlug
Heat Pump Water Heaters	Reduce Standby Wattage
Solar Water Heating	**Miscellaneous**
Geothermal HP Desuperheater	High-Efficiency Furnace Fan
Drainwater Heat Recovery	High-Efficiency Pool Pumps
Faucet Aerators	Pool Pump Timer

5.1.2 Commercial and Industrial Sector

Table 5-2 and Table 5-3 present a list of the commercial and industrial measures, respectively.

Table 5-2
Summary of Commercial Energy-efficiency Measures

Cooling	Interior Lighting
High-efficiency central cooling systems	Compact Fluorescent Lamps (CFLs)
High-efficiency packaged units	High Intensity Discharge Lamps (HID)
High-efficiency PTAC units	Efficient Linear Fluorescent Lamps (T8, T5)
Energy Management System	Advanced Incandescent Lamps
Dual Enthalpy Economizer	Lighting Retrofit
VSD on Water Pumps	De-lamp
Advanced Design (New Construction)	Advanced Design (New Construction)
Water Temperature Reset	Daylighting Controls
Programmable Thermostat	Occupancy Sensors
Duct Testing and Sealing	Lighting Timers
External Shades	Task Lighting
Duct Insulation	LED Exit Lighting
Efficient Windows	**Exterior Lighting**
Roof Insulation	Lighting Timers
Wall Insulation	Solar PV Outdoor Lighting
Cool Roof	**Space Heating**
HVAC Retro-commissioning	Duct Testing and Sealing
Refrigeration	Energy Management System
Anti-Sweat Heater Controls	Dual Enthalpy Economizer
Floating head Pressure Controls	Programmable Thermostat
Glass Doors	Advanced Design (New Construction)
High-efficiency Icemakers	Duct Insulation
Miscellaneous	HVAC Retro-commissioning
Vending Miser	Efficient Windows
Efficient Escalators	Roof Insulation
Efficient Elevators	Wall Insulation
Water Heating	**Food Service**
High-efficiency Water Heaters	Energy Star Kitchen Equipment
Geothermal HP Desuperheater	Kitchen Schedule and Maintenance
Ventilation	
VSD on Fans	

Table 5-3
Summary of Industrial Energy-efficiency Measures

Process Heating	Lighting
Efficient Radio Frequency Heating Applications	Compact Fluorescent Lamps (CFLs)
Optimized Electric Resistance Heating	High Intensity Discharge Lamps (HID)
Motors and Drives	Efficient Linear Fluorescent Lamps (T8, T5)
High-efficiency motors	**HVAC**
Variable-Speed Drives	High-efficiency HVAC equipment
	HVAC Retro-commissioning and Maintenance

A brief technical description of all the measures included in the analysis can be found at the end of this section. The description includes a narrative of the measure objectives, its performance, the building types where it is typically installed, and its market and technical applicability.

5.2 MEASURE CHARACTERISTICS

For each measure permutation considered, the following data categories were considered as part of the measure characterization:

- **Energy Impacts**: The energy-savings impacts represent the annual reduction in consumption (kWh of electricity) attributable to each specific measure. For the residential and commercial sectors, the BEST simulation model was used to determine the savings impacts. For the industrial sector, secondary data resources such as energy efficiency program "best practices" were used to develop assessments of savings at the end use level.
- **Peak Demand Impacts**: Savings during the peak demand periods are specified for each measure. These impacts relate to the energy savings and depend on each measure's "coincidence" with the system peak. To accurately express the peak impacts of the energy efficiency measures considered, a combination of prototype simulation (BEST model) and review of secondary sources such as the draft Technical Resource Manual (TRM) under development by the Pennsylvania Public Service Commission were incorporated.
- **Full Costs**. The measure characterization includes the full cost of the measure on a per-unit or per-square-foot basis for the residential and commercial sectors, respectively. These costs were developed using a combination of national data sources (California DEER Database, RS Means Construction Cost Manual) with regional adjustment for the PECO service territory and regional data such as the TRM.
- **Incremental Costs**. For equipment and some other measures, the incremental cost is the cost difference between the standard efficiency option and the high-efficiency option. Incremental costs were computed directly from the full-cost data.
- **Measure Lifetimes**. These estimates were derived from the technical data and secondary data sources that support the measure demand and energy savings analysis. The initial values were obtained from Global's Database of Energy Efficiency Measures, with refinements based on a review of California's DEER database and comparable energy efficiency studies.

Table 5-4 and Table 5-5 present a sample of the detailed data inputs behind equipment and non-equipment measures, respectively, for the case of residential central air conditioners. The first table displays the various efficiency levels available as equipment measures, as well as the corresponding useful life metrics, usage and cost estimates and anticipated replacement rate. These values all contribute to the outcome of the stock accounting model, in which the purchase of an above-standard unit is first analyzed for cost effectiveness (comparing incremental cost to lifetime benefits) and then, for the levels that pass the screen, incorporated into the new units

purchased. The replacement rate is a measure of the likelihood that a unit reaching the end of its useful life will be replaced with a new unit.

In Table 5-5, the additional measures affecting a home with central air conditioning are enumerated. These measures are also evaluated for cost effectiveness based on the lifetime benefits compared to the full or incremental cost of the measure, depending on the circumstance. The total savings is calculated for each year of the model and depends on the base year saturation of the measure, the overall applicability, and the savings as a percentage of the relevant energy usage.

Table 5-4
Sample Equipment Measures for Central Air Conditioning

Efficiency Level	Useful Life	Usage (kWh)	Cost	Replacement Rate
SEER 13	14	1,815	$3,793.94	50%
SEER 14	14	1,665	$3,952.13	50%
SEER 15	14	1,608	$4,130.10	50%
SEER 16	14	1,560	$4,776.26	50%
SEER 18	14	1,484	$5,530.97	50%
SEER 20	14	1,468	$6,194.10	50%
Ductless VRF	14	1,271	$8,193.42	50%

Table 5-5
Sample Non-Equipment Measures

End Use	Measure	Savings (%)	Base Saturation	Applicability	Cost	Lifetime
Commercial	Dual Enthalpy Economizer	18.0%	22.5%	76.6%	$ 0.25	10
Commercial	EMS	20.8%	16.6%	76.6%	$ 0.27	14
Commercial	VSD on Fans	2.9%	17.2%	76.6%	$ 0.59	16
Commercial	Programmable Thermostat	7.9%	19.2%	76.6%	$ 0.13	11
Commercial	VSD on Water Pump	4.8%	0.9%	18.0%	$ 0.15	20
Commercial	Water Temperature Reset	15.2%	0.9%	18.0%	$ 0.15	15
Commercial	Cool Roof	2.0%	1.5%	28.0%	$ 0.62	15
Commercial	Duct Insulation	1.8%	32.4%	48.0%	$ 0.87	15
Commercial	Duct Testing and Sealing	8.0%	4.5%	18.0%	$ 0.47	15
Commercial	Efficient Windows	5.0%	46.0%	76.6%	$ 8.75	25
Commercial	External Shades	5.0%	17.2%	76.6%	$ 0.15	10
Commercial	Roof Insulation	1.5%	9.5%	76.6%	$ 1.50	15
Commercial	Wall Insulation	0.0%	17.2%	76.6%	$ 0.97	15
Commercial	Advanced Design	60.0%	0.0%	0%	$ 2.90	25
Commercial	HVAC Retrocommissioning	16.0%	5.4%	54.0%	$ 0.25	7
Commercial	Dual Enthalpy Economizer	18.0%	22.5%	76.6%	$ 0.25	10
Commercial	EMS	20.8%	16.6%	76.6%	$ 0.36	14
Commercial	VSD on Fans	2.9%	17.2%	76.6%	$ 0.59	16
Commercial	Programmable Thermostat	7.9%	19.2%	76.6%	$ 0.13	11
Commercial	VSD on Water Pump	4.8%	0.9%	18.0%	$ 0.15	20
Commercial	Water Temperature Reset	6.2%	0.9%	18.0%	$ 0.15	15
Commercial	Cool Roof	2.0%	1.5%	28.0%	$ 0.11	15
Commercial	Duct Insulation	1.8%	32.4%	48.0%	$ 0.77	15
Commercial	Duct Testing and Sealing	8.0%	0.0%	0.0%	$ 0.47	15
Commercial	Efficient Windows	5.0%	46.0%	76.6%	$ 2.66	25
Commercial	External Shades	5.0%	17.2%	76.6%	$ 0.15	10
Commercial	Roof Insulation	1.5%	9.5%	76.6%	$ 1.25	15
Commercial	Wall Insulation	0.0%	17.2%	76.6%	$ 0.87	15
Commercial	Advanced Design	60.0%	1.6%	90%	$ 2.90	25
Commercial	HVAC Retrocommissioning	16.0%	0.0%	0.0%	$ 0.25	7
Commercial	Lighting Retrofit	5%	4.3%	58.0%	$ 0.89	6
Commercial	Lighting Retrofit	5%	0.0%	0.0%	$ 0.89	6

5.3 ECONOMIC SCREENING

In order to assess the total potential for achievable energy efficiency, it is first necessary to perform an economic screen on each measure. Within the framework of the LoadMAP model, this screening is performed dynamically in order to account for changing savings and cost data. Changes in these inputs to the economic screen can result in measures passing for some but not all of the years in the forecast; however, the relatively short timeframe considered for the PECO programs allows for limited dynamic effects. All details presented in this report are based on the analysis performed for the first forecast year.

A unique screen was performed for each measure permutation including specific customer segment, and both new construction and existing dwellings/buildings.

The economic screen applied in this study is a Total Resource Cost (TRC) test that compares the lifetime benefits (both energy and peak demand) of each applicable measure with installed cost (including material, labor and administration of a delivery mechanism, such as a DSM program). The lifetime benefits are obtained by multiplying the annual energy and demand savings for each measure by PECO avoided costs for each year, and discounting the dollar savings to present value equivalent basis. The measure savings, costs and lifetimes are obtained as part of the measure characterization. For economic screening of measures (in contrast to programs), incentives are not included because they represent a simple transfer from one party to another but have no effect on the overall measure cost.

The economic screening was performed for those measures with available savings and cost estimates. Note the following:

- The economic evaluation of every measure in the screens is conducted relative to a baseline condition. For instance, in order to determine the kilowatt-hour (kWh) savings potential of a measure, its kWh consumption must be compared to the kWh consumption of a baseline condition.
- The economic screen uses either the full or the incremental cost for each measure. Incremental cost was used for situations in which the decision is between the purchase and installation of a standard efficiency unit and a high-efficiency unit. For instance, the incremental cost of an Energy Star refrigerator is the additional cost of purchasing this unit compared to a comparable unit without the Energy Star rating.
- The economic screening was conducted only for measures that are applicable to each building type and vintage; thus if a measure is deemed to be irrelevant to a particular building type and vintage, it is excluded from the respective economic screen table.

5.3.1 Avoided Costs

The lifetime benefits of each energy efficiency measure depend on the forecast of PECO Energy avoided costs. For this study, avoided costs were developed by Global Energy Partners analysis of PECO internal forecasts. Table 5-6 presents a summary of these costs as well as a forecast of average electricity retail prices obtained from the EIA Annual Energy Outlook (AEO 2008) for the Northeast Region.

Table 5-6
Avoided Cost and Retail Electricity Price Forecasts

	PY2009	PY2010	PY2011	PY2012
Residential Avoided Cost of Energy ($/MWh)	$153.50	$140.05	$142.54	$145.08
Business Avoided Cost of Energy ($/MWh)	$127.30	$107.13	$109.03	$110.97
Avoided Cost of Capacity ($/kW-yr)	$65.78	$54.10	$64.81	$64.81
Residential Retail Price ($/kWh)	$0.15	$0.13	$0.14	$0.14
Business Retail Price ($/kWh)	$0.13	$0.12	$0.19	$0.19

5.4 RESULTS OF THE ECONOMIC SCREEN

The results of the economic screen are summarized in Table 5-7. Out of the 425 permutations of measures considered in the study, 223 passed the economic screen in the first year, or slightly more than half. While this result seems modest, it should be noted that many of the measure permutations in consideration embody emerging and undeveloped technologies. Although not found to be cost-effective at present, these technologies are likely to play a large role in shaping future energy savings. Complete results of the economic screening, including initial cost, first-year savings in kWh per household or kWh per square foot, and benefit to cost ratio for each measure permutation (sector, segment, and vintage) have been delivered separately to PECO.

Table 5-7
Summary of Economic Screen Results

		Equipment Measures	Non-Equipment Measures	Total Measures
Residential	Considered	50	156	206
	Passed Screen	29	75	104
Commercial	Considered	47	172	219
	Passed Screen	29	90	119

CHAPTER | 6

ENERGY EFFICIENCY POTENTIAL

Chapter 4 described determination of the baseline forecast, which forecasts electricity use though May of 2013 and serves as the reference point from which to make energy efficiency potential comparisons. Chapter 5 laid the groundwork for analyzing energy efficiency measures. This chapter describes the results of the potentials analysis in the context of the baseline forecast.

6.1 INTRODUCTION

Three types of energy efficiency potentials were estimated for PECO Energy's service territory: technical, economic, and achievable potential. Each of these potentials embodies a set of assumptions about the decisions consumers make regarding the efficiency of purchased equipment, the maintenance and controls of energy-consuming equipment, and the building envelopes in use. In terms of the modeling performed, the potential cases are defined by a set of purchase shares representing the fraction of purchases at each efficiency level under consideration.

As in the baseline forecast, the results described in this section were derived using the LoadMAP forecasting tool. Unlike common *top-down* approaches used to estimate savings potential, LoadMAP allows a fully integrated set of potential estimates that are calculated at the end-use and technology level, and then aggregated from the *bottom-up* to produce alternative *forecasts* for each potential case.

6.1.1 Technical Potential

Technical potential is defined as the theoretical upper limit of energy efficiency potential assuming that all feasible measures are adopted by customers, regardless of economics and customer acceptance. It provides the broadest and highest definition of market potential. In the context of the baseline forecast, the technical potential is obtained by setting all new equipment purchases to the most efficient available option. These efficient technologies then propagate into the forecast as equipment turns over. Examples of technologies incorporated into the technical potential include:

- Ductless "mini-split" air conditioners with variable refrigerant flow;
- Ground source heat pumps, with desuperheater for water heating;
- Multiple-drawer refrigerators and freezers; and
- Solid state (LED) lighting for general service, both interior and exterior.
- Technical potential also assumes the adoption of every available non-equipment measure, where applicable. For example, technical potential includes installation of high-efficiency windows in each new construction opportunity and repair and sealing of air ducts in existing buildings.

6.1.2 Economic Potential

Economic potential represents the adoption of all ***cost-effective*** energy efficiency measures. As described in Chapter 5, an economic screen was performed to determine which measures are

economically viable, then set the purchase decisions to reflect the most efficient measure that passes the screen. Like technical potential, economic potential is a theoretical construct.

6.1.3 Achievable Potential

After the technical and economic potentials have been determined, the next step is to obtain the achievable potential. The achievable potential refines the economic potential by taking into account expected program participation, customer preferences, and budget constraints.

The achievable potential was developed by addressing market acceptance which yields a maximum level of potential, which in this study is referred to as achievable potential. Achievable potential is defined as the fraction of the cost-effective savings that could be achieved after consideration of market acceptance. Customer-based barriers such as dislike of the color index of a CFL or the perceived lack of cooling associated with a programmable thermostat are expected to limit the capacity for program designers and implementers to achieve all of the savings considered economical. These barriers are introduced in the LoadMAP model through a set of Market Acceptance Ratios (MARs). Based on current available market data, such as ENERGY STAR sales figures, and augmented through an expert review process, the MARs embody assumptions about customer attitudes toward energy efficiency and generally increase through the forecast horizon. This increase reflects the growing acceptance of energy efficiency in modern society, a trend that is assumed (under achievable potential conditions) to continue throughout the forecast period. Table 6-1 and Table 6-2 present the market acceptance ratios used in this study. In cases where no efficiency options are considered in the modeling, the achievable potential factors are zero.

Table 6-1
Residential Market Acceptance Ratios by Technology

End use	Technology	MARs
Cooling	Central AC	26%
Cooling	Room AC	53%
Space heat	Heat Pumps	26%
Space heat	Other heating	0%
Lighting	Screw-in	53%
Lighting	Fluorescent	100%
Refrigerators	Refrigerators	100%
Freezers	Freezers	100%
Water heat	Water Heating	35%
Appliances	Clothes Washers	53%
Appliances	Clothes Dryers	53%
Appliances	Dishwashers	53%
Appliances	Cooking	0%
Electronics	Color TV	53%
Electronics	Personal Computers	53%
Furnace Fans	Furnace Fans	26%
Miscellaneous	Miscellaneous	0%

Table 6-2
Commercial Market Acceptance Ratios by Technology

End use	Technology	MARs
Cooling	Central Chiller	26%
Cooling	Packaged AC	31%
Cooling	Room AC	0%
Space Heating	Electric Resistance	0%
Space Heating	Heat Pump	26%
Ventilation	Ventilation	0%
Water Heating	Water Heater	26%
Interior Lighting	Interior Lighting	52%
Exterior Lighting	Exterior Lighting	52%
Office Equipment	PC	52%
Office Equipment	Server	52%
Office Equipment	Monitor	52%
Office Equipment	Printer/Copier	52%
Refrigeration	Walk-in Refrigeration	0%
Refrigeration	Reach-in Refrigeration	0%
Miscellaneous	Food Service	0%
Miscellaneous	Miscellaneous	0%

6.2 SUMMARY OF ENERGY EFFICIENCY POTENTIAL

The total achievable potential for energy efficiency in the PECO service territory rises from 686 GWh in the first program year (PY 2009) to 3,131 GWh in PY 2012. These estimates combine the totals of the residential, commercial and industrial customer sectors and represent 1.7-7.2% of the PECO baseline forecast. In addition to these energy savings, energy efficiency is capable of reducing system peak demand by as much as 1,204 MW. The aggregate potentials are presented in Table 6-3 and displayed as a percentage of the baseline in Figure 6-1.

Table 6-3
Total Potential Estimates

	PY 2009	PY 2010	PY 2011	PY 2012
Baseline Electricity Forecast (GWh)	38,215	38,564	39,366	39,828
Energy Savings (GWh)				
Achievable Potential	636	1,578	2,434	3,130
Economic Potential	1,515	3,074	4,474	5,366
Technical Potential	1,992	4,026	5,832	7,086
Energy Savings as % of Baseline				
Achievable Potential	1.7%	3.8%	5.7%	7.2%
Economic Potential	4.0%	8.0%	11.4%	13.5%
Technical Potential	5.2%	10.4%	14.8%	17.8%
Peak Demand Savings (MW)				
Achievable Potential	257	561	831	1,204
Economic Potential	830	1,488	2,023	2,441
Technical Potential	1,001	1,789	2,422	2,913

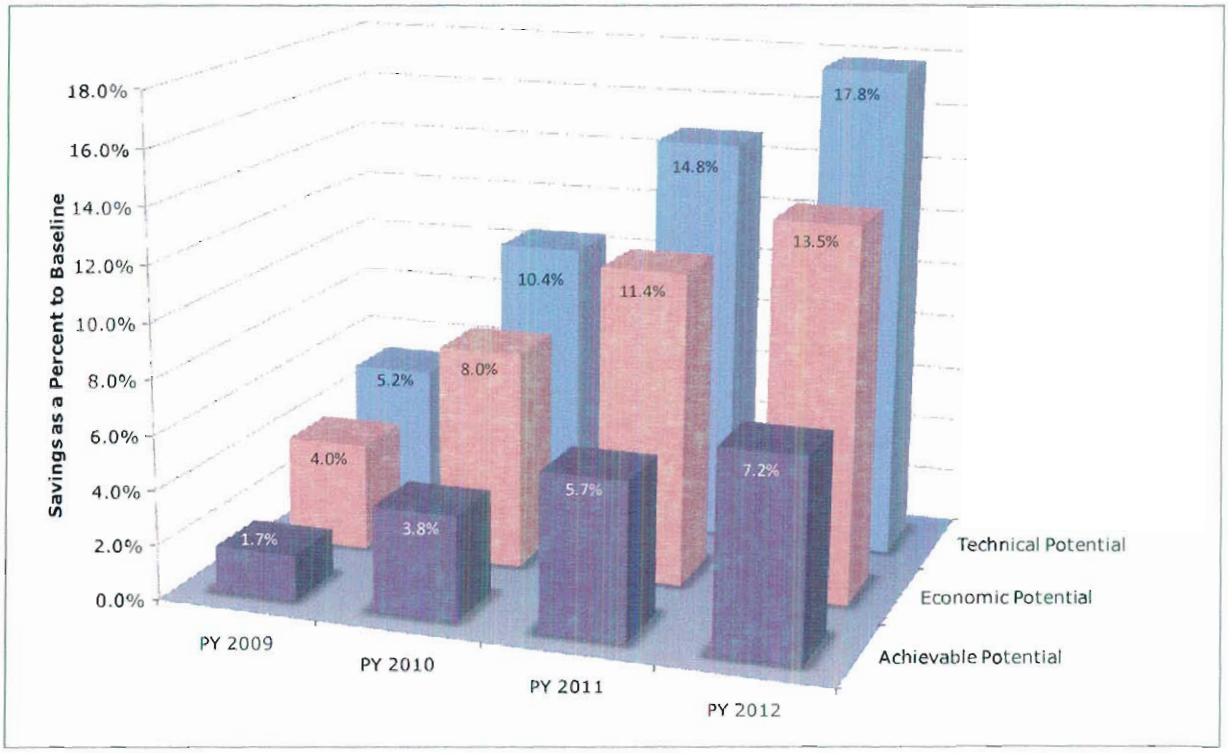

Figure 6-1
Total PECO Energy Efficiency Potential as Percentages of Baseline Forecast

The potential estimates for PECO were derived through three separate models, each tailored to the end uses and technologies embodied within the three primary customer sectors: residential, commercial, and industrial. Table 6-4 displays the potential estimates in annual energy savings by sector. The remainder of this chapter is devoted to individual treatment of each of these sectors.

Table 6-4
Total Potential Estimates by Sector

	PY 2009	PY 2010	PY 2011	PY 2012
Achievable Potential (GWh)				
Residential	334	820	1,282	1,494
Business	302	649	975	1381
Industrial	50	109	178	256
Total	686	1,578	2,435	3,131
Economic Potential (GWh)				
Residential	597	1,360	2,054	2,344
Business	806	1,489	2,080	2,566
Industrial	112	224	340	456
Total	1,515	3,073	4,474	5,366
Technical Potential (GWh)				
Residential	787	1,773	2,648	3,102
Business	1,035	1,911	2,667	3,288
Industrial	170	342	518	696
Total	1,992	4,026	5,833	7,086

6.3 ENERGY EFFICIENCY POTENTIAL FOR THE RESIDENTIAL SECTOR

Estimates of the potential for energy savings in the residential sector are summarized in e.

Table 6-5 and graphically displayed in Figure 6-2. The energy efficiency impacts are included in the table as energy savings values relative to the baseline (GWh) and as percentage reductions in the baseline forecast. The figure shows the percentage reductions, which reflect the potential for reducing energy consumption relative to the baseline.

Table 6-5
Residential Potential Estimates

	PY 2009	PY 2010	PY 2011	PY 2012
Baseline Electricity Forecast (GWh)	13,703	13,840	14,115	14,326
Energy Savings (GWh)				
Achievable Potential	334	820	1,282	1,494
Economic Potential	597	1,360	2,054	2,344
Technical Potential	787	1,773	2,648	3,102
Energy Savings as % of Baseline				
Achievable Potential	2.4%	5.9%	9.1%	10.4%
Economic Potential	4.4%	9.8%	14.6%	16.4%
Technical Potential	5.7%	12.8%	18.8%	21.7%
Peak Demand Savings (GW)				
Achievable Potential	26	49	68	89
Economic Potential	73	119	149	167
Technical Potential	89	142	173	188

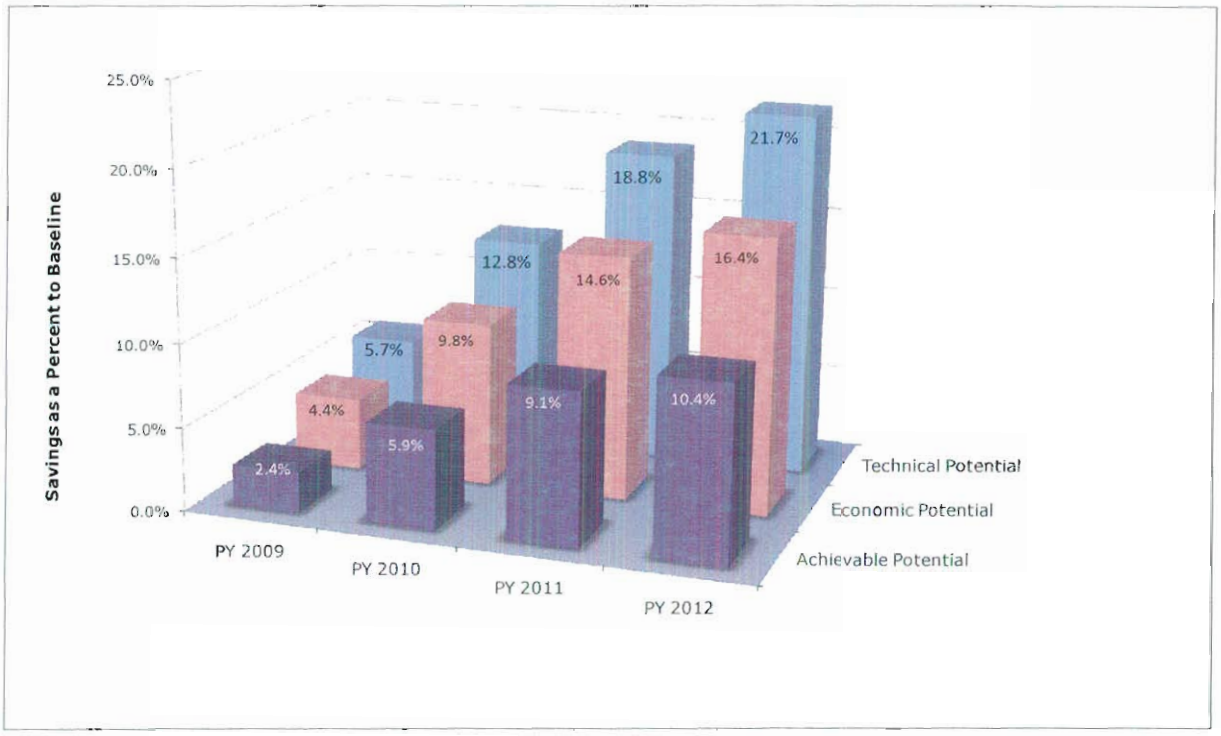

Figure 6-2
Residential Sector Energy Efficiency Potential

Under the assumption that programs are fully implemented by the beginning of calendar year 2010, the achievable potential for the residential sector begins strong, reaching 2.4% of total electricity consumption in PY 2009. It remains strong through PY 2012, reaching 10.4% of total electricity use. Most of the savings come from residential lighting and the adoption of compact fluorescent lamps. In PY 2012, the start of the lighting standard in EISA is felt, and what might have been achieved through utility programs is mandated and becomes part of the baseline forecast. Therefore the potential for program savings from lighting diminish slightly, reducing the amount of overall savings. Since these standards will phase in between 2012 and 2014, the majority of savings from this mandate occur after the forecast of this report. It is important to note that overall consumption is reduced, but the source of the savings shifts from utility programs to legislation.

The analysis and conclusions for economic potential are the same as for achievable potential. The economic potential is 4.4% in PY 2009 and 16.4% in PY 2012. The impacts accelerate through 2012 and decrease as appliance standards, building codes, and naturally occurring efficiency limit the opportunities for energy efficiency through utility programs. Similarly, the technical potential is 5.7% of the baseline in PY 2009 and then ascends to 21.7% by PY 2012.

Figure 6-3 illustrates the relationship between the baseline forecast and the forecasts for the three potentials. Note the widening of the potential estimates as the purchase decisions and programs swing into full use during the early years of the forecast.

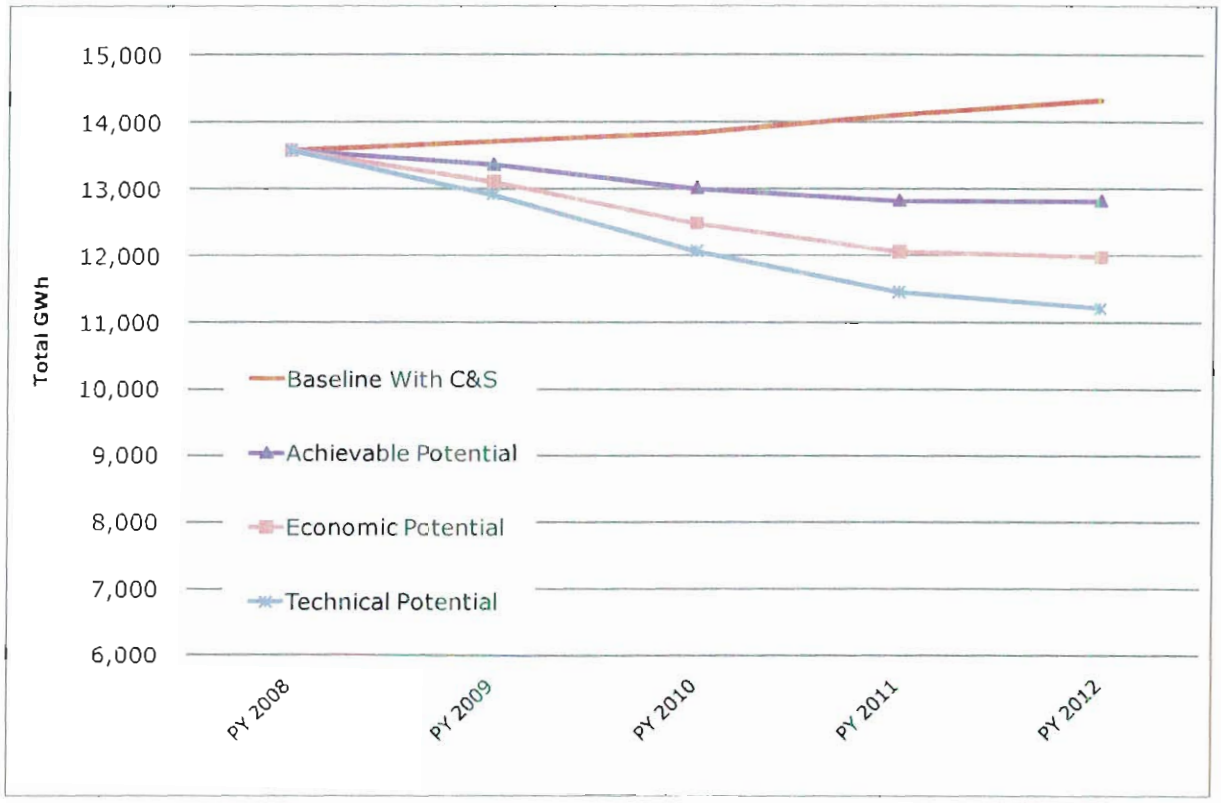

Figure 6-3
Residential Energy Efficiency Potential Forecast

6.3.1 Residential Potential Estimates by End-Use

The resolution of the modeling approach allows for analysis at the end-use level. Table 6-6 provides a summary of technical, economic, and achievable potential estimates for each of the primary end-uses considered relative to the baseline. Interior lighting equipment replacement accounts for a high portion of the savings in absolute (GWh) terms as well as a high percentage of the baseline. Water heating, electronics, exterior lighting, cooling, electronics and appliances also contribute to the savings. Because of the relatively small share of homes with electric space heating, the contributions are small from this end-use.

Table 6-6
Residential Potential by End-Use

		Savings (GWh)			
End Use	**Case**	**PY 2009**	**PY 2010**	**PY 2011**	**PY 2012**
Space Heater	Achievable	-	-	2	4
	Economic	12	22	31	38
	Technical	-	-	1	1
Cooling	Achievable	1	2	4	5
	Economic	33	66	95	121
	Technical	2	5	8	12
Water Heating	Achievable	18	33	45	56
	Economic	50	91	125	154
	Technical	6	11	15	20
Interior Lighting	Achievable	70	412	749	887
	Economic	88	521	949	1,181
	Technical	37	219	398	475
Exterior Lighting	Achievable	59	117	173	194
	Economic	68	136	202	232
	Technical	30	61	91	102
Appliances	Achievable	17	35	50	69
	Economic	36	73	105	134
	Technical	14	29	42	58
Electronics	Achievable	96	142	186	238
	Economic	118	194	268	360
	Technical	50	74	97	126
Miscellaneous	Achievable	4	8	12	15
	Economic	4	8	12	15
	Technical	1	2	3	4

6.3.2 Residential Potential Estimate by Segment

Table 6-7 lists the three types of potential estimates by segment. It provides values in absolute terms relative to the baseline for the residential (excluding low income) and the low income segments. Roughly one-fifth of the potential is attributed to the low income segment. For both segments, the achievable potentials represent 10.4% of the baseline in PY 2012.

Table 6-7
Residential Potential by Segment (GWh Savings)

		PY 2009	PY 2010	PY 2011	PY 2012
Total	Achievable	265	748	1,221	1,469
	Economic	409	1,111	1,787	2,236
	Technical	140	400	655	799
Residential	Achievable	185	592	990	1,165
	Economic	298	891	1,463	1,809
	Technical	99	318	533	637
Low income	Achievable	80	157	231	305
	Economic	111	220	323	426
	Technical	41	82	121	162

6.3.3 Residential Potential Estimates by Measure Type

In this section, estimates of realistic achievable potential for equipment and non-equipment measures are presented. As shown in Table 6-8, interior lighting accounts for the most savings primarily due to lamp conversion from incandescent to CFL's. There are also substantial opportunities in cooling and electronics. As shown in Table 6-9, home electronics controls (standby wattage and SmartPlug), occupancy sensors on interior lights, low-flow showerheads and programmable thermostats have the largest share of savings.

Table 6-8
Residential Potential Savings (GWh) by Technology – Equipment Measures

End Use	Technology	PY 2009	PY 2010	PY 2011	PY 2012
Cooling	Electric Resistance	-	-	-	-
	Furnace	-	-	-	-
Space Heating	Heat Pump	0	1	1	2
	Central AC	9	17	24	31
	Room AC	3	6	10	15
Water Heating	Water Heater	36	67	93	116
Interior Lighting	Linear Fluorescent	2	4	6	8
	Screw-in	47	305	566	606
Exterior Lighting	Linear Fluorescent	-	-	-	-
	Screw-in	42	85	128	138
Electronics	Color TV	10	22	33	45
	Other Electronics	52	60	68	76
	Personal Computer	13	30	47	72
Appliances	Clothes Dryer	3	7	9	12
	Clothes Washer	2	4	6	8
	Combined Washer-Dryer	-	-	-	-
	Cooking	1	1	2	3
	Dishwasher	6	13	19	25
	Freezer	4	8	12	15
	Refrigerator	13	26	37	53
	Second Refrigerator	-	-	-	-
Miscellaneous	Furnace Fan	1	2	3	4
	Other Miscellaneous	-	-	-	-
	Pool Pump	-	-	-	-
Total		168	549	915	907

Table 6-9
Residential Achievable Potential Savings (GWh) - Non-equipment Measures

Measure	PY 2009	PY 2010	PY 2011	PY 2012
AC Maintenance	1.2	2.5	3.7	5.3
Attic Fan	-	-	-	-
Ceiling Fan	2.2	4.9	7.1	10.5
Ceiling Insulation	0.1	0.2	0.4	0.6
Dehumidifier	3.0	6.5	9.4	13.8
Drainwater Heat Recovery	-	-	-	-
Duct Insulation	0.1	0.2	0.3	0.4
Duct Repair	2.1	4.4	6.5	9.1
External Shades	0.0	0.1	0.1	0.2
Faucet Aerators	2.1	4.1	5.6	7.2
Foundation Insulation	-	-	-	-
High Efficiency Windows	2.1	4.2	6.3	8.4
HP Maintenance	0.1	0.2	0.3	0.4
Infiltration Control	2.8	5.8	8.4	11.8
Lighting Timer	8.9	13.5	14.3	14.9
Lighting Timer	-	-	-	-
Low-Flow Showerheads	8.3	15.7	21.8	28.0
Motion Detectors	-	-	-	-
Occupancy Sensor	20.1	31.9	37.4	38.8
Photosensors	-	-	-	-
Pipe Insulation	3.3	6.3	8.8	11.3
Pool Pump Timer	0.9	2.1	3.0	4.6
Programmable Thermostat	3.1	6.6	9.8	13.9
Radiant Barrier	-	-	-	-
Reduce Standby Wattage	10.3	18.3	24.7	29.7
Reflective Roof	0.0	0.1	0.3	0.5
SmartPlug	19.6	34.9	46.8	56.2
Storm Doors	-	-	-	-
Wall Insulation	0.1	0.3	0.4	0.7
Whole-House Fan	0.1	0.2	0.4	0.5
Total	90.6	162.9	215.8	266.9

6.4 ENERGY EFFICIENCY POTENTIAL FOR THE COMMERCIAL SECTOR

Estimates of the potential for energy savings in the commercial sector are summarized in Table 6-10 displayed in Figure 6-4. The energy efficiency impacts are included in the table as energy savings values relative to the baseline (GWh) and as percentage reductions in the baseline forecast. The figure shows the percentage reductions, which reflect the potential for reducing energy consumption relative to the baseline.

Table 6-10
Commercial Potential Estimates

	PY 2009	PY 2010	PY 2011	PY 2012
Baseline Electricity Forecast (GWh)	17,404	17,554	17,928	18,106
Energy Savings (GWh)				
Achievable Potential	302	649	975	1,381
Economic Potential	806	1,489	2,080	2,566
Technical Potential	1,035	1,911	2,667	3,288
Energy Savings as % of Baseline				
Achievable Potential	1.7%	3.7%	5.4%	7.6%
Economic Potential	4.6%	8.5%	11.6%	14.2%
Technical Potential	5.9%	10.9%	14.9%	18.2%
Peak Demand Savings (GW)				
Achievable Potential	232	512	763	1,115
Economic Potential	757	1,369	1,874	2,275
Technical Potential	912	1,647	2,249	2,725

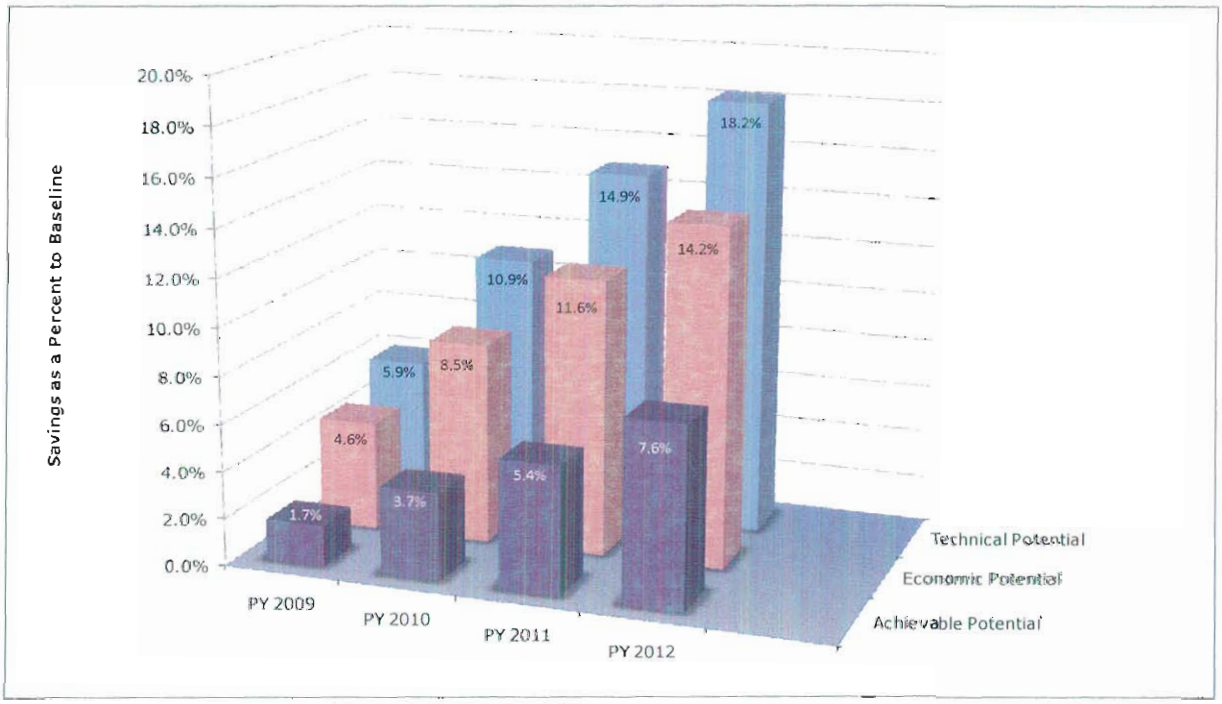

Figure 6-4
Commercial Energy Efficiency Potential

With fully implemented and operation programs by the beginning of calendar year 2010, the achievable potential for the commercial sector reaches 1.7% of total electricity consumption in PY 2009. By PY 2012, the achievable potential is 7.6% of total electricity use. Most of the savings come from commercial lighting, though as a percentage to total lighting the commercial savings are 20% less than residential. The economic potential is 4.6% in PY 2009 and 14.2% in PY 2012.

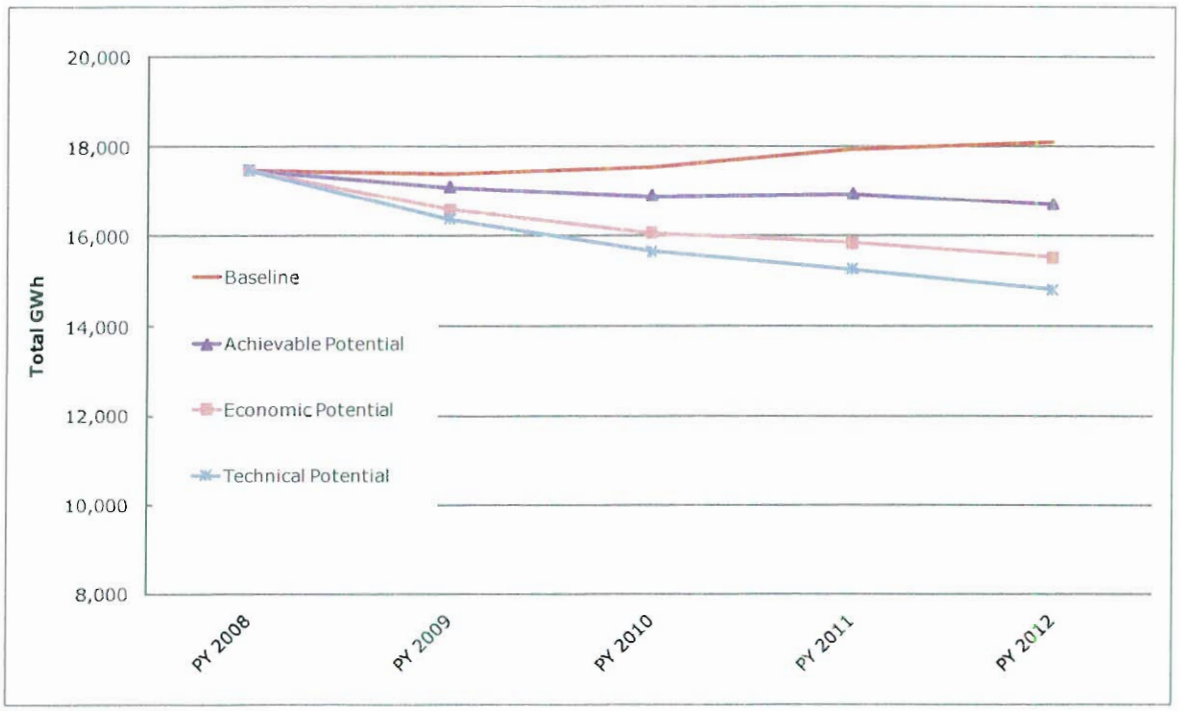

Figure 6-5 illustrates the relationship between the baseline forecast and the forecasts for the three potentials. In PY 2009 the baseline dips as the economy continues through the recession, picking back up in PY 2010. In PY 2011 the baseline increases as new construction stock is added. In the early years of the forecast the potential is lower because of market acceptance and equipment stock turnover. As the forecast progress the potentials change dramatically as acceptance rates increase and old equipment stock is replaced.

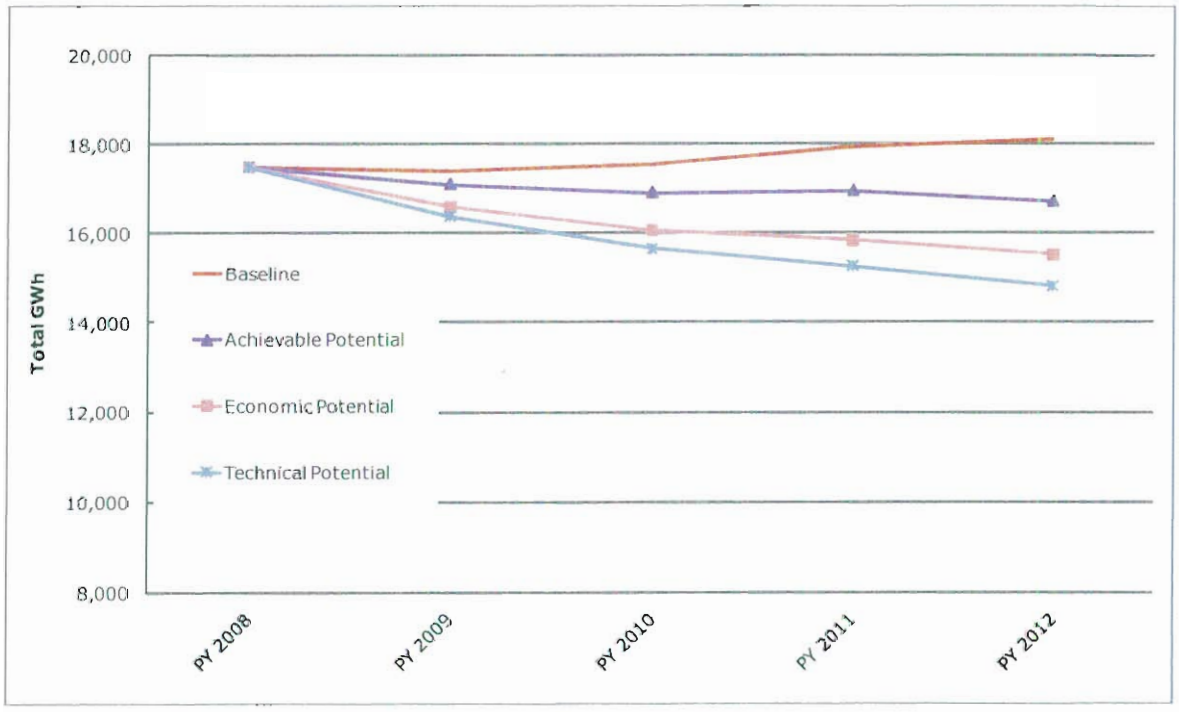

Figure 6-5
Commercial Energy Efficiency Potential Forecast

6.4.1 Commercial Potential Estimates by End-Use

Table 6-11 provides a summary of technical, economic, and achievable potential estimates for each of the primary end-uses considered relative to the baseline. Interior lighting equipment replacement accounts for a high portion of the savings in absolute (GWh) terms as well as a high percentage of the baseline. Space cooling, ventilation, office equipment, and refrigeration also contribute to the savings. Because of the relatively small share of buildings with electric space heating and electric water heating, the contributions are small from these end-uses.

Table 6-11
Commercial Potential by End-Use

		Savings (GWh)			
End Use	**Case**	**PY 2009**	**PY 2010**	**PY 2011**	**PY 2012**
Space Heating	Achievable	0.2	0.6	1.0	1.5
	Economic	0.8	1.8	3.2	4.6
	Technical	2.0	4.8	8.5	12.1
Cooling	Achievable	7.9	17.8	28.8	40.3
	Economic	17.1	37.9	61.2	83.8
	Technical	28.0	61.7	99.4	136.0
Ventilation	Achievable	13.9	29.7	45.8	62.5
	Economic	35.8	74.6	114.0	151.4
	Technical	35.8	74.6	114.0	151.4
Water Heating	Achievable	0.1	0.3	0.5	0.7
	Economic	0.2	0.4	0.7	0.9
	Technical	3.7	8.1	13.1	17.9
Interior Lighting	Achievable	59.4	127.5	204.3	284.8
	Economic	114.6	236.4	358.1	471.1
	Technical	207.5	428.2	648.5	853.3
Exterior Lighting	Achievable	3.7	7.9	12.7	17.7
	Economic	7.1	14.7	22.3	29.3
	Technical	12.6	26.0	39.3	51.8
Office Equipment	Achievable	14.2	32.3	53.0	73.8
	Economic	24.8	55.5	90.5	124.3
	Technical	33.8	75.4	122.4	167.5
Refrigeration	Achievable	10.0	21.4	33.4	45.4
	Economic	14.2	30.2	46.9	63.0
	Technical	17.6	37.4	57.9	77.5
Miscellaneous	Achievable	0.2	0.6	1.0	1.5
	Economic	0.8	1.8	3.2	4.6
	Technical	2.0	4.8	8.5	12.1

6.4.2 Commercial Potential Estimate by Segment

Table 6-12 lists the energy savings in GWh associated with each of the three types of potential estimates by segment. It provides values in absolute terms relative to the baseline for the commercial (excluding government) and the government segments. Roughly one-third of the potential is attributed to the government segment.

Table 6-12
Commercial Savings Potential by Segment (GWh)

		PY 2009	PY 2010	PY 2011	PY 2012
Total	Achievable	302	649	975	1,381
	Economic	806	1,489	2,080	2,566
	Technical	1,035	1,911	2,667	3,288
Commercial	Achievable	202	437	661	941
	Economic	551	1,018	1,428	1,764
	Technical	714	1,318	1,843	2,274
Government	Achievable	100	212	314	440
	Economic	256	471	652	802
	Technical	321	593	824	1,014

6.4.3 Commercial Sector Potential Estimates by Measure Type

Table 6-13 and Table 6-14 present results at by measure group. In the commercial sector, the equipment measures have a smaller share of the total potential than the non-equipment measures. Among the equipment measure group, lighting has the largest realistic achievable potential in PY 2012. Ventilation and refrigeration are also substantial.

Among the non-equipment measures in PY 2012, a number of HVAC-related measures show significant savings. These include EMS, VSD on fans, economizers, occupancy sensors and HVAC retro-commissioning. Various lighting measures, including lighting retrofit, and lighting controls also show substantial savings.

Table 6-13
Commercial Realistic Potential by Technology – Equipment Measures (GWh)

End Use	Technology	PY 2009	PY 2010	PY 2011	PY 2012
Space Heating	Electric Resistance	-	-	-	-
	Heat Pump	0	1	1	2
Cooling	Central Chiller	1	2	4	5
	Room AC	0	0	1	1
	Packaged AC	7	15	25	35
Ventilation	Ventilation	14	30	46	63
Water Heating	Water Heater	0	0	1	1
Interior Lighting	Interior Lighting	59	127	204	285
Exterior Lighting	Exterior Lighting	4	8	13	18
Office Equipment	Monitor	3	6	10	14
	PC	5	11	18	26
	Printer/Copier	1	2	4	5
	Server	5	12	20	29
Refrigeration	Reach-in Refrigeration	9	20	31	42
	Walk-in Refrigeration	1	2	3	4
Miscellaneous	Food Service	-	-	-	-
	Miscellaneous	-	-	-	-
	Total	109	238	380	527

Table 6-14
Commercial Realistic Achievable Potential for Non-equipment Measures (GWh)

Measure	PY 2009	PY 2010	PY 2011	PY 2012
Advanced Design	-	2.2	5.9	12.4
Anti-Sweat Heater Controls	-	-	-	-
Cool Roof	-	-	-	-
Daylighting Controls	16.0	31.1	43.3	55.5
De-lamp	16.7	31.9	44.3	56.7
Dual Enthalpy Economizer	11.6	26.6	38.9	58.8
Duct Insulation	-	-	-	-
Duct Testing and Sealing	-	-	-	-
Efficient Elevators	5.2	12.9	23.4	35.4
Efficient Escalators	4.1	9.4	15.9	24.6
Efficient Windows	-	-	-	-
EMS	15.8	36.2	52.8	80.4
External Shades	-	-	-	-
Floating Head Pressure Controls	4.5	10.1	14.8	22.1
Glass Doors	-	-	-	-
HVAC Retrocommissioning	9.7	21.1	30.3	44.7
Icemakers	1.6	3.4	5.0	7.4
LED Exit Lighting	-	-	-	-
Lighting Retrofit	54.9	117.7	165.7	238.4
Lighting Timers	3.2	6.3	8.8	11.4
Lighting Timers Indoors	7.3	14.1	19.6	25.3
Occupancy Sensors	18.5	35.5	49.3	63.0
Outdoor Lighting - Photovoltaic, Installation (parking lots)	-	-	-	-
Programmable Thermostat	9.1	20.9	30.7	46.8
Roof Insulation	-	-	-	-
Task Lighting	-	-	-	-
Vending Miser	2.3	5.3	8.9	14.0
VSD on Fans	11.6	25.9	37.1	56.2
VSD on Water Pump	0.0	0.1	0.1	0.2
Wall Insulation	-	-	-	-
Water Temperature Reset	0.2	0.4	0.5	0.8
Grand Total	192.4	411.1	595.5	853.9

6.5 ENERGY EFFICIENCY POTENTIAL FOR THE INDUSTRIAL SECTOR

The potential for energy efficiency in the PECO industrial sector falls in line with the baseline consumption in this sector of 19% of the base year consumption. While the savings opportunities are large as a result of energy intensive processes, they are also customized on a site-by-site basis and require significant engineering investments to obtain. In keeping with the analysis performed for the industrial sector in the Northeast region for the EPRI National Study, these customized opportunities were largely ignored for this analysis. The result is a set of potentials that a smaller percentage of baseline energy consumption than the other two customer sectors,

as illustrated in Table 6-15 and Figure 6-6. Overall, in PY 2009 achievable potential is 0.7% and PY 2012 is 3.5%.

Table 6-15
Industrial Realistic Achievable Potential (GWh)

	PY 2009	PY 2010	PY 2011	PY 2012
Baseline Electricity Forecast (GWh)	7,108	7,170	7,323	7,396
Energy Savings (GWh)				
Achievable Potential	50	109	178	256
Economic Potential	112	224	340	456
Technical Potential	170	342	518	696
Energy Savings as % of Baseline				
Achievable Potential	0.7%	1.5%	2.4%	3.5%
Economic Potential	1.6%	3.1%	4.6%	6.2%
Technical Potential	2.4%	4.8%	7.1%	9.4%

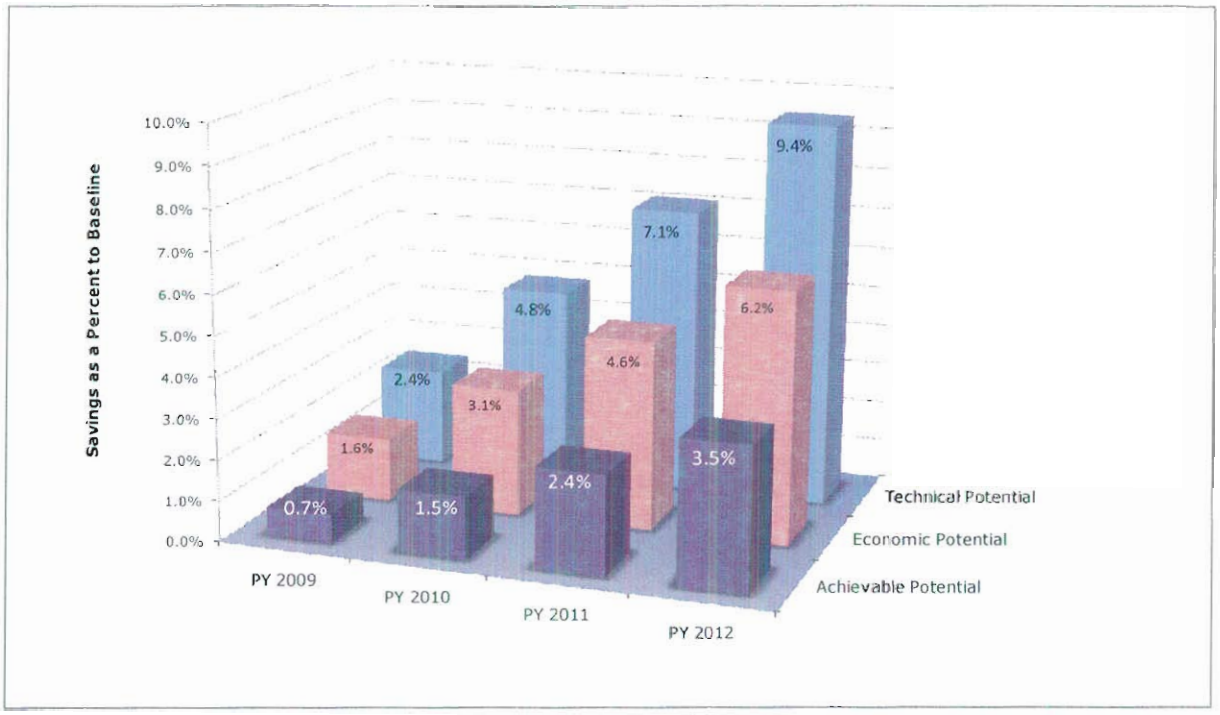

Figure 6-6
Industrial Energy Efficiency Potential as Percentage of Baseline

6.5.1 Industrial Potential Estimates by End Use

Table 6-16 represents all end uses considered for the industrial analysis. Machine drives have the biggest savings. As expected from the baseline characterization outlined in Chapter 4, the machine drives category is the source of the largest potential for energy efficiency. Totaling 126 GWh of achievable potential by the end of the forecast period, machine drive savings is attained through a number of measures:

- High-efficiency and premium-efficiency motors, both as incremental measures when a new motor is installed and as retrofits of standard efficiency motors currently in operation.
- Variable-speed drives and other controls to match motor output to the specifications of the required task.

In addition to motors and drives, there is also significant savings opportunity in lighting and HVAC, as many industrial facilities contain office space and other indoor environments along with onsite processes.

Table 6-16
Industrial Achievable Potential by End Use

End Use	PY 2009	PY 2010	PY 2011	PY 2012
HVAC	2.0	4.8	8.5	13.0
Lighting	18.9	40.2	64.2	90.9
Machine Drive	23.9	52.7	87.0	126.5
Other	2.2	4.8	7.8	11.1
Process Heating	2.9	6.3	10.2	14.7
Total	**49.8**	**108.8**	**177.7**	**256.2**

APPENDIX F-2.

RESIDENTIAL SATURATION SURVEY

PECO Residential Online Survey

Q0) E Rewards introduction

Thank you for your interest in this study. Once you have completed the study, please allow up to 7-10 business days for your survey credit to appear in your account. Thank you for your time and opinions!

Q1) Do you or another household member pay your own utility bill?
Choice
1) Yes
2) No [Terminate]

Q2) Are you 18 years of age or older?
Choice
1) Yes
2) No [Terminate]

Q4) Are you or anyone in your household employed by the following types of companies? (Check all that apply)
Choice
1) Market research firm [Terminate]
2) Electric or natural gas utility [Terminate]
3) None of the above

Q139) Which of the following categories best describes your total household income, before taxes? (Note: This is for information purposes only and will not be shared.)
Choice
1) Less than $10,000
2) $10,000 - $24,999
3) $25,000 - $34,999
4) $35,000 - $44,999
5) $45,000 - $59,999
6) $60,000 - $74,999
7) $75,000 - $99,999
8) $100,000 - $149,999
9) $150,000 - $199,999
10) $200,000 or more
11) Prefer not to answer [Terminate]

Q3) In which Pennsylvania County do you reside?
Choice
1) Philadelphia
2) Bucks
3) Chester
4) Delaware
5) Montgomery
6) None of these [Terminate]
7) Don't know [Terminate]

Q3a) We want to confirm the level of service you receive from PECO. From the following list, please choose the category that best describes your service from PECO (select one).
Choice
1) Electric service only
2) Gas service only
3) Both electric and gas
4) Neither [Terminate]

Qstreet) Please enter the address where you receive electrical service from PECO.
Street Address: _____

Qcity) City:

_____

Qzip) Zip code:

_____

Q6) What type of home do you live in?
Choice
1) Single family home
2) Condominium/Townhome/Row house
3) Apartment in building with less than 5 units
4) Apartment in building with 5 or more units
5) Mobile home
6) Other (please specify) This question uses other field from question Q6o1

Q6o1) OTHER - Other (please specify)

_____

Q7) Do you rent or own your home?
Choice
1) Own
2) Rent

Q9) Approximately, what is your average monthly utility bill in the summer? (Type in whole numbers only, no decimals.)
$_____

Q10) Approximately, what is your average monthly utility bill in the winter? (Type in whole numbers only, no decimals.)
$_____

Q11) When, approximately, was your home built?
Choice
1) Before 1940
2) 1940-1949
3) 1950-1959
4) 1960-1969

5) 1970-1979
6) 1980-1989
7) 1990-1999
8) 2000-2008
9) Unsure

Q12) What is the approximate square footage of your home?

_____

Q13) How many bedrooms are in your home?
Choice
1) 0 Studio
2) 1
3) 2
4) 3
5) 4
6) 5
7) 6 or more

Q14) How many bathrooms are in your home? (A half-bath does not include a bathtub or shower.)
Choice
1) .5
2) 1
3) 1.5
4) 2
5) 2.5
6) 3
7) 3.5
8) 4 or more

Q17) Which of the following improvements have you or a previous homeowner made to your home since 2000? (Select all that apply.)
Choice
1) Added square footage
2) Replaced the roof
3) Replaced windows
4) Replaced an air conditioner
5) Added an air conditioner
6) Replaced a heating system
7) Finished a basement
8) Finished an attic
9) None of the above

Please provide your best estimate of the year the replacement or renovation took place for each item.	Year
Q17a) Added square footage	
Q17b) Replaced the roof	
Q17c) Replaced windows	

Q17d) Replaced an air conditioner	
Q17e) Added an air conditioner	
Q17f) Replaced a heating system	
Q17g) Finished a basement	
Q17h) Finished an attic	

Q18) How many levels does your home have, excluding basement and attic? If you live in a multi-family building, select the number of levels of your individual home.
Choice
1) 1
2) 2
3) 3
4) 4 or more

Q19) Does your home have an attic?
Choice
1) Yes, and it is heated
2) Yes, but it is not heated
3) No

Q20) Does your home have a basement?
Choice
1) Yes, and it is heated
2) Yes, but it is not heated
3) No

Q22) What types of windows does your home have? (Select one.)
Choice
1) Single pane windows
2) Double pane windows or better
3) Mixture of single and double pane windows
4) Don't know

Q23) What is the primary fuel used for heating your home?
Choice
1) Electricity
2) Natural gas
3) Propane
4) Fuel oil
5) Solar
6) Wood
7) Steam
8) Other (please specify) This question uses other field from question Q23o1
9) None (My home is not heated) [Skip to Q47]

Q23o1) OTHER - Other (please specify)
_____

Q25) What type of primary heating system is used in your home? (Select one.) A primary heating system is used to heat most, or all, of your home.
Choice
1) Central warm air furnace with ducts/vents to individual rooms
2) Central boiler with hot water/steam radiators or baseboards in individual rooms
3) Electric baseboard or electric coils radiant heating
4) Wall furnace
5) Fireplace
6) Portable electric heater or wall insert electric heater
7) Air-source heat pump
8) Geothermal heat pump
9) Other (please specify) This question uses other field from question Q25o1
10) No heating system
11) Unsure

Q25o1) OTHER - Other, please specify

_____

Q26) When was your primary heating system installed? If you are unsure, your best estimate is fine.
Choice
1) Before 1970
2) 1970-1979
3) 1980-1989
4) 1990-1994
5) 1995-1999
6) 2000-2005
7) 2005-2008

Q27) Does your home use a supplemental space heating system? A supplemental heating system provides part of the total space heating need of your home.
Choice
1) Yes
2) No [Skip to Q47]

Q28) Which of the following do you use for supplemental heating? (Select all that apply)
Choice
1) Electric (wall-mounted) space heater
2) Natural gas (wall-mounted) space heater
3) Wood burning fireplace
4) Gas log fireplace
5) Wood burning stove
6) Portable gas space heater
7) Portable electric space heater
8) Portable kerosene space heater
9) Other (please specify) This question uses other field from question Q28o1

Q28o1) OTHER - Other (please specify)

_____

Q29- Q37) When was your supplemental heating system installed or purchased? We are interested in the age of the current item used in your home. If you or a previous homeowner made a new purchase, installation or replacement, please indicate the appropriate year.

	Before 1970	1970-1979	1980-1989	1990-1999	2000-2008	Unsure
Q29) Electric (wall-mounted) space heater						
Q30) Natural gas (wall-mounted) space heater						
Q31) Wood burning fireplace						
Q32) Gas log fireplace						
Q33) Wood burning stove						
Q34) Portable gas space heater						
Q35) Portable electric space heater						
Q36) Portable kerosene space heater						
Q37) ~Q28o1~						

Q38-Q46) What type of fuel is used in the supplemental heating system?

	Electricity	Wood	Natural gas	Propane	Fuel Oil	Unsure
Q38) Electric (wall-mounted) space heater						
Q39) Natural gas (wall-mounted) space heater						
Q40) Wood burning fireplace						
Q41) Gas log fireplace						
Q42) Wood burning stove						
Q43) Portable gas space heater						
Q44) Portable electric space heater						
Q45) Portable kerosene space heater						
Q46) ~Q28o1~						

Q48) What type of primary cooling system is used in your home? (Select one.) A primary cooling system provides cooling for most, or all, of your home.

Choice

1) Central air conditioner
2) Room air conditioner(s) mounted in a window or wall
3) Evaporative cooler
4) Air-source heat pump
5) Geothermal heat pump
6) Portable room air conditioner(s)
7) Portable dehumidifier(s)
8) Whole house attic fan
9) Ceiling and/or window/room fan(s)
10) No cooling system Q54
11) Other, please specify This question uses other field from question Q48o1
12) Unsure

Q48o1) OTHER - Other, please specify

_____

Q49) When was your ~Q48~ installed?
Choice
1) Before 1970
2) 1970-1979
3) 1980-1989
4) 1990-1999
5) 2000-2008
6) Unsure

Q50- Q52) How many of the following does your home have?

	0	1	2	3	4	5	More than 5
Q50) Window/room fans							
Q51) Ceiling fans							
Q52) Room air conditioners mounted in a window							

Q53) Does your home use a whole-house or attic fan?
Choice
1) Yes
2) No

Q55) Does your home use a thermostat to control heating and/or cooling?
Choice
1) Yes, standard thermostat
2) Yes, programmable thermostat
3) No thermostat [Skip to Q60]

Q58-Q59) What is the typical heating temperature setting for the thermostat?

	Less than 60 °F	60-64 ° F	65-69 °F	70-74 °F	75 °F or higher	Not applicable

Q58) Day						
Q59) Night						

Q56-Q57) What is the typical cooling temperature setting for the thermostat?

	Less than 60 °F	60-64 ° F	65-69 °F	70-74 °F	75 °F or higher	Not applicable
Q56) Day						
Q57) Night						

Q61) Do you have a water heater in your home?
Choice
1) No, water heater or hot water is provided by the building to residents [Skip to Q64]
2) Yes, conventional water heater with storage tank
3) Yes, tankless (instantaneous) water heater
4) Yes, heat pump water heater
5) Other, please specify This question uses other field from question Q61o1
6) Unsure

Q61o1) OTHER – Other, please specify

_____

Q62) What fuel does your water heater use?
Choice
1) Natural gas
2) Electricity
3) Fuel oil
4) Propane
5) Wood
6) Other, please specify This question uses other field from question Q62o1
7) Unsure

Q62o1) OTHER - Other, please specify

_____

Q63) When was your water heater installed?
Choice
1) Before 1970
2) 1970-1979
3) 1980-1989
4) 1990-1999
5) 2000-2008
6) Unsure

Q65-Q88) Approximately how many of each type of lighting do you have inside each area of your home?

	Incandescent lamp	Compact fluorescent lamp (CFL)	Tubular fluorescent lamp	Low voltage (halogen, LED, etc.)
1 Bedrooms	Q65	Q66	Q67	Q68
2 Bathrooms	Q69	Q70	Q71	Q72
3 Kitchen	Q73	Q74	Q75	Q76
4 Living areas	Q77	Q78	Q79	Q80
5 Hallways/Stairwells	Q81	Q82	Q83	Q84
6 Other	Q85	Q86	Q87	Q88

Q89) Do you use any of the following devices to control the lights inside your home? (Select all that apply)
Choice
1) Timer
2) Motion detectors or occupancy sensors
3) Dimming switch
4) None of the above

Q90-Q92) Approximately how many of each device do you have to control lighting inside your home?

	# of devices
1 Timer	Q90
2 Motion detectors or occupancy sensors	Q91
3 Dimming switch	Q92

Q93) What types of lighting do you have outside your home? (Select all that apply)
Choice
1) Incandescent lamp
2) Compact fluoresent lamp
3) Low voltage landscape system
4) LED lamp
5) HID (sodium vapor, metal halide)
6) Other (please specify) This question uses other field from question Q93o1
7) None of the above

Q93o1) OTHER - Other (please specify)

_____

Q94-Q99) Approximately how many of each type of lighting do you have outside your home?

	# of lights
1 Incandescent lamp	Q94

2 Compact fluorescent lamp	Q95
3 Low voltage landscape system	Q96
4 LED lamp	Q97
5 HID (sodium vapor, metal halide)	Q98
6 ~Q93o1~	Q99

Q100) Do you use any of the following devices to control the lights outside your home? (Select all that apply)
Choice
1) Timer
2) Motion detectors or occupancy sensors
3) Dusk-to-dawn sensors
4) None of the above

Q101-Q103) Approximately how many of each device do you have to control the lighting outside your home?

	# of devices
1 Timers	Q101
2 Motion detector	Q102
3 Dusk-to-dawn sensor	Q103

Q105-Q107) How many refrigerators and freezers does your home have?

	# of units
1 Combination refrigerator/freezer unit	Q105
2 Refrigerator-only unit	Q106
3 Freezer-only unit	Q107

Q108-Q110) When was the refrigerator/freezer purchased? If there is more than one unit in a category, please enter the information for the largest unit.

	Before 1993	1993-2001	2002-present	Not sure
Q108 Refrigerator/freezer combination unit				
Q109 Refrigerator-only unit				
Q110 Freezer-only unit				

Q112) What type of stove or range does your home have?
Choice
1) Natural gas
2) Electric
3) Propane
4) Other, please specify This question uses other field from question Q112o1
5) None

Q112o1) OTHER - Other, please specify

Q113) What type of oven does your home have?
Choice
1) Natural gas
2) Electric
3) Propane
4) Other, please specify This question uses other field from question Q113o1
5) None

Q113o1) OTHER - Other, please specify

Q114) What type of clothes washer does your home have?
Choice
1) Standard
2) ENERGY STAR top-loading
3) ENERGY STAR front-loading
4) None

Q115) What type of clothes dryer does your home have?
Choice
1) Natural gas dryer
2) Electric dryer
3) Has a dryer, but not sure about the type
4) None

Q116) What type of dishwasher does your home have?
Choice
1) Standard
2) ENERGY STAR
3) None

Q118-Q121) What types of TVs and how many are used in your home?

	# of units
Q118 Standard TV	
Q119 LCD TV	
Q120 Plasma TV	
Q121 Rear projection TV	

Q132-Q151) What size is your television? If you are unsure, please use your best guess.

	35" or less	36"-40"	41"-50"	51"-56"	More than 56"
Q132 Standard #1					
Q133 Standard #2					
Q134 Standard #3					

Q135 LCD #1					
Q136 LCD #2					
Q145 LCD #3					
Q146 Plasma #1					
Q147 Plasma #2					
Q148 Plasma #3					
Q149 Rear Projection #1					
Q150 Rear Projection #2					
Q151 Rear Projection #3					

Q122) On average, how many total hours per day is a TV on in your home? (For example, if one TV is on for 4 hours and another TV is on for 2 hours, select '5-8 hours per day')
Condition: Display this question if $Q118>=2 OR $Q119>=2 OR $Q120==2 OR $Q121==2
Choice
1) Less than 2 hours per day
2) 2-4 hours per day
3) 5-8 hours per day
4) 8-12 hours per day
5) 12-16 hours per day
6) More than 16 hours per day

Q123) Does anyone in your household work from home or regularly telecommute during the day on weekdays?
Choice
1) Yes
2) No

Q124) How many days a week does someone work from home?
Condition: Display this question if $Q123==1
Choice
1) 1
2) 2
3) 3
4) 4
5) 5 or more

Q126) How many desktop and laptop computers do you regularly use in your home?
Choice
1) None Q128
2) 1
3) 2
4) 3
5) 4
6) 5 or more

Q127) On average, how many total hours per day is a desktop or laptop computer on in your home? (For example, if one computer is on for 4 hours and another computer is on for 2 hours, select '5-8 hours per day')
Choice
1) Less than 2 hours per day
2) 2-4 hours per day
3) 5-8 hours per day
4) 8-12 hours per day
5) 12-16 hours per day
6) More than 16 hours per day

Q128) Which of the following electronics and appliances can be found in your home? (Select all that apply)
Choice
1) Cable/satellite box
2) DVD player
3) Personal video recorder (TIVO, DVR)
4) VCR
5) Home theater system
6) Spa/hot tub
7) Swimming pool
8) Electrical medical equipment
9) Back-up portable power generator

Q130) Which of the following energy saving steps have you taken in your home? (Select all that apply)
Choice
1) ENERGY STAR refrigerator
2) ENERGY STAR clothes washer [Show if $Q114==2 OR $Q114==3]
3) ENERGY STAR dishwasher [Show if $Q116==2]
4) ENERGY STAR water heater
5) ENERGY STAR TV
6) ENERGY STAR computer/laptop
7) Power strip that turns electronic equipment off when not in use
8) Water heater insulation blanket
9) Lowered water heater temperature
10) Enhanced water pipe insulation
11) Enhanced insulation of ducts, ceiling, wall, attic, and/or foundation
12) Weather stripping/caulking of windows and/or doors
13) Storm doors
14) Annual HVAC maintenance
15) Dehumidifier
16) Low-flow shower heads
17) Low-flow faucet aerators
18) Combined (all-in-one) clothes washer and dryer
19) Moisture sensor that turns clothes dryer off when clothes are dry
20) Reflective roof
21) External shades
22) None of the above

Q131) Which of the following energy saving steps do you have planned within the next 6 months? (Select all that apply)
Choice displayed if NOT selected in Q130
Choice
1) ENERGY STAR refrigerator
2) ENERGY STAR clothes washer
3) ENERGY STAR dishwasher
4) ENERGY STAR water heater
5) ENERGY STAR TV
6) ENERGY STAR computer/laptop
7) Power strip that turns electronic equipment off when not in use
8) Water heater insulation blanket
9) Lowered water heater temperature
10) Enhanced water pipe insulation
11) Enhanced insulation of ducts, ceiling, wall, attic, and/or foundation
12) Weather stripping/caulking of windows and/or doors
13) Storm doors
14) Annual HVAC maintenance
15) Dehumidifier
16) Low-flow shower heads
17) Low flow faucet aerators
18) Combined (all-in-one) clothes washer and dryer
19) Moisture sensor that turns clothes dryer off when clothes are dry
20) Reflective roof
21) External shades
22) Replace incandescent lights with CFLs
23) None of the above

Q137) Demographics Please indicate your gender.
Choice
1) Male
2) Female

Q4g) Are you...
Choice
1) Employed full time
2) Employed part time
3) Self employed
4) A student
5) A homemaker
6) Not employed/able
7) Not employed/unable
8) Retired

Q144) How many people are in your household, including yourself?
Choice
1) 1
2) 2
3) 3
4) 4
5) 5

6) 6
7) 7 or more

Q144b) And how many people, including infants and children, are in your home during weekdays in the summer (when the electricity system experiences high usage)?
Choice
1) 0
2) 1
3) 2
4) 3
5) 4
6) 5
7) 6
8) 7 or more
9) Prefer not to answer

Q138) What is the highest level of education that you have completed?
Choice
1) Some high school or less
2) Graduated high school or GED
3) Some college, no degree
4) Graduated college with an Associate Degree (2-year)
5) Graduated college with a Bachelor Degree (4-year)
6) Post graduate work or degree
7) Prefer not to answer

Q141) Do you have any other comments about this survey? If not, please click continue to submit your answers.

PECO Residential Saturation Survey Results

```
WEIGHT OFF.
```

Frequencies

Statistics

Segment

N	Valid	1481
	Missing	0

Segment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Residential	1377	93.0	93.0	93.0
	Low Income	104	7.0	7.0	100.0
	Total	1481	100.0	100.0	

Crosstabs

Segment * In which Pennsylvania County do you reside? Crosstabulation

Count

		In which Pennsylvania County do you reside?					
		Philadelphia	Bucks	Chester	Delaware	Montgomery	Total
Segment	Residential	265	303	258	241	310	1377
	Low Income	55	8	9	16	16	104
	Total	320	311	267	257	326	1481

```
WEIGHT BY CountyWt.
```

Crosstabs

In which Pennsylvania County do you reside? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
In which Pennsylvania County do you reside?	Philadelphia	32.9%	70.5%	39.6%
	Bucks	15.8%	5.2%	13.9%

In which Pennsylvania County do you reside? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
In which Pennsylvania County do you reside?	Chester	14.2%	5.6%	12.7%
	Delaware	17.5%	12.3%	16.5%
	Montgomery	19.7%	6.4%	17.4%
	Total	100.0%	100.0%	100.0%

What type of home do you live in? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
What type of home do you live in?	Single family home	50.6%	18.4%	44.9%
	Condominium/Townhome/Row house	32.3%	32.0%	32.3%
	Apartment in building with less than 5 units	5.7%	17.5%	7.8%
	Apartment in building with 5 or more units	11.3%	29.6%	14.5%
	Other (please specify)		2.5%	.4%
	Total	100.0%	100.0%	100.0%

Do you rent or own your home? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Do you rent or own your home?	Own	73.3%	33.0%	66.2%
	Rent	26.7%	67.0%	33.8%
	Total	100.0%	100.0%	100.0%

In which Pennsylvania County do you reside? * Segment Crosstabulation

% within In which Pennsylvania County do you reside?

		Segment		
		Residential	Low Income	Total
In which Pennsylvania County do you reside?	Philadelphia	68.5%	31.5%	100.0%
	Bucks	93.4%	6.6%	100.0%
	Chester	92.1%	7.9%	100.0%
	Delaware	86.9%	13.1%	100.0%
	Montgomery	93.4%	6.6%	100.0%
	Total	82.3%	17.7%	100.0%

Segment	Average Monthly Bill	
	Summer bill	Winter bill
Residential	186	208
Low Income	114	148
Grand Total	174	198

When, approximately, was your home built? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
When, approximately, was your home built?	Before 1940	20.9%	36.8%	23.2%
	1940-1949	8.9%	11.0%	9.2%
	1950-1959	18.7%	23.0%	19.3%
	1960-1969	10.3%	11.6%	10.5%
	1970-1979	11.9%	7.9%	11.4%
	1980-1989	10.6%	3.1%	9.6%
	1990-1999	9.9%	2.1%	8.8%
	2000-2008	8.8%	4.5%	8.2%
	Total	100.0%	100.0%	100.0%

Segment	What is the approximate square footage of your home? Mean
Residential	1806
Low Income	1321
Grand Total	1728

How many bedrooms are in your home? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
How many bedrooms are in your home?	0 Studio	1.0%	6.4%	2.0%
	1	8.2%	22.2%	10.7%
	2	20.4%	24.2%	21.1%
	3	43.1%	34.1%	41.5%
	4	22.5%	9.5%	20.2%
	5	3.7%	1.9%	3.4%
	6 or more	1.1%	1.7%	1.2%
	Total	100.0%	100.0%	100.0%

How many bathrooms are in your home? (A half-bath does not include a bathtub or shower.) * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
How many bathrooms are in your home? (A half-bath does not include a bathtub or shower.)	1	29.9%	70.6%	37.1%
	2	20.0%	14.2%	19.0%
	2	15.2%	9.0%	14.1%
	3	26.5%	4.4%	22.6%
	3	3.2%	.4%	2.7%
	4	3.7%		3.0%
	4 or more	1.5%	1.3%	1.4%
	Total	100.0%	100.0%	100.0%

How many levels does your home have, excluding basement and attic? If you live in a multi-family building, select the number of levels of your individual home. * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
How many levels does your home have, excluding basement and attic? If you live in a multi-family building, select the number of levels of your individual home.	1	21.1%	36.1%	23.8%
	2	57.0%	38.8%	53.8%
	3	17.6%	21.3%	18.2%
	4 or more	4.3%	3.8%	4.2%
	Total	100.0%	100.0%	100.0%

Does your home have an attic? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Does your home have an attic?	Yes, and it is heated	4.2%		3.5%
	Yes, but it is not heated	43.4%	18.4%	39.0%
	No	52.4%	81.6%	57.6%
	Total	100.0%	100.0%	100.0%

Does your home have a basement? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Does your home have a basement?	Yes, and it is heated	35.1%	14.4%	31.4%
	Yes, but it is not heated	37.1%	45.6%	38.6%
	No	27.8%	40.0%	30.0%
	Total	100.0%	100.0%	100.0%

What types of windows does your home have? (Select one.) * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
What types of windows does your home have? (Select one.)	Single pane windows	31.1%	53.7%	34.9%
	Double pane windows or better	52.5%	31.1%	48.9%
	Mixture of single and double pane windows	16.4%	15.2%	16.2%
	Total	100.0%	100.0%	100.0%

What is the primary fuel used for heating your home? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
What is the primary fuel used for heating your home?	Electricity	23.9%	18.6%	23.0%
	Natural gas	55.0%	61.3%	56.1%
	Propane	3.0%	.8%	2.6%
	Fuel oil	16.0%	16.0%	16.0%
	Wood	.5%	.8%	.5%
	Steam	1.1%	2.6%	1.4%
	Other (please specify)	.1%		.1%
	None (My home is not heated)	.3%		.2%
	Total	100.0%	100.0%	100.0%

What type of primary heating system is used in your home? (Select one.) A primary heating system is used to heat most, or all, of your home. * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
What type of primary heating system is used in your home? (Select one.) A primary heating system is used to heat most, or all, of your home.	Central warm air furnace with ducts/vents to individual roo	57.7%	53.6%	57.0%
	Central boiler with hot water/steam radiators or baseboards	26.3%	28.5%	26.7%
	Electric baseboard or electric coils radiant heating	5.2%	9.7%	6.0%
	Wall furnace	1.0%	3.5%	1.5%
	Fireplace	.3%		.3%
	Portable electric heater or wall insert electric heater	1.1%	2.0%	1.3%
	Air-source heat pump	6.4%	1.5%	5.6%
	Geothermal heat pump	.3%		.2%
	Other (please specify)	1.4%	1.1%	1.4%
	No heating system	.1%		.1%
	Total	100.0%	100.0%	100.0%

When was your primary heating system installed? If you are unsure, your best estimate is fine. * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
When was your primary heating system installed? If you are unsure, your best estimate is fine.	Before 1970	18.3%	31.8%	20.7%
	1970-1979	10.6%	6.7%	9.9%
	1980-1989	16.1%	11.8%	15.4%

When was your primary heating system installed? If you are unsure, your best estimate is fine. * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
When was your primary heating system installed? If you are unsure, your best estimate is fine.	1990-1994	10.6%	11.7%	10.8%
	1995-1999	12.1%	10.6%	11.8%
	2000-2005	17.1%	19.1%	17.4%
	2005-2008	15.2%	8.2%	14.0%
	Total	100.0%	100.0%	100.0%

What type of primary cooling system is used in your home? (Select one.) A primary cooling system provides cooling for most, or all, of your home. * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
What type of primary cooling system is used in your home? (Select one.) A primary cooling system provides cooling for most, or all, of your home.	Central air conditioner	59.1%	35.4%	54.9%
	Room air conditioner(s) mounted in a window or wall	28.3%	43.1%	30.9%
	Evaporative cooler	.2%		.1%
	Air-source heat pump	5.2%	.8%	4.4%
	Geothermal heat pump	.1%		.1%
	Portable room air conditioner(s)	2.1%	3.0%	2.2%
	Whole house attic fan	.1%		.1%
	Ceiling and/or window/room fan(s)	3.4%	7.3%	4.1%
	No cooling system	1.5%	10.4%	3.1%
	Other, please specify	.1%		.1%
	Total	100.0%	100.0%	100.0%

When was your cooling system installed? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
When was your cooling system installed?	Before 1970	2.8%	5.4%	3.2%
	1970-1979	5.4%	2.1%	4.9%
	1980-1989	11.5%	6.9%	10.8%
	1990-1999	23.1%	20.9%	22.7%
	2000-2008	57.2%	64.7%	58.4%
	Total	100.0%	100.0%	100.0%

{Day} What is the typical heating temperature setting for the thermostat? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
{Day} What is the typical heating temperature setting for the thermostat?	Less than 60 °F	6.0%	11.6%	6.9%
	60-64 °F	24.6%	21.8%	24.1%
	65-69 °F	48.1%	43.2%	47.4%
	70-74 °F	20.5%	21.8%	20.7%
	75 °F or higher	.8%	1.6%	.9%
	Total	100.0%	100.0%	100.0%

{Night} What is the typical heating temperature setting for the thermostat? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
{Night} What is the typical heating temperature setting for the thermostat?	Less than 60 °F	8.6%	15.1%	9.6%
	60-64 °F	30.9%	21.0%	29.4%
	65-69 °F	43.1%	38.0%	42.3%
	70-74 °F	16.3%	23.8%	17.5%
	75 °F or higher	1.1%	2.1%	1.2%
	Total	100.0%	100.0%	100.0%

{Day} What is the typical cooling temperature setting for the thermostat? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
{Day} What is the typical cooling temperature setting for the thermostat?	Less than 66 °F	6.4%	13.8%	7.3%
	66-69 °F	19.9%	24.9%	20.5%
	70-74 °F	43.6%	35.1%	42.6%
	75-79 °F	25.6%	16.0%	24.5%
	80 °F or higher	4.5%	10.2%	5.2%
	Total	100.0%	100.0%	100.0%

{Night} What is the typical cooling temperature setting for the thermostat? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
{Night} What is the typical cooling temperature setting for the thermostat?	Less than 66 °F	6.9%	8.9%	7.1%
	66-69 °F	23.5%	34.0%	24.8%
	70-74 °F	43.9%	36.5%	43.0%
	75-79 °F	23.7%	13.1%	22.4%

{Night} What is the typical cooling temperature setting for the thermostat? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
{Night} What is the typical cooling temperature setting for the thermostat?	80 °F or higher	2.1%	7.5%	2.7%
	Total	100.0%	100.0%	100.0%

Do you have a water heater in your home? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Do you have a water heater in your home?	No, water heater or hot water is provided by the building t	6.5%	18.1%	8.3%
	Yes, conventional water heater with storage tank	86.7%	77.7%	85.4%
	Yes, tankless (instantaneous) water heater	3.6%	1.0%	3.2%
	Yes, heat pump water heater	1.5%	2.2%	1.6%
	Other, please specify	1.7%	1.0%	1.6%
	Total	100.0%	100.0%	100.0%

What fuel does your water heater use? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
What fuel does your water heater use?	Natural gas	59.2%	71.2%	60.9%
	Electricity	30.1%	23.6%	29.2%
	Fuel oil	8.4%	4.1%	7.8%
	Propane	2.3%	1.2%	2.1%
	Total	100.0%	100.0%	100.0%

When was your water heater installed? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
When was your water heater installed?	Before 1970	3.4%	4.4%	3.5%
	1970-1979	4.0%	6.6%	4.3%
	1980-1989	8.7%	10.9%	9.0%
	1990-1999	23.6%	23.5%	23.6%

When was your water heater installed? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
When was your water heater installed?	2000-2008	60.4%	54.7%	59.6%
	Total	100.0%	100.0%	100.0%

Average Number of Lamps per Household by Type

Segment	Incandescent	CFL	Tube Fluorescent	Low Voltage	Total
Residential	13.68	5.44	1.66	2.92	23.70
Low Income	7.46	4.26	1.55	1.29	14.55
Grand Total	12.58	5.23	1.64	2.63	22.08

Do you use a timer? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Do you use a timer?	No	81.5%	93.2%	83.5%
	Yes	18.5%	6.8%	16.5%
	Total	100.0%	100.0%	100.0%

Do you use a motion detector or occupancy sensor? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Do you use a motion detector or occupancy sensor?	No	93.7%	96.7%	94.2%
	Yes	6.3%	3.3%	5.8%
	Total	100.0%	100.0%	100.0%

Do you use a dimming switch? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Do you use a dimming switch?	No	54.4%	90.5%	60.7%
	Yes	45.6%	9.5%	39.3%
	Total	100.0%	100.0%	100.0%

None of the above lighting controls * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
None of the above lighting controls	No	53.9%	17.6%	47.5%
	Yes	46.1%	82.4%	52.5%

None of the above lighting controls * Segment Crosstabulation

% within Segment

	Segment		
	Residential	Low Income	Total
Total	100.0%	100.0%	100.0%

Average Number of Exterior Lights per Household by Type

Segment Type	Incandescent	CFL	Low voltage landscape	LED	HID	Other
Residential	2.83	2.33	4.73	2.87	2.14	2.97
Low Income	1.61	1.46	11.25	3.35	4.00	.
Grand Total	2.66	2.26	5.48	2.93	2.49	2.97

Do you use a timer to control the lights outside your home? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Do you use a timer to control the lights outside your home?	No	87.1%	94.2%	88.3%
	Yes	12.9%	5.8%	11.7%
	Total	100.0%	100.0%	100.0%

Do you use motion detectors or occupancy sensorsto control the lights outside your home? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Do you use motion detectors or occupancy sensorsto control the lights outside your home?	No	75.5%	82.0%	76.7%
	Yes	24.5%	18.0%	23.3%
	Total	100.0%	100.0%	100.0%

Do you use dusk-to-dawn sensors to control the lights outside your home? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Do you use dusk-to-dawn sensors to control the lights outside your home?	No	86.9%	90.6%	87.6%
	Yes	13.1%	9.4%	12.4%
	Total	100.0%	100.0%	100.0%

Do you use any of the following devices to control the lights outside your home? (Select all that apply) - None of the above * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Do you use any of the following devices to control the lights outside your home? (Select all that apply) - None of the above	No	41.0%	29.2%	38.9%
	Yes	59.0%	70.8%	61.1%
	Total	100.0%	100.0%	100.0%

What type of stove or range does your home have? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
What type of stove or range does your home have?	Natural gas	51.1%	74.8%	55.3%
	Electric	45.7%	23.1%	41.7%
	Propane	3.0%	.8%	2.6%
	None	.3%	1.3%	.4%
	Total	100.0%	100.0%	100.0%

What type of oven does your home have? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
What type of oven does your home have?	Natural gas	47.8%	71.0%	51.9%
	Electric	49.5%	27.0%	45.5%
	Propane	2.4%	.8%	2.1%
	None	.3%	1.3%	.5%
	Total	100.0%	100.0%	100.0%

What type of clothes washer does your home have? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
What type of clothes washer does your home have?	Standard	45.7%	49.9%	46.5%
	ENERGY STAR top-loading	31.3%	16.8%	28.7%
	ENERGY STAR front-loading	15.5%	2.5%	13.2%
	None	7.4%	30.7%	11.6%
	Total	100.0%	100.0%	100.0%

What type of clothes dryer does your home have? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
What type of clothes dryer does your home have?	Natural gas dryer	32.0%	20.5%	30.1%
	Electric dryer	58.8%	38.1%	55.3%
	None	9.2%	41.4%	14.6%
	Total	100.0%	100.0%	100.0%

What type of dishwasher does your home have? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
What type of dishwasher does your home have?	Standard	43.2%	22.7%	39.5%
	ENERGY STAR	34.5%	7.6%	29.7%
	None	22.3%	69.7%	30.7%
	Total	100.0%	100.0%	100.0%

{Standard TV} How many TVs and what types do you have in your home? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
{Standard TV} How many TVs and what types do you have in your home?	0	10.9%	14.0%	11.4%
	1	27.3%	41.7%	29.8%
	2	30.8%	22.0%	29.2%
	3	17.2%	11.9%	16.3%
	More than 3	13.8%	10.4%	13.2%
	Total	100.0%	100.0%	100.0%

{LCD TV} How many TVs and what types do you have in your home? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
{LCD TV} How many TVs and what types do you have in your home?	0	52.0%	65.4%	54.3%
	1	31.5%	22.0%	29.8%
	2	11.7%	11.4%	11.6%
	3	3.7%		3.0%
	More than 3	1.2%	1.3%	1.2%
	Total	100.0%	100.0%	100.0%

{Plasma TV} How many TVs and what types do you have in your home? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
{Plasma TV} How many TVs and what types do you have in your home?	0	86.2%	95.1%	87.8%
	1	11.0%	3.6%	9.7%
	2	1.9%		1.6%
	3	.4%		.3%
	More than 3	.4%	1.3%	.6%
	Total	100.0%	100.0%	100.0%

{Rear projection TV} How many TVs and what types do you have in your home? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
{Rear projection TV} How many TVs and what types do you have in your home?	0	88.5%	94.3%	89.6%
	1	10.7%	5.7%	9.8%
	2	.4%		.3%
	3	.2%		.1%
	More than 3	.2%		.2%
	Total	100.0%	100.0%	100.0%

On average, how many total hours per day is a TV on in your home? (For example, if one TV is on for 4 hours and another TV is on for 2 hours, select '5-8 hours per day') * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
On average, how many total hours per day is a TV on in your home? (For example, if one TV is on for 4 hours and another TV is on for 2 hours, select '5-8 hours per day')	Less than 2 hours per day	6.5%	8.9%	6.9%
	2-4 hours per day	30.9%	24.7%	29.9%
	5-8 hours per day	39.0%	33.6%	38.1%

On average, how many total hours per day is a TV on in your home? (For example, if one TV is on for 4 hours and another TV is on for 2 hours, select '5-8 hours per day') * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
On average, how many total hours per day is a TV on in your home? (For example, if one TV is on for 4 hours and another TV is on for 2 hours, select '5-8 hours per day')	8-12 hours per day	15.3%	14.3%	15.1%
	12-16 hours per day	5.7%	12.0%	6.8%
	More than 16 hours per day	2.5%	6.6%	3.2%
	Total	100.0%	100.0%	100.0%

Does anyone in your household work from home or regularly telecommute during the day on weekdays? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Does anyone in your household work from home or regularly telecommute during the day on weekdays?	Yes	17.9%	9.0%	16.4%
	No	82.1%	91.0%	83.6%
	Total	100.0%	100.0%	100.0%

How many days a week does someone work from home? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
How many days a week does someone work from home?	1	9.8%	14.3%	10.3%
	2	21.1%	8.5%	19.8%
	3	18.3%	37.0%	20.1%
	4	8.9%		8.0%

How many days a week does someone work from home? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
How many days a week does someone work from home?	5 or more	41.9%	40.2%	41.7%
	Total	100.0%	100.0%	100.0%

How many desktop and laptop computers do you regularly use in your home? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
How many desktop and laptop computers do you regularly use in your home?	None	2.0%	.6%	1.7%
	1	36.0%	50.0%	38.5%
	2	36.6%	22.7%	34.2%
	3	17.0%	18.8%	17.3%
	4	5.8%	5.3%	5.7%
	5 or more	2.6%	2.6%	2.6%
	Total	100.0%	100.0%	100.0%

On average, how many total hours per day is a desktop or laptop computer on in your home? (For example, if one computer is on for 4 hours and another computer is on for 2 hours, select '5-8 hours per day') * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
On average, how many total hours per day is a desktop or laptop computer on in your home? (For example, if one computer is on for 4 hours and another computer is on for 2 hours, select '5-8 hours per day')	Less than 2 hours per day	11.8%	6.3%	10.8%
	2-4 hours per day	28.4%	16.8%	26.3%
	5-8 hours per day	24.1%	33.1%	25.7%
	8-12 hours per day	14.0%	13.7%	13.9%
	12-16 hours per day	6.0%	14.3%	7.5%
	More than 16 hours per day	15.6%	15.8%	15.7%
	Total	100.0%	100.0%	100.0%

Cable/satellite box * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Cable/satellite box	No	17.0%	33.2%	19.9%
	Yes	83.0%	66.8%	80.1%
	Total	100.0%	100.0%	100.0%

DVD player * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
DVD player	No	7.5%	10.1%	7.9%
	Yes	92.5%	89.9%	92.1%
	Total	100.0%	100.0%	100.0%

Personal video recorder (TIVO, DVR) * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Personal video recorder (TIVO, DVR)	No	63.4%	82.1%	66.7%
	Yes	36.6%	17.9%	33.3%
	Total	100.0%	100.0%	100.0%

VCR * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
VCR	No	34.4%	43.6%	36.0%
	Yes	65.6%	56.4%	64.0%
	Total	100.0%	100.0%	100.0%

Home theater system * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Home theater system	No	75.0%	77.0%	75.3%
	Yes	25.0%	23.0%	24.7%
	Total	100.0%	100.0%	100.0%

Spa/hot tub * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Spa/hot tub	No	93.3%	98.7%	94.3%
	Yes	6.7%	1.3%	5.7%
	Total	100.0%	100.0%	100.0%

Swimming pool * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Swimming pool	No	94.0%	98.6%	94.8%
	Yes	6.0%	1.4%	5.2%
	Total	100.0%	100.0%	100.0%

Electrical medical equipment * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Electrical medical equipment	No	96.2%	95.3%	96.0%
	Yes	3.8%	4.7%	4.0%
	Total	100.0%	100.0%	100.0%

Back-up portable power generator * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Back-up portable power generator	No	97.1%	99.2%	97.5%
	Yes	2.9%	.8%	2.5%
	Total	100.0%	100.0%	100.0%

Energy saving step- ENERGY STAR refrigerator * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step- ENERGY STAR refrigerator	No	66.6%	78.9%	68.8%
	Step taken	33.4%	21.1%	31.2%
	Total	100.0%	100.0%	100.0%

Energy saving step - ENERGY STAR clothes washer * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - ENERGY STAR clothes washer	No	22.7%	13.9%	22.0%
	Step taken	77.3%	86.1%	78.0%
	Total	100.0%	100.0%	100.0%

Energy saving step - ENERGY STAR dishwasher * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - ENERGY STAR dishwasher	No	14.1%	26.9%	14.7%
	Step taken	85.9%	73.1%	85.3%
	Total	100.0%	100.0%	100.0%

Energy saving step - ENERGY STAR water heater * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - ENERGY STAR water heater	No	80.4%	90.4%	82.1%
	Step taken	19.6%	9.6%	17.9%
	Total	100.0%	100.0%	100.0%

Energy saving step - ENERGY STAR TV * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - ENERGY STAR TV	No	82.0%	84.2%	82.4%
	Step taken	18.0%	15.8%	17.6%
	Total	100.0%	100.0%	100.0%

Energy saving step - ENERGY STAR computer/laptop * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - ENERGY STAR computer/laptop	No	81.0%	81.1%	81.0%
	Step taken	19.0%	18.9%	19.0%
	Total	100.0%	100.0%	100.0%

Energy saving step - Power strip that turns electronic equipment off when not in use * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - Power strip that turns electronic equipment off when not in use	No	71.9%	74.5%	72.3%
	Step taken	28.1%	25.5%	27.7%
	Total	100.0%	100.0%	100.0%

Energy saving step - Water heater insulation blanket * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - Water heater insulation blanket	No	89.7%	93.6%	90.4%
	Step taken	10.3%	6.4%	9.6%
	Total	100.0%	100.0%	100.0%

Energy saving step - Lowered water heater temperature * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - Lowered water heater temperature	No	71.1%	84.2%	73.5%
	Step taken	28.9%	15.8%	26.5%
	Total	100.0%	100.0%	100.0%

Energy saving step - Enhanced water pipe insulation * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - Enhanced water pipe insulation	No	89.7%	96.7%	91.0%
	Step taken	10.3%	3.4%	9.0%
	Total	100.0%	100.0%	100.0%

Energy saving step - Enhanced insulation of ducts, ceiling, wall, attic, and/or foundation * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - Enhanced insulation of ducts, ceiling, wall, attic, and/or foundation	No	86.0%	98.6%	88.2%
	Step taken	14.0%	1.4%	11.8%
	Total	100.0%	100.0%	100.0%

Energy saving step - Weather stripping/caulking of windows and/or doors * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - Weather stripping/caulking of windows and/or doors	No	57.5%	71.0%	59.9%
	Step taken	42.5%	29.0%	40.1%
	Total	100.0%	100.0%	100.0%

Energy saving step - Storm doors * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - Storm doors	No	54.4%	73.7%	57.8%
	Step taken	45.6%	26.3%	42.2%
	Total	100.0%	100.0%	100.0%

Energy saving step - Annual HVAC maintenance * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - Annual HVAC maintenance	No	76.6%	95.4%	80.0%
	Step taken	23.4%	4.6%	20.0%
	Total	100.0%	100.0%	100.0%

Energy saving step - Dehumidifier * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - Dehumidifier	No	78.8%	93.2%	81.3%
	Step taken	21.2%	6.8%	18.7%
	Total	100.0%	100.0%	100.0%

Energy saving step - Low-flow shower heads * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - Low-flow shower heads	No	70.0%	76.3%	71.1%
	Step taken	30.0%	23.7%	28.9%
	Total	100.0%	100.0%	100.0%

Energy saving step - Low-flow faucet aerators * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - Low-flow faucet aerators	No	89.8%	87.8%	89.5%
	Step taken	10.2%	12.2%	10.5%
	Total	100.0%	100.0%	100.0%

Energy saving step - Combined (all-in-one) clothes washer and dryer * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - Combined (all-in-one) clothes washer and dryer	No	99.0%	100.0%	99.2%
	Step taken	1.0%		.8%
	Total	100.0%	100.0%	100.0%

Energy saving step - Moisture sensor that turns clothes dryer off when clothes are dry * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - Moisture sensor that turns clothes dryer off when clothes are dry	No	79.4%	92.3%	81.7%
	Step taken	20.6%	7.7%	18.3%
	Total	100.0%	100.0%	100.0%

Energy saving step - Reflective roof * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - Reflective roof	No	95.1%	97.0%	95.5%
	Step taken	4.9%	3.0%	4.5%
	Total	100.0%	100.0%	100.0%

Energy saving step - External shades * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - External shades	No	97.5%	96.3%	97.3%
	Step taken	2.5%	3.7%	2.7%
	Total	100.0%	100.0%	100.0%

Energy saving step - None of the above * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Energy saving step - None of the above	No	85.3%	73.1%	83.2%
	No energy steps taken	14.7%	26.9%	16.8%
	Total	100.0%	100.0%	100.0%

Demographics Please indicate your gender. * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Demographics Please indicate your gender.	Male	48.6%	30.3%	45.4%
	Female	51.4%	69.7%	54.6%
	Total	100.0%	100.0%	100.0%

Are you... * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
Are you...	Employed full time	67.4%	19.0%	58.8%
	Employed part time	7.6%	16.7%	9.2%
	Self employed	2.2%	2.3%	2.2%
	A student	4.1%	31.7%	9.0%
	A homemaker	4.3%	8.6%	5.1%
	Not employed/able	3.3%	5.3%	3.7%
	Not employed/unable	1.3%	6.6%	2.3%
	Retired	9.7%	9.9%	9.8%
	Total	100.0%	100.0%	100.0%

How many people are in your household, including yourself? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
How many people are in your household, including yourself?	1	14.9%	29.9%	17.6%
	2	35.4%	29.3%	34.3%
	3	20.3%	15.3%	19.4%
	4	19.0%	15.2%	18.3%
	5	7.9%	5.7%	7.5%
	6	1.6%	1.3%	1.5%
	7 or more	.9%	3.3%	1.4%
	Total	100.0%	100.0%	100.0%

And how many people, including infants and children, are in your home during weekdays in the summer (when the electricity system experiences high usage)? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
And how many people, including infants and children, are in your home during weekdays in the summer (when the electricity system experiences high usage)?	0	24.9%	23.8%	24.7%
	1	10.6%	12.2%	10.9%

And how many people, including infants and children, are in your home during weekdays in the summer (when the electricity system experiences high usage)? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
And how many people, including infants and children, are in your home during weekdays in the summer (when the electricity system experiences high usage)?	2	31.7%	31.5%	31.6%
	3	18.2%	14.1%	17.5%
	4	10.5%	10.4%	10.5%
	5	2.7%	5.4%	3.2%
	6	.9%	1.3%	1.0%
	7 or more	.5%	1.3%	.6%
	Total	100.0%	100.0%	100.0%

What is the highest level of education that you have completed? * Segment Crosstabulation

% within Segment

		Segment		
		Residential	Low Income	Total
What is the highest level of education that you have completed?	Some high school or less	.9%	3.7%	1.4%
	Graduated high school or GED	10.1%	22.2%	12.2%
	Some college, no degree	17.1%	27.3%	18.9%
	Graduated college with an Associate Degree (2-year)	9.4%	9.5%	9.4%
	Graduated college with a Bachelor Degree (4-year)	32.6%	15.9%	29.6%
	Post graduate work or degree	29.9%	21.3%	28.4%
	Total	100.0%	100.0%	100.0%

MEETING THE NEEDS OF THE CONSTANTLY CHANGING ENERGY INDUSTRY

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PECO Residential

Saturation Survey results

Ingrid Rohmund, Bridget Kester
Global Energy Partners, LLC

June 1, 2009

PECO

Presentation Outline

- Methodology
- Response
- Weights
- Demographics
- Market profile

Residential saturation survey methodology

- Saturation survey sent out using e-Rewards panel
  - Soft launch on February 27
  - Full launch on March 3
  - e-Rewards handled recruiting and incentives
  - A copy of the survey is included in Appendix F-2
- Low-income customers (less than $25K) were oversampled
- Screening criteria:
  - Age: less than 18 years old
  - Not a PECO customer
  - Do not pay their own utility bill
  - Employed by a market research firm or an electric or gas utility

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Residential saturation survey results

- Received 1,481 complete, usable responses
  - Total was 1,504 responses but removed 23 for straight-lining and "speeders"
  - Average response time was 12 minutes, not including outliers (people who left the survey and came back to complete it)
- Responses were segmented into low-income or all other residential for each of the five counties
- Weighted low-income more to reflect share of population

Residential Saturation Survey Weights

To develop weights the following assumptions were made:

Segment	Customers
Low-income	250,000
Residential	1,162,463
Total Residential	1,412,449

The percent of low-income customers by county was based on the percent of persons below poverty in 2007 from the U.S. Census Bureau.

County	% of all customers	% low-income
Philadelphia	39.6%	24%
Bucks	13.9%	5%
Chester	12.7%	6%
Delaware	16.5%	10%
Montgomery	17.4%	5%

The methodology is discussed in Chapter 3 of Appendix F-1.

Residential Saturation Survey Weights

Survey responses by segment

County	Residential	Low-Income	Total
Philadelphia	265	55	**320**
Bucks	303	8	**311**
Chester	258	9	**267**
Delaware	241	16	**257**
Montgomery	310	16	**326**
Total	**1,377**	**104**	**1,481**

Mean-per-Unit Expansion Weights

County	Residential	Low-Income
Philadelphia	1,443.30	3,203.58
Bucks	604.52	1,610.19
Chester	638.75	1,567.33
Delaware	842.23	1,919.30
Montgomery	738.81	1,006.68

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Respondent demographics - Income

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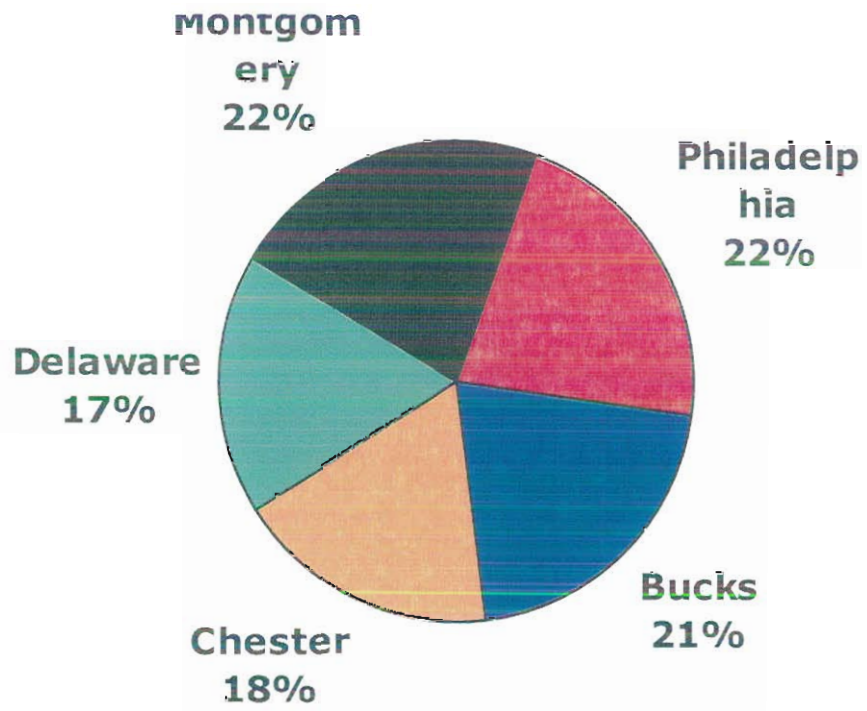
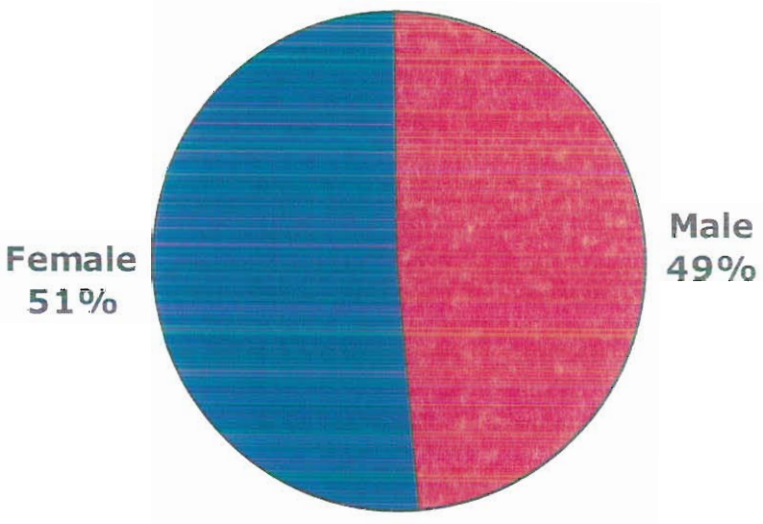
Survey results – County and gender

- Respondents were evenly distributed by county
- Slightly more women responded to the survey





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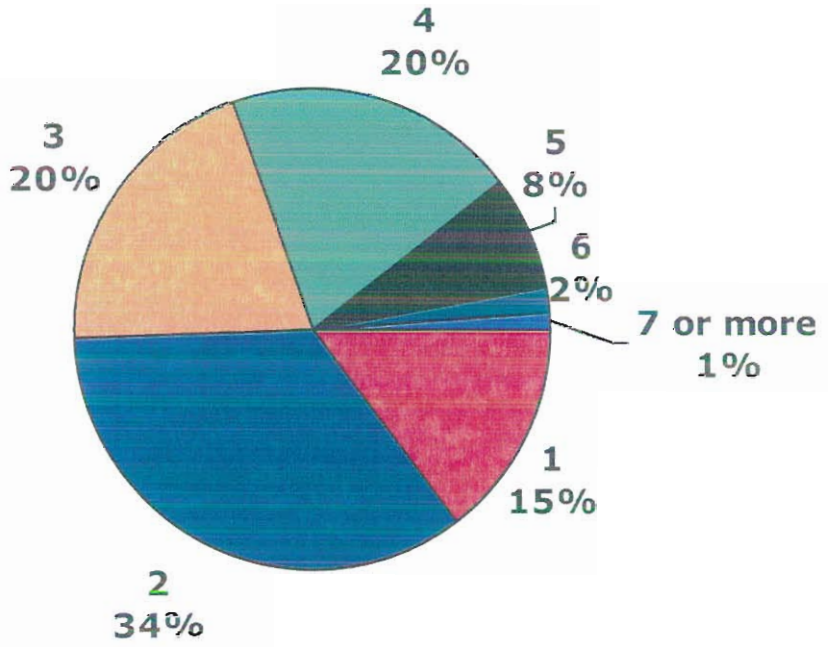
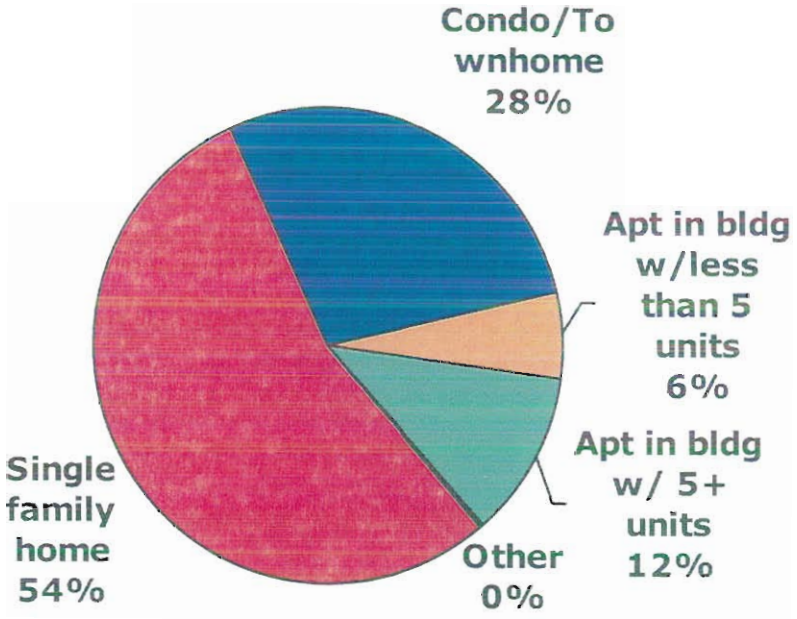
Survey results – Size of household and housing type

- The average household size is 2.8
- Just over half of respondents live in a single-family home





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Survey data → market profiles

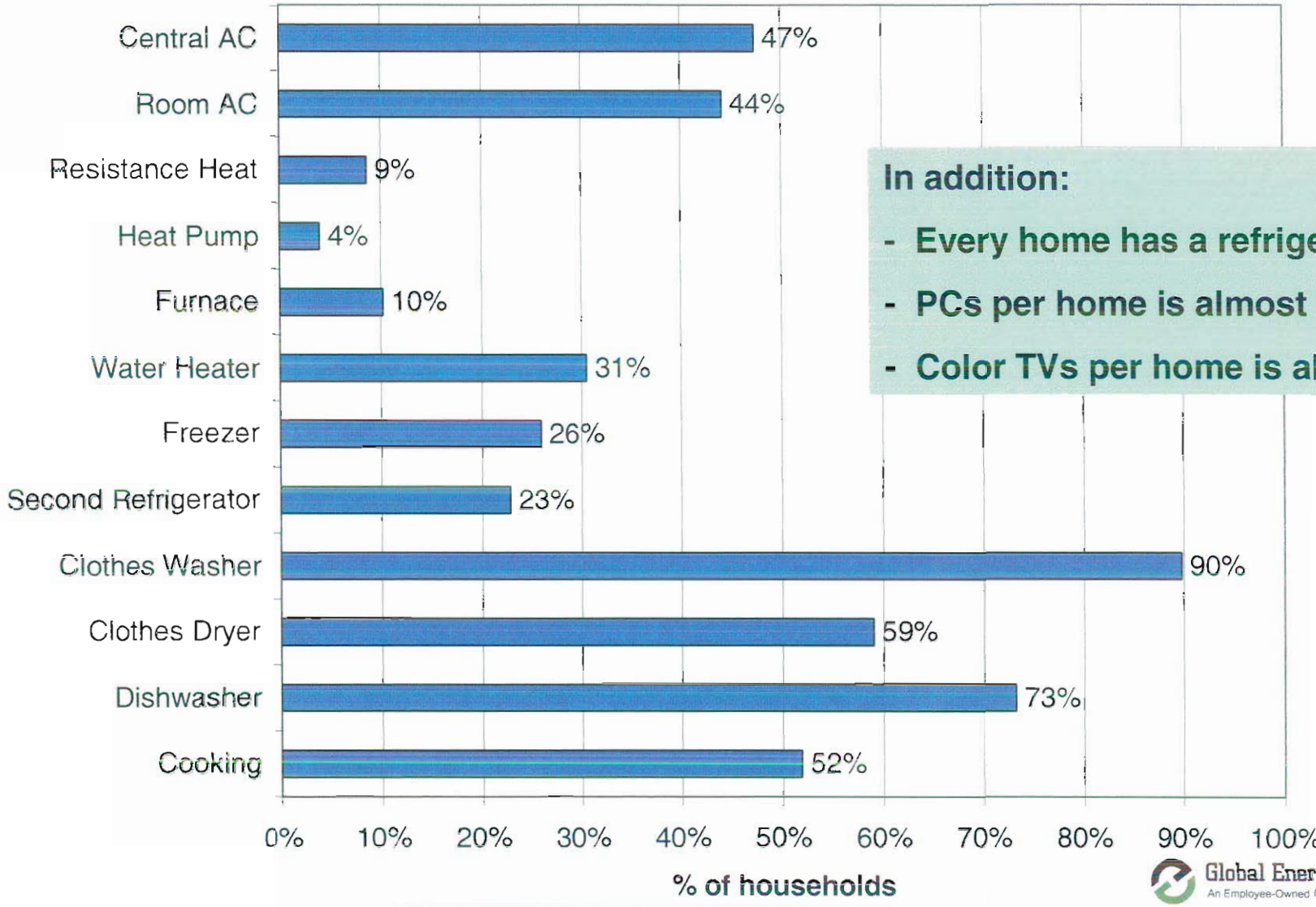
Market profiles characterize current electricity use by end use and technology

Elements include:

- Appliance/equipment saturations
- Fuel shares – fraction that is electric
- Whole-house intensity
- Unit energy consumption (UEC) – developed using BEST engineering analysis and Northeast region data from EPRI National Potential Study

Separate profiles for existing homes and new construction

Saturations of electric equipment
Residential sector average



In addition:

- **Every home has a refrigerator**
- **PCs per home is almost 2**
- **Color TVs per home is almost 3**

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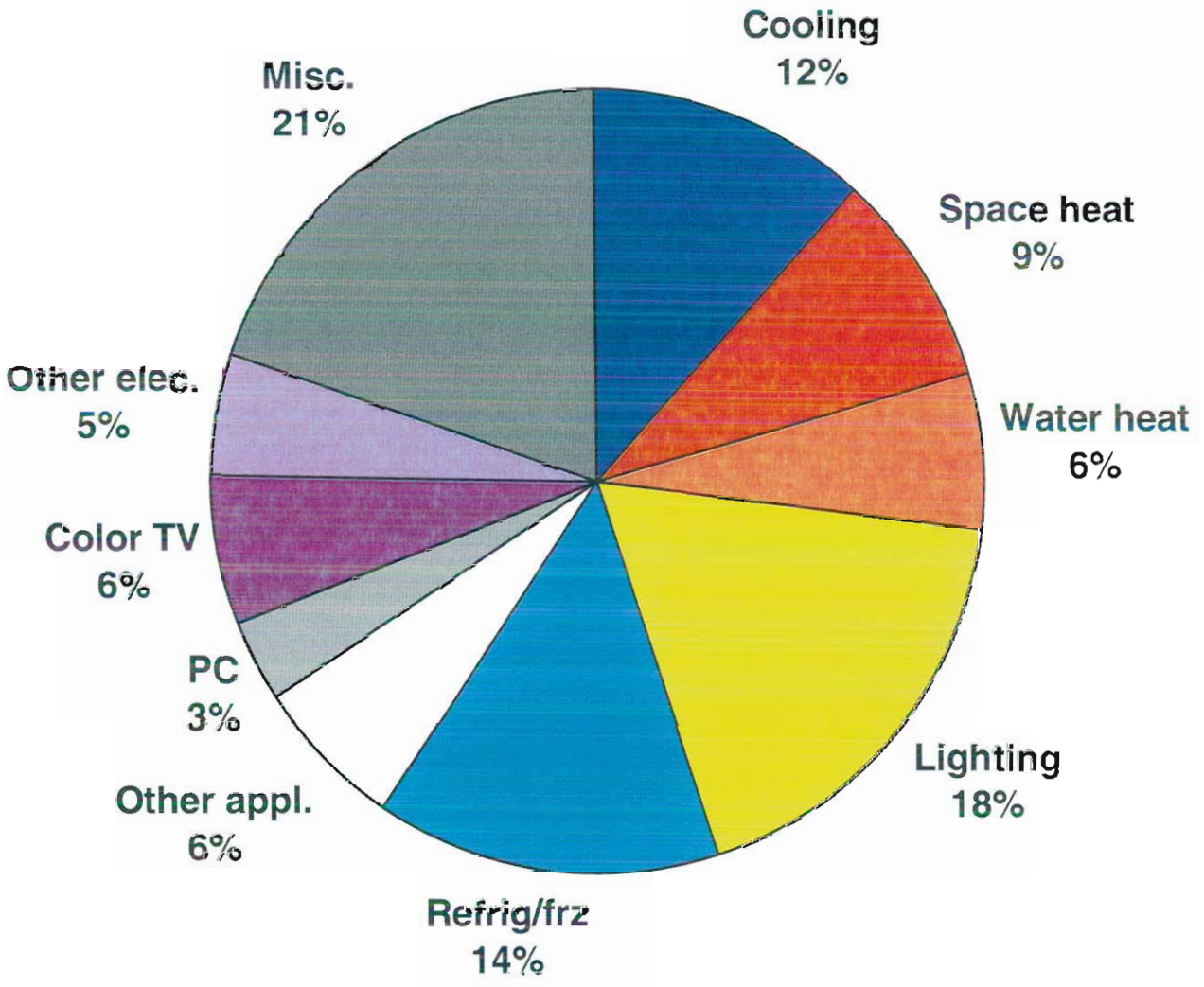
Preliminary electricity use by end use
Residential sector total



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Preliminary electricity market profile
Residential sector average/total

End use	Technology	Share (% of hh)	UEC (ckWh/hh)	Intensity (kWh/hh)	Use (GWh)	Share of Total
Cooling	Central AC	47%	1,520	720	1,017	7.4%
Cooling	Room AC	44%	932	411	580	4.2%
Space Heat	Electric Resistance	9%	3,970	341	481	3.5%
Space Heat	Heat Pump	4%	3,092	121	171	1.3%
Space Heat	Furnace	10%	4,014	408	576	4.2%
Space Heat	Water Heater	31%	1,941	592	837	6.1%
Int. Light	Screw-in	89%	1,674	1,497	2,114	15.5%
Int. Light	Linear Fluorescent	8%	416	32	45	0.3%
Ext. Light	Screw-in	77%	301	231	326	2.4%
Appliances	Refrigerator	100%	941	941	1,329	9.7%
Appliances	Freezer	26%	742	192	271	2.0%
Appliances	Second Refrigerator	23%	1,136	259	365	2.7%
Appliances	Clothes Washer	90%	128	115	162	1.2%
Appliances	Clothes Dryer	59%	530	313	442	3.2%
Appliances	Dishwasher	73%	90	66	93	0.7%
Appliances	Cooking	52%	256	133	188	1.4%
Electronics	Personal Computer	196%	160	313	442	3.2%
Electronics	Color TV	291%	205	597	843	6.2%
Electronics	Other Electronics	100%	492	492	695	5.1%
Misc.	Pool Pump	0%	-	-	-	0.0%
Misc.	Furnace Fan	60%	187	112	158	1.2%
Misc.	Other Miscellaneous	100%	1,783	1,783	2,518	18.4%
Total				**9,667**	**13,654**	**100.0%**

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Other survey results for potentials analysis

Appliance / equipment details

- Vintage data are proxy for efficiency levels
- Equipment densities – number of units
- Current saturation of EE equipment
- Current saturation of EE measures

Building information

- Home size
- Current saturation of EE measures

Behavioral information

- Home occupancy patterns
- Hours of appliance/equipment operation

Contact information

- If you have any questions about the survey results, please contact Bridget Kester

Bridget Kester

Phone: 858-780-2635

Email: bkester@gepllc.com

APPENDIX F-3.

CUSTOMER MARKET RESEARCH

MEETING THE NEEDS OF THE CONSTANTLY CHANGING ENERGY INDUSTRY

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Momentum
Market Intelligence
Predictive Insight

Market Potential for Residential and Business Energy Efficiency and Demand Response Initiatives

Ingrid Rohmund
Global Energy Partners, LLC

David Lineweber / Dan Tochen
Momentum Market Intelligence

April 8, 2009

PECO

Outline

- Objective
- Methodology
- Executive Summary
- Program descriptions evaluated in focus groups

Objective

- PECO seeks to understand how new energy efficiency and demand response programs might affect total use of – and peak demand for – electricity.
  - PECO is considering a range of programs for both residential and commercial customers, as well as programs targeted specifically at low-income residential customers.
  - Key points of interest:
    - The likelihood that customers will adopt each program.
    - Concerns or attitudinal biases that might prevent customers from adopting each program.
    - Additional information required for customers to make a decision.

Methodology: Respondent requirements and dates / locations for data collection

- Data collection consisted of 12 focus groups conducted from March 23 to March 26.
- Each group focused on one of the four customer types described below.

Residential

General residential customers (4 groups)

- HH income ≥ $25,000
- Half of group has central A/C
- No more than three renters
- No more than three multi-family dwellings
- Summer electric bill: max. of four with bill under $50, max. of two with bill under $25

Low income residential customers (2 groups)

- HH income < $25,000
- Half of group has A/C
- No more than seven renters
- No more than seven multi-family dwellings
- Summer electric bill: max. of six with bill under $50, max. of three with bill under $25

Business

Small/medium business customers (2 groups)

- Employee headcount from 1-25
- At least 25% must own facility
- Half of group has central A/C cooling at least 2/3 of facility
- Electricity bill: at least half over $250, at least three under $250
- Mix of building types

Large business customers (4 groups)

- Employee headcount > 25
- At least 75% must own facility
- 3/4 of group has central A/C cooling at least 2/3 of facility
- Electricity bill: at least half over $1,500, at least 3 from $250 to $1,500, none > $250
- Mix of building types

- Half the groups were conducted in Philadelphia, and half in Bala Cynwyd (see details below)

	General residential	Low income residential	Small/med business	Large business	Total
Philadelphia	--	2	2	2	6
Bala Cynwyd	4	--	--	2	6

Methodology: Programs tested

- The programs evaluated in this study are listed below.
  - The full program descriptions reviewed by participants are shown in slides 12 to 15.

	Business	Residential
Energy Efficiency Programs	• Energy efficiency rebates for specific equipment • Custom energy efficiency rebate programs • New energy efficient construction • Energy efficiency programs specifically for government, other public facilities and not-for-profit organizations	• Compact Fluorescent bulb discounts • In-home energy audits • Online energy audits • Home energy incentives • Appliance pickup • Energy efficient new home building • Solar power • Energy improvements for low-income customers (low-income groups only)
Demand Response Programs	• Direct load control • Curtailable load control • Peak time pricing • Real-time pricing • Electricity use shifting • Temporary voltage reduction	• Direct load control • Critical peak time pricing • Real-time pricing • Peak use rebates
Green Power Programs		• "Green" electricity plan

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Methodology: Focus group discussion guide

- The focus groups lasted from 1.5 to two hours.
- The discussions generally followed the outline below.

Initial Exploration	EE Program Discussion	EE Program Assessment	DR Program Discussion	DR Program Assessment	Overall Assessment
Discussion of attitudes towards electricity and energy efficiency: •Attitude towards electricity bill. •Anything they've done at their home or workplace to conserve electricity. •Is energy efficiency about being "green" or saving money?	**Discussion of EE programs:** •Things they like or find attractive about the programs. •Things they dislike about the programs or would like to see changed. •Additional information they would want before making a decision on each program.	**Rating EE programs:** •Participants rate their likelihood to participate in each EE program. Ratings are on a 10-point scale where 1 is "Certain not to participate" and 10 is "Certain to participate". •Discussion of reasons for each rating.	**Discussion of DR programs:** •Things they like or find attractive about the programs. •Things they dislike about the programs or would like to see changed. •Additional information they would want before making a decision on each program.	**Rating DR programs:** •Participants rate their likelihood to participate in each EE program. Ratings are on a 10-point scale where 1 is "Certain not to participate" and 10 is "Certain to participate". •Discussion of reasons for each rating.	**Second rating of EE and DR programs:** •Participants now have full context of all EE and DR programs under consideration, and have had time to consider each. •Participants can opt to change their rating if their opinion of each program has changed.

Executive Summary: Overview of customer response to tested programs

- All four audiences are more receptive to EE programs than to DR programs.
  - The highest-rated programs are all EE programs.
  - Having said that, there are a few DR programs that receive a positive response. This is particularly true among residential customers.
- Saving money is the key driver for both EE and DR programs.
  - Though almost all residential customers say that environmental concerns are important to them, there is consensus that cutting electric bills is a higher priority.
  - Business customers' primary focus is the bottom line and controlling costs; they are less likely to mention environmental issues as a factor in decision making.
- As suggested by the universal focus on cost cutting, the current economic climate appears to be affecting customer decisions on energy related issues.
  - Most customers indicate that, while they have not been dramatically affected by the current recession personally, they are taking a more conservative approach to both capital expenditures and taking a closer look at ongoing operating costs.
  - The implications for energy-related decisions are that customers are likely to prefer to extend the life of old appliances or equipment, and to avoid other capital expenses as long as possible, although if there are / were low / no cost ways to reduce operating costs, these would be viewed positively.

Executive Summary: Aggregate customer responses to tested programs

	Large business	Small / med business
EE rebates for specific equipment	●	◕
Custom EE rebate programs	◕	◕
New energy efficient construction	◕	◕
EE program for gov't, public facilities and NPOs	□	□
Direct load control	○	□
Curtailable load control	○	□
Peak time pricing	○	□
Real-time pricing	○	□
Electricity use shifting	□	○
Temporary voltage reduction	○	○

○ Few/none would adopt □ Some would adopt ◕ Many would adopt ● Most would adopt

	General residential	Low-income residential
CFL bulb discounts	●	●
In-home energy audits	○	□
Online energy audits	◕	◕
Home energy incentives	◕	●
Appliance pickup	◕	●
EE new home building	□	◕
Solar power	□	□
Energy improvements for low-income customers	--	●
Direct load control	○	○
Critical peak time pricing	□	○
Real-time pricing	○	○
Peak use rebates	●	●

Summary findings for residential customers

- Three energy efficiency programs and one demand response program are the primary focus for residential customers.
- The top three priorities for residential customers are:
  1) CFL bulb discounts
  2) home energy incentives, and
  3) programs specifically targeting low-income residential customers.
    - Although customers support energy efficient new home building programs, the incidence of customers building new homes is too low to effectively target this group. Instead of implementing this as a customer-facing program, PECO should explore collaborating with homebuilders and developers to increase the energy efficiency of the homes they build.
    - Finally, although appliance pickup receives strong ratings from low-income residential customers, relatively few actually have old appliances that are still in use that they're willing to discard.
      - Educating customers about the costs of running an old refrigerator and encouraging them to unplug them when they're not in use may offer better ROI than implementing an appliance pickup program.
- In addition, PECO should consider implementing a single demand reduction program: peak use rebates.
    - Both general residential and low-income residential customers give this program high marks; it is the only one not regarded as punitive, and customers are eager to participate.

Summary findings for business customers

Energy Efficiency

- For all businesses, energy efficiency programs should be a higher priority than demand reduction.
  - Business customers are much more likely to participate in EE programs.
- Energy efficiency rebates for specific equipment should be the top priority for all business customers.
  - This program receives the highest ratings across all programs from both large and small businesses.
- Large businesses are also interested in custom energy efficiency rebates.
  - However, a flexible implementation is important. Large businesses would like the ability to pick and choose from a menu of improvements recommended by PECO. A program that requires them to complete all recommended improvements to claim rebates or incentives would be much less attractive.

Demand reduction

- As noted above, there is less interest in demand reduction programs than energy efficiency programs.
- Among large businesses, electricity use shifting receives more interest than any other demand reduction program.
  - Because businesses are concerned about up-front costs and payback time for new equipment, promoting/incentivizing ways of shifting electricity use that do not require new equipment (i.e., scheduling work shifts and energy-intensive tasks outside of peak hours) will maximize the impact of this program.
- Meanwhile, small businesses express some interest in peak time pricing programs; it has slightly higher ratings for small businesses than any other demand reduction program.
  - However, though this program does receive the best ratings of any DR program, interest is relatively low compared to the most popular EE program.
  - Therefore, we do not see this as a priority, as the infrastructure investment required to implement this program is likely to outweigh the benefits.

While the impact has not been severe on most customers (yet), recession concerns loom large, and are affecting energy-related decisions

- Customers view the broader economy as a very high priority area of concern, although most indicate that they themselves have not been dramatically affected.
  - Many (but not all) business customers indicated that their revenue is off significantly (one small business owner quipped that he would likely earn more in the incentive he was to receive for the group than his business would have made for the entire month), but few indicated that they had had to make significant structural rearrangements in their business, or that they were on the verge of bankruptcy.
  - Several residential customers indicated that they had recently lost a job, or thought that this might happen to them, but alternately, most indicated that they did not think this was a real threat for them in the near term.
- In general, then, customers believe that the current economic climate is a cause for concern, but not a calamity, at least not yet.
- Consistent with the observations made for the broader US population in the popular media, customers (both residential and business) report being more conservative in their expenditures, buying "cheap" more often than they may have in the past, postponing home / business improvements, and the like.
- These efforts to reduce operating costs and delay capital expenditures broadly extend to energy related issues as well, with most customers reporting changes in habits and practices associated with energy use (i.e., monitoring lights, thermostats more carefully and more conservatively).
- Even so, a few businesses report making at least some small capital investments specifically with the goal of reducing energy costs (e.g., installing motion sensors or CFLs).

Within this economic context, environmental concerns – while deemed valid – run second to near-term economic concerns for most customers

- There is near consensus across all customer groups around the idea that protecting the environment is important, but not a sufficient grounds to justify incremental expenditures.
  - But how "real" and important are specific issues such as global warming are vigorously disputed by some.
  - And the idea that individuals "should" act in ways that cost them money in order to "save the environment," is seen as an equation that is not easy to justify these days.
  - Especially for businesses, "saving the environment" is not likely to be a sufficient motivator to drive EE investments.
    - Having said this, a limited number of businesses have such a strong environmental commitment at the top level that they may consider such investments (with a similar logic driving decisionmaking among a small number of households).
- Most businesses say they will evaluate EE investments in strictly economic terms; considering the cost of capital and payback period and will not invest in a program that "doesn't pencil out."
- Many residential customers take the same approach: systems with high up-front costs, such as solar power installations, are seen as unrealistic due to the difficulty of making the initial payment and long payback periods.
- Respondents tend to say, for example, that they would take advantage of rebates to buy energy-efficient replacements when appliances wear out (if they are large enough), but that for now, they will postpone replacements as long as possible.

Program descriptions evaluated in focus groups: Residential EE

Compact fluorescent bulb discounts:

PECO would work with Compact fluorescent lamps (CFL) manufacturers and retailers, such as Home Depot and Ace Hardware, to make a greater variety of high-quality ENERGY STAR® rated bulbs available to consumers and at a lower price. Participating stores will offer periodic promotional discounts and information about where you can install bulbs to achieve significant energy savings.

In-home energy audits:

A professional energy use analyst would come to your home and conduct tests to determine the best things that you could do to reduce your energy use. The results would include specific recommendations, some that might be simple and easy to make (such as changing some of your light bulbs to compact fluorescent bulbs) and others that might be more involved (such as adding insulation, or upgrading your cooling system to a more energy efficient model). The analyst could also offer information on rebates and other assistance programs available to help you take action. PECO would pay part of the cost of this service so that an audit would be available to you for a reasonable fee.

Online energy audits:

PECO could offer an on-line audit service that would provide recommendations based on your billing history and answers to a short set of questions. The results would include specific recommendations, some that might be simple and easy to make (such as changing some of your light bulbs to compact fluorescent bulbs) and others that might be more involved (such as adding insulation, or upgrading your cooling system to a more energy efficient model). The online audit could also offer information on rebates and other assistance programs available to help you take action.

Home energy incentives:

Rebate payments that PECO could make to you that would reduce the cost of installing new, more energy efficient, ENERGY STAR® rated appliances in your home. PECO might, for example, be able to pay you a rebate for replacing your current air conditioner, refrigerator, or other significant energy using appliance with a more energy efficient model.

Appliance pickup

A service that would make it easy for you to get rid of old appliances that you may still be using, but which you do not really need. Some people, for example, have old refrigerators that they put out in their garages, and continue to use, but really don't need. This service would offer to take away appliances like this for free.

Energy efficient new home building

This program would make it easier for people who were thinking of buying a new home, to buy the most energy efficient home possible. Under the program PECO would offer people rebates that would cover part or all of the cost of specific improvements that could be built into new homes that would make them more energy efficient.

Solar power:

PECO would provide homeowners with information about financial incentives, including tax breaks, and help connect you with access to technical experts for the installation of solar power systems to offset your electricity use and gas hot water use. PECO may also provide financial assistance or loans to help with the upfront cost of installing a solar system at your home.

Energy improvements specifically targeted for low-income customers *(Note: only evaluated by low-income customers)*

This program would provide a combination of financial assistance and no-cost installations that would help residents reduce their use of electricity, even for customers who live in apartments or smaller homes. Under the program PECO might install compact fluorescent bulbs, weather stripping, replace a water heater, or repair broken gas heaters, either for free, or at a greatly reduced cost.

Program descriptions evaluated in focus groups: Residential DR

Direct load control:

Under this program, PECO would pay you a certain amount of money each month to let the company cycle down your air conditioner compressor, and / or electric hot water heating element, during certain times of the day for a few days each month during the summer. Often these programs allow customers to either have these appliances turned off completely for a few hours, or turned off for 30 minutes or so every hour during these periods. Most programs only activate these controls for 10-15 days each summer.

Critical peak time pricing

Under this plan, PECO would charge more for the electricity you use during highest or critical peak times, a few times each year, when use is the very highest and it costs most to generate power--usually very hot summer afternoons. And PECO would charge less for the electricity you use at all other times of the day for the rest of the year. Participants would be provided with advance notifcation of a critical peak occurrence. Often, utilities that use this type of pricing offer people controls that allow them to program their appliances to turn off (or turn down) automatically when electricity prices are higher.

Real-time pricing

This plan recognizes that the cost that PECO has to pay for electricity differs at different times of the day and at different times of the year. Under the plan, rather than paying the same amount for each unit of electricity you use, the price you pay would reflect the price that PECO pays. As a result, electricity would cost more on hot summer weekday afternoons, and less on summer evenings, during the winter, and at most other times.

Peak use rebates

This plan would operate a lot like the Critical Peak Time Pricing one. The difference is that, while PECO would issue notification of a critical peak period day, you would not have to commit to any specific amount you will reduce your electricity use by and there is no penalty for not reducing your use. You would receive a special rebate for reducing use during the special critical peak periods based on how much you reduce, but your regular electricity price will not be affected.

Program descriptions evaluated in focus groups: Business EE

Energy efficiency rebates for specific equipment

This program would offer payments that PECO could make to you that would reduce the cost of installing new, more energy efficient lighting, equipment, or appliances in your business. PECO would, for example, pay you a rebate for replacing your current air conditioner, refrigerator, or other significant energy using appliance with a specific, more energy efficient model.

Custom energy efficiency rebate programs

Under this program, PECO would offer you payments to make changes in your facility that would make it more energy efficient. Since businesses often have unique situations, PECO would work with you to identify a package of changes that might include changes to your building (such as adding insulation or making changes to windows), changes to your lighting, and / or changes to other specific equipment you use. Based on these specific changes and the expected impact these would have on your electricity use, PECO would offer a customized rebate payment for implementing these changes.

New energy efficient construction

This program would make it easier for people who were thinking of building a new facility for their business, to build the most energy efficient facility possible. Under the program PECO would offer businesses rebates that would cover part or all of the cost of specific improvements that could be built into new facilities that would make them more energy efficient.

Energy efficiency program specifically for government, other public facilities, and not-for-profit organizations

Since government and similar organizations often operate under different, and sometimes challenging, requirements for investing in energy efficiency, this program would be specifically designed to help organizations like these make these investments. In general, the goal of this program would be to offer rebates to reduce the cost of making improvements in energy efficiency at government / not-for-profit facilities, but would be structured to make it as easy as possible for such organizations to participate.

Program descriptions evaluated in focus groups: Business DR

Direct load control:

Under this program, PECO would pay you a certain amount of money each month to let the company cycle down your cooling system(s), and / or electric water heaters during certain times of the day for a few days each month during the summer. Often these programs allow customers to either have these appliances turned off completely for a few hours, or turned off for 30 minutes or so every hour during these periods. Most programs only activate these controls for 10-15 days each summer.

Curtailable load control:

Similar to the direct load control program, with this option, PECO would pay you a certain amount of money each month to let the company cycle down specific electric equipment that might include process, or other manufacturing equipment, motors used for different uses, or other activities that you would agree to be able to stop (or "curtail") during the afternoon for a few days each month during the summer. As with the direct load control program, most of these programs only activate these controls for 10-15 days each summer.

Peak time pricing

Under this plan, PECO would charge more for the electricity you use during highest or critical peak times, a few times each year, when use is the highest and it costs most to generate power – usually very hot summer afternoons. And, PECO would charge less for the electricity you use at all other times of the day for the rest of the year. Participants would be provided with advance notification of a critical peak occurrence. Often, utilities that use this type of pricing also offer businesses controls that allow them to program their appliances to turn off (or turn down) automatically when electricity prices are higher.

Real-time pricing

This plan recognizes that the cost that PECO has to pay for electricity differs at different times of the day and at different times of the year. Under the plan, rather than paying the same amount for each unit of electricity you use, the price your business pays would reflect the price that PECO pays. As a result, electricity would cost more on hot summer weekday afternoons, and less on summer evenings, during the winter, and at most other times.

Electricity use shifting

Under this plan, PECO would work with you to see if there are ways for your business to permanently shift some of your electricity usage from weekday afternoons to other times of the day. Some buildings, for example, can put equipment in place that lets them make ice at night, then use the ice to cool the building during the day, reducing the need to run air conditioning. Other examples include installation of solar electric and hot water systems and microturbines. Ordinarily, installed systems can be connected to the utility to enable activation during peak periods, and customers can also use the equipment at any time. Incentives are provided for the capital cost and sometimes also for specific peak period reductions.

Temporary voltage reduction

Under this plan, PECO would pay your business for allowing them to temporarily reduce the voltage at which you receive your electricity. Safeguards would be put in place at your facility to protect equipment from damage. Testing would be conducted to assess the practicality of this reduction since it would be activated for all customers served by the same power distribution feeder.

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APPENDIX F-4.

ENERGY EFFICIENCY PROGRAM BENCHMARK REVIEW

APPENDIX F-4. Energy Efficiency Program Benchmark Review

Many different energy efficiency programs are referred while designing the energy efficiency programs for PECO. This benchmark review provides a sampling of programs found to be most common and/or most applicable for development of PECO's Energy Efficiency and Conservation Plan. It includes only a few program references for each category of the PECO's energy efficiency programs, not all the programs reviewed. In particular, Commonwealth Edison's programs are not referenced, even though they were all reviewed, because of PECO's known familiarity with them.

The information about the example programs was obtained from the program websites, other web sources, and in some cases through direct contact with the program managers. The details for the programs described are the most recent available on the each program's website as of April 2009. The programs are categorized by the respective program in this plan developed for PECO.

Residential CFL Initiative

United Illuminating (UI) Company - ENERGY STAR® Lighting Rebates, Connecticut

UI's *ENERGY STAR Lighting Rebates* program offers discounts on lighting products which include ENERGY STAR CFLs and fixtures. The program promotes sale of these lighting products through negotiated cooperative promotions with manufacturers and retailers, and offers price markdowns at the participating retail stores. The utility is working with about 18 retail stores and seven manufacturers. A memorandum of understanding is signed between the utility, manufacturers, and retailers regarding the incentive levels and program process. Incentives are offered to the manufacturers based on the negotiated rates for the different types of bulbs and wattages. The manufacturers in turn provide CFLs at lower prices to the participating retailers, and retailers pass on this discount to the customers. The incentives, up to $0.85 per lamp, are offered for the standard CFLs, and the incentives ranging from $2.00-$2.85 per lamp are offered for the specialty lamps, depending upon the wattage. These incentives vary from manufacturer to manufacturer as it is purely based on the negotiations. The manufacturers collect the sales data from the retailers and submit it to the utility for the incentive payments. In addition, CFLs are also promoted through instant coupons at local area stores, and these local stores are offered higher incentives for stocking CFLs. The coupons offer $1.50 off for the ENERGY STAR bulbs priced at $2.50 or more at the participating local stores. These participating stores are reimbursed by the utility based on the number of coupons for the sold CFLs.

The program also offers discount coupons of $10 off for the ENERGY STAR fixtures including torcheries, ventilation fans with light kits, or ceiling fans, at the participating retail stores. The program has a marketing component which is targeted towards consumer education.

Sources:

1. http://www.uinet.com/uinet/connect/UINet/Top+Navigator/Your+Home/UI+Products+%26+Services/Energy+Star+Products/Lighting

2. Direct contact with utility program manager
3. 2008 ENERGY STAR® Summary of Lighting Programs by Energy Efficiency Program Sponsors *Updated February 2008*

Sacramento Municipal Utility District (SMUD) - Residential Retail Lighting Programs, California

The SMUD's lighting program aims to make ENERGY STAR efficient lighting products purchased as a regular practice in its territory. CFL sales are promoted through manufacturer buydowns, consumer education, outreach events, in-store displays, point of purchase displays, tradeshows, advertising, bill inserts, webpages, media, and special events during the spring and Change a Light campaigns. The program has a cooperative marketing fund which can be used to provide consumer incentives, manufacturer buydowns, and other marketing activities. Participating manufacturers and retailers need to fill in the application and agreement forms, and are also required to contribute a minimum 33% of the total cost in the form of a cost buydown or as product marketing. The incentive levels for the CFLs range between $1.25-$4.00 per lamp depending upon the type of CFL and wattage. The incentive levels for ENERGY STAR lighting fixtures range from $5.00-$10.00 per fixture. The program also intends to promote ENERGY STAR solid-state lighting products.

Sources:
1. Direct contact with utility program manager
2. 2008 ENERGY STAR® Summary of Lighting Programs by Energy Efficiency Program Sponsors *Updated February 2008*

Seattle City Light (SCL) - Twist & Save Program, Washington

The Seattle City Light promotes ENERGY STAR lighting products through its *Twist & Save* program. Over 600 markdowns are offered at the different participating retail stores for the different CFL products. The program offers markdowns up to $2.25 for standard CFLs and up to $3.50 for specialty lamps, at the participating retail stores. Also, an instant rebate of $20.00 per fixture is available at the participating stores. The utility has hired a third party to implement the program. The program has a marketing component which includes CFL giveaways, in-store events, promotion at summer fairs and festivals, print ads, utility bill inserts, point-of purchase signage, and participation in Change a Light campaigns. CFLs are distributed at BlockWatch meetings, environmental events, and other neighborhood events.

Sources:
1. http://www.seattle.gov/light/conserve/cv5_lw1.htm
2. Direct contact with utility program manager
3. 2008 ENERGY STAR® Summary of Lighting Programs by Energy Efficiency Program Sponsors *Updated February 2008*

Los Angeles Department of Water & Power (LADWP) - CFL Program, California

To generate awareness about CFLs, LADWP is distributing two CFLS door-to-door, along with educational material to every LAWDP residential customer. The utility has hired a third party contractor to distribute CFLs. In addition, the utility also distributes

CFLs and educational materials at various community events, through refrigerator recycling, and GREENLA program. The utility also has a CFL manufacturer buydown program targeted at the manufacturer/distributor level so as to provide CFLs at a reduced price to the retailers, and retailers then sell these CFLs at a lower price to the LADWP customers.

Sources:

1. Direct contact with utility program manager
2. 2008 ENERGY STAR® Summary of Lighting Programs by Energy Efficiency Program Sponsors *Updated February 2008*

Residential Low-Income Energy Efficiency

Unitil - Home Energy Assistance Program, New Hampshire

Unitil, in a partnership with New Hampshire's Weatherization Network, offers the *Home Energy Assistance* program to low-income households in the New Hampshire. The program provides up to $4000 per household for energy efficiency improvements. The qualifying participants receive products and services free of charge through this program. As a part of the program, a professional auditor performs energy audit at the participant's home, and submits a recommendation report for the possible energy improvements. From the recommendations, participants can choose to install all or any of the energy efficiency measures at no cost. Unitil's qualified contractor installs eligible efficiency measures which include: attic, wall, and basement insulation; air leak sealing and weather-stripping; ENERGY STAR programmable thermostats; hot water conservation items such as low-flow shower heads and aerators; and ENERGY STAR light fixtures. The program has an educational component which aims to educate the participating customers about energy efficiency, and it also provides them with the educational materials. The program website lists the income qualification guidelines, and has uploaded the sign-up form for the prospective participants.

Source: http://services.unitil.com/ceco/energy_efficiency.asp?t=3

The New Jersey Comfort Partners Program, New Jersey

The *New Jersey Comfort Partners* program is a no-cost energy savings and energy education program for eligible low-income customers. Certified Building Performance Institute (BPI) contractors do the home energy evaluations. Based on the evaluations, contractors install low-cost energy efficient measures which may include: efficient lighting products; hot water conservation measures (water heater insulation, water heater pipe insulation and energy-saving showerheads and aerators); replacement of inefficient refrigerators; thermostats; insulation upgrades (attic, wall, etc.); blower-door guided air sealing; duct sealing and repair; heating/cooling equipment maintenance; and other measures. In addition, contractors also provide comprehensive energy education and counseling to the participating customers. The program website lists the details regarding utilities contact information, program enrollment process, and income guidelines.

Source: http://www.njcleanenergy.com/residential/programs/comfort-partners/comfort-partners

Focus on Energy - Targeted Home Performance with ENERGY STAR, Wisconsin

Focus on Energy's *Targeted Home Performance with ENERGY STAR* assists income eligible customers for making energy improvements in their homes. The program website lists the income eligibility criteria for the program. Qualifying customers get free home evaluations through the program consultants. Based on the results of evaluations, participating customers may choose to implement all or some of the recommended measures, and are responsible for minimal costs of the improvements.

Source: http://www.focusonenergy.com/Residential/Targeted-Home-Performance.aspx

Residential Whole Home Performance and Audit Programs

Georgia Power - Energy Efficiency Home Improvements, Georgia

The program offers rebates up to $1900 per household to customers who hire Home Performance with ENERGY STAR contractors for their home energy assessments and improvements. The participating contractors are certified by Building Performance Institute (BPI) and are registered with the Georgia Power. Qualifying customers first choose a contractor from the registered list of contractors. After discussing the participating customer's concerns, the contractor conducts the home performance assessment which include a visual walkthrough of the home and a diagnostic analysis to identify infiltration and duct leakage. The contractor also provides the list of necessary improvements to the homeowner. The customer is responsible for paying the total cost of home assessment to the contractor. The program offers 50% rebate on home assessment fees and up to maximum amount of $200. The rebates are offered for a wide variety of improvements which include: thermostats, water heater insulation, attic insulation, wall insulation, floor and foundation insulation, air sealing, and duct sealing. The amounts of incentives vary for each of these measures and details can be accessed on the program website.

The Georgia Power also provides an online energy check up for customers. A customer needs to answer some questions online and based on the customer's responses and energy use, a report is generated. The customers can also get free in-home audits through the Georgia Power's consultants and dealers.

Source: http://www.georgiapower.com/energystar/home_rebates.asp

Focus on Energy - Home Performance with ENERGY STAR, Wisconsin

Focus on *Energy's Home Performance with ENERGY STAR* program offers in-home energy audits and cash incentives for installing select recommended energy efficiency measures. Focus on Energy has partnered with the energy consultants and contractors in Wisconsin who inspect home energy systems, identify energy efficiency measures, and assist participating customers in the incentive application process. Each of the participating consultants has his or her rates for an evaluation. The incentives vary with the type of measures adopted. The program website has details about eligibility criteria, participating consultants/contractors, and program participation process.

Source: http://www.focusonenergy.com/Residential/Home-Improvement/

Residential Home Energy Incentives

The Baltimore Gas & Electric Company (BGE) - Smart Energy Savers Program,Maryland

BGE's *Smart Energy Savers* program offers rebates and discounts on ENERGY STAR appliances to promote energy efficiency among its residential customers. The rebates are offered on the purchase of ENERGY STAR refrigerators, freezers, and clothes washers. A rebate of $50 each is available on the purchase of the refrigerator and freezer. The rebate amount for the clothes washer is $50-$75 depending upon its modified energy factor (MEF). The program website contains the list of stores that carry these ENERGY STAR appliances. To obtain the rebate, the appliance rebate form must be mailed along with a proof of purchase within 60 days from the purchase date. Rebate is limited to one unit per each category per BGE residential customer. The program also offers discounts on the purchase of ENERGY STAR CFLs. The markdowns of $1.50 per CFL and $3.00 per multipack are available through participating retail stores with a limit of 25 bulbs per residential customer.

Source: http://conservation.bgesmartenergy.com/residential/lighting-appliances

Efficiency Vermont - Residential Energy Incentives Program,Vermont

Efficiency Vermont offers incentives for ENERGY STAR lighting & home appliances through *Residential Energy Incentives* program. The program offers rebates for ENERGY STAR appliances including refrigerators or freezers ($50 rebate); clothes washers ($50 rebate); room air conditioners (seasonal); humidifiers (seasonal); forced hot air furnace with ECM motors ($100 rebate); and efficient central air conditioning systems ($100 rebate). The program website provides details about eligible equipment models, brands, specifications, rebate forms, ENERGY STAR retailers, and specific terms & conditions.

The program also provides discounts for ENERGY STAR lighting products which include CFLs, fixtures, torcheries, floor lamps, and select LEDs. The discounts for lighting products are offered through coupons and internet catalog. The coupons are redeemable at the participating retail stores. The discounts are: $1.50 per CFL, $10 off per fixture, $10 off per floor lamp and torch, and $30 off on select LEDs. The program website lists the participating retailers for the lighting products. There is a limit of 6 single-bulb packages, 6 fixtures or 2 multi-bulb packages per residential electric account per calendar year, and a limit of 25 single-bulb packages, 25 fixtures, 25 multi-bulb (4-5 bulb) packages, or 16 multi-bulb (6 or more bulbs) per business electric account per calendar year.

Source:
www.efficiencyvermont.com/pages/Residential/Lightingandappliances/ENERGYSTARAppliances/

Residential New Construction

PG&E- Residential New Construction Program, California

Single-Family Homes:

PG&E offers incentives to builders for constructing energy efficient single-family homes. The incentives are offered through three separate options that builders can choose from: The ENERGY STAR Performance Method, The New Solar Homes Partnership Performance Method, and The Prescriptive Method.

The ENERGY STAR Performance Method: With this option, the builders of single-family homes can get incentives if their homes are at least 15% more efficient than the 2005 Title 24 Energy Code and meet all EPA requirements. Program participants can also earn incremental incentives by adding energy efficient appliances and lighting.

The New Solar Home Partnership Method: This option provides incentives to the home builders who construct homes with built-in Solar Photovoltaic (PV). To qualify for this option, the homes must meet certain efficiency levels. There are Tier 1 and Tier 2 participation options available. For Tier 1, the homes that are at least 15% more energy efficient than Title 24 Energy Code are eligible. The Tier 2 option is available for the single-family homes that exceed Title 24 Standards by 35% and also show 40% reduction in building cooling energy requirement compared to Title 24 Standards. In addition, all the appliances provided by the builders must be ENERGY STAR qualified.

The Prescriptive Method: This option offers incentives to the builders who upgrade any of the prescriptive features of the homes. Incentives are paid for each qualifying feature that is not used to meet the 2005 Title 24 baseline.

Multifamily Homes:
The PG&E's *Multifamily New Home* program offers incentives for implementing energy efficient measures in New Construction Multifamily Projects. A third party administers the program for PG&E. The program specifies homes to be at least 15% more efficient compared to Title 24 Standards. The details on the incentives and program participation process can be accessed at the program website.

Source: http://www.pge.com/mybusiness/energysavingsrebates/incentivesbyindustry/newconstruction/

NJ Energy Star Homes, New Jersey

As a part of EPA's ENERGY STAR program, the *NJ ENERGY STAR Home* program promotes energy efficient construction in New Jersey. The program has partnered with the EPA and area builders to provide ENERGY STAR homes to New Jersey residents. The New Jersey ENERGY STAR homes are 15% more energy efficient than International Energy Conservation Code (IECC) 2006, and score 85 or less on Home Energy Rating System (HERS) index. The program website has uploaded the list of participating builders, and the participation documents for the builders which include: specification submittal form, builder guidelines for mechanical systems and building envelopes, thermal bypass checklist, thermal bypass guide, and tax clearance certification for multifamily projects. The program contacts and other details can be accessed through the program website.

Source: http://www.njcleanenergy.com/residential/programs/nj-energy-star-homes/what-nj-energy-star-homes/what-nj-energy-star-homes

NYSERDA - New Construction Program (NCP), New York

The NYSERDA's *New Construction* program offers technical & financial assistance to incorporate energy efficiency measures in the design, construction, and operation of new buildings and major renovation projects. The program provides technical assistance to evaluate energy efficiency measures and guidance to design team for incorporating energy efficient technologies in the buildings. It also provides financial assistance to offset the incremental cost of approved efficiency measures and services. The assistance is also available for commissioning services, advanced solar day lighting technologies, and green building opportunities. Businesses, state and local governments, not-for-profits and private institutions, public and private schools, colleges and universities, multifamily buildings (seeking green building services), and health-care facilities are eligible for the program. The program website hosts the application forms and other eligibility criteria for the program.

Several incentives are available through the program, including: technical assistance incentives, design incentives, capital cost incentives, building commissioning incentives, green building incentives, and solar day lighting incentives. The details regarding incentives and technical assistance contacts are available on the program website. To qualify for the program, a participant must be an electric service customer of Consolidated Edison, Central Hudson, National Grid formerly Niagara Mohawk, New York State Electric & Gas, Orange and Rockland Utilities, or Rochester Gas and Electric and pay the New York State System Benefits Charge (SBC).

Source: http://www.nyserda.org/programs/New_Construction/default.asp

Residential Appliance Pickup

PG&E - Appliance Recycling Program, California

PG&E offers rebates for recycling old refrigerators, freezers, and air conditioners. PG&E customers can get a $35 rebate for recycling old refrigerators or freezers and $25 for air conditioners. PG&E has partnered with a third party to pickup the recycled appliance. The PG&E customers who wish to recycle their appliances can either call or go to the program website for scheduling a pick-up appointment. The program website contains the contact details for the program. After the pick-up of the appliance, PG&E sends the rebate check of required amount to the eligible customer within 6-8 weeks. In addition, special drop-off events are organized in the partnership with ENERGY STAR retailers for room AC units.

Source: http://www.pge.com/myhome/saveenergymoney/rebates/recycling/

Commercial/Industrial Equipment Incentives

Connecticut Light & Power (CL&P) - Small Business Energy Advantage, Connecticut

CL&P offers incentives to its commercial & industrial customers for installing certain energy efficiency measures. The customers with 12-month peak average demand ranging between 10 kW and 200 kW are eligible for the program. The incentives are offered for a variety of energy efficiency measures including lighting, HVAC, refrigeration, air compressors, premium efficiency motors, and variable frequency drives. The incentive

amounts are paid on per unit basis and vary by type of energy efficiency measures. Incentives are paid directly to the customers after installation of the recommended measures through the CL&P qualified contractor.

Source: http://www.cl-p.com/business/saveenergy/services/energyadvantage.aspx

Sacramento Municipal Utility District (SMUD) - Commercial Energy Efficiency Program, California

SMUD provides rebates for increasing energy efficiency among its commercial, industrial, and agricultural customers. The incentives are offered for a wide variety of energy efficient measures including lighting, HVAC, refrigeration, and controls. The program offers express, customized, and prescriptive measures for the different equipment categories. The program website lists the amount of the incentives and qualifying criteria for each category of the energy efficiency measures.

Source: http://www.smud.org/en/business/rebates/Pages/index.aspx

National Grid Large Business Program - Energy Initiative, Massachusetts

National Grid's *Energy Initiative* program offers technical assistance and incentives to its commercial and industrial customers for installing energy efficient equipment. Incentives are offered for lighting and controls, HVAC systems and controls, custom projects, compressed air equipments, and variable frequency drives. The program website lists the qualification criteria, amount of incentives, and other program details for each of the mentioned categories. The program offers incentives of up to 45% of the total project cost.

Source: https://www.nationalgridus.com/masselectric/business/energyeff/4_existing.asp

Commercial/Industrial New Construction

National Grid Large Business Program - Design2000plus, Massachusetts

National Grid's *Design2000plus* program offers incentives and technical assistance to the commercial and industrial customers who are constructing new facilities, enhancing manufacturing capacities, or undergoing major renovations. Incentives are offered for lighting and controls, HVAC systems and controls, custom projects, compressed air equipment, and variable frequency drives. The program website lists the qualification criteria, amount of incentives, and other program details for each of the mentioned categories. The program offers incentives of up to 75% of the additional cost for efficiency upgrades.

Source: https://www.nationalgridus.com/masselectric/business/energyeff/4_new.asp

NSTAR - Construction Solutions, Massachusetts

NSTAR offers incentives to the non-residential customers participating in *Construction Solutions* program. The program offers incentives for new construction, major renovations, or replacement of equipment. Customers wishing to participate must fill in the application form and get an approval before starting the project. The participating

customers can receive incentives up to 90%of the incremental cost differential for comprehensive design or rebates up to 75% of the incremental cost between standard baseline and high-efficiency equipment. Additionally, participating customers can get a cost sharing incentives for engineering, design, and commissioning services. The incentives are offered for lighting, HVAC systems & controls, variable speed drives, compressed air, advanced buildings, and custom projects. The program website contains all the details regarding the energy efficiency measures, incentives, and qualifying criteria.

Source:
http://www.nstaronline.com/business/energy_efficiency/electric_programs/construction_solutions.asp

Government/Public Facility/Non-Profit Energy Savings

Energy Efficiency in State Government - Virginia Energy Plan, Virginia

The Governor of Virginia signed Executive Order 48, "Energy Efficiency in State Government", on April 5, 2007, which set a goal to reduce non-renewable energy purchases and promote energy efficiency. The executive order directs all agencies and institutions constructing state-owned facilities over 5,000 gross square feet in size to be designed and constructed as per the LEED rating system designed by U.S. Green Building Council or as per the U.S. EPA/Department of Energy's ENERGY STAR rating system. Additionally, the order also directs Commonwealth Agencies or Institutions to give preference to buildings meeting the LEED/ENERGY STAR ratings when leasing facilities for state use. Agencies and institutions must purchase or lease ENERGY STAR equipment and appliances for all the classifications for which an ENERGY STAR designation is available. Virginia's Department of Mines, Minerals, and Energy issued a status report in April, 2008 on the progress of the goals set out in the executive order.

Source: http://www.governor.virginia.gov/Initiatives/ExecutiveOrders/pdf/EO_48.pdf

Green Building Action Plan for State Facilities, California

On December 14, 2004, the Governor of California signed Executive Order S-20-04 regarding green buildings. The executive order has a set goal of reducing energy use in state-owned buildings by 20% by 2015 from 2003 levels. The order directs compliance with the Green Building Action Plan, in order to achieve the set goals. The order directs agencies, departments, and institutions to design, construct, and operate all new building and renovations projects as per the LEED Silver or higher building standards. The order also instructs leasing office spaces in the buildings rated with U.S. EPA ENERGY STAR rating and purchasing ENERGY STAR equipment and appliances wherever possible.

The order also requires cooperation of different agencies including California Public Utility Commission (CPUC), California Energy Commission (CEC), California Public Employees Retirement System, State Teachers Retirement System, University of California, California Sate University, California Community Colleges, and Schools for embracing energy efficiency in government and private buildings. The order also directs to develop building commissioning guidelines, suggest plans for existing buildings renovation, and promote the Green Building Action Plan in the commercial buildings.

Source: http://www.energy.ca.gov/greenbuilding/index.html

Energy Conservation in the State Buildings, Maryland

According to Maryland's State Buildings and Conservation Act, all the state agencies are required to reduce their energy consumption by 5% by 2009 and by 10% by 2010 from the 2005 levels. The state agencies were required to submit their energy conservation plans which include energy conservation measures (ECM) by July 1, 2008 to Maryland Energy Administration (MEA) and Department of General Services (DGS). Measures include energy performance contracting, energy efficient lighting retrofits, water conservation devices, weatherization, efficient heating and cooling devices, and employee training. The DGS, in cooperation with MEA is to set energy performance indices for each state agency. Each state agency is required to do energy analysis of each of the buildings for its electricity and gas consumption and cost of this consumption. The program site has uploaded list of potential energy conservation measures, agency energy conservation checklist, facility operator energy conservation checklist, and other templates for the program.

Source: http://energy.maryland.gov/incentives/state-local/sbeeca/index.asp

Renewable Resources

Pasadena Water & Power (PWP) - Pasadena Solar Initiative, California

The Pasadena Water & Power utility has a set goal of installing 14 MW of solar power by 2017 as a part of the California Solar Initiative (CSI). To achieve this goal, the utility offers performance-based rebates to its customer through Pasadena Solar Initiative (PSI). The rate of rebate payments varies by customer class (residential and commercial customers) and the size of installed system. Systems up to 50 kW are eligible for Expected Performance Based Buydown (EPBB), and can get one-time lump sum payment based on estimated AC energy output, after the installation and inspection approval of the systems. Systems over 50 kW and up to 1000 kW are eligible for Performance Based Incentives (PBI). The eligible customers receive five annual PBI payments based on actual metered solar power generated during each five years of operation and the incentive rate remains fixed during the five-year payment period. The energy output is estimated using the California Energy Commission's Clean Power Estimator, which accounts for installation factors such as current and future shading, and system orientation. Further details on different incentive levels can be accessed on the utility website.

PWP organizes number of free solar workshops throughout the year for its electric customers to help them with application process, choosing a vendor, permit requirements, financing options and lease agreements, and calculation of energy savings and system costs.

Source: http://www.cityofpasadena.net/waterandpower/solar/default.asp

NYSERDA - PON 1050 Solar Electric Incentive Program, New York

The New York State Energy Research and Development Authority (NYSERDA) provides cash incentives for installation of solar electric or photovoltaic (PV) systems by Eligible Installers. The Eligible Installers are those who have considerable experience with solar system installations and have signed an agreement with NYSERDA's program. Incentives close to $13.8 million are available for program year 2009 and additional funding may be made available based on the customer demands and program progress. The incentives are paid to Eligible Installers which are in turn passed on to the end-use customers. Eligible Installers are responsible for preparing the incentive applications and submitting required paperwork to the NYSERDA. Generally, incentives cover 40-45% of the installed cost for a commercial or residential PV system. The program website contains the list of Eligible Installers, application forms, information for customers, installer's eligibility criteria, incentive guidelines, and other program details.

Source: http://www.powernaturally.org/Programs/Solar/incentives.asp

Focus on Energy - Renewable Energy Incentives & Grants, Wisconsin

Focus on Energy offers incentives and grants to residential, business and agricultural customers for clean renewable energy resources. Eligible customers can get incentives for the renewable technologies which include solar electric, solar hot water, wind, and biomass combustion or biogas digestion. The incentives are divided as:

Planning Incentives: These incentives cover the costs of site assessments, site evaluations, environmental permitting, and development and feasibility studies for an application of the given renewable energy technology at a given project site.

Installation Incentives: Eligible customers can receive installation incentives which include Cash-Back Rewards, Implementation Grants, and Opportunity Grants. The incentives are classified based on the capacities of the different systems. The Cash Back Rewards incentives are available for small-to medium-sized renewable energy systems with a capacity up to 20 kW or 5000 therms per year.

Implementation Grants are available for the solar electric systems of capacities 20 to 50 kW; solar hot water systems of capacities 5000 to 15,000 therms each year; wind power systems of capacities 20 kW to 100 kW; biomass combustion system costing two million dollars or less; and industrial/municipal/farm anaerobic digesters costing two million dollars or less. These systems can be used to meet electricity, water heating, process heating, space heating and cooling requirements at home, institutions, farms, and industries.

Opportunity Grants are available for limited time, and are applicable to the large renewable systems. The grants offer incentives for solar electric system of capacity greater than 50 kW; solar hot water systems of capacities more than 15,000 therms each year; wind power systems of capacities greater than 100 kW; biogas/landfill gas/biomass/hydro systems costing between two and five million dollars.

The details on the application process and incentive guidelines can be accessed on the program website. Eligible customers must fill in the application forms and get Focus on Energy approval before purchasing, ordering, or installing equipment or services.

Source: http://www.focusonenergy.com/Incentives/Renewable/

Other References : http://www.dsireusa.org/

APPENDIX F-5.

DEMAND REDUCTION PROGRAM BENCHMARK REVIEW

APPENDIX F-5 Demand Response (DR) Program Benchmark Review

This appendix presents brief summaries of Demand Response (DR) programs that were reviewed while designing the Demand Response programs for PECO. It includes examples under the specific DR program categories considered for PECO. Information on these programs was primarily obtained through secondary sources such as program websites, evaluation reports, and other relevant program documents.

I. Residential Direct Load Control

(a) Long Island Power Authority (LIPA) – LIPA Edge Program, New York

As a part of its clean energy initiative, Long Island Power Authority (LIPA) offered the *LIPA Edge Program* to its residential and small business customers. The program helps manage electric supply during peak periods by controlling HVAC loads during the summer. Participating customers are offered a two way communicating programmable thermostat which allows control of the Central Air Conditioning systems remotely. In addition, small business customers are offered a one-time incentive of $50 per site. LIPA initiates load control events during summers between 2-6 p.m. for maximum up to seven times per summer. The control is achieved either by increasing the set point on LIPA Edge thermostats by a few degrees or by cycling air conditioning compressors 50% per hour. The participants have the flexibility of overriding the curtailment events at the thermostat level.

The program outreach efforts included direct mailings, bill inserts, telemarketing, newspaper advertisements, door-to-door marketing, participant rewards (referral) program, and various print publications. LIPA provided 24/7 customer support through a call center and overnight emergency line support for the program. In addition, LIPA thanked participants by sending pre-season mailings which also included instructions on how to set thermostat for the summer season. By the end of 2007, the program had 33,859 participants and achieved demand savings of close to 50.7 MW.

Sources:
http://www.lipower.org/pdfs/cei/annual07.pdf
http://www.lipower.org/pdfs/cei/2003biennal.pdf
http://www.lipaedge.com/news.asp?articleid=27

(b) Florida Power & Light- Residential On Call Program

Florida Power and Light offers the largest residential Direct Load Control (DLC) program in the country, called 'Residential On Call'. Currently, the program has been in place for over 15 years. It enables the utility to occasionally cycle off select major appliances at a customer house for short period of time, during emergency periods. The appliances that can be controlled are conventional electric water heaters, central electric air conditioning, swimming pool pumps, and central electric space heating. Average incentive provided to a customer is $45/year. If a customer signs up for all options (that includes all major equipments), he/she can receive up to $137/year. The program is called

on an average 3 to 5 times a year for load control. During hurricanes (and other emergency conditions), the program can sometimes be called up to 8-9 days in a row. Customer notification takes place by a glowing light on the transponder during the time the program is being called. Also, a customer can call the utility 'call center' and a 'voice recorded' message notifies them of the event.

In delivering the program to its customers- the utility undertakes marketing and customer recruitment, while electrical contractors undertake equipment installation at the customer site. A variety of methods are used for customer education and outreach. It includes bill inserts, direct mail, customer visits by utility representatives for conducting energy audits, media coverage, word-of-mouth, and email campaigns to sign up on the web. Over a period of time, program experience shows which strategies work the best. Customer service is provided through a 1-800 customer service number.

Source:
https://app.fpl.com/secure/forms/oncall.shtml

(c) Pacific Gas & Electric (PG&E) - SmartAC Program, California

PG&E offers the *SmartAC* program, which is a direct load program, to its residential and business customers. The program uses paging signals to control participants' air conditioners during times of peak demand in the summer season. A control device, which is either a switch or a programmable thermostat, is installed at the participant's residence or business. The participants can choose the type of control device they wish to install. Demand reduction is achieved either by raising the thermostat temperature setting up to four degrees or by cycling the air conditioner on and off at a regular intervals, generally at 15 minutes. Residential customers with central air conditioning or heat pump and small business customers with central air conditioning unit or heat pump, with loads under 200 kW, are eligible to participate in the program. Participating customers receive a one-time $25 reward. In addition, those participants who choose to install thermostats receive a free programmable communicating thermostat.

PG&E manages the overall program including marketing the program to its customers and initiating control events. A third party is responsible for enrolling customers, scheduling installations, installing control devices, and addressing customer issues on a program hotline. The program is marketed through direct mailings, telemarketing, media events, and bill inserts. It was started in spring 2007, and by January 2008, there were around 26,000 participants with installed devices and another 22,000 participants enrolled and waiting for devices to be installed.

Sources:
http://www.pge.com/myhome/saveenergymoney/energysavingprograms/smartac/
http://www.calmac.org/publications/SmartAC_Load_Impact__Final_4-24-2008_v3_01.pdf

II Residential Super Peak TOU

(a) Alabama Power – Residential Rider Critical Peak Pricing (CPP), Alabama

Alabama Power offers a Critical Peak Pricing Rider to its residential customers. The rider is available only to customers who are enrolled under a Time-Of-Use rate offered to residential customers, and who are active participants in the company's SmartPOWER program of the company. Alabama Power's SmartPOWER program combines a TOU rate with the CPP component and two-way communicating programmable thermostats with web access capabilities.

The rider is applicable for the months from June 1 to September 30 every year. The total number of hours during which critical peak events are called may not exceed 120 hours every year. During a critical peak period, which may last from 1 to 5 hours, participating customers are charged critical peak rates for energy use. The on-peak period charge, effective from 12.00 noon to 7:00 p.m., Monday through Friday, is 13.0422 cents per kWh. The critical peak period charge, which may occur at any time during the peak period, is 30.5422 cents per kWh. The rider incorporates rate stabilization and equalization factor to adjust the kWh charges against the TOU Rate. Customers have web access to control their thermostat settings and to choose a response to a critical price signal. Critical price signals are sent via the web to the thermostat using 900 MHz paging signals. Customers are notified via e-mail (if they enroll) and at the thermostat during a critical price event. This program has been effective since June, 2008.

Sources:
http://www.alabamapower.com/pricing/pdf/cpp.pdf
http://www.aeic.org/load_research/docs/4_SmartPOWER_Critical_Peak_Pricing_(CPP)_Pilot.pdf

III Commercial/Industrial Direct Load Control

(a) Southern California Edison (SCE) – Commercial Summer Discount Plan, California

SCE offers the *Summer Discount Plan* to its commercial customers during summer months from June 1 to October 1. As a part of the program, SCE provides and installs a control device at participating customers' central air conditioning (CAC) units. This control device allows SCE to cycle air conditioning units on and off periodically by sending radio signals. As a reward for participation, customers can earn credits on summer electric bills. The credits depend on the capacity of CAC unit, amount of cycling, and electricity usage of the customers. Currently SCE offers two types of summer discount plans- Base Credit and Enhanced Credit. Under 'Base Credit', the customer's AC unit can be turned off for a maximum of 15 times per summer season, with a limit of 6 hours per event. Under 'Enhanced Credit', the customer's AC unit can be turned off unlimited number of times during the summer season, with a limit of 6 hours per day. The three cycling options are- 30%, 50% and 100%. The details regarding

discount plans, program enrollment, and eligibility criteria can be accessed on the program website.

Source:
http://www.sce.com/summerdiscount/summer-discount-plan.htm

(b) San Diego Gas and Electric (SDG&E) – Summer Saver Program, California

Under the *Summer Saver Program*, SDG&E installs a control device on the participating customers' air conditioning units which allows cycling of the units on and off for few hours on limited numbers of days during summer. In exchange, customers earn annual electric bill credit as reward for program participation. Customers have a choice of four participation levels with variations in cycling strategies and limitations on number of event days. The credit varies with the type of participation option. The details on all four options are available at the program website link provided below.

Source:
http://www.summersaverprogram.com/business.html

IV Commercial/Industrial Super Peak TOU

(a) PG&E Critical Peal Pricing Program, California

PG&E's commercial and industrial customers can receive a discounted rate year round by participating in the *Critical Peak Pricing (CPP) Program*. Customers who participate in the CPP program pay higher rates on CPP event days, which can go up to a maximum of 12 days during summer from May 1 to October 31. The rates are higher from 3 p.m. to 6 p.m. and are moderate from noon to 3 p.m. on CPP event days. PG&E notifies participants about CPP events days on a day-ahead basis by noon. Participants benefit by shifting their demand to non-critical periods on CPP event days. As an incentive for participation, customers receive electricity bill credits during summer months. They can also avail of the optional rate protection plan which prevents participants from paying more than they would have under the previous rate in which they are enrolled, during the first twelve months. The program website lists the eligibility criteria and participation process for the program.

Source:
http://www.pge.com/mybusiness/energysavingsrebates/demandresponse/cpp/index.shtml

(b) SCE Large Business – Critical Peak Pricing Program, California

SCE's *Critical Peak Pricing (CPP) Program* offers rate discounts to business customers for shifting or reducing electricity demand during critical peak event days in summer. This is an optional rate available to business customers already enrolled under existing TOU rates. CPP events are activated during the months of June-October between noon to 6 p.m. CPP event days are limited to 12 per summer season. Two participation options

are available- CPP-Volumetric Charge Discount (CPP-VCD), and CPP-Generation Capacity Charge Discount (CPP-GCCD). CPP-VCD is applicable to customers with 200 kilowatts (kW) or greater demand. CPP-GCCD is applicable to customers with demands of 500kW or greater. As an incentive for participation, customers receive electricity bill credits during summer months. They can also avail of the optional rate protection plan which prevents participants from paying more than they would have under the previous rate, during the first 12 consecutive months of participation. The program website lists the eligibility criteria and participation processes for the program.

Source:
http://www.sce.com/b-rs/large-business/cpp/critical-peak-pricing.htm

V DR Aggregator Contracts

(a) Rocky Mountain Power – Cool Keeper Program, Utah

Rocky Mountain offers *Cool Keeper*, a direct load control program for its residential and small commercial and industrial customers. The program offers cash incentives up to $40 for program participation and web programmable thermostats or digital cycling units for controlling/cycling the air-conditioning load during the peak periods.

The utility has hired a third party to implement the program in a specific territory of Utah. This third party is responsible for program implementation including marketing, customer recruitment, hardware installation, operation and maintenance. The third party is responsible for delivering a demand savings of 90 MW over a period of 10 years. The utility only pays for the measured verified load reduction to the third party. The program is has been in operation since 2003.

Sources:
http://www.coolkeeper.net/index-biz.html
http://www.comverge.com/knowledge-support/casestudy/PacificorpCaseStudy.pdf

VI Distributed Energy Resources

(a) NYSERDA - Existing Facilities Program - Combined Heat and Power (CHP) Performance Based Incentives, New York

Through the *Existing Facilities Program*, NYSERDA offers incentives for the installation of clean, efficient, and commercially available CHP Systems that provide summer on-peak demand reduction. Performance based incentives are calculated based on summer on-peak demand reductions (kW), energy generation in kWh, and fuel conversion efficiency of CHP systems. Commercial CHP systems that are based on reciprocating engines or gas turbines, with a 60% annual fuel conversion efficiency, are eligible for incentives. In addition, the CHP system should supply at least 75% of generated electricity on-site and have a NOx emission rate less than 1.6 lbs/MWhr. Incentives are capped at $2,000,000 per CHP project and may not exceed 50% of the

project cost. Projects involving installation of CHP systems with greater than 250 kW capacity or addition of CHP systems with greater than 250 kW capacity to existing CHP system are eligible for the program. Also, there are penalties in terms of incentive reduction for non performance with respect to agreed upon demand reduction and system specifications. The program website includes information on incentive details, program participation procedures, and other eligibility criteria for the CHP systems.

Source:
http://www.nyserda.org/programs/Existing_Facilities/chp.html

(b) San Diego Gas & Electric's (SDG&E's) Standby Generator Program, California

Under this program, SDG&E offers incentive to commercial and industrial customers for operating their standby generators during peak demand periods. The utility offers two programs under this umbrella: Peak Generation Program and ClenGen Program.

The 'Peak Generation Program' provides customers with an interval data recorder and an online energy management tool. Customers are offered incentives at a rate of $0.35/kWh bill credit, for volunteering backup generator operation during peak demands. The 'ClenGen Program' provides incentives to customers for upgrades to generators, in exchange for allowing SDG&E to use these generators during peak demand periods. The utility retrofits the generators with backend emission controls, and also provides funds for operation and maintenance as well as pays for the fuel costs for operating generators during peak periods. SDG&E manages these two programs through a third party. The program website includes information details on participation process and eligibility criteria for participation in these programs.

Source:
http://www.sdge.com/business/esc/documents/sbgp_factsheet.pdf

© Portland General Electric (PGE) - Dispatchable Standby Generation, Oregon

PGE offers the *Dispatchable Standby Generation* program to its commercial and industrial customers having standby generators of capacity 250 kW and above. Through this program, PGE networks participant's generator to PGE's communication and power control systems, and operates the standby generators for up to 400 hours annually to meet peak power demands. In exchange, PGE pays for the fuel and maintenance costs of the generators, and installs necessary control and communications hardware at the participant site. In addition, PGE also provides fuel storage facilities, if needed. The program includes detailed information on eligibility criteria and participation process.

Source:
www.portlandgeneral.com/business/large_industrial/dispatchable_generation.aspx

VII Permanent Load Reduction

Minnesota Power: Commercial Controlled Access/Storage Heating

Minnesota Power offers a Controlled Access/Storage Heating rate to its commercial/industrial customers, which allows customers to store energy during off-peak periods for meeting energy requirements during peak periods. During the time period of 11 p.m. to 7 a.m., when electricity costs as well as system demands are low, special energy storage equipment turns on and stores energy for the rest of the day. An energy storage system may consist of thermal storage room units, a central storage furnace, a central hot water system or slab heat. The electricity required to energize these systems is switched on only between 11 p.m. to 7 a.m. The utility offers an electricity rate of 3.2-3.5 c/kWh for use during off-peak periods along with a 7.5% interim increase and a $10 monthly service charge.

Source:
http://www.mnpower.com/customer_service/cost_savings/commercial_storage_offpeak_heating.htm

APPENDIX F-6.

UNIVERSAL LIST OF MEASURES

UNIVERSAL LIST OF ENERGY EFFICIENCY MEASURES
RESIDENTIAL SECTOR

End-Use	Energy Efficiency Measure
Cooling	Air Conditioner - Central, Early Replacement
Cooling	Air Conditioner - Central, Energy Star or better
Cooling	Air Conditioner - Central, Maintenance
Cooling	Air Conditioner - Central, Ductless Variable Refrigerant Flow
Cooling	Air Conditioner - Room, Energy Star or better
Cooling	Air Conditioner - Room, Removal of second unit
Cooling	Air Conditioner, Evaporative Precooler
Cooling	Air Conditioner, Proper Sizing of Equipment
Cooling	Attic Fan, Installation
Cooling	Attic Fan - Photovoltaic, Installation
Cooling	Ceiling Fan, Installation
Cooling	Dehumidifier
Cooling	Natural Ventilation & Cooling
Cooling	Thermal Energy Storage
Cooling	Trees for Shading
Cooling	Whole-House Fan, Installation
Heating	Boiler - Gas, High Efficiency
Heating	Boiler - Gas, Retrofit on Electric Heating
Heating	Furnace - Gas, High Efficiency
Heating	Furnace - Gas, Maintenance
Heating	Furnace Fan, Electronically Commutated Motor
Heating	Passive Solar Heating
Heating	Radiant Heating
Heating / Cooling	Heat Pump - Central, High Efficiency Air Source
Heating / Cooling	Heat Pump - Central, Maintenance
Heating / Cooling	Heat Pump - Cold Climate Heat Pump
Heating / Cooling	Heat Pump - Room, High Efficiency Air Source
Heating / Cooling	Heat Pump, Geothermal or Water Source
Heating / Cooling	Heat Pump, Solar System
HVAC	Ducting, Insulation
HVAC	Ducting, Repair and Sealing
HVAC	HVAC System, Zoning
HVAC	Thermostat, Clock/Programmable
Building Envelope	Building Massing/Orientation
Building Envelope	Ceiling Height Variation
Building Envelope	Displacement Ventilation / Raised Floor
Building Envelope	Doors, Storm and Thermal
Building Envelope	External Shades or Overhangs/Fins
Building Envelope	Glazing, Selection by Orientation
Building Envelope	Infiltration Control (caulk, weather strip, etc.)
Building Envelope	Insulation, Aerogel
Building Envelope	Insulation, Ceiling
Building Envelope	Insulation, Ceiling + Radiant Barrier
Building Envelope	Insulation, Foundation
Building Envelope	Insulation, Wall Cavity
Building Envelope	Insulation, Wall Sheathing
Building Envelope	Roofs, High Reflectivity
Building Envelope	Room Surface Reflectance
Building Envelope	Windows, Aerogel Insulation
Building Envelope	Windows, Install reflective film

UNIVERSAL LIST OF ENERGY EFFICIENCY MEASURES
RESIDENTIAL SECTOR

End-Use	Energy Efficiency Measure
Building Envelope	Windows, High Efficiency/Energy Star
Building Envelope	Windows, Layout Alternatives
Building Envelope	Windows, Shading
Lighting	Compact Fluorescent Lamps
Lighting	Compact Fluorescent Lamps, Outdoor
Lighting	Fluorescent, T5 Lamps and Fixtures
Lighting	Fluorescent, T8 Lamps and Fixtures
Lighting	Fluorescent Torchieres
Lighting	Halogen Cap Lamps, Indoors
Lighting	High Pressure Sodium Lamps, Outdoor
Lighting	Incandescent Lamps, Advanced
Lighting	Incandescent Lamps, Advanced - Outdoor
Lighting	Incandescent Lamps, Coated
Lighting	Incandescent Lamps, Reduced-Wattage
Lighting	LED, White
Lighting	LED, White - Outdoor
Lighting	Low Pressure Sodium Lamps, Outdoor
Lighting	Metal Halide, Outdoor
Lighting	Outdoor Lighting - Photovoltaic, Installation
Lighting	Photosensor Control - Lighting, Outdoor
Water Heating	Faucet Aerators
Water Heating	Hot Water System Pumps, High Efficiency
Water Heating	Pipe - Hot Water, Insulation
Water Heating	Showerheads, Low-Flow
Water Heating	Water Heater - Electric, High-Efficiency
Water Heating	Water Heater - Gas, High-Efficiency
Water Heating	Water Heater, Heat Pump
Water Heating	Water Heater, Ground-Source Heat Pump
Water Heating	Water Heater, Tank Blanket/Insulation
Water Heating	Water Heater - Electric, Tankless
Water Heating	Water Heater - Gas, Tankless
Water Heating	Water Heater, Thermostat Setback
Water Heating	Water Heater, Timer
Water Heating	Water Heating, Drainwater Heat Recovery
Water Heating	Water Heating, Heat Trap
Water Heating	Water Heating, Hot Water Saver
Water Heating	Water Heating, Hot Water Storage
Water Heating	Solar Water Heating System
Appliances	Clothes Dryer Duct Heat Recovery
Appliances	Clothes Dryer, Heat Pump
Appliances	Clothes Dryer - Electric, High Efficiency
Appliances	Clothes Dryer - Gas, High Efficiency
Appliances	Clothes Dryer, Microwave
Appliances	Clothes Dryer, Moisture Sensor
Appliances	Clothes Washer, Energy Star or better
Appliances	Clothes Washer, Horizontal Axis
Appliances	Clothes Washer, Inverter-Drive
Appliances	Clothes Washer / Dryer, Combination
Appliances	Combination Ovens
Appliances	Convection Oven - Electric, High Efficiency

UNIVERSAL LIST OF ENERGY EFFICIENCY MEASURES
RESIDENTIAL SECTOR

End-Use	Energy Efficiency Measure
Appliances	Convection Oven - Gas, High Efficiency
Appliances	Dishwasher, Energy Star or better
Appliances	Freezer, Compact
Appliances	Freezer, Energy Star or better
Appliances	Home Electronics - Copier/Printer, Energy Star
Appliances	Home Electronics - DVD/VCR/Audio, Energy Star
Appliances	Home Electronics - Monitor, Energy Star
Appliances	Home Electronics - Personal Computer, Energy Star
Appliances	Home Electronics - Television, Energy Star
Appliances	Home Electronics - Television, CEE 2
Appliances	Home Electronics, Reduce Standby Wattage
Appliances	Induction Stovetop
Appliances	Range and Oven - Electric, Energy Star or better
Appliances	Range and Oven - Gas, Energy Star or better
Appliances	Refrigerator/Freezer, Early replacement
Appliances	Refrigerator/Freezer, Energy Star or better
Appliances	Refrigerator/Freezer, Energy Star (Advanced)
Appliances	Refrigerator/Freezer, Maintenance
Appliances	Refrigerator/Freezer, Multiple Drawers
Appliances	Refrigerator/Freezer, Removal of secondary unit
Other	Energy-Efficient Manufactured Homes (New Construction)
Other	Energy Star Homes (New Construction)
Other	Home Energy Management System
Other	Passive Solar Design
Other	Pool, Pump Timer
Other	Pool, Solar Heating System
Other	Smart Appliances
Other	Solar Photovoltaic
Demand Response	Home Energy Management System
Demand Response	Time-of-use Meters
Demand Response	AMI Meters
Demand Response	Air Conditioners, Direct Load Control, Switch
Demand Response	Air Conditioners, Direct Load Control, PCT
Demand Response	Water Heaters, Direct Load Control, Switch

UNIVERSAL LIST OF ENERGY EFFICIENCY MEASURES
COMMERCIAL SECTOR

End-Use	Energy Efficiency Measure
Cooling	Air Conditioner - Packaged, High-Efficiency
Cooling	Air Conditioner - Packaged, Ductless Variable Refrigerant Flow
Cooling	Air Conditioner - Packaged, Maintenance
Cooling	Air Conditioner - Room, Energy Star or Better
Cooling	Air Conditioner, Proper Sizing of Equipment
Cooling	Air Curtain Doors
Cooling	Attic Fan - Photovoltaic, Installation
Cooling	Chilled Water, Reset
Cooling	Chilled Water, Variable-Flow System
Cooling	Chiller - Air-Cooled, High-Efficiency
Cooling	Chiller - Water-Cooled, High-Efficiency
Cooling	Chiller - Variable Refrigerant Flow
Cooling	Chiller, VSD Centrifugal
Cooling	Cooling Tower, High-Efficiency Fans
Cooling	Cooling Tower Water to Chilled Water
Cooling	Condenser Water, Temperature Reset
Cooling	Economizer, Installation
Cooling	Natural Ventilation & Cooling
Cooling	Solar Thermal Absorption Cooling
Cooling	Thermal Energy Storage - Cooling
Cooling	Trees for Shading
Heating	Boiler - Gas, High Efficiency
Heating	Furnace - Gas, High Efficiency
Heating	Furnace - Gas, Maintenance
Heating	Heat Recovery From Chiller / Refrigeration
Heating	Hot Water, Reset
Heating	Hot Water, Variable-Flow System
Heating	Passive Solar Heating
Heating	Radiant Heating
Heating / Cooling	Heat Pump - Air-Source, High-Efficiency
Heating / Cooling	Heat Pump - Air-Source, Maintenance
Heating / Cooling	Heat Pump - Cold Climate Heat Pump
Heating / Cooling	Heat Pump - Room, High Efficiency
Heating / Cooling	Heat Pump, Geothermal or Water Source
Heating / Cooling	Heat Pump, Multizone
HVAC	Decoupled Outdoor Air Path
HVAC	Ducting, Insulation
HVAC	Ducting, Repair and Sealing
HVAC	Energy Management System
HVAC	Exhaust Hoods - Cooking, Sensor Control
HVAC	Fans, Energy-Efficient Motors
HVAC	Fans, Motor Downsizing
HVAC	Fans, Reduction in Flow Rate
HVAC	Fans, Variable Speed Control
HVAC	HVAC Retrocommissioning
HVAC	Pumps, Variable Speed Control
HVAC	Thermostat, Clock/Programmable
HVAC	Variable Air-Volume Systems
HVAC	Ventilation, CO2-Controlled

UNIVERSAL LIST OF ENERGY EFFICIENCY MEASURES
COMMERCIAL SECTOR

End-Use	Energy Efficiency Measure
HVAC	Ventilation, Pre-Conditioned Air
Building Envelope	Building Massing / Orientation
Building Envelope	Ceiling Height Variation
Building Envelope	Displacement Ventilation / Raised Floor
Building Envelope	Enclose Loading Docks with Shelters/Seals/Curtains
Building Envelope	External Shades or Overhangs/Fins
Building Envelope	Glazing, Selection by Orientation
Building Envelope	Insulation, Aerogel
Building Envelope	Insulation, Ceiling
Building Envelope	Insulation, Ceiling + Radiant Barrier
Building Envelope	Insulation, Wall Cavity
Building Envelope	Room Surface Reflectance
Building Envelope	Vestibule Doors
Building Envelope	Window Layout Alternatives
Building Envelope	Windows, Aerogel Insulation
Building Envelope	Windows, High Efficiency
Lighting	Compact Fluorescent Fixtures
Lighting	Compact Fluorescent Lamps
Lighting	Compact Fluorescent Lamps, Outdoor
Lighting	Daylighting Controls, Outdoors
Lighting	Fluorescent, Delamp and Install Reflectors
Lighting	Fluorescent, High Bay Fixtures
Lighting	Fluorescent, T5 Lamps and Fixtures*
Lighting	Fluorescent, T8 Lamps and Fixtures*
Lighting	Fluorescent, Super T8 Lamps and Fixtures*
Lighting	Halogen Cap Lamps, Indoors
Lighting	High-Pressure Sodium Lamps
Lighting	Incandescent Lamps, Advanced
Lighting	Incandescent Lamps, Advanced - Outdoor
Lighting	LED, White
Lighting	LED, White - Outdoor
Lighting	LED Exit Lighting
Lighting	LED Street Lighting
Lighting	LED Traffic Lights
Lighting	Lighting Retrocommissioning
Lighting	Low Pressure Sodium Lamps, Outdoor
Lighting	Metal Halide, Outdoor
Lighting	Metal Halide Lighting with Pulse Start
Lighting	Microwave sulfur lamps (with light guides)
Lighting	Occupancy Sensors
Lighting	Outdoor Lighting - Photovoltaic, Installation (parking lots)
Lighting	Task Lighting
Lighting	Time Clocks and Timers (lighting)
Water Heating	Faucet Aerators
Water Heating	Pipe - Hot Water, Insulation
Water Heating	Water Heater - Electric, High-Efficiency
Water Heating	Water Heater - Electric, Tankless
Water Heating	Water Heater - Gas, High-Efficiency
Water Heating	Water Heater - Gas, Tankless

UNIVERSAL LIST OF ENERGY EFFICIENCY MEASURES
COMMERCIAL SECTOR

End-Use	Energy Efficiency Measure
Water Heating	Water Heater, Heat Pump
Water Heating	Water Heater, Ground-Source Heat Pump
Water Heating	Water Heater, Install Timer
Water Heating	Water Heater, Tank Blanket/Insulation
Water Heating	Water Heater, Thermostat Setback
Water Heating	Water Heating, Chiller Heat Recovery
Water Heating	Water Heating, Heat Trap
Water Heating	Water Heating, Hot Water Saver
Water Heating	Water Heating, Hot Water Storage
Water Heating	Water Heating, Low-Flow Nozzles
Water Heating	Solar Water Heating System
Refrigeration	Compressor, High-Efficiency
Refrigeration	Compressor, Parallel Unequal
Refrigeration	Compressor, Multi-plex
Refrigeration	Controls, Anti-Sweat Heater
Refrigeration	Controls, Floating Head Pressure
Refrigeration	Glass Doors, Installation
Refrigeration	Reach-In Coolers and Freezers
Refrigeration	Walk-In Strip Curtains, Installation
Other	Hotel Guestroom Controls (occupancy)
Other	Comprehensive Retrocommissioning
Other	Cooking Equipment, High Efficiency
Other	Icemaker, High Efficiency
Other	Integrated Design Process for New Construction
Other	Office Electronics - Copier/Printer, Energy Star
Other	Office Electronics - Copier/Printer, Supersavers
Other	Office Electronics - Monitor, Energy Star
Other	Office Electronics - Monitor, Supersavers
Other	Office Electronics - Personal Computer, Energy Star
Other	Office Electronics - Personal Computer, ClimateSavers
Other	Office Electronics - Personal Computer, Supersavers
Other	Office Electronics - Server, Energy Star
Other	Office Electronics - Server, Supersavers
Other	Office Electronics - Other Electronics, Energy Star
Other	Office Electronics - Other Electronics, Supersavers
Other	Partition Variations / Workstation Layout
Other	Passive Solar Design
Other	Powerstrip with Occupancy Sensor
Other	Solar Photovoltaic
Other	Transformer, High Efficiency
Other	Vending Machine, High Efficiency
Demand Response	Energy Management System, Whole-Facility
Demand Response	Energy Management System, Packaged HVAC
Demand Response	Lighting, Dimmer Control System
Demand Response	Load Control Relay Switch
Demand Response	AMI Meters
Demand Response	Real-Time Meters
Demand Response	Air Conditioners, Direct Load Control, Switch
Demand Response	Air Conditioners, Direct Load Control, PCT

UNIVERSAL LIST OF ENERGY EFFICIENCY MEASURES
COMMERCIAL SECTOR

End-Use	Energy Efficiency Measure
Demand Response	Water Heaters, Direct Load Control, Switch
Demand Response	Direct Load Control, Other End-Uses
Distributed Generation	Microturbines
Distributed Generation	Fuel Cells
Distributed Generation	Reciprocating Engine Generators

* Includes package of electronic ballast.

UNIVERSAL LIST OF ENERGY EFFICIENCY MEASURES
INDUSTRIAL SECTORS

End Use	Energy Efficiency Measure
Process Heating	Direct-Arc Melting
Process Heating	Direct-Resistance Melting
Process Heating	Electron Beam Heating
Process Heating	Heat Cascading
Process Heating	Heat Recovery
Process Heating	Heat Transformers
Process Heating	Autothermal Reforming
Process Heating	Industrial Process Heat Pumps
Process Heating	Induction Curing
Process Heating	Process Heat Recovery
Process Heating	Induction Heating
Process Heating	Infrared Drying and Curing
Process Heating	Insulated Surfaces
Process Heating	Microwave Heating
Process Heating	Radio Frequency
Refrigeration	Speed Control: Variable Frequency Drive
Refrigeration	Speed Control: Magnetic Adjustable Speed Drives
Refrigeration	Repair Refrigerant Leak
Refrigeration	High Efficiency Refrigeration
Boilers	High-Pressure Condensate Return System
Boilers	Speed Control: Variable Frequency Drive
Boilers	Speed Control: Magnetic Adjustable Speed Drives
Air Compressor	Compressor Replacement
Air Compressor	Air leak Reduction
Air Compressor	Waste Heat Recovery from Air Compressors
Air Compressor	Compressed Air System Improvements
Air Compressor	Piping Retrofits
Air Compressor	Filter Changes
Air Compressor	Pressure Controls/Reductions
Air Compressor	Purge Controls for Desiccant Dryers
Air Compressor	Sequencers
Air Compressor	System Optimization
HVAC	Cooling Tower, High-Efficiency Fans
HVAC	Speed Control: Variable Frequency Drive
HVAC	Speed Control: Magnetic Adjustable Speed Drives
HVAC	Cooling Tower Efficiency Improvements
HVAC	Clock/Programmable Thermostat
HVAC	Duct Insulation
HVAC	Chilled Water Reset
HVAC	Duct Repair and Sealing
HVAC	Energy Management System
Lighting	Daylighting Controls - Outdoors
Lighting	T5/Electronic Ballasts
Lighting	T8/Electronic Ballasts
Lighting	Halogen Lamps: Indoor
Lighting	High-Intensity Discharge Lamps
Lighting	High-Pressure Sodium Lamps
Lighting	LED Exit Lighting

UNIVERSAL LIST OF ENERGY EFFICIENCY MEASURES
INDUSTRIAL SECTORS

End Use	Energy Efficiency Measure
Lighting	Super T8 Fluorescent Lamps
Lighting	Time Clocks and Timers (lighting)
Industry-Specific Processes	Electrolysis - Membrane Separation
Industry-Specific Processes	Fine Bubble Diffusers
Industry-Specific Processes	Furnace Upgrades
Industry-Specific Processes	Sludge Reduction Techniques
Industry-Specific Processes	Efficient Baghouses
Industry-Specific Processes	Soil Moisture Monitoring and Services
Industry-Specific Processes	Ultrasonic Cleaning
Industry-Specific Processes	Water Management System Improvements
Industry-Specific Processes	Speed Control: Variable Frequency Drive
Industry-Specific Processes	Speed Control: Magnetic Adjustable Speed Drives
Industry-Specific Processes	Chilled Water Pipe Insulation
Industry-Specific Processes	Steam and Hot Water Pipe Insulation
Industry-Specific Processes	Electrolytic
Industry-Specific Process	Microwave Dryer
Industry-Specific Process	Milkhouse Heat Reclaimer
Industry-Specific Process	Automatic Milker Takeoffs
Industry-Specific Process	Variable Speed Vacuum Pumps
Industry-Specific Process	Tractor Heater Timers
Industry-Specific Process	Low-Pressure Irrigation
Industry-Specific Process	Livestock Waterer
Industry-Specific Process	Milk Precoolers
Other	Comprehensive System-Level Optimization
Other	Efficient Fans
Other	Fan Flow Control
Other	High Efficiency Transformers
Other	Irrigation Improvements
Other	High Efficiency Material Handling Systems
Other	Motor Downsizing
Other	Proper Motor Sizing
Other	Motor Rewind Training/Standards
Other	Steam Trap Maintenance
Other	Power Factor Improvements
Other	Process Optimization (DO monitors)
Other	Pumping System Optimization
Process Equipment	Premium Efficiency Motors
Process Equipment	Speed Control: Variable Frequency Drive
Process Equipment	Speed Control: Magnetic Adjustable Speed Drives
Demand Response	Energy Management System, Whole Facility
Demand Response	Energy Management System, Packaged HVAC
Demand Response	Lighting, Dimmer Control System
Demand Response	Load Control Relay Switch
Demand Response	Time-of-use Meters
Demand Response	AMI Meters
Distributed Generation	Microturbines
Distributed Generation	Fuell Cells
Distributed Generation	Reciprocating Engine Generators

TABLE 1:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – RESIDENTIAL

End-Use	Energy Efficiency Measure	Description
Cooling	Air Conditioner - Central, Energy Star or better	Central air conditioners consist of a refrigeration system using a direct expansion cycle. Equipment includes a compressor, an air-cooled condenser (located outdoors), an expansion valve, and an evaporator coil. A supply fan is located near the evaporator coil in order to distribute supply air through air ducts to many rooms inside the building. Cooling efficiencies vary based on the quality of the materials used, the size of equipment, the condenser type and the configuration of the system. Central air conditioners may be of the unitary variety (all components housed in a factory-built assembly) or a split system (an outdoor condenser section and an indoor evaporator section connected by refrigerant lines and with the compressor at either the outdoor or indoor location). The EPA Energy Star Program rates the energy efficiency of central air conditioners according to the size of the unit. A metric of efficiency performance is the Seasonal Energy Efficiency Rating (SEER), which ranges from a baseline value of 13 to a 20 or more. Systems with Variable Refrigerant Flow further improve the operating efficiency.
Cooling	Air Conditioner - Room, Energy Star or better	Room air conditioners are designed to cool a single room or space. This type of unit incorporates a complete air-cooled refrigeration and air-handling system in an individual package. Cooled air is discharged in response to thermostatic controls to meet room requirements. Each unit has a self-contained, air-cooled direct expansion (DX) cooling system and associated controls. Room air conditioners come in several forms, including window, split-type, and packaged terminal units. The EPA Energy Star Program rates the energy efficiency of room air conditioners according to the size of the unit. Energy Star labeled room air conditioners must exceed minimum federal standards for energy consumption by at least 10 percent, with Energy Efficiency Ratings (EER) typically greater than 10.
Heating / Cooling	Heat Pump - Central, High Efficiency	A central heat pump consists of components similar to a central air conditioner. In fact, oftentimes a unit is capable of functioning both as a heat pump and an air conditioner. It consists of a refrigeration system using a direct expansion (DX) cycle. Equipment includes a compressor, an air-cooled condenser (located outdoors), an expansion valve, and an evaporator coil (located in the supply air duct near the supply fan) and a reversing valve to change the DX cycle from cooling to heating when required. The cooling and heating efficiencies vary based on the quality of the materials used, the size of equipment, the condenser type and the configuration of the system. Heat pumps may be of the unitary variety (all components housed in a factory-built assembly) or be a split system (an outdoor condenser section and an indoor evaporator section connected by refrigerant lines and with the compressor at either the outdoor or indoor location). Air-source heat pumps are only appropriate for use in climates where there are mild winter temperatures.
Heating / Cooling	Heat Pump, Geothermal or Water Source	Geothermal heat pumps are similar to ordinary air conditioners and heat pumps, but use the ground or groundwater instead of outside air to provide heating, cooling, and, in most cases, hot water. A geothermal heat pump system generally consists of three major subsystems or parts: a geothermal heat pump to move heat between the building and the fluid in the earth connection, an earth connection for transferring heat between its fluid and the earth, and a distribution subsystem for delivering heating or cooling to the building. Each system may also have a desuperheater to supplement the building's water heater, or a full-demand water heater to meet all of the building's hot water needs. In heating mode, heat is extracted from the fluid in the earth connection by the geothermal heat pump and distributed to the home or building -- typically through a system of air ducts. In cooling mode, the cycle is reversed and the earth serves as a heat sink where the heat pump rejects heat transferred from the building.

TABLE 1:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – RESIDENTIAL

End-Use	Energy Efficiency Measure	Description
Lighting	Compact Fluorescent Lamps	Compact fluorescent lamps can consist of either electronic or magnetic ballast and a twin tube or quad tube lamp. They are designed to be a replacement for standard incandescent lamps and use about 25% of the energy used by incandescent lamps to produce the same lumen output. Integral compact fluorescent lamps have the ballast integrated into the base of the lamp and have a standard screw-in base and a spiral design which permits installation into existing incandescent fixtures.
Lighting	Fluorescent, T8 Lamps and Electronic Ballasts	T8 fluorescent lamps are smaller in diameter than standard T12 lamps, which result in greater light output per watt input (more efficient lighting). T8 lamps also operate at a lower current and wattage, which also increases the efficiency of the ballast but requires the lamps to be compatible with the ballast. Fluorescent lamp fixtures can include a reflector that increases the light output from the fixture, and thus making it possible to use a fewer number of lamps in each fixture. T5 lamps further increase efficiency by reducing the lamp diameter to 5/8"".
Lighting	Solid State Lighting	LED lighting has seen recent penetration in specific applications such as traffic lights and exit signs. With the potential for extremely high conversion efficiency, LED's show promise to provide general use white lighting for interior spaces. Current models commercially available have efficacies comparable to CFL's. However, theoretical efficiencies are significantly higher. White LED models under development are expected to provide efficacies greater than 80 lumens per watt.
Interior Lighting	Occupancy Sensors	The installation of occupancy sensors allows lights to be turned off during periods when a space is unoccupied. Such systems are appropriate for areas with intermittent use, such as conference rooms or bathrooms. There are several types of occupancy sensors in the market.
Exterior Lighting	Photosensors	Photosensors controls for exterior lighting determine the need for lighting by measuring the ambient lighting levels. When it becomes dark outside, the controls turn on exterior lights and turns them off again when ambient light levels increase. This eliminates the operation of exterior lighting during daylight hours.
Exterior Lighting	Motion Detectors	Many applications of outdoor lighting are for security purposes. These lights can be fitted with motion sensors to reduce the energy required by constant operation.
Exterior Lighting	Lighting Timer	While outdoor lighting is typically useful only at night, the requirement to manually switch off the lights leads to many applications where lighting is turned on continuously. A simple timer can set a diurnal schedule for outdoor lighting and thus reduce the operating hours by roughly 50%.

TABLE 1:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – RESIDENTIAL

End-Use	Energy Efficiency Measure	Description
Appliance	Refrigerator/Freezer, Energy Star or better	An energy-efficient refrigerator/freezer is designed by improving the various components of the cabinet and refrigeration system. These components improvements include cabinet insulation, compressor efficiency, evaporator fan efficiency, defrost controls, mullion heaters, oversized condenser coils, and improved door seals. The Energy Star Program has a system for labeling refrigerator/freezer units that are energy efficient. In this analysis, a NAECA-standard refrigerator is assumed to consume 60 kWh per year less than a standard refrigerator. An Energy Star refrigerator is assumed to consume 15% (approximately 156 kWh per year) less than a standard refrigerator. Further efficiency increases can be obtained by reducing the volume of refrigerated space, or adding multiple compartments to reduce losses from opening doors.
Water Heating	Water Heater - Electric, High Efficiency	For electric residential hot water heating, common heaters include automatic storage heaters and instantaneous heaters. Automatic storage heaters incorporate the electric heating element, storage tank, outer jacket, insulation, and controls in a single unit and are normally installed without dependence on other hot water storage equipment. Efficient residential electric water heaters are characterized by a high recovery or thermal efficiency and low standby losses (the ratio of heat lost per hour to the content of the stored water).
Water Heating	Water Heater, Heat Pump	An electric heat pump water heater uses a vapor-compression thermodynamic cycle similar to that found in an air-conditioner or refrigerator. The electrical work input to the process allows a heat pump water heater to extract heat from an available source (e.g., air) and reject that heat to a higher temperature sink, in this case, the water in the water heater. Because the heat pump makes use of available ambient heat rather than generating all of the heat required to heat the water, the coefficient of performance is greater than one—typically in the range of 2 to 3. By utilizing the earth as a thermal reservoir, ground source heat pump water heaters can reach even higher levels of efficiency. The heat pump can be integrated with a traditional water storage tank or installed remote to the storage tank.
Water Heating	Water Heating, Solar	Solar water heating is a renewable energy technology that is well proven and readily available and has considerable potential for application. Solar water-heating systems can be used effectively in residential buildings that have an appropriate near-south-facing roof or nearby unshaded grounds for installation of a collector. Although there are a large number of different types of solar water-heating systems, the basic technology is very simple. Sunlight strikes and heats an "absorber" surface within a "solar collector" or an actual storage tank. Either a heat-transfer fluid or the actual potable water to be used flows through tubes attached to the absorber and picks up the heat from it. (Systems with a separate heat-transfer-fluid loop include a heat exchanger that then heats the potable water.) The heated water is stored in a separate preheat tank or a conventional water heater tank until needed. If additional heat is needed, it is provided by electricity or fossil-fuel energy by the conventional water-heating system.
Appliance	Dishwasher, Energy Star or better	Energy Star labeled dishwashers save by using both improved technology for the primary wash cycle, and by using less hot water to clean. Construction includes more effective washing action, energy-efficient motors, and other advanced technology such as sensors that determine the length of the wash cycle and the temperature of the water necessary to clean the dishes.

TABLE 1:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – RESIDENTIAL

End-Use	Energy Efficiency Measure	Description
Appliance	Clothes Washer, Energy Star or better	Energy Star labeled clothes washers use superior designs that require less water to get clothes thoroughly clean. These machines use sensors to match the hot water needs to the load, preventing energy waste. There are two designs: top-loading and front-loading. The front-loading is a horizontal axis machine and utilizes significantly less water than the standard vertical axis machines. A horizontal axis clothes washer utilizes a cylinder that rotates horizontally to wash, rinse, and spin the clothes. Further energy and water savings can be achieved through advanced technologies such as inverter-drive or combination washer-dryer units.
Appliance	Clothes Dryer – Electric, High Efficiency	An energy-efficient clothes dryer has a moisture-sensing device to terminate the drying cycle rather than using a timer, and an energy-efficient motor is used for spinning the dryer tub. Application of a heat pump cycle for extracting the moisture from clothes leads to additional energy savings.
Appliance	Range and Oven – Electric, High Efficiency	These products have additional insulation in the oven compartment and tighter-fitting oven door gaskets and hinges to save energy. Conventional ovens must first heat up about 35 pounds of steel and a large amount of air before they heat up the food. Tests indicate that only 6% of the energy output of a typical oven is actually absorbed by the food. In this analysis, high-efficiency range and oven are assumed to consume 20% less energy than a standard range and oven.
Electronics	Color TVs and Home Electronics, Energy Star or better	In the average home, 90% of the energy used to power electronic products is consumed when the products are turned off - energy used to maintain features like clock, remote control, and channel/station memory. Energy Star labeled consumer electronics can drastically reduce consumption during standby mode, in addition to increasing operation through advanced power management during normal use.
Electronics	Personal Computers, Energy Star or better	Computers are responsible for an increasing share of power consumption as the penetration of PC's grows and the performance requirements rise. Power supplies for specialty gaming systems, for example, draw as much as 750 W of power, resulting in 6570 kWh per year if the unit runs continuously. Improved power management can significantly reduce the annual consumption of a Personal Computer, in both standby and normal operation.
Electronics	Home Electronics, Reduce Standby Wattage	Representing a growing portion of home electricity consumption, plug-in electronics such as set-top boxes, dvd players, digital video recorders and even battery chargers for mobile phones and laptop computers are often designed to supply a set voltage. When the units are not in use, this voltage could be dropped significantly (~1 W) and thereby generate a significant energy savings, assumed for this analysis to be between 4-5% on average. These savings are in excess of the measures already discussed for computers and televisions.
Electronics	SmartPlug	SmartPlug technology is based on reducing phantom loads. A Phantom loads occures when electronics are not being used, but are still drawing energy. SmartPlugs sense when this is occuring and automatically disconnect the energy source from the electronic equipment. Using a Smartplug is comparable to unplugging home electronics everytime they are turned off. Estimated savings are between $50 to $150 annually.

TABLE 1:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – RESIDENTIAL

End-Use	Energy Efficiency Measure	Description
Other	Furnace Fans, Electronically Commutating Motor	In homes heated by a gas-fired furnace, there is still substantial energy use by the fan responsible for moving the hot air throughout the ductwork. Application of an Electronically Commutating Motor (ECM) ensures that motor speed matches the heating requirements of the system and saves energy when compares to a continuously operating standard motor.
Cooling	Ceiling Fan	Ceiling fans can reduce the need for air conditioning. However, the house occupants must also select a ceiling fan with a high-efficiency motor and setup the thermostat temperature of the air conditioning system in order to realize the potential energy savings. Some ceiling fans also come with lamps. In this analysis, it is assumed that there are no lamps, and installing a ceiling fan will allow occupants to increase the thermostat cooling setpoint up by 2 degrees (F).
Cooling	Dehumidifier	Dehumidifiers can reduce the need for air conditioning by reducing the latent heat in the air. Effective in humid climates during moderate days, the installation of a dehumidifier is assumed to reduce the number of days of operation of central or room AC units.
Cooling	Whole-House Fan	Whole house fans can reduce the need for air conditioning on moderate-weather days or on cool evenings. The fan facilitates a quick air change throughout the entire house. Several windows must be open to achieve the best results. The fan is mounted on the top floor of the house, usually in a hallway ceiling.
Cooling	Attic Fan	Attic fans can reduce the need for air conditioning by reducing the heat transfer from the attic through the ceiling of the house. A well-ventilated attic reaches temperatures several degrees lower than in comparable, unventilated space.
HVAC - Other	Duct Insulation	Air distribution ducts can be insulated to reduce heating or cooling losses. Best results can be achieved by covering the entire surface area with insulation. Insulation material inhibits the transfer of heat through the air-supply duct. Several types of ducts and duct insulation are available, including flexible duct, pre-insulated duct, duct board, duct wrap, tacked, or glued rigid insulation, and waterproof hard shell materials for exterior ducts. This analysis assumes that installing duct insulation can reduce the temperature drop/gain in ducts by 50%.
HVAC – Other	Programmable Thermostat	A programmable thermostat can be added to most heating/cooling systems. They are typically used during winter to lower temperatures at night and in summer to increase temperatures during the afternoon. There are two-setting models, and well as models that allow separate programming for each day of the week. The energy savings from this type of thermostat are identical to those of a "setback" strategy with standard thermostats, but the convenience of a programable thermostat makes it a much more attractive option. In this analysis, the baseline is assumed to have no thermostat setback.

TABLE 1:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – RESIDENTIAL

End-Use	Energy Efficiency Measure	Description
Building Envelope	Storm Doors	In addition to their obvious function of providing entry and egress to or from the home, doors also function as part of the thermal envelope or shell of the home. Like other components of the shell, doors are subject to several types of heat loss: conduction, infiltration, and radiant losses. Like a storm window, a storm door works by creating an insulating air space between the storm and primary doors. A tight fitting storm door can also help reduce air leakage or infiltration. Thermal doors have exceptional thermal insulation properties and also are provided with weather-stripping on the doorframe to reduce air leakage.
Building Envelope	External Shades	Physical features on the exterior of buildings that provide additional shade for windows and/or wall areas. This reduces the heat gain of the building from direct sunlight, which reduces the cooling load, thus saving cooling energy.
Building Envelope	Wall Insulation	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation can conserve energy by reducing the heat loss or gain of a building. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose; loose-fill (blown) fiberglass; and rigid polystyrene.
Building Envelope	Foundation Insulation	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation can conserve energy by reducing the heat loss or gain of a building. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose; loose-fill (blown) fiberglass; and rigid polystyrene.
Building Envelope	Ceiling Insulation	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation can conserve energy by reducing the heat loss or gain of a building. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose; loose-fill (blown) fiberglass; and rigid polystyrene.
Building Envelope	Reflective Roof	The color and material of a building structure surface will determine the amount of solar radiation absorbed by that surface and subsequently transferred into a building. This is called solar absorptance. By using a material or painting the roof with a light color (and a lower solar absorptance), the roof will absorb less solar radiation and consequently reduce the cooling load. This analysis assumes that implementing high reflectivity roofs will decrease the roof's absorptance of solar radiation by 45%.
Building Envelope	High Efficiency Windows	High-efficiency windows, such as those labeled under the Energy Star Program, are designed to reduce a building's energy bill while increasing comfort for the occupants at the same time. High-efficiency windows have reducing properties that reduce the amount of heat transfer through the glazing surface. For example, some windows have a low-E coating, which is a thin film of metallic oxide coating on the glass surface that allows passage of short-wave solar energy through glass and prevents long-wave energy from escaping. Another example is double-pane glass that reduces conductive and convective heat transfer. There are also double-pane glasses that are gas-filled (usually argon) to further increase the insulating properties of the window.

TABLE 1:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – RESIDENTIAL

End-Use	Energy Efficiency Measure	Description
Water Heating	Faucet Aerators	Water faucet aerators are threaded screens that attach to existing faucets. They reduce the volume of water coming out of faucets while introducing air into the water stream. This measure provides both water conservation through reduced water flow for both hot and cold water and energy conservation through the reduction in hot water use. In this analysis, it is assumed that faucet aerators reduce hot water consumption by 4%.
Water Heating	Pipe Insulation	Insulating hotwater pipes decreases the amount of energy lost during distribution of hotwater throughout the building. Insulating pipes will result in quicker deliverly of hotwater and allow you to lower your water set points which saves energy. There are several different types of insulation,the most common being polyethelene and neoprene.
Water Heating	Low-Flow Showerheads	Similar to faucet aerators, low-flow showerheads reduce the consumption of hot water, which results in decreasing the energy used for creating hot water.
Cooling	Air Conditioner Maintenance	An air conditioner's filters, coils, and fins require regular cleaning and maintenance for the unit to function effectively and efficiently throughout its years of service. Neglecting necessary maintenance will lead to a steady decline in air conditioning performance which causes requires the AC unit to do more work for the same cooling load. This analysis assumes that maintenance will increase the efficiency of poorly performing equipment by 11%.
Heating / Cooling	Heat Pump Maintenance	A heat pump's filters, coils, and fins require regular cleaning and maintenance for the unit to function effectively and efficiently throughout its years of service. Neglecting necessary maintenance ensures a steady decline in heating performance while energy use steadily increases. This analysis assumes that maintenance will increase the efficiency of poorly performing heat pump equipment by 10%.
HVAC – Other	Duct Repair	An ideal duct system would be free of leaks. Leakage in unsealed ducts varies considerably becuase of the differences in fabricating machinery used, the methods for assembly, installation workmanship, and age of the ductwork. Air leaks from the system to the outdoors result in a direct loss proportional to the amount of leakage and the difference in enthalpy between the outdoor air and the conditioned air. To seal ducts, a wide variety of sealing methods and products exist. Each has a relatively short shelf life, and no documented research has identified the aging characteristics of sealant applications. This analysis assumes that the baseline air loss from ducts has doubled, and conducting repair and sealing of the ducts will restore leakage from ducts to the original baseline level.
Building Envelope	Infiltration Control	Significant energy savings can be obtained by lowering the infiltration rate through caulking small leaks and weather-stripping around window frames, doorframes, power outlets, plumbing and wall corners. Weather-stripping doors and windows will create a tight seal and further reduce air infiltration. This analysis assumes that conducting infiltration control will reduce the overall infiltration by 50%.
Comprehensive	In-home Feedback Monitor	By providing customers with accurate and timely information about their electricity consumption, in-home displays typically lead to energy savings through a combination of behavioral modifications and equipment choices. Under existing electricity rate structures, this analysis assumes an overall reduction of 2.6% in annual energy consumption.

TABLE 1:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – RESIDENTIAL

End-Use	Energy Efficiency Measure	Description
Building Envelope	Radiant Barrier	Radiant Barriers are materials installed to reduce the heat gain in buildings. Radiant barriers are made from materials that are highly reflective and have low emissivity like aluminum. The closer the emissivity is to 0 the better they will perform. Radiant barriers can be placed above the insulation or on the on the roof rafters.
Electronics	Reduce Standby Wattage	In the average home, 90% of the energy used to power electronic products is consumed when the products are turned off - energy used to maintain features like clock, remote control, and channel/station memory. Energy Star labeled consumer electronics can drastically reduce consumption during standby mode, in addition to increasing operation through advanced power management during normal use.
Miscellaneous	Pool Pump Timer	Reducing the time a pool pump is running has a significant effect on energy consumption. Using a pool pump timer allows the pump to turn off automatically, eliminating the wasted energy associated with unnecessary pumping. This analysis assumes an average 10% reduction in energy consumption through the use of pool pump timers.
Water Heating	Drainwater Heat Recovery	Drainwater heat recovery is a system in which drain water is used to preheat cold water entering the water heater. While these systems themselves are relatively inexpensive, upgrading an existing system could be unreasonable because of demolition costs.

TABLE 2:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – COMMERCIAL

End-Use	Energy Efficiency Measure	Description
Cooling	Central Cooling Systems	Commercial buildings are often cooled with a central chiller plant that creates chilled water for distribution throughout the facility. Chillers can be air source or water source, which include heat rejection via a condenser loop and cooling tower. Because of the wide variety of building types and sizes within the Con Ed service territory, savings and cost values for efficiency improvements in chiller systems represent an average over air- and water-cooled systems, as well as screw, reciprocating, and centrifugal technologies. Under this simplified approach, each central system is characterized by an aggregate efficiency value (inclusive of chiller, pumps, motors and condenser loop equipment), ranging from 1.35 kW/ton to 0.85 kW/ton, with a further efficiency upgrade through the application of variable refrigerant flow technology.
Cooling, Space Heating	Energy Management System	An energy management system (EMS) allows managers/owners to monitor and control the major energy-consuming systems within a commercial building. At the minimum, the EMS can be used to monitor and record energy consumption of the different end-uses in a building, and can control operation schedules of the HVAC and lighting systems. The monitoring function helps building managers/owners to identify systems that are operating inefficiently so that actions can be taken to correct the problem. The EMS can also provide preventive maintenance scheduling that will reduce the cost of operations and maintenance in the long run. The control functionality of the EMS allows the building manager/owner to operate building systems from one central location. The operation schedules set via the EMS help to prevent building systems from operating during unwanted or unoccupied periods. This analysis assumes that this measure is limited to buildings with a central HVAC system.
Cooling, Space Heating	Dual Enthalpy Economizer	Economizers allow outside air (when it is cool and dry enough) to be brought into the building space to meet cooling loads instead of using mechanically cooled interior air. A dual enthalpy economizer consists of indoor and outdoor temperature and humidity sensors, dampers, motors, and motor controls. Economizers are most applicable to temperate climates and savings will be smaller in extremely hot or humid areas.
Cooling	VSD on Water Pumps	The part-load efficiency of chilled water loop pumps can be improved substantially by varying the speed of the motor drive according to the building demand for cooling. There is also a reduction in piping losses associated with this measure that has a major impact on the energy use for a building. However, pump speeds can generally only be reduced to a minimum specified rate, because chillers and the control valves may require a minimum flow rate to operate. There are two major types of variable speed drives: mechanical and electronic. An additional benefit of variable-speed drives is the ability to start and stop the motor gradually, thus extending the life of the motor and associated machinery. This analysis assumes that electronic variable speed drives are installed.

TABLE 2:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – COMMERCIAL

End-Use	Energy Efficiency Measure	Description
Cooling	Water Temperature Reset	Chilled water reset controls save energy by improving chiller performance through increasing the supply chilled water temperature, which allows increased suction pressure during low load periods. Raising the chilled water temperature also reduces chilled water piping losses. However, the primary savings from the chilled water reset measure results from chiller efficiency improvement. This is due partly to the smaller temperature difference between chilled water and ambient air, and partly due to the sensitivity of chiller performance to suction temperature.
Cooling	Packaged Cooling Systems and Heat Pumps	Packaged cooling systems are simple to install and maintain, and are commonly used in small commercial buildings. Applications range from a single supply system with air intake filters, supply fan, and cooling coil, or can become more complex with the addition of a return air duct, return air fan, and various controls to optimize performance. For this analysis, units with Energy Efficiency Ratios (EER) of 8.9 and higher were considered, as well as ductless or "mini-split" systems with variable refrigerant flow.
Cooling, Space Heating	HVAC Retrocommissioning	Over time, the complex mechanical systems providind heating and cooling to commercial spaces become mismatched to the loads they are serving as a result of deteriorating equipment, clogged filters, changing demands and schedules, and pressure imbalances. Retrocommissioning is a comprehensive analysis of an entire system in which an engineer assesses shortcomings in system performance, then optimizes through a process of tune-up, maintenance, and reprogramming of control or automation software. Energy efficiency programs throughout the country promote retrocommissioning as a means of greatly reducing energy consumption in existing buildings; for this analysis, a retrocommissioning project is assumed to save 15% of the energy used for HVAC.
Cooling	Room (Window) Air Conditioners	Window (or wall) mounted room air conditioners (and heat pumps) are designed to cool (or heat) a single room or space. This type of unit incorporates a complete air-cooled refrigeration and air-handling system in an individual package. Conditioned air is discharged in response to thermostatic control to meet room requirements. Each unit has a self-contained, air-cooled direct expansion (DX) cooling system, a heat pump or other fuel-based heating system and associated controls. The energy saving decreases with each incremental increase in efficiency.
Cooling, Space Heating	Programmable Thermostat	A programmable thermostat can be added to most heating/cooling systems. They are typically used during winter to lower temperatures at night and in summer to increase temperatures during the afternoon. There are two-setting models, and well as models that allow separate programming for each day of the week. The energy savings from this type of thermostat are identical to those of a "setback" strategy with standard thermostats, but the convenience of a programable thermostat makes it a much more attractive option. In this analysis, the baseline is assumed to have no thermostat setback.

TABLE 2:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – COMMERCIAL

End-Use	Energy Efficiency Measure	Description
Cooling, Space Heating	Duct Testing and Sealing	An ideal duct system would be free of leaks. Leakage in unsealed ducts varies considerably becuase of the differences in fabricating machinery used, the methods for assembly, installation workmanship, and age of the ductwork. Air leaks from the system to the outdoors result in a direct loss proportional to the amount of leakage and the difference in enthalpy between the outdoor air and the conditioned air. To seal ducts, a wide variety of sealing methods and products exist. Each has a relatively short shelf life, and no documented research has identified the aging characteristics of sealant applications. This analysis assumes that the baseline air loss from ducts has doubled, and conducting repair and sealing of the ducts will restore leakage from ducts to the original baseline level.
Cooling	External Shades	Physical features on the exterior of buildings that provide additional shade for windows and/or wall areas. This reduces the heat gain of the building from direct sunlight, which reduces the cooling load, thus saving cooling energy.
Cooling	Cool Roof	The color and material of a building structure surface will determine the amount of solar radiation absorbed by that surface and subsequently transferred into a building. This is called solar absorptance. By using a material or painting the roof with a light color (and a lower solar absorptance), the roof will absorb less solar radiation and consequently reduce the cooling load. This analysis assumes that implementing high reflectivity roofs will decrease the roof's absorptance of solar radiation by 45%.
Cooling, Space Heating	Duct Insulation	Air distribution ducts can be insulated to reduce heating or cooling losses. Best results can be achieved by covering the entire surface area with insulation. Insulation material inhibits the transfer of heat through the air-supply duct. Several types of ducts and duct insulation are available, including flexible duct, pre-insulated duct, duct board, duct wrap, tacked, or glued rigid insulation, and waterproof hard shell materials for exterior ducts. This analysis assumes that installing duct insulation can reduce the temperature drop/gain in ducts by 50%.
Cooling, Space Heating	Efficient Windows	High-efficiency windows, such as those labeled under the Energy Star Program, are designed to reduce a building's energy bill while increasing comfort for the occupants at the same time. High-efficiency windows have reducing properties that reduce the amount of heat transfer through the glazing surface. For example, some windows have a low-E coating, which is a thin film of metallic oxide coating on the glass surface that allows passage of short-wave solar energy through glass and prevents long-wave energy from escaping. Another example is double-pane glass that reduces conductive and convective heat transfer. There are also double-pane glasses that are gas-filled (usually argon) to further increase the insulating properties of the window.
Cooling, Space Heating	Ceiling Insulation	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation can conserve energy by reducing the heat loss or gain of a building. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose; loose-fill (blown) fiberglass; and rigid polystyrene.

TABLE 2:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – COMMERCIAL

End-Use	Energy Efficiency Measure	Description
Space Heating	Heat Pump Units	Heat pumps heat and cool spaces by moving heat from one place to another. In the summer, they transfer heat from indoor air to air outside the conditioned space. In the winter, they extract heat from outdoor air and deliver it inside. Packaged-thermal heat pumps can be designed to serve a room or multiple zones. Most air-source heat pumps that are installed in commercial buildings are unitary, which means they are pre-engineered and factory- assembled in one or two modules. For this analysis, heat pumps as the primary mechanism for space heating are very rare in the early forecast horizon, due to the fact that air-source heat pumps do not perform well at low temperatures. However, recent advances in low-temperature or "cold-climate" heat pumps could mean that heat pumps will play a larger role in future years.
Ventilation, Cooling	VSD on Fans	The part-load efficiency of ventilation fans can be improved substantially by varying the speed of the motor drive. There are two major types of variable speed controls: mechanical and electronic. An additional benefit of variable-speed controls is the ability to start and stop the motor gradually, thus extending the life of the motor and associated machinery. This analysis assumes that electronic variable speed controls are installed.
Water Heating	Water Heater Systems	Efficient electric water heaters are characterized by a high recovery or thermal efficiency (percentage of delivered electric energy which is transferred to the water) and low standby losses (the ratio of heat lost per hour to the content of the stored water). Included in the savings associated with high-efficiency electric water heaters are timers that allow temperature setpoints to change with hot water demand patterns. For example, the heating element could be shut off throughout the night, increasing the overall energy factor of the unit. In addition, tank and pipe insulation reduces standby losses and therefore reduces the demands on the water heater. This analysis considers conventional electric water heaters with efficiency greater than 96%, as well as heat pump and geothermal heat pump water heaters for effective efficiency greater than one.
Interior Lighting, Exterior Lighting	Lamp Replacement	Commercial lighting differs from the residential sector in that efficiency changes typically require more than the simple purchase and quick installation of a screw-in compact fluorescent lamp. Restrictions regarding ballasts, fixtures, and circuitry limit the potential for direct substitution of one lamp type for another. However, such replacements do exist. For example, during the buildout for a leased office space, the management could decide to replace all T12 lamps and magnetic ballasts with T8/electronic ballast configurations. This type of decision-making is modeled on a stock turnover basis because of the time between opportunities for upgrades.
Interior Lighting, Cooling	Lighting Retrofit	In contrast to lamp replacement, lighting retrofit projects are common in commercial buildings and do not require an event such as a tenant turnover, a major renovation, or an update to electrical circuits to drive its adoption. Rather, a decision-maker can decide at any time to perform a comprehensive audit of a facility's lighting systems, followed by an upgrade of equipment (lamps, ballasts, fixtures, reflectors), controls (occupancy sensors, daylighting controls, central automation). A typical retrofit project can reduce lighting demand by approximately a third, as well as reduce the cooling load because of the reduction in heat generated by inefficient lamps.

TABLE 2:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – COMMERCIAL

End-Use	Energy Efficiency Measure	Description
Interior Lighting, Cooling	Delamping	While sometimes included in lighting retrofit projects, delamping is often performed as a separate energy efficiency measure in which a lighting engineer analyzes the lighting provided by current systems compared to the requirements of building occupants. This often leads to the removal of unnecessary lamps and the corresponding reduction in energy usage.
Interior Lighting, Exterior Lighting	Lighting Timer	While outdoor lighting is typically useful only at night, the requirement to manually switch off the lights leads to many applications where lighting is turned on continuously. A simple timer can set a diurnal schedule for outdoor lighting and thus reduce the operating hours by roughly 50%.
Interior Lighting	Daylighting Controls	The installation of occupancy sensors allows lights to be turned off during periods when a space is unoccupied. Such systems are appropriate for areas with intermittent use, such as conference rooms or bathrooms. There are several types of occupancy sensors in the market.
Interior Lighting	Occupancy Sensor	The installation of occupancy sensors allows lights to be turned off during periods when a space is unoccupied, virtually eliminating the wasted energy due to lights being left on. There are several types of occupancy sensors in the market.
Interior Lighting	LED Exit Lighting	The lamps inside exit signs represent a significant energy end-use, since they usually operate 24 hours per day. Many old exit signs use incandescent lamps, which consume approximately 40 watts per sign. The incandescent lamps can be replaced with LED lamps that are specially designed for this specific purpose. In comparison, the LED lamps consume approximately 2-5 watts.
Interior Lighting	Task Lighting	In commercial facilities, individual work areas can use task lighting instead of brightly lighting the entire area. Significant energy savings can be realized by focusing light directly where it is needed and lowering the general lighting level. An example of task lighting is the common desk lamp. A 25W desk lamp can be installed in place of a typical lamp in a fixture.
Exterior Lighting	Solar Photovoltaic Lighting	Outdoor photovoltaic (PV) lighting systems use PV panels (or modules), which convert sunlight to electricity. The electricity is stored in batteries for use at night. They can be cost effective relative to installing power cables and/or step down transformers for relatively small lighting loads. The "nightly run time" listings on most "off-the-shelf" products are based on specific sunlight conditions. Systems located in places that receive less sunlight than the system is designed for will operate for fewer hours per night than expected. Nightly run times may also vary depending on how clear the sky is on any given day. Shading of the PV panel by landscape features (vegetation, buildings, etc.) will also have a large impact on battery charging and performance. Open areas with no shading, such as parking lots, are ideal places where PV lighting systems can be used.

TABLE 2:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – COMMERCIAL

End-Use	Energy Efficiency Measure	Description
Office Equipment	Personal Computing Equipment	Energy Star labeled office equipment saves energy by powering down and "going to sleep" when not in use. ENERGY STAR labeled computers automatically power down to 15 watts or less when not in use and may actually last longer than conventional products because they spend a large portion of time in a low-power sleep mode. ENERGY STAR labeled computers also generate less heat than conventional models. The ClimateSavers Initiative, made up of leading computer processor manufacturers, has stated a goal of reducing power consumption in active mode by 50% by integrating innovative power management into the chip design process.
Office Equipment	Displays	Energy Star labeled office equipment saves energy by powering down and "going to sleep" when not in use. ENERGY STAR labeled monitors automatically power down to 15 watts or less when not in use.
Office Equipment	Servers	In addition to the "sleep" mode a reductions and the efficient processors being designed by members of the ClimateSavers Initiative, servers have additional energy-saving opportunities through "virtualization" and other architecture solutions that involve optimal matching of computation tasks to hardware requirements
Office Equipment	Printers and Copiers	Energy Star labeled office equipment saves energy by powering down and "going to sleep" when not in use. ENERGY STAR labeled copiers are equipped with a feature that allows them to automatically turn off after a period of inactivity, reducing a copier's annual electricity costs by over 60%. High-speed copiers that include a duplexing unit that is set to automatically make double-sided copies can reduce paper costs by $60 a month and help to save trees.
Refrigeration	Walk-in Refrigeration Systems	Standard compressors typically operate at approximately 65% efficiency. High-efficiency models are available that can improve compressor efficiency by 15%.
Refrigeration	Reach-in Refrigeration Units	In addition to walk-in, "cold-storage" refrigeration, a significant amount of energy in the commercial sector can be attributed to "reach-in" units. These stand-alone appliances can range from a residential-style refrigerator/freezer unit in an office kitchen or the breakroom of a retail store to the refrigerated display cases in some grocery or convenience stores. As in the case of residential units, these refrigerators can be designed to perform at higher efficiency through a combination of compressor equipment upgrades, default temperature settings, and defrost patterns.
Refrigeration	Anti-Sweat Heater Controls	Anti-sweat heaters are used in virtually all low-temperature display cases and many medium-temperature cases to control humidity and prevent the condensation of water vapor on the sides and doors and on the products contained in the cases. Typically, these heaters stay on all the time, even though they only need to be on about half the time. Anti-sweat heater controls can come in the form of humidity sensors or timeclocks.

TABLE 2:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – COMMERCIAL

End-Use	Energy Efficiency Measure	Description
Refrigeration	Floating Head Pressure Controls	Floating head pressure control allows the pressure in the condenser to "float" with ambient temperatures. This method reduces refrigeration compression ratios, improves system efficiency and extends the compressor life. The greatest savings with a floating head pressure approach occurs when the ambient temperatures are low, such as in the winter season. Floating head pressure control is most practical for new installations. However, retrofits installation can be completed with some existing refrigeration systems. Installing floating head pressure control increases the capacity of the compressor when temperatures are low, which may lead to short cycling.
Refrigeration	Glass Doors	Glass doors can be used to enclose multi-deck display cases for refrigerated items in supermarkets. In the past, stores were reluctant to close refrigerated cases because they feared that any obstruction would impede customers from reaching (and buying) refrigerated products.
Refrigeration	Icemakers	In certain building types (restaurant, hotel), the production of ice is a significant usage of electricity. By optimizing the timing of ice production and the type of output to the specific application, icemakers are assumed to deliver a 15% electricity savings.
Food Service	Energy Star Kitchen Equipment	Commercial cooking and food preparation equipment represent a significant contribution to energy consumption in restaurants and other food service applications. By replacing old units with efficient ones, this energy consumption can be greatly reduced. This measure includes fryers, commercial ovens, broilers, and steamers, and embodies savings between 15 and 50 percent, depending on the specific unit being replaced.
Food Service	Kitchen Schedule and Maintenance	Behavioral changes such as starting ovens only when needed as opposed to leaving them on, or properly cleaning and maintaining fryers and broilers, can lead to enhanced operation, energy savings, and longer equipment lifetimes.
Miscellaneous	Efficient Escalators	With significant variation in loads depending on the time of day, many escalator applications could be modified in a relatively straightforward way to obtain significant energy savings. This analysis assumes an average reduction of 12% through the application of controls such as occupancy detectors and the corresponding drive technology
Miscellaneous	Efficient Elevators	In high-rise buildings, elevator consumption can be a large contributor to miscellaneous energy use. While replacement of the elevator units, motors and hardware is almost always impractical, software solutions that alter the dispatching of elevators to best meet building demands can reduce consumption in this area by 6%.

TABLE 2:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – COMMERCIAL

End-Use	Energy Efficiency Measure	Description
Miscellaneous	Vending Miser	Cold beverage vending machines usually operate 24 hours a day regardless of whether the surrounding area are occupied or not. The result is that the vending machine consumes energy unnecessarily, because it will operate all night to keep the beverage cold even when there would be no customer until the next morning. There is a product called the Vending Miser that can reduce energy consumption by 47% without compromising the temperature of the vended product. The Vending Miser uses an infrared sensor to monitor the surrounding area's occupancy and will power down the vending machine when the area is unoccupied. It will also monitor the room's temperature and will re-power the machine at one to three hour intervals independent of occupancy to ensure that the product stays cold. In this analysis, it is assumed that a vending machine normally consumes 3,500 kWh per year, and installing a Vending Miser will reduce the annual electricity consumption by 47%.

TABLE 3:
ENERGY EFFICIENCY MEASURE DESCRIPTIONS – INDUSTRIAL

End-Use	Energy Efficiency Measure	Description
Industrial Process Equip.	Efficient Process Heating	Because of the customized nature of industrial heating applications, a variety of opportunities are summarized in a general improvement of process heating, focusing on electric resistance heating and the injection of RF waves as two electrotechnologies.
Industrial Process Equip.	Motors, Premium Efficiency	Premium efficiency motors reduce the amount of lost energy going into heat rather than power. Since less heat is generated, less energy is needed to cool the motor with a fan. Therefore, the initial cost of energy efficient motors is generally higher than for standard motors. However their life-cycle costs can make them far more economical because of savings they generate in operating expense. Premium efficiency motors can provide savings of 0.5% to 3% over standard motors. The savings results from the fact that energy efficient motors run cooler than their standard counterparts, resulting in an increase in the life of the motor insulation and bearing. In general, an efficient motor is a more reliable motor because there are fewer winding failures, longer periods between needed maintenance, and fewer forced outages. For example, using copper instead of aluminum in the windings, and increasing conductor cross-sectional area, lowers a motor's I2R losses. This analysis assumes 75% loading factor (for peak efficiency) for 1800 rpm motor. Hours of operation vary depending on horsepower size. In addition, improved drives and controls are assumed to be implemented along with the motors, resulting in savings as high as 10% of annual energy consumption
HVAC	General HVAC Improvements	While small in comparison to process usage, HVAC systems at industrial facilities account for a significant amount of energy consumption. Improvements such as those identified in the residential and commercial sectors are assumed to provide a savings of between 9-20% of the typical industrial HVAC energy usage.
Lighting	Efficient Lighting Technologies	Because industrial sites differ from the other sectors and vary widely in terms of facility layout, usage patterns and application, lighting improvements are estimated at a general level to provide savings between 28% (replacing T12 with T8) and 76% (replacing incandescent with CFL).

APPENDIX F-7.

QUALITATIVE SCREEN OF MEASURES

ENERGY EFFICIENCY MEASURE SCREEN -- RESIDENTIAL SECTOR

Row #	End-Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Switching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Avail-ability	Customer Accept	Non-Energy Benefits		
1	Cooling	Air Conditioner - Central, Early Replacement								-		No	Residential customers are likely to change central HVAC equipment only at the end of the equipment's service life or when the equipment breaks down.
2	Cooling	Air Conditioner - Central, Energy Star or better						+	+			Yes	
3	Cooling	Air Conditioner - Central, Maintenance						+	+			Yes	
4	Cooling	Air Conditioner - Central, Ductless Variable Refrigerant Flow										Yes	
5	Cooling	Air Conditioner - Room, Early Replacement						+				Yes	
6	Cooling	Air Conditioner - Room, Energy Star or better						+	+			Yes	
7	Cooling	Air Conditioner - Room, Removal of second unit						+				Yes	
8	Cooling	Air Conditioner, Evaporative Precooler				X						No	This technology functions best in dry climates, and thus it is not appropriate for climate conditions in PECO territory.
9	Cooling	Air Conditioner, Proper Sizing of Equipment						+				Yes	This measure will be analyzed as part of the "Advanced New Contruction Designs" measure (Row 109).
10	Cooling	Attic Fan, Installation										Yes	
11	Cooling	Attic Fan - Photovoltaic, Installation										Yes	
12	Cooling	Ceiling Fan, Installation						+				Yes	
13	Cooling	Dehumidifier						+	+			Yes	
14	Cooling	Natural Ventilation & Cooling						+				Yes	This measure will be analyzed as part of the "Advanced New Contruction Designs" measure (Row 109).
15	Cooling	Thermal Energy Storage						-	-			No	Thermal energy storage is a more appropriate measure for the commercial sector. The market availability of this measure in the residential sector is almost non-existent.
16	Cooling	Trees for Shading					X				+	No	Savings from this measure are indeterminable due to site-specific factors, such as tree type, location, height, building height, etc.
17	Cooling	Whole-House Fan, Installation						+	+			Yes	
18	Heating	Boiler - Gas, High Efficiency						+	+			Yes	This measure will be characterized and analyzed only from the perspective of electric to gas switching (see Row 19).
19	Heating	Boiler - Gas, Retrofit on Electric Heating						+	+			Yes	
20	Heating	Furnace - Gas, High Efficiency						+	+			Yes	This measure will be characterized and analyzed only from the perspective of electric to gas switching (see Row 23).
21	Heating	Furnace - Gas, Maintenance	X					+	+			No	This is a gas-related measure.
22	Heating	Furnace - Gas, Repair/Restore/Replace						+	+			Yes	This measure is for low-income customers that have had their gas service shut off.
23	Heating	Furnace - Gas, Retrofit on Electric Heating						+	+			Yes	
24	Heating	Furnace Fan, Electronically Commutated Motor							-			No	The market availability of this technology for residential sector applications is almost non-existent.
25	Heating	Passive Solar Heating										Yes	This measure will be analyzed as part of the "Advanced New Contruction Designs" measure (Row 109).
26	Heating	Radiant (Infrared) Heating System				X			-			No	This technology is a more appropriate measure for the commercial sector. The market availability of this technology in the residential sector is very low, with the exception of a stand-alone unit used for supplemental heating.
27	Heating / Cooling	Heat Pump - Central, High Efficiency Air Source						+	+			Yes	
28	Heating / Cooling	Heat Pump - Central, Maintenance						+	+			Yes	
29	Heating / Cooling	Heat Pump - Cold Climate Heat Pump										Yes	

Row #	End-Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Swiching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Avail-ability	Customer Accept	Non-Energy Benefits		
30	Heating / Cooling	Heat Pump - Room, High Efficiency Air Source						+	+			Yes	
31	Heating / Cooling	Heat Pump, Geothermal or Water Source						+	+			Yes	
32	HVAC	Ducting, Insulation						+	+			Yes	
33	HVAC	Ducting, Repair and Sealing						+	+			Yes	
34	HVAC	Thermostat, Clock/Programmable						+	+			Yes	
35	Building Envelope	Doors, Storm and Thermal						+	+			Yes	
36	Building Envelope	External Shades or Overhangs/Fins						+				Yes	This measure will be analyzed as part of the "Advanced New Contruction Designs" measure (Row 109).
37	Building Envelope	Infiltration Control (caulk, weather strip, etc.)						+	+			Yes	
38	Building Envelope	Insulation, Aerogel							-			No	Not commercially available.
39	Building Envelope	Insulation, Ceiling						+	+			Yes	
40	Building Envelope	Insulation, Ceiling + Radiant Barrier						+				Yes	
41	Building Envelope	Insulation, Foundation						+	+			Yes	This measure is only applicable in new constructions.
42	Building Envelope	Insulation, Wall Cavity						+	+			Yes	
43	Building Envelope	Insulation, Wall Sheathing						+	+			Yes	This measure is only applicable in new constructions.
44	Building Envelope	Roofs, High Reflectivity (Cool Roofs)						+	+			Yes	
45	Building Envelope	Windows, Aerogel Insulation							-			No	Not commercially available.
46	Building Envelope	Windows, Install reflective film						+	+			Yes	
47	Building Envelope	Windows, High Efficiency/Energy Star						+	+			Yes	
48	Lighting	Compact Fluorescent Lamps						+	+			Yes	
49	Lighting	Compact Fluorescent Lamps, Outdoor						+	+			Yes	
50	Lighting	Fluorescent, T8 Lamps and Fixtures						+	+			Yes	
51	Lighting	Fluorescent, T9 Lamps and Fixtures						+	+			Yes	
52	Lighting	Fluorescent Torchieres						+				Yes	
53	Lighting	Halogen Cap Lamps, Indoors					X	+	+			No	This technology is used in specific lighting applications and usually there are no energy efficiency benefits. For general indoor residential lighting, compact fluorescent lamps are more energy-efficient.
54	Lighting	High Pressure Sodium Lamps, Outdoors						+		-		Yes	
55	Lighting	Incandescent Lamps, Advanced					X					No	Compact fluorescent lamps are more energy-efficient.
56	Lighting	Incandescent Lamps, Advanced - Outdoor					X					No	Compact fluorescent lamps are more energy-efficient.
57	Lighting	Incandescent Lamps, Coated					X					No	Compact fluorescent lamps are more energy-efficient.
58	Lighting	Incandescent Lamps, Reduced-Wattage					X					No	Compact fluorescent lamps are more energy-efficient.
59	Lighting	LED, White										Yes	
60	Lighting	LED, White - Outdoor										Yes	
61	Lighting	Low Pressure Sodium Lamps, Outdoor						+		-		Yes	
62	Lighting	Metal Halide, Outdoor										Yes	
63	Lighting	Outdoor Lighting - Photovoltaic, Installation										Yes	
64	Lighting	Photosensor Control - Lighting, Outdoors						+	+			Yes	

Row #	End-Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Swiching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Avail-ability	Customer Accept	Non-Energy Benefits		
65	Water Heating	Faucet Aerators						+	+		+	Yes	
66	Water Heating	Hot Water System Pumps, High Efficiency				X						No	There is a very low saturation of hot water system pumps used in residences. The water pressure from the mains is sufficient in most homes. Therefore, this measure's contribution to the savings potential is considered to be negligible.
67	Water Heating	Pipe - Hot Water, Insulation						+	+			Yes	
68	Water Heating	Showerheads, Low-Flow						+	+	-	+	Yes	
69	Water Heating	Water Heater - Electric, High-Efficiency						+	+			Yes	
70	Water Heating	Water Heater - Gas, High-Efficiency						+	+			Yes	This measure will be characterized and analyzed only from the perspective of electric to gas switching.
71	Water Heating	Water Heater, Heat Pump										Yes	
72	Water Heating	Water Heater, Ground-Source Heat Pump										Yes	
73	Water Heating	Water Heater, Tank Blanket/Insulation						+	+			Yes	
74	Water Heating	Water Heater - Electric, Tankless				X		+				No	Replacing a standard (tank) electric water heater with an electric tankless water heater will usually result in an increase in electric demand during peak periods.
75	Water Heating	Water Heater - Gas, Tankless						+				Yes	This measure will be characterized and analyzed only from the perspective of electric to gas switching.
76	Water Heating	Water Heater, Thermostat Setback						+	+			Yes	
77	Water Heating	Water Heater, Timer						+	+			Yes	
78	Water Heating	Water Heating, Drainwater Heat Recovery						+	-			Yes	This measure is only applicable in new constructions.
79	Water Heating	Water Heating, Heat Trap		X				+				No	Most water heaters already come with a factory-installed heat trap (one-way valve that prevents unwanted hot water flow out from the tank).
80	Water Heating	Water Heating, Hot Water Storage				X				-		No	There is no peak demand charge for residential customers. It would be difficult to convince customers to implement this measure if they do not save any money by heating their water at non-peak times of the day.
81	Water Heating	Solar Water Heating System										Yes	
82	Appliances	Clothes Dryer Duct Heat Recovery							-			No	This technology is not commercially available.
83	Appliances	Clothes Dryer, Heat Pump						-	-			No	This technology is not commercially available.
84	Appliances	Clothes Dryer - Electric, High Efficiency						+	+			Yes	This measure consists of clothes dryers that are equipped with moisture detection capability.
85	Appliances	Clothes Dryer - Gas, High Efficiency						+	+			Yes	This measure will be characterized and analyzed only from the perspective of electric to gas switching.
86	Appliances	Clothes Dryer, Microwave						-	-			No	This technology is not commercially available. Prototypes encountered problems with metal in clothing, e.g., zippers, metallic thread, etc.
87	Appliances	Clothes Washer, Energy Star or better						+	+			Yes	
88	Appliances	Clothes Washer, Horizontal Axis						+	+			Yes	
89	Appliances	Clothes Washer, Inverter-Drive										Yes	
90	Appliances	Convection Oven - Electric, High Efficiency										Yes	

ENERGY EFFICIENCY MEASURE SCREEN -- RESIDENTIAL SECTOR

Row #	End-Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Switching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Avail-ability	Customer Accept	Non-Energy Benefits		
91	Appliances	Convection Oven - Gas, High Efficiency										Yes	This measure will be characterized and analyzed only from the perspective of electric to gas switching.
92	Appliances	Dishwasher, Energy Star or better						+	+			Yes	
93	Appliances	Freezer, Energy Star or better						+	+			Yes	
94	Appliances	Home Electronics - Copier/Printer, Energy Star						+	+			Yes	
95	Appliances	Home Electronics - DVD/VCR/Audio, Energy Star						+	+			Yes	
96	Appliances	Home Electronics - Monitor, Energy Star						+	+			Yes	
97	Appliances	Home Electronics - Personal Computer, Energy Star						+	+			Yes	
98	Appliances	Home Electronics - Television, Energy Star						+	+			Yes	
99	Appliances	Home Electronics - Television, CEE 2						+	+			Yes	
100	Appliances	Home Electronics, Reduce Standby Wattage						+	+			Yes	
101	Appliances	Induction Stovetop										Yes	
102	Appliances	Range and Oven - Electric, Energy Star or better						+	+			Yes	
103	Appliances	Range and Oven - Gas, Energy Star or better						+	+			Yes	This measure will be characterized and analyzed only from the perspective of electric to gas switching.
104	Appliances	Refrigerator/Freezer, Early replacement										Yes	
105	Appliances	Refrigerator/Freezer, Energy Star or better										Yes	
106	Appliances	Refrigerator/Freezer, Energy Star (Advanced)										Yes	
107	Appliances	Refrigerator/Freezer, Maintenance				x						No	This measure is more appropriate for commercial refrigerators and freezers.
108	Appliances	Refrigerator/Freezer, Removal of secondary unit										Yes	
109	Other	Advanced New Construction Designs										Yes	This measure is only applicable in new constructions.
110	Other	Energy-Efficient Manufactured Homes (New Construction)						+				Yes	This measure is only applicable in new constructions.
111	Other	Energy Star Homes (New Construction)						+				Yes	This measure is only applicable in new constructions.
112	Other	Home Energy Management System										Yes	
113	Other	Microturbine										Yes	
114	Other	Pool, Pump Timer						+	+			Yes	
115	Other	Pool, Solar Heating System										Yes	
116	Other	Smart Appliances						-	-			No	Appliance manufacturers are now beginning to install smart chips into their products. However there is still a limited market that integrates the appliances with the control systems.
117	Other	Smart Powerstrip										Yes	
118	Other	Solar Photovoltaic										Yes	
119	Demand Response	Home Energy Management System w/ Smart T-Stat										Yes	
120	Demand Response	Time-of-use Meters										Yes	
121	Demand Response	AMI Meters										Yes	
122	Demand Response	Air Conditioners, Direct Load Control, Switch										Yes	
123	Demand Response	Air Conditioners, Direct Load Control, PCT										Yes	
124	Demand Response	Water Heaters, Direct Load Control, Switch										Yes	

101 of 124 Measures passed screens

ENERGY EFFICIENCY MEASURE SCREEN -- COMMERCIAL SECTOR

Row #	End-Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Swiching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Avail-ability	Customer Accept	Non-Energy Benefits		
1	Cooling	Air Conditioner - Packaged, High-Efficiency						+				Yes	
2	Cooling	Air Conditioner - Packaged, Ductless Variable Refrigerant Flow										Yes	
3	Cooling	Air Conditioner - Packaged, Maintenance						+	+			Yes	
4	Cooling	Air Conditioner - Room, Energy Star or Better						+	+			Yes	
5	Cooling	Air Conditioner, Proper Sizing of Equipment										Yes	This measure will be analyzed as part of the "Integrated Design Process for New Contruction" measure (Row 108).
6	Cooling	Air Curtain Doors						+				Yes	This measure will be analyzed as part of the "Enclose Loading Docks with Shelters/Seals/Curtains" measure (Row 46).
7	Cooling	Chilled Water, Reset						+	+			Yes	
8	Cooling	Chilled Water, Variable-Flow System						+				Yes	
9	Cooling	Chiller - Air-Cooled, High-Efficiency						+	+			Yes	
10	Cooling	Chiller - Water-Cooled, High-Efficiency						+	+			Yes	
11	Cooling	Chiller, VSD Centrifugal						+				Yes	
12	Cooling	Cooling Tower, High-Efficiency Fans						+	+			Yes	
13	Cooling	Condenser Water, Temperature Reset						+				Yes	
14	Cooling	Economizer, Installation						+				Yes	
15	Cooling	Natural Ventilation & Cooling						+				Yes	This measure will be analyzed as part of the "Advanced New Contruction Designs" measure (Row 103).
16	Cooling	Solar Thermal Absorption Cooling							-			No	This technology is not commercially mature.
17	Cooling	Thermal Energy Storage - Cooling						+	+			Yes	
18	Cooling	Trees for Shading					X				+	No	Savings from this technology are not determinable due to site-specific factors, such as tree type, location, height, building height, etc. Therefore, contribution to technical savings potential cannot be determined.
19	Heating	Boiler - Gas, High Efficiency						+	+			Yes	This measure will be characterized and analyzed only from the perspective of electric to gas switching.
20	Heating	Furnace - Gas, High Efficiency						+	+			Yes	This measure will be characterized and analyzed only from the perspective of electric to gas switching.
21	Heating	Furnace - Gas, Maintenance	X					+	+			No	This is a gas-related measure.
22	Heating	Heat Recovery From Chiller / Refrigeration					X					No	Savings from this technology are not determinable. Site-specific factors such as compressor operation and temperature, compressor location, and condenser loop water temperature can influence savings. Therefore, contribution to the savings potential cannot be determined except in a case-by-case analysis.
23	Heating	Hot Water, Reset						+	+			Yes	
24	Heating	Hot Water, Variable-Flow System						+	+			Yes	
25	Heating	Passive Solar Heating										Yes	This measure will be analyzed as part of the "Advanced New Contruction Designs" measure (Row 103).
26	Heating	Radiant (Infrared) Heating System										Yes	
27	Heating / Cooling	Heat Pump - Air-Source, High-Efficiency						+	+			Yes	The cold climate during the winter may force heat pumps to use auxiliary electric heating, and thus negating any demand savings due to the heat pump itself.

ENERGY EFFICIENCY MEASURE SCREEN – COMMERCIAL SECTOR

Row #	End-Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Swiching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Avail-ability	Customer Accept	Non-Energy Benefits		
28	Heating / Cooling	Heat Pump - Air-Source, Maintenance						+	+			Yes	The cold climate during the winter may force heat pumps to use auxiliary electric heating, and thus negating any demand savings due to the heat pump itself.
29	Heating / Cooling	Heat Pump - Cold Climate Heat Pump										Yes	
30	Heating / Cooling	Heat Pump - Room, High Efficiency						+	+			Yes	
31	Heating / Cooling	Heat Pump, Geothermal or Water Source						+	+			Yes	
32	HVAC	Ducting, Insulation		X				+	+			No	It is already standard practice to install insulation on HVAC ductwork in commercial buildings. A more appropriate measure is to repair and seal old ducting insulation.
33	HVAC	Ducting, Repair and Sealing						+	+			Yes	
34	HVAC	Energy Management System						+				Yes	
35	HVAC	Exhaust Hoods - Cooking, Sensor Control						+				Yes	Assume 3 hp per hood, or 10 hp per establishment
36	HVAC	Fans, Energy-Efficient Motors						+	+			Yes	
37	HVAC	Fans, Variable Speed Control						+	+			Yes	
38	HVAC	Heat Recovery Make-Up Air Units										Yes	An example of this technology is enthalpy wheels used in schools.
39	HVAC	HVAC Retrocommissioning						+				Yes	Covers tune up and maintenance activities, but does not cover installation of new equipment.
40	HVAC	Pumps, High-Efficiency Motor						+	+			Yes	
41	HVAC	Pumps, Variable Speed Control						+				Yes	
42	HVAC	Thermostat, Clock/Programmable						+	+			Yes	
43	HVAC	Variable Air-Volume Systems						+	+			Yes	
44	HVAC	Ventilation, CO2-Controlled										Yes	This measure is similar in concept to having an occupancy sensor for the ventilation system.
45	HVAC	Ventilation, Pre-Conditioned Air										Yes	This measure will be analyzed as part of the "Heat Recovery Make-Up Air Units" measure (Row 38 above).
46	Building Envelope	Enclose Loading Docks with Shelters/Seals/Curtains										Yes	
47	Building Envelope	External Shades or Overhangs/Fins						+	+			Yes	
48	Building Envelope	Insulation, Aerogel							-			No	Not commercially available.
49	Building Envelope	Insulation, Ceiling						+	+			Yes	
50	Building Envelope	Insulation, Ceiling + Radiant Barrier						+				Yes	
51	Building Envelope	Insulation, Wall Cavity						+	+			Yes	
52	Building Envelope	Roofs, High Reflectivity (Cool Roofs)						+	+			Yes	
53	Building Envelope	Windows, Aerogel Insulation							-			No	Not commercially available.
54	Building Envelope	Windows, High Efficiency						+	+			Yes	For the commercial sector, this measure is likely to be appropriate only in new constructions.
55	Lighting	Compact Fluorescent Fixtures						+	+			Yes	
56	Lighting	Compact Fluorescent Lamps						+	+			Yes	
57	Lighting	Compact Fluorescent Lamps, Outdoor						+	+			Yes	
58	Lighting	Daylighting Controls, Outdoors						+	+			Yes	
59	Lighting	Fluorescent, Delamp and Install Reflectors						+	+			Yes	

ENERGY EFFICIENCY MEASURE SCREEN – COMMERCIAL SECTOR

Row #	End-Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Swiching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Avail-ability	Customer Accept	Non-Energy Benefits		
60	Lighting	Fluorescent, High Bay Fixtures						+	+			Yes	
61	Lighting	Fluorescent, T5 Lamps and Fixtures*						+				Yes	
62	Lighting	Fluorescent, T8 Lamps and Fixtures*						+	+			Yes	
63	Lighting	Fluorescent, Super T8 Lamps and Fixtures*						+				Yes	
64	Lighting	Halogen Cap Lamps, Indoors					X	+				No	This technology is used in specific lighting applications and usually there are no energy efficiency benefits. For general residential lighting applications, compact fluorescent lamps are more energy-efficient.
65	Lighting	High-Pressure Sodium Lamps						+	+	-		Yes	
66	Lighting	Incandescent Lamps, Advanced				X				-		No	Compact fluorescent lamps are more energy-efficient and appropriate in commercial building applications.
67	Lighting	Incandescent Lamps, Advanced - Outdoor				X				-		No	Compact fluorescent lamps are more energy-efficient and appropriate in commercial building applications.
68	Lighting	LED, White						+		-		Yes	
69	Lighting	LED, White - Outdoor						+		-		Yes	
70	Lighting	LED Exit Lighting						+	+			Yes	
71	Lighting	LED Street Lighting										Yes	
72	Lighting	LED Traffic Lights						+	+			Yes	
73	Lighting	Lighting Retrocommissioning						+	+			Yes	
74	Lighting	Low Pressure Sodium Lamps, Outdoor						+	+			Yes	
75	Lighting	Metal Halide, Outdoor						+	+			Yes	
76	Lighting	Metal Halide Lighting with Pulse Start						+	+			Yes	
77	Lighting	Microwave sulfur lamps (with light guides)							-			No	This technology is not commercially mature.
78	Lighting	Occupancy Sensors						+	+			Yes	
79	Lighting	Outdoor Lighting - Photovoltaic, Installation (parking lots)						+				Yes	
80	Lighting	Task Lighting						+				Yes	
81	Lighting	Time Clocks and Timers (lighting)						+	+			Yes	
82	Water Heating	Faucet Aerators and Low Flow Nozzles						+	+		+	Yes	
83	Water Heating	Pipe - Hot Water, Insulation						+	+			Yes	
84	Water Heating	Water Heater - Electric, High-Efficiency						+	+			Yes	
85	Water Heating	Water Heater - Electric, Tankless				X		+	+			No	Replacing a standard (tank) electric water heater with an electric tankless water heater will usually result in an increase in electric demand during peak periods.
86	Water Heating	Water Heater - Gas, High-Efficiency						+	+			Yes	This measure will be characterized and analyzed only from the perspective of electric to gas switching.
87	Water Heating	Water Heater - Gas, Tankless						+				Yes	This measure will be characterized and analyzed only from the perspective of electric to gas switching.
88	Water Heating	Water Heater, Heat Pump										Yes	This technology is only applicable to small commercial buildings.
89	Water Heating	Water Heater, Ground-Source Heat Pump										Yes	
90	Water Heating	Water Heater, Install Timer				X		+	+			No	This technology is more appropriate for residential buildings.
91	Water Heating	Water Heater, Tank Blanket/Insulation						+	+			Yes	
92	Water Heating	Water Heater, Thermostat Setback				X						No	This technology is more appropriate for residential buildings.

ENERGY EFFICIENCY MEASURE SCREEN -- COMMERCIAL SECTOR

Row #	End-Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Swiching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Avail-ability	Customer Accept	Non-Energy Benefits		
93	Water Heating	Water Heating, Chiller Heat Recovery					X					No	Savings from this technology are not determinable. Site-specific factors such as total hot water use and temperature, water heater size and location, and chiller condenser loop water temperature can influence savings. Therefore, contribution to the savings potential cannot be determined except in a case-by-case analysis.
94	Water Heating	Water Heating, Heat Trap		X				+				No	Most water heaters already come with a factory-installed heat trap (one-way valve that prevents unwanted hot water flow out from the tank).
95	Water Heating	Water Heating, Hot Water Storage										Yes	
96	Water Heating	Solar Water Heating System						+				Yes	
97	Refrigeration	Compressor, High-Efficiency						+	+			Yes	
98	Refrigeration	Compressor, Multi-plex						+				Yes	
99	Refrigeration	Controls, Anti-Sweat Heater						+				Yes	
100	Refrigeration	Controls, Floating Head Pressure						+				Yes	
101	Refrigeration	Glass Doors, Installation						+				Yes	
102	Refrigeration	Walk-In Strip Curtains, Installation					X					No	Savings from this technology are not determinable due to site-specific factors such as store clerk behavior regarding door closing and the presence of doors on the display side of the box. Therefore, contribution to the savings potential cannot be determined except in a case-by-case analysis.
103	Other	Advanced New Construction Designs										Yes	
104	Other	Hotel Guestroom Controls (occupancy)						+				Yes	
105	Other	Comprehensive Retrocommissioning										Yes	
106	Other	Cooking Equipment, High Efficiency						+				Yes	
107	Other	Icemaker, High Efficiency						+				Yes	
108	Other	Integrated Design Process for New Construction						+				Yes	
109	Other	Office Electronics - Copier/Printer, Energy Star						+				Yes	
110	Other	Office Electronics - Copier/Printer, Supersavers						+				Yes	
111	Other	Office Electronics - Monitor, Energy Star						+				Yes	
112	Other	Office Electronics - Monitor, Supersavers						+				Yes	
113	Other	Office Electronics - Personal Computer, Energy Star						+				Yes	
114	Other	Office Electronics - Personal Computer, ClimateSavers						+				Yes	
115	Other	Office Electronics - Personal Computer, Supersavers						+				Yes	
116	Other	Office Electronics - Server, Energy Star						+				Yes	
117	Other	Office Electronics - Server, Supersavers						+				Yes	
118	Other	Office Electronics - Other Electronics, Energy Star						+				Yes	
119	Other	Office Electronics - Other Electronics, Supersavers						+				Yes	
120	Other	Partition Variations / Workstation Layout					X					No	Savings from this technology are not determinable due to site-specific factors, including ceiling height, window area, lighting type and wiring, and ability to fine control lighting. Therefore, contribution to the savings potential cannot be determined except in a case-by-case analysis.
121	Other	Powerstrip with Occupancy Sensor (Smart Powerstrip)										Yes	
122	Other	Vending Machine, High Efficiency						+				Yes	
123	Demand Response	Energy Management System, Central HVAC (w/ Smart T-Stat)						+				Yes	
124	Demand Response	Energy Management System, Packaged HVAC (w/ Smart T-Stat)						+				Yes	

ENERGY EFFICIENCY MEASURE SCREEN -- COMMERCIAL SECTOR

Row #	End-Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Swiching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Avail-ability	Customer Accept	Non-Energy Benefits		
125	Demand Response	Lighting, Dimmer Control System						+				Yes	
126	Demand Response	AMI Meters						+				Yes	
127	Demand Response	Real-Time Meters						+				Yes	
128	Demand Response	Air Conditioners, Direct Load Control, Switch						+				Yes	
129	Demand Response	Air Conditioners, Direct Load Control, PCT						+				Yes	
130	Demand Response	Water Heaters, Direct Load Control, Switch						+				Yes	
131	Demand Response	Direct Load Control, Other End-Uses						+				Yes	
132	Distributed Generation	Fuel Cells										Yes	
133	Distributed Generation	Microturbines						+				Yes	
134	Distributed Generation	Photovoltaics						+				Yes	
135	Distributed Generation	Reciprocating Engine Generators						+	+			Yes	

* Includes package of electronic ballast.

117 of 135 Measures passed screens

ENERGY EFFICIENCY MEASURE SCREEN -- INDUSTRIAL SECTOR

Row #	End Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Switching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Availability	Customer Accept	Non-Energy Benefits		
1	Process Heating	Direct-Arc Melting			X		X					No	Fuel switching measure: process heating is traditionally provided by gas or other fuel. Switching to electricity-based process heating will increase the peak demand. Also, savings are site-specific.
2	Process Heating	Direct-Resistance Melting			X		X					No	Fuel switching measure: process heating is traditionally provided by gas or other fuel. Switching to electricity-based process heating will increase the peak demand. Also, savings are site-specific.
3	Process Heating	Electron Beam Heating			X		X					No	Fuel switching measure: process heating is traditionally provided by gas or other fuel. Switching to electricity-based process heating will increase the peak demand. Also, savings are site-specific.
4	Process Heating	Heat Cascading			X		X					No	Fuel switching measure: process heating is traditionally provided by gas or other fuel. Switching to electricity-based process heating will increase the peak demand. Also, savings are site-specific.
5	Process Heating	Heat Recovery										Custom Measure	Savings from this technology are site-specific due to process and/or heat loads. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
6	Process Heating	Heat Transformers			X		X					No	Fuel switching measure: process heating is traditionally provided by gas or other fuel. Switching to electricity-based process heating will increase the peak demand. Also, savings are site-specific.
7	Process Heating	Autothermal Reforming			X		X					No	Fuel switching measure: process heating is traditionally provided by gas or other fuel. Switching to electricity-based process heating will increase the peak demand. Also, savings are site-specific.
8	Process Heating	Industrial Process Heat Pumps			X		X					No	Fuel switching measure: process heating is traditionally provided by gas or other fuel. Switching to electricity-based process heating will increase the peak demand. Also, savings are site-specific.
9	Process Heating	Induction Curing			X		X					No	Fuel switching measure: process heating is traditionally provided by gas or other fuel. Switching to electricity-based process heating will increase the peak demand. Also, savings are site-specific.
10	Process Heating	Process Heat Recovery										Custom Measure	Savings from this technology are site-specific due to process and/or heat loads. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
11	Process Heating	Induction Heating			X		X					No	Fuel switching measure: process heating is traditionally provided by gas or other fuel. Switching to electricity-based process heating will increase the peak demand. Also, savings are site-specific.
12	Process Heating	Infrared Drying and Curing			X		X					No	Fuel switching measure: process heating is traditionally provided by gas or other fuel. Switching to electricity-based process heating will increase the peak demand. Also, savings are site-specific.
13	Process Heating	Insulated Surfaces			X		X					No	Savings are site specific, and therefore cannot be estimated for the purposes of this study.
14	Process Heating	Microwave Heating			X		X					No	Fuel switching measure: process heating is traditionally provided by gas or other fuel. Switching to electricity-based process heating will increase the peak demand. Also, savings are site-specific.
15	Process Heating	Radio Frequency			X		X					No	Fuel switching measure: process heating is traditionally provided by gas or other fuel. Switching to electricity-based process heating will increase the peak demand. Also, savings are site-specific.
16	Refrigeration	Speed Control: Variable Frequency Drive						+	+			Custom Measure	Savings from this technology are site-specific. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.

ENERGY EFFICIENCY MEASURE SCREEN – INDUSTRIAL SECTOR

Row #	End Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Switching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Availability	Customer Accept	Non-Energy Benefits		
17	Refrigeration	Speed Control: Magnetic Adjustable Speed Drives						+	+			Custom Measure	Savings from this technology are site-specific. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
18	Refrigeration	Repair Refrigerant Leak										Custom Measure	Savings from this technology are site-specific. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
19	Refrigeration	High Efficiency Refrigeration						+	+			Custom Measure	Savings from this technology are site-specific. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
20	Boilers	High-Pressure Condensate Return System										Custom Measure	Savings from this technology are site-specific due to the capacity of the boiler, makeup water needs, and process temperatures. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
21	Boilers	Speed Control: Variable Frequency Drive						+	+			Custom Measure	Savings from this technology are site-specific. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
22	Boilers	Speed Control: Magnetic Adjustable Speed Drives						+	+			Custom Measure	Savings from this technology are site-specific. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
23	Air Compressor	Compressor Replacement						+	+			Custom Measure	Savings from this technology are site-specific. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
24	Air Compressor	Air leak Reduction										Custom Measure	Savings from this technology are site-specific. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.

ENERGY EFFICIENCY MEASURE SCREEN – INDUSTRIAL SECTOR

Row #	End Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Switching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Availability	Customer Accept	Non-Energy Benefits		
25	Air Compressor	Waste Heat Recovery from Air Compressors										Custom Measure	Savings from this technology are site-specific due to process or conditioning heat loads as well as compressor type and size. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
26	Air Compressor	Compressed Air System Improvements										Custom Measure	Savings from this technology are site-specific due to the type and extent of the improvements. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
27	Air Compressor	Piping Retrofits										Custom Measure	Savings from this technology are site-specific due to the capacity of the current system, pipe length and diameter, and compressor efficiency. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
28	Air Compressor	Filter Changes										Custom Measure	Savings from this technology are site-specific due to frequency of changes, system capacity, and intake air quality. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
29	Air Compressor	Pressure Controls/Reductions										Custom Measure	Savings from this technology are site-specific due to system pressure fluctuations, pressure needs, and system storage. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
30	Air Compressor	Purge Controls for Desiccant Dryers										Custom Measure	Savings from this technology are site-specific due to ambient temperature and humidity and site air requirements. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
31	Air Compressor	Sequencers										Custom Measure	Savings from this technology are site-specific due to compressor capacities and system air requirements. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
32	Air Compressor	System Optimization										Custom Measure	Savings from this measure are site-specific due to the type and extent of the optimization. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
33	HVAC	Cooling Tower, High-Efficiency Fans						+				Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
34	HVAC	Speed Control: Variable Frequency Drive						+	+			Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.

ENERGY EFFICIENCY MEASURE SCREEN – INDUSTRIAL SECTOR

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			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Switching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Ventilable or Indeterminable Savings	Tech. Maturity	Market Availability	Customer Accept	Non-Energy Benefits		
35	HVAC	Speed Control: Magnetic Adjustable Speed Drives						+	+			Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
36	HVAC	Cooling Tower Efficiency Improvements						+				Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
37	HVAC	Clock/Programmable Thermostat										Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
38	HVAC	Duct Insulation		X				+	+			No	It is already standard practice to install insulation on HVAC ductwork. A more appropriate measure is to repair and seal old ducting insulation.
39	HVAC	Chilled Water Reset										Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
40	HVAC	Duct Repair and Sealing						+	+			Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
41	HVAC	Energy Management System						+				Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
42	Building Envelope	Roofs, High Reflectivity (Cool Roofs)						+	+			Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
43	Lighting	Daylighting Controls - Outdoors						+				Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
44	Lighting	T5/Electronic Ballasts										Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
45	Lighting	T8/Electronic Ballasts						+	+			Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
46	Lighting	Halogen Lamps: Indoor					X	+				No	This technology is used in specific lighting applications and usually there are no energy efficiency benefits. For general residential lighting applications, compact fluorescent lamps are more energy-efficient.
47	Lighting	High-Intensity Discharge Lamps						+				Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
48	Lighting	High-Pressure Sodium Lamps						+				Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
49	Lighting	LED Exit Lighting						+	+			Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
50	Lighting	Super T8 Fluorescent Lamps						+				Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
51	Lighting	Time Clocks and Timers (lighting)						+	+			Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
52	Industry-Specific Processes	Electrolysis - Membrane Separation										Custom Measure	Savings from this technology are site-specific. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
53	Industry-Specific Processes	Fine Bubble Diffusers										Custom Measure	Savings from this technology are site-specific. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.

ENERGY EFFICIENCY MEASURE SCREEN -- INDUSTRIAL SECTOR

Row #	End Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Switching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Availability	Customer Accept	Non-Energy Benefits		
54	Industry-Specific Processes	Furnace Upgrades										Custom Measure	Savings from this technology are site-specific due to existing furnace output, fuel type, efficiency, age, and heating requirements. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
55	Industry-Specific Processes	Sludge Reduction Techniques										Custom Measure	Savings from this technology are site-specific. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
56	Industry-Specific Processes	Efficient Baghouses										Custom Measure	Savings from this technology are site-specific. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
57	Industry-Specific Processes	Soil Moisture Monitoring and Services										Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
58	Industry-Specific Processes	Ultrasonic Cleaning										Custom Measure	Savings from this technology are site-specific. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
59	Industry-Specific Processes	Water Management System Improvements						+		+	+	Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
60	Industry-Specific Processes	Speed Control: Variable Frequency Drive						+	+			Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
61	Industry-Specific Processes	Speed Control: Magnetic Adjustable Speed Drives						+	+			Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
62	Industry-Specific Processes	Chilled Water Pipe Insulation										Custom Measure	Savings will depend on piping length and diameter, chilled water temperature, ambient air temperature, etc. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.

ENERGY EFFICIENCY MEASURE SCREEN – INDUSTRIAL SECTOR

Row #	End Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Switching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Availability	Customer Accept	Non-Energy Benefits		
63	Industry-Specific Processes	Steam and Hot Water Pipe Insulation										Custom Measure	Savings will depend on piping length and diameter, hot water/steam temperature, ambient air temperature, etc. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
64	Industry-Specific Processes	Electrolytic			X							No	This process heating is traditionally provided by gas. Switching to electricity-based process heating will increase the peak demand.
65	Industry-Specific Process	Microwave Dryer			X							No	This process heating is traditionally provided by gas. Switching to electricity-based process heating will increase the peak demand.
66	Industry-Specific Process	Milkhouse Heat Reclaimer										Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
67	Industry-Specific Process	Automatic Milker Takeoffs										Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
68	Industry-Specific Process	Variable Speed Vacuum Pumps										Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
69	Industry-Specific Process	Tractor Heater Timers										Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
70	Industry-Specific Process	Low-Pressure Irrigation										Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
71	Industry-Specific Process	Livestock Waterer										Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
72	Industry-Specific Process	Milk Precoolers										Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.

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Row #	End Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Switching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Availability	Customer Accept	Non-Energy Benefits		
73	Other	Comprehensive System-Level Optimization						+	+			Custom Measure	Savings from this measure are site-specific due to the type and extent of the optimization. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
74	Other	Efficient Fans						+	+			Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
75	Other	Fan Flow Control						+				Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
76	Other	Irrigation Improvements										Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
77	Other	High Efficiency Material Handling Systems										Custom Measure	Savings from this technology are site-specific due to the nature of the materials and the system. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
78	Other	Motor Downsizing										Custom Measure	Savings from this technology are site-specific due to how much a motor can be downsized without affecting the process or drive. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
79	Other	Proper Motor Sizing										Custom Measure	Savings from this technology are site-specific due to the process, drive, and slack conditions in the system. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
80	Other	Motor Rewind Training/Standards										Custom Measure	Savings from this technology are site-specific due to what standards a shop is already rewinding motors to and how many times a given motor has been rewound. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
81	Other	Steam Trap Maintenance	X									No	This is a gas-related measure.

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82	Other	Power Factor Improvements										Custom Measure	Savings from this technology are site-specific due to existing power factor conditions. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
83	Other	Process Optimization (DO monitors)										Custom Measure	Savings from this technology are site-specific due to existing conditions, the flexibility for changes in the process, and process characteristics. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
84	Other	Pumping System Optimization										Custom Measure	Savings from this technology are site-specific due to existing conditions, the flexibility for changes in the process, and process characteristics. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
85	Process Equipment	Premium Efficiency Motors						+	+			Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
86	Process Equipment	Speed Control: Variable Frequency Drive						+	+			Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
87	Process Equipment	Speed Control: Magnetic Adjustable Speed Drives						+	+			Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
88	Demand Response	Energy Management System, Central HVAC (w/ Smart T-Stat)						+				Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
89	Demand Response	Energy Management System, Packaged HVAC (w/ Smart T-Stat)						+				Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
90	Demand Response	Lighting, Dimmer Control System						+				Yes	The savings and cost of this measure will be characterized as part of the commercial sector measure analysis.
91	Demand Response	Load Control Relay Switch										Yes	
92	Demand Response	Time-of-use Meters						+				Yes	
93	Demand Response	AMI Meters						+				Yes	
94	Distributed Generation	Fuel Cells										Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.

ENERGY EFFICIENCY MEASURE SCREEN – INDUSTRIAL SECTOR

Row #	End Use	Energy Efficiency Measure	Inapplicability Screen					Qualitative Screen				Pass Inapplicability and Qualitative Screens?	Comments
			Gas-Related Measure	Already Widely Implemented or Required by Code	Requires Fuel Switching (gas to electric)	Bad Match to Local Conditions, etc.	Non-Verifiable or Indeterminable Savings	Tech. Maturity	Market Availability	Customer Accept	Non-Energy Benefits		
95	Distributed Generation	Microturbines						+				Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
96	Distributed Generation	Photovoltaics						+				Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.
97	Distributed Generation	Reciprocating Engine Generators						+	+			Custom Measure	Savings from this technology are site-specific and industry-dependent. Therefore, this measure should be a "custom measure" that is evaluated on a case-by-case basis in a Custom Rebates Program. We plan to include this type of measure in a "top-down" approach in analyzing the savings potential in each industrial segment (by end-use) instead of attempting to characterize the impacts and costs at the per-measure level.

79 of 97 Measures passed screens

APPENDIX F-8.

ECONOMIC SCREEN OF MEASURES

ENERGY EFFICIENCY MEASURE SCREEN -- INDUSTRIAL SECTOR

Row #	End Use	Energy Efficiency Measure	Pass Inapplicability and Qualitative Screens?	Pass Economic Screen?	Comments
1	Process Heating	Direct-Arc Melting	No		
2	Process Heating	Direct-Resistance Melting	No		
3	Process Heating	Electron Beam Heating	No		
4	Process Heating	Heat Cascading	No		
5	Process Heating	Heat Recovery	Custom Measure		
6	Process Heating	Heat Transformers	No		
7	Process Heating	Autothermal Reforming	No		
8	Process Heating	Industrial Process Heat Pumps	No		
9	Process Heating	Induction Curing	No		
10	Process Heating	Process Heat Recovery	Custom Measure		
11	Process Heating	Induction Heating	No		
12	Process Heating	Infrared Drying and Curing	No		
13	Process Heating	Insulated Surfaces	No		
14	Process Heating	Microwave Heating	No		
15	Process Heating	Radio Frequency	No		
16	Refrigeration	Speed Control: Variable Frequency Drive	Custom Measure		
17	Refrigeration	Speed Control: Magnetic Adjustable Speed Drives	Custom Measure		
18	Refrigeration	Repair Refrigerant Leak	Custom Measure		

Row #	End Use	Energy Efficiency Measure	Pass Inapplicability and Qualitative Screens?	Pass Economic Screen?	Comments
19	Refrigeration	High Efficiency Refrigeration	Custom Measure		
20	Boilers	High-Pressure Condensate Return System	Custom Measure		
21	Boilers	Speed Control: Variable Frequency Drive	Custom Measure		
22	Boilers	Speed Control: Magnetic Adjustable Speed Drives	Custom Measure		
23	Air Compressor	Compressor Replacement	Custom Measure		
24	Air Compressor	Air leak Reduction	Custom Measure		
25	Air Compressor	Waste Heat Recovery from Air Compressors	Custom Measure		
26	Air Compressor	Compressed Air System Improvements	Custom Measure		
27	Air Compressor	Piping Retrofits	Custom Measure		
28	Air Compressor	Filter Changes	Custom Measure		
29	Air Compressor	Pressure Controls/Reductions	Custom Measure		
30	Air Compressor	Purge Controls for Desiccant Dryers	Custom Measure		
31	Air Compressor	Sequencers	Custom Measure		
32	Air Compressor	System Optimization	Custom Measure		
33	HVAC	Cooling Tower, High-Efficiency Fans	Yes	Yes	Efficient HVAC
34	HVAC	Speed Control: Variable Frequency Drive	Yes	Yes	Efficient HVAC
35	HVAC	Speed Control: Magnetic Adjustable Speed Drives	Yes	Yes	Efficient HVAC
36	HVAC	Cooling Tower Efficiency Improvements	Yes	Yes	Efficient HVAC
37	HVAC	Clock/Programmable Thermostat	Yes	Yes	Efficient HVAC
38	HVAC	Duct Insulation	No		
39	HVAC	Chilled Water Reset	Yes	Yes	Efficient HVAC
40	HVAC	Duct Repair and Sealing	Yes	Yes	Efficient HVAC
41	HVAC	Energy Management System	Yes	Yes	Efficient HVAC

Row #	End Use	Energy Efficiency Measure	Pass Inapplicability and Qualitative Screens?	Pass Economic Screen?	Comments
42	Building Envelope	Roofs, High Reflectivity (Cool Roofs)	Yes	N/A	
43	Lighting	Daylighting Controls - Outdoors	Yes	Yes	Efficient Lighting
44	Lighting	T5/Electronic Ballasts	Yes	Yes	Efficient Lighting
45	Lighting	T8/Electronic Ballasts	Yes	Yes	Efficient Lighting
46	Lighting	Halogen Lamps: Indoor	No		
47	Lighting	High-Intensity Discharge Lamps	Yes	Yes	Efficient Lighting
48	Lighting	High-Pressure Sodium Lamps	Yes	Yes	Efficient Lighting
49	Lighting	LED Exit Lighting	Yes	Yes	Efficient Lighting
50	Lighting	Super T8 Fluorescent Lamps	Yes	Yes	Efficient Lighting
51	Lighting	Time Clocks and Timers (lighting)	Yes	Yes	Efficient Lighting
52	Industry-Specific Processes	Electrolysis - Membrane Separation	Custom Measure		
53	Industry-Specific Processes	Fine Bubble Diffusers	Custom Measure		
54	Industry-Specific Processes	Furnace Upgrades	Custom Measure		
55	Industry-Specific Processes	Sludge Reduction Techniques	Custom Measure		
56	Industry-Specific Processes	Efficient Baghouses	Custom Measure		
57	Industry-Specific Processes	Soil Moisture Monitoring and Services	Custom Measure		
58	Industry-Specific Processes	Ultrasonic Cleaning	Custom Measure		
59	Industry-Specific Processes	Water Management System Improvements	Custom Measure		

Row #	End Use	Energy Efficiency Measure	Pass Inapplicability and Qualitative Screens?	Pass Economic Screen?	Comments
60	Industry-Specific Processes	Speed Control: Variable Frequency Drive	Custom Measure		
61	Industry-Specific Processes	Speed Control: Magnetic Adjustable Speed Drives	Custom Measure		
62	Industry-Specific Processes	Chilled Water Pipe Insulation	Custom Measure		
63	Industry-Specific Processes	Steam and Hot Water Pipe Insulation	Custom Measure		
64	Industry-Specific Processes	Electrolytic	No		
65	Industry-Specific Process	Microwave Dryer	No		
66	Industry-Specific Process	Milkhouse Heat Reclaimer	Custom Measure		
67	Industry-Specific Process	Automatic Milker Takeoffs	Custom Measure		
68	Industry-Specific Process	Variable Speed Vacuum Pumps	Custom Measure		
69	Industry-Specific Process	Tractor Heater Timers	Custom Measure		
70	Industry-Specific Process	Low-Pressure Irrigation	Custom Measure		
71	Industry-Specific Process	Livestock Waterer	Custom Measure		

ENERGY EFFICIENCY MEASURE SCREEN -- INDUSTRIAL SECTOR

Row #	End Use	Energy Efficiency Measure	Pass Inapplicability and Qualitative Screens?	Pass Economic Screen?	Comments
72	Industry-Specific Process	Milk Precoolers	Custom Measure		
73	Other	Comprehensive System-Level Optimization	Custom Measure		
74	Other	Efficient Fans	Custom Measure		
75	Other	Fan Flow Control	Custom Measure		
76	Other	Irrigation Improvements	Custom Measure		
77	Other	High Efficiency Material Handling Systems	Custom Measure		
78	Other	Motor Downsizing	Custom Measure		
79	Other	Proper Motor Sizing	Custom Measure		
80	Other	Motor Rewind Training/Standards	Custom Measure		
81	Other	Steam Trap Maintenance	No		
82	Other	Power Factor Improvements	Custom Measure		
83	Other	Process Optimization (DO monitors)	Custom Measure		
84	Other	Pumping System Optimization	Custom Measure		
85	Process Equipment	Premium Efficiency Motors	Custom Measure		
86	Process Equipment	Speed Control: Variable Frequency Drive	Custom Measure		
87	Process Equipment	Speed Control: Magnetic Adjustable Speed Drives	Custom Measure		
88	Demand Response	Energy Management System, Central HVAC (w/ Smart T-Stat)	Yes	N/A	
89	Demand Response	Energy Management System, Packaged HVAC (w/ Smart T-Stat)	Yes	N/A	

ENERGY EFFICIENCY MEASURE SCREEN -- INDUSTRIAL SECTOR

Row #	End Use	Energy Efficiency Measure	Pass Inapplicability and Qualitative Screens?	Pass Economic Screen?	Comments
90	Demand Response	Lighting, Dimmer Control System	Yes	N/A	
91	Demand Response	Load Control Relay Switch	Yes	N/A	
92	Demand Response	Time-of-use Meters	Yes	N/A	
93	Demand Response	AMI Meters	Yes	N/A	
94	Distributed Generation	Fuel Cells	Custom Measure		
95	Distributed Generation	Microturbines	Custom Measure		
96	Distributed Generation	Photovoltaics	Custom Measure		
97	Distributed Generation	Reciprocating Engine Generators	Custom Measure		
			79 of 97	16 of 23	Measures passed screens (Not including custom measu

*Some measures were not modeled in LoadMAP but treated as part of the program analysis. Reasons for excluding measures range from fuel choice (LoadMAP only models electricity) to programmatic approach (LoadMAP is built to model energy efficiency and does not include renewable energy or demand response).

Residential – New Construction – Non-Equipment Measures					
End Use	Measure	Savings (kWh)	Cost	Lifetime	BC Ratio
Cooling	Programmable Thermostat	378	$ 96.97	15	6.6
Cooling	AC Maintenance	-	$ 203.39	7	-
Cooling	Infiltration Control	219	$ 300.00	12	1.2
Cooling	Duct Repair	805	$ 423.74	14	3.1
Cooling	External Shades	375	$1,728.84	15	0.4
Cooling	Storm Doors	67	$ 152.54	12	0.7
Cooling	Reflective Roof	98	$ 167.00	25	1.6
Cooling	Radiant Barrier	16	$ 781.94	12	0.0
Cooling	Duct Insulation	162	$ 211.87	20	1.6
Cooling	High Efficiency Windows	765	$ 952.00	20	1.9
Cooling	Ceiling Insulation	109	$ 234.00	25	1.2
Cooling	Wall Insulation	131	$ 100.00	25	3.3
Cooling	Foundation Insulation	31	$ 793.23	20	0.1
Cooling	Ceiling Fan	226	$ 220.34	15	2.1
Cooling	Whole-House Fan	148	$ 274.58	18	1.2
Cooling	Dehumidifier	33	$ 169.49	12	0.3
Cooling	Attic Fan	7	$ 81.78	18	0.2
Space Heating	Programmable Thermostat	378	$ 96.97	12	6.6
Space Heating	HP Maintenance	375	$ 254.24	7	1.3
Space Heating	Infiltration Control	219	$ 300.00	12	1.2
Space Heating	Duct Repair	805	$ 423.74	14	3.1
Space Heating	Storm Doors	67	$ 152.54	12	0.7
Space Heating	Ceiling Insulation	109	$ 234.00	25	1.2
Space Heating	High Efficiency Windows	765	$ 952.00	20	1.9
Space Heating	Duct Insulation	162	$ 211.87	20	1.6
Space Heating	Wall Insulation	131	$ 100.00	25	3.3
Space Heating	Foundation Insulation	31	$ 793.23	20	0.1
Water Heating	Pipe Insulation	138	$ 20.34	15	10.5
Water Heating	Faucet Aerators	90	$ 8.47	20	20.0
Water Heating	Low-Flow Showerheads	476	$ 40.68	15	18.1
Water Heating	Drainwater Heat Recovery	208	$ 667.38	14	0.5
Interior Lighting	Lighting Timer	53	$ 42.37	8	1.3
Interior Lighting	Occupancy Sensor	96	$ 145.00	15	1.1
Exterior Lighting	Photosensors	14	$ 76.27	8	0.2
Exterior Lighting	Motion Detectors	19	$ 61.02	15	0.5
Exterior Lighting	Lighting Timer	11	$ 61.02	15	0.3
Electronics	Reduce Standby Wattage	54	$ 0.21	8	262.8
Electronics	SmartPlug	85	$ 38.14	8	2.3
Miscellaneous	Pool Pump Timer	293	$ 135.60	15	3.5

Residential – Existing Construction – Non-Equipment Measures					
End Use	Measure	Savings (kWh)	Cost	Lifetime	BC Ratio
Cooling	Programmable Thermostat	362	$ 96.97	15	6.3
Cooling	AC Maintenance	175	$ 186.44	7	1.1
Cooling	Infiltration Control	184	$ 271.19	12	1.1
Cooling	Duct Repair	771	$ 423.74	14	2.9
Cooling	External Shades	298	$2,593.26	15	0.2
Cooling	Storm Doors	20	$ 152.54	12	0.2
Cooling	Reflective Roof	78	$1,313.25	25	0.2
Cooling	Radiant Barrier	39	$ 781.94	12	0.1
Cooling	Duct Insulation	144	$ 423.74	20	0.7
Cooling	High Efficiency Windows	318	$2,134.00	20	0.3
Cooling	Ceiling Insulation	98	$2,603.45	25	0.1
Cooling	Wall Insulation	30	$2,118.68	20	0.0
Cooling	Foundation Insulation	118	$1,586.46	20	0.2
Cooling	Ceiling Fan	170	$ 220.34	15	1.6
Cooling	Whole-House Fan	111	$ 274.58	18	0.9
Cooling	Dehumidifier	156	$ 169.49	12	1.6
Cooling	Attic Fan	4	$ 81.78	18	0.1
Space Heating	Programmable Thermostat	362	$ 96.97	12	6.3
Space Heating	HP Maintenance	359	$ 254.24	7	1.2
Space Heating	Infiltration Control	184	$ 300.00	12	1.1
Space Heating	Duct Repair	771	$ 423.74	14	2.9
Space Heating	Storm Doors	20	$ 152.54	12	0.2
Space Heating	Ceiling Insulation	98	$2,603.45	25	0.1
Space Heating	High Efficiency Windows	318	$2,134.00	20	0.3
Space Heating	Duct Insulation	144	$ 423.74	20	0.7
Space Heating	Wall Insulation	30	$2,118.68	20	0.0
Space Heating	Foundation Insulation	118	$1,586.46	15	0.2
Water Heating	Pipe Insulation	192	$ 152.54	15	1.9
Water Heating	Faucet Aerators	125	$ 20.34	20	11.6
Water Heating	Low-Flow Showerheads	659	$ 81.36	20	15.3
Water Heating	Drainwater Heat Recovery	288	$ 889.84	15	0.5
Interior Lighting	Lighting Timer	162	$ 42.37	8	3.9
Interior Lighting	Occupancy Sensor	292	$ 216.95	15	2.2
Exterior Lighting	Photosensors	36	$ 76.27	8	0.5
Exterior Lighting	Motion Detectors	50	$ 61.02	15	1.3
Exterior Lighting	Lighting Timer	29	$ 61.02	15	0.7
Electronics	Reduce Standby Wattage	63	$ 0.21	8	305.0
Electronics	SmartPlug	98	$ 38.14	8	2.6
Miscellaneous	Pool Pump Timer	311	$ 135.60	15	3.7

Commercial – Existing Construction – Non-Equipment Measures					
End Use	Measure	Savings (kWh)	Cost	Lifetime	BC Ratio
Cooling	Dual Enthalpy Economizer	0.405	$ 0.25	10	2.02
Cooling	EMS	0.496	$ 0.27	14	2.89
Cooling	VSD on Fans	0.379	$ 0.59	16	1.13
Cooling	Programmable Thermostat	0.257	$ 0.13	11	2.40
Cooling	VSD on Water Pump	0.196	$ 0.15	20	2.67
Cooling	Water Temperature Reset	0.614	$ 0.15	15	6.87
Cooling	Cool Roof	0.045	$ 0.62	15	0.12
Cooling	Duct Insulation	0.074	$ 0.87	15	0.14
Cooling	Duct Testing and Sealing	0.180	$ 0.47	15	0.64
Cooling	Efficient Windows	0.152	$ 8.75	25	0.04
Cooling	External Shades	0.112	$ 0.15	10	0.93
Cooling	Roof Insulation	0.045	$ 1.50	15	0.05
Cooling	Wall Insulation	0.114	$ 0.97	15	0.14
Cooling	Advanced Design	1.585	$ 2.90	25	1.32
Cooling	HVAC Retrocommissioning	0.423	$ 0.25	7	1.54
Space Heating	Dual Enthalpy Economizer	0.405	$ 0.25	15	2.02
Space Heating	EMS	0.496	$ 0.36	14	2.89
Space Heating	Programmable Thermostat	0.257	$ 0.13	11	2.40
Space Heating	Duct Insulation	0.074	$ 0.87	15	0.14
Space Heating	Efficient Windows	0.152	$ 8.75	25	0.04
Space Heating	Roof Insulation	0.045	$ 1.50	15	0.05
Space Heating	Wall Insulation	0.114	$ 0.87	15	0.14
Space Heating	Advanced Design	1.585	$ 2.90	25	1.32
Space Heating	HVAC Retrocommissioning	0.423	$ 0.25	7	1.54
Interior Lighting	Daylighting Controls	0.332	$ 0.15	10	2.07
Interior Lighting	Lighting Timers Indoors	0.304	$ 0.02	10	14.23
Interior Lighting	Occupancy Sensors	0.342	$ 0.26	8	1.04
Interior Lighting	LED Exit Lighting	0.030	$ 0.04	10	0.71
Interior Lighting	Task Lighting	0.331	$ 0.24	5	0.77
Interior Lighting	Advanced Design	1.585	$ 2.90	25	1.32
Interior Lighting	De-lamp	0.571	$ 0.49	6	0.74
Interior Lighting	Lighting Retrofit	1.444	$ 0.89	6	1.06
Exterior Lighting	Lighting Timers	0.029	$ 0.02	10	1.29
Exterior Lighting	Outdoor Lighting - Photovoltaic, Installation (parking lots)	0.073	$ 0.92	5	0.04
Refrigeration	Anti-Sweat Heater Controls	0.108	$ 0.50	12	0.23
Refrigeration	Floating Head Pressure Controls	0.180	$ 0.15	15	1.52
Refrigeration	Icemakers	0.180	$ 0.10	15	2.28
Refrigeration	Glass Doors	0.090	$ 1.10	10	0.08
Ventilation	VSD on Fans	0.379	$ 0.59	16	1.13
Miscellaneous	Efficient Elevators	0.637	$ 0.46	10	1.30
Miscellaneous	Efficient Escalators	0.382	$ 0.35	10	1.03
Miscellaneous	Vending Miser	0.425	$ 0.02	10	19.97
Cooling	Lighting Retrofit	1.444	$ 0.89	6	1.06

Commercial – New Construction – Non-Equipment Measures					
End Use	Measure	Savings (kWh)	Cost	Lifetime	BC Ratio
Cooling	Dual Enthalpy Economizer	0.314	$ 0.25	10	1.56
Cooling	EMS	0.393	$ 0.36	14	1.70
Cooling	VSD on Fans	0.261	$ 0.59	16	0.78
Cooling	Programmable Thermostat	0.224	$ 0.13	11	2.04
Cooling	VSD on Water Pump	0.165	$ 0.15	20	2.26
Cooling	Water Temperature Reset	0.212	$ 0.15	15	2.37
Cooling	Cool Roof	0.035	$ 0.11	15	0.53
Cooling	Duct Insulation	0.062	$ 0.77	15	0.14
Cooling	Duct Testing and Sealing	0.139	$ 0.47	15	0.50
Cooling	Efficient Windows	0.130	$ 2.66	25	0.10
Cooling	External Shades	0.087	$ 0.15	10	0.72
Cooling	Roof Insulation	0.039	$ 1.25	15	0.05
Cooling	Wall Insulation	0.124	$ 0.87	15	0.17
Cooling	Advanced Design	1.300	$ 2.90	25	1.06
Cooling	HVAC Retrocommissioning	0.347	$ 0.25	7	1.24
Space Heating	Dual Enthalpy Economizer	0.314	$ 0.25	15	1.56
Space Heating	EMS	0.393	$ 0.36	14	1.70
Space Heating	Programmable Thermostat	0.224	$ 0.13	11	2.04
Space Heating	Duct Insulation	0.062	$ 0.77	15	0.14
Space Heating	Efficient Windows	0.130	$ 2.66	25	0.10
Space Heating	Roof Insulation	0.039	$ 1.25	15	0.05
Space Heating	Wall Insulation	0.124	$ 0.87	15	0.17
Space Heating	Advanced Design	1.300	$ 2.90	25	1.06
Space Heating	HVAC Retrocommissioning	0.347	$ 0.25	7	1.24
Interior Lighting	Daylighting Controls	0.242	$ 0.15	10	1.51
Interior Lighting	Lighting Timers Indoors	0.222	$ 0.02	10	10.36
Interior Lighting	Occupancy Sensors	0.249	$ 0.26	8	0.76
Interior Lighting	LED Exit Lighting	0.022	$ 0.04	10	0.52
Interior Lighting	Task Lighting	0.241	$ 0.24	5	0.56
Interior Lighting	Advanced Design	1.300	$ 2.90	25	1.06
Interior Lighting	De-lamp	0.692	$ 0.49	6	0.90
Interior Lighting	Lighting Retrofit	1.056	$ 0.89	6	0.78
Exterior Lighting	Lighting Timers	0.021	$ 0.02	10	0.93
Exterior Lighting	Outdoor Lighting - Photovoltaic, Installation (parking lots)	0.053	$ 0.92	5	0.03
Refrigeration	Anti-Sweat Heater Controls	0.100	$ 0.50	12	0.22
Refrigeration	Floating Head Pressure Controls	0.167	$ 0.15	15	1.41
Refrigeration	Icemakers	0.167	$ 0.10	15	2.11
Refrigeration	Glass Doors	0.083	$ 1.10	10	0.07
Ventilation	VSD on Fans	0.261	$ 0.59	16	0.78
Miscellaneous	Efficient Elevators	0.632	$ 0.35	10	1.70
Miscellaneous	Efficient Escalators	0.379	$ 0.35	10	1.02
Miscellaneous	Vending Miser	0.421	$ 0.02	10	19.80
Cooling	Lighting Retrofit	1.056	$ 0.89	6	0.78

Residential Equipment Measures						
End Use	Technology	Measure	First Year Savings (kWh)	Cost	Lifetime	BC Ratio
Cooling	Central AC	SEER 14	153.9	$174.01	14	1.88
Cooling	Central AC	SEER 15	212.0	$369.78	14	1.22
Cooling	Central AC	SEER 16	260.8	$1,080.55	14	0.51
Cooling	Central AC	SEER 18	338.5	$1,910.73	14	0.38
Cooling	Central AC	SEER 20	355.2	$2,640.18	14	0.29
Cooling	Central AC	Ductless VRF	556.7	$4,839.43	14	0.24
Cooling	Room AC	EER 10.2	80.9	$117.25	10	1.14
Cooling	Room AC	EER 10.8	116.8	$200.85	10	0.96
Cooling	Room AC	EER 11	165.5	$450.44	10	0.61
Cooling	Room AC	EER 11.5	180.5	$600.58	10	0.50
Space Heating	Heat Pump	HSPF=9.3; SEER=14	439.1	$649.26	12	0.97
Space Heating	Heat Pump	HSPF=12.0; SEER=18	882.7	$3,268.69	12	0.39
Space Heating	Heat Pump	GSHP	1,484.5	$10,638.36	12	0.20
Water Heating	Water Heater	EF=0.93	78.4	$44.94	14	2.83
Water Heating	Water Heater	HP COP=2	1,138.4	$1,246.11	14	1.48
Water Heating	Water Heater	Solar	1,805.9	$6,218.11	14	0.47
Water Heating	Water Heater	GSHP Desuperheater	2,167.0	$21,435.10	14	0.16
Interior Lighting	Screw-in	Halogen	30.6	$38.37	6	0.71
Interior Lighting	Screw-in	Advanced Incandescent	750.6	$108.26	6	6.19
Interior Lighting	Screw-in	CFL	1,707.6	$50.34	6	30.27
Interior Lighting	Screw-in	HID	1,843.7	$182.50	6	9.02
Interior Lighting	Screw-in	LED	2,081.7	$3,303.08	6	0.56
Interior Lighting	Linear Fluorescent	T8	33.7	$2.21	6	13.58
Interior Lighting	Linear Fluorescent	T5	108.2	$93.35	6	1.03
Exterior Lighting	Screw-in	Halogen	4.5	$1.99	4	1.42
Exterior Lighting	Screw-in	Advanced Incandescent	109.5	$8.70	4	7.94
Exterior Lighting	Screw-in	CFL	249.0	$4.05	4	38.84
Exterior Lighting	Screw-in	HID	268.9	$23.08	4	7.36
Exterior Lighting	Screw-in	LED	303.6	$265.73	4	0.72
Appliances	Refrigerator	Efficient	52.8	$37.52	13	2.26
Appliances	Refrigerator	Energy Star	113.0	$97.58	13	1.86
Appliances	Refrigerator	Super Efficient	150.7	$225.95	13	1.07
Appliances	Refrigerator	Multiple Drawers	226.1	$377.32	13	0.96
Appliances	Freezer	Efficient	66.9	$17.69	13	6.07
Appliances	Freezer	Energy Star	99.6	$35.39	13	4.52
Appliances	Freezer	Compact	132.2	$445.89	13	0.48
Appliances	Clothes Washer	Energy Star	31.0	$29.44	11	1.49
Appliances	Clothes Washer	Horizontal Axis	37.8	$536.24	11	0.10
Appliances	Clothes Dryer	Moisture Sensor	54.7	$53.24	14	1.74
Appliances	Clothes Dryer	Efficient	81.8	$134.98	14	1.03
Appliances	Clothes Dryer	Heat Pump	272.6	$662.79	14	0.70
Appliances	Dishwasher	Efficient	80.4	$0.61	11	188.37
Appliances	Dishwasher	Energy Star	113.2	$1.60	11	100.61
Appliances	Cooking	Efficient	36.3	$2.05	18	35.94
Electronics	Personal Computer	Energy Star	39.2	$1.32	4	19.68
Electronics	Personal Computer	ClimateSavers	87.6	$0.00	4	N/A
Electronics	Color TV	Energy Star	61.0	$0.62	11	140.47
Electronics	Other Electronics	Efficient	105.0	$0.70	6	133.63
Miscellaneous	Furnace Fan	ECM	71.0	$0.70	18	204.20

Commercial Equipment Measures						
End Use	Technology	Measure	First Year Savings (kWh)	Cost	Lifetime	BC Ratio
Cooling	Central Chiller	1.23 kW/ton	0.19	$0.10	14	3.42
Cooling	Central Chiller	1.11 kW/ton	0.52	$1.17	14	0.79
Cooling	Central Chiller	0.96 kW/ton	0.65	$2.01	14	0.57
Cooling	Central Chiller	0.85 kW/ton	0.73	$2.43	14	0.53
Cooling	Central Chiller	VRF	1.02	$3.40	14	0.52
Cooling	Packaged AC	EER = 8.9	0.19	$0.31	14	1.08
Cooling	Packaged AC	EER = 10.1	0.67	$0.91	14	1.29
Cooling	Packaged AC	EER = 11	0.96	$1.52	14	1.11
Cooling	Packaged AC	Ductless VRF	1.38	$3.65	14	0.66
Cooling	Room AC	EER 10.2	0.17	$0.23	14	1.31
Cooling	Room AC	EER 10.8	0.41	$0.64	14	1.12
Cooling	Room AC	EER 11	0.48	$1.40	14	0.60
Cooling	Room AC	EER 11.5	0.65	$1.94	14	0.59
Cooling	Room AC	Advanced Tech	1.32	$0.00	14	
Space Heating	Heat Pump	COP=3.0	0.12	$0.04	25	4.97
Space Heating	Heat Pump	COP=3.2	0.22	$0.23	25	1.72
Space Heating	Heat Pump	COP=3.6	0.38	$0.39	25	1.81
Space Heating	Heat Pump	Geothermal HP	0.99	$3.20	25	0.57
Ventilation	Ventilation	Variable Air Volume	0.39	$0.08	14	8.89
Water Heating	Water Heater	EF=0.93	0.02	$0.02	14	1.21
Water Heating	Water Heater	HP COP=2	0.13	$0.84	14	0.19
Water Heating	Water Heater	Solar	0.44	$3.04	14	0.18
Water Heating	Water Heater	GSHP Desuperheater	0.60	$12.21	14	0.06
Interior Lighting	Interior Lighting	Halogen	0.18	$0.02	14	12.64
Interior Lighting	Interior Lighting	Advanced Incandescent	5.03	$0.03	14	235.27
Interior Lighting	Interior Lighting	T12	9.42	$0.56	14	26.00
Interior Lighting	Interior Lighting	CFL	10.06	$2.50	14	6.24
Interior Lighting	Interior Lighting	T8	10.52	$0.00	14	148,080.26
Interior Lighting	Interior Lighting	HID	10.87	$1.99	14	8.45
Interior Lighting	Interior Lighting	T5	11.35	$1.10	14	15.97
Interior Lighting	Interior Lighting	LED	11.53	$5.45	14	3.28
Exterior Lighting	Exterior Lighting	Halogen	0.01	$0.02	14	0.54
Exterior Lighting	Exterior Lighting	Advanced Incandescent	0.25	$0.03	14	10.04
Exterior Lighting	Exterior Lighting	T12	0.47	$0.56	14	1.11
Exterior Lighting	Exterior Lighting	CFL	0.50	$2.50	14	0.27
Exterior Lighting	Exterior Lighting	T8	0.53	$0.00	14	6,318.57
Exterior Lighting	Exterior Lighting	HID	0.54	$1.99	14	0.36
Exterior Lighting	Exterior Lighting	T5	0.57	$1.10	14	0.68
Exterior Lighting	Exterior Lighting	LED	0.58	$5.45	14	0.14
Office Equipment	PC	Energy Star	0.15	$0.01	18	21.06
Office Equipment	PC	ClimateSavers	0.22	$0.02	18	15.87
Office Equipment	Server	Energy Star	0.13	$0.01	18	18.26
Office Equipment	Server	ClimateSavers	0.34	$0.02	18	24.47
Office Equipment	Monitor	Energy Star	0.16	$0.01	14	19.56
Office Equipment	Printer/Copier	Energy Star	0.05	$0.01	14	5.91
Refrigeration	Walk-in Refrigeration	Efficient	1.17	$25.69	14	0.06
Refrigeration	Reach-in Refrigeration	Efficient	0.46	$0.03	18	21.80