KANSAS CITY POWER AND LIGHT
FINAL REPORT
C&I ENERGY EFFICIENCY MEASURES POTENTIAL STUDY

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ACKNOWLEDGEMENTS

This study was a collaborative effort between Summit Blue and KCPL, and the following KCP&L personnel were key contributors:

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E. EXECUTIVE SUMMARY

This section of the report provides a high-level overview of the project methodology and results.

E.1 Introduction and Overall Methodology

Kansas City Power and Light (KCP&L) hired Summit Blue Consulting (Summit Blue) and Energy Insights in January 2007 to conduct a commercial and industrial (C&I) energy efficiency potential study. This study was requested to help fulfill the goals of the DSM aspects of KCP&L's Comprehensive Energy Plan.

Study Strategy and Tactics

This project was conducted in two phases. Phase I was completed in March 2007 and included the following elements:

1. An avoided cost study, for both residential customers and C&I customers.

2. Baseline market profiles for large and small office buildings, education, and manufacturing.

3. A market potential study for energy efficiency for the C&I sector, based on the results of Summit Blue's DSM benchmarking analysis.

Phase II of the study was completed in July 2007 and included:

1. Baseline market profiles for communications, health care, retail, grocery, entertainment, printing, data centers, petroleum, utilities, warehouses, lodging, churches, restaurants, apartments, and transportation.

2. Characterization of C&I energy efficiency measures, including energy and peak demand savings, lifetimes, and costs.

3. DSMore benefit-cost analysis for the C&I energy efficiency measures.

4. Technical, economic, and market energy efficiency potential estimates.

E.2 DSM Benchmarking and Best Practices Assessment

Data and information were collected for 2005 DSM program results for twenty-five utilities and energy agencies in five regions—the US Midwest, Northeast, Southeast, West, as well as Canada. This analysis of DSM program results normalized the reported total program results for utility or agency size, sales to major customer class, and currency, where necessary.

The achievement of significant DSM savings is influenced by several factors, including the regulatory environment under which utilities and agencies operate, whether DSM funds are provided through systems benefits charges, how the issue of lost revenues is addressed, the provision of financial incentives for DSM performance, etc. British Columbia, California, Iowa,

Minnesota, New York, and Vermont all achieved about 1% or more reduction in annual energy sales due to DSM programs in 2005.

All states achieving high DSM savings either set significant mandated goals for utilities' DSM programs or use public benefits funds to implement DSM programs. Other success factors include financial incentives for cost-effective DSM (Minnesota, Vermont), adjustments for lost revenues caused by DSM programs (California), and use of the TRC test or societal test for cost-effectiveness rather than the RIM test (British Columbia, California, Iowa, Minnesota, New York, Vermont).

Table E-1 shows the median results for DSM spending, savings, and costs overall for the C&I customer sector for all organizations.

Table E-1. Medians for Overall Results

Spending as % of Revenue	Energy Savings as % of Sales	Demand Savings as % of Peak Demand	Cost of Savings	
			$/kWh	$/kW
1.0%	0.5%	0.5%	0.16	803

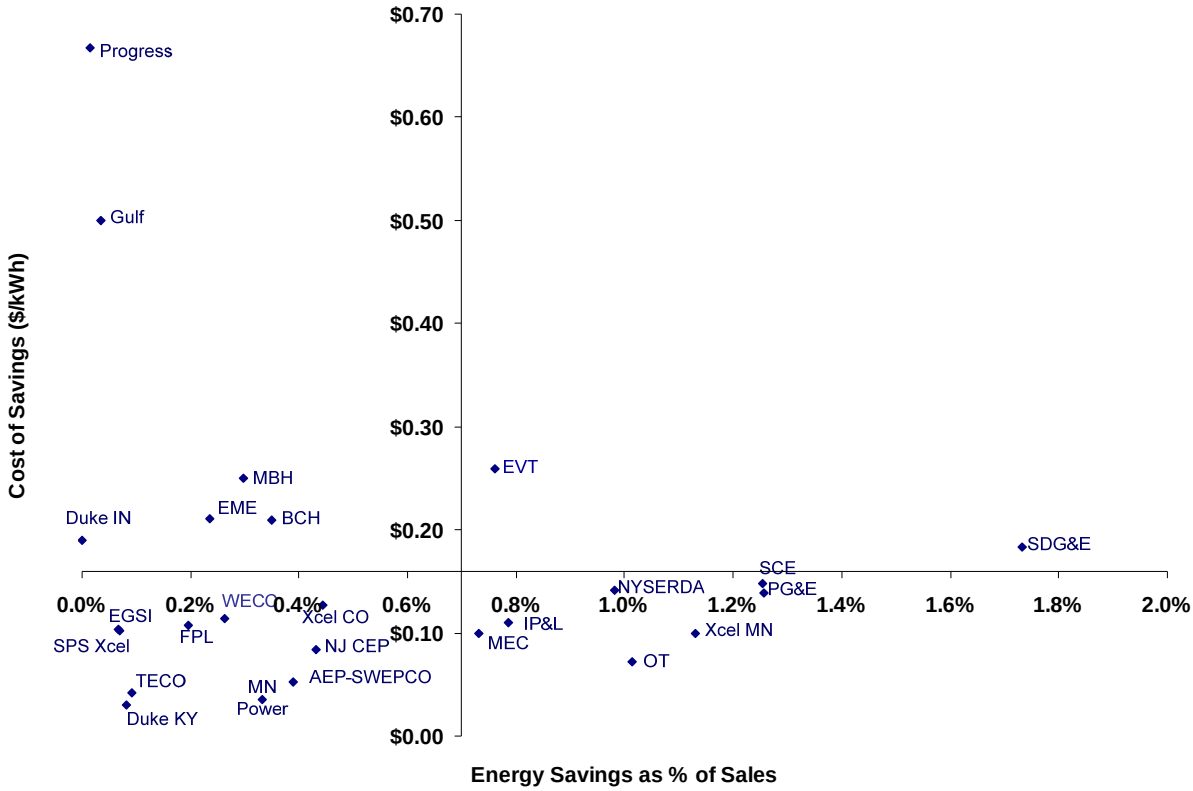
Utilities with the highest spending rates are San Diego Gas & Electric (SDG&E) and Manitoba Hydro at 2.2% - 3.1% of revenues. In the Midwest, Xcel Energy (MN), Interstate Power and Light, and Otter Tail Power have the highest DSM spending as a percentage of revenue at 1.3% - 2.0% of revenues.

SDG&E has the highest energy savings as a percentage of sales at about 1.7%. In the Midwest, Xcel Energy (MN), Interstate Power and Light, and Otter Tail have the highest percentage of savings rates at 0.8% -1.1% of sales. Duke Energy Kentucky, Minnesota Power, and Tampa Electric achieved the lowest cost of energy savings at $0.03 to $0.04 per first year kWh saved.

SDG&E, Interstate Power & Light, Xcel Energy (MN), and NYSERDA have the highest demand savings as a percent of peak demand at 1.2% - 1.5% of baseline C&I peak demands. Duke Energy Kentucky and Minnesota Power have the lowest costs of conserved demand at $97/kW and $333/kW respectively.

The scatter plot below portrays the utility energy savings and costs of conserved energy graphically.

Figure E-1. Scatter Plot of C&I Energy Savings and First Year Costs ($/kWh)



E.3 Avoided Cost Analysis

Summaries of the approaches taken to produce avoided costs and some of the results are presented here:

Avoided capacity costs are calculated with a capacity spreadsheet model. There are three cases in the model – low, base, and high peak demand – and each case has a "with EE" and "without EE" scenario. The difference in NPV of capital costs between the two scenarios for each case gives the avoided costs, presented as levelized $/kW-yr. A weighted average of the three cases is calculated to give a final single value, as shown in Table E-2.

Table E-2. Summary of Capacity Model Results

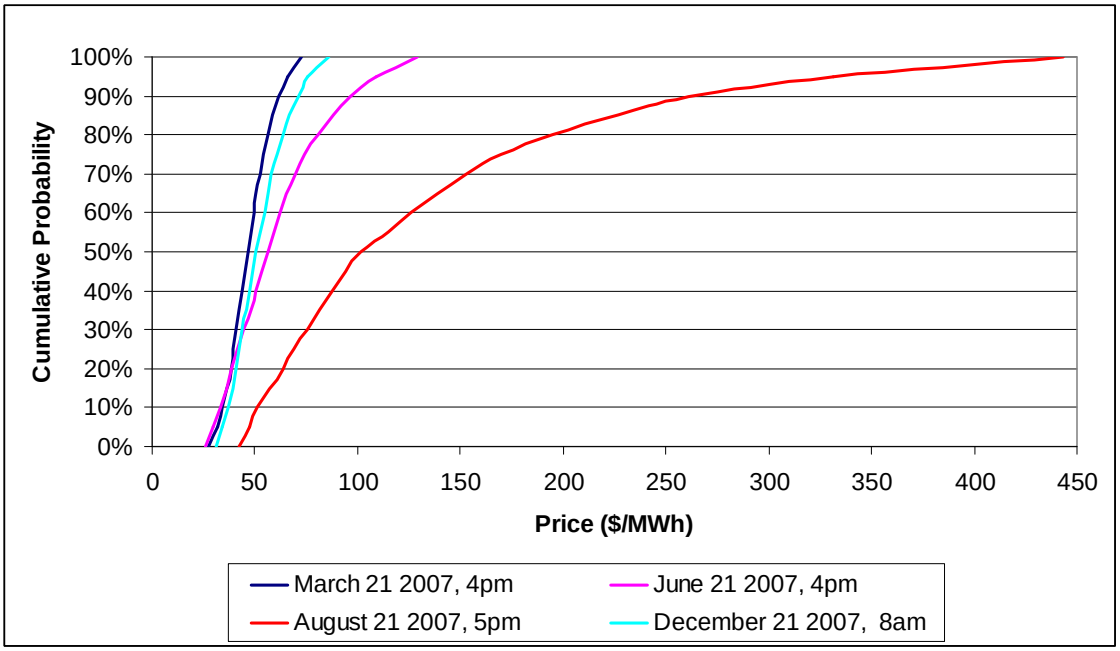
Case	Probability	Annualized NPV Savings	Annualized MW from EE	Mean	5%	95%	Std. Dev.
Low Demand	15%	$6,092,293	85.1	$71.57	64.59	78.69	4.29
Base Demand	55%	$9,624,582	88.0	$109.32	89.59	129.74	12.13
High Demand	30%	$11,930,391	89.9	$132.75	113.95	151.80	11.46
Weighted Average				110.69	93.15	128.70	10.75

Source: Final KCP&L Avoided Capacity Model.xls

Avoided energy costs are derived from the MIDAS market prices, in $/MWh. These prices are adjusted to reflect the fact that a proportion of energy is sold by the system, and then formatted into unique probability distributions for each hour of the year. These distributions represent the 35 cases of price drivers run through the model. Three sets of these distributions will be produced. The values in the 2nd and 3rd sets will be adjusted to reflect the mid CO2 and high CO2 cases from the CO2 MIDAS runs.

As the final data set of avoided energy costs is large (distributions for 8760 hours times 20 years), it is not possible to show the data in this report. Instead, four sample hours are shown here to give an idea of the spread of prices in the 35 values for one hour (Note: these prices have not yet been adjusted to reflect energy sales). Figure E-2 below shows cumulative probability for four different hours and the range of possible prices for those hours.

Figure E-2. Cumulative Probability for Ranges of Prices, for Four Different Hours



E.4 Baseline Energy Consumption Profiles

KCP&L supplied considerable input data for this task including customer counts and billing data by market segment and sales forecasts for the Company's overall commercial and industrial customer sectors. Other data sources included Energy Insights' proprietary Energy Market Profiles data, available to KCP&L through their Load Analysis Strategies subscription. Table E-3 below shows end use consumption estimates for small office buildings, an example of the results from a Phase I market segment.

Table E-3. Small Office Energy Consumption Profile

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	24.6%	4.07	1.00	31.5
Space Cooling	90.1%	2.50	2.26	70.8
Water Heating	54.5%	0.59	0.32	10.1
Ventilation	100.0%	0.36	0.36	11.4
Cooking	1.5%	0.19	0.00	0.1
Lighting	100.0%	2.81	2.81	88.2
Refrigeration	5.1%	0.09	0.00	0.1
Office Equipment (PC)	89.4%	1.30	1.16	36.5
Office Equipment (non-PC)	100.0%	3.13	3.13	98.0
Other Uses	100.0%	5.87	5.87	184.1
Total			16.92	530.7

E.5 DSM Measure Characterization and DSMore Benefit-Cost Analysis Results

Summit Blue evaluated 33 C&I DSM measures for possible inclusion in KCP&L's DSM portfolio. Representative and common examples of each technology type, such as compact fluorescent lamps, were analyzed. The majority of measures evaluated were cost effective from each of the four main California stakeholder perspectives considered. All analyses were done using the DSMore benefit-cost analysis model, and the analyses were conducted on a net present value basis over the lifetime of the measures.

1. The utility test (UT): measures are cost effective from this perspective if the avoided costs caused by the measures' energy and demand savings is greater than the utility DSM program costs to promote the measure, including customer rebates.

2. The total resource cost (TRC) test: measures are cost effective from this perspective if their avoided costs are greater than the sum of the measure costs and the DSM program administrative costs.

3. The rate impact (RIM) test: measures are cost effective from this perspective if their avoided costs are greater than the sum of the DSM program costs and the "lost revenues" caused by the measure.

4. The participant test: measures are cost effective from this perspective if the reduced electric costs to the participating customer from the measure exceed the after-rebate cost of the measure to the customer.

KCP&L decided to treat the TRC test as the main cost effectiveness test for this project. The RIM test is a more restrictive test that is only used as the main DSM benefit-cost test in very few states.[1] Only one to three measures analyzed did not pass the TRC test for one or more market segments.

The number of C&I measures by end use were:

- Thirteen lighting energy efficiency measures.
- Nine HVAC and controls energy efficiency measures.
- Five efficient refrigeration measures.
- Three custom and efficient motors measures.
- Three hot water energy efficiency measures.

Almost all of the C&I measures analyzed passed each of the utility, TRC, and RIM tests, so they were almost all considered to be cost effective, and applicable to KCP&L's C&I DSM program portfolio. Additional DSM measures beyond the 30 or so analyzed are expected to be covered by a KCP&L's Custom Rebate program.

E.6 DSM Potential Results

The total estimated commercial and industrial energy efficiency potential over the 20 year forecast period is about 2,300 GWh and 510 peak MW. Slightly more than half of this energy efficiency potential is projected to come from energy efficient lighting products, about 20% is projected to come from energy efficient HVAC equipment and controls, and about 25% of the total potential is expected to come from custom and motors measures. The total C&I energy efficiency potential amounts to approximately 17% of KCP&L's forecast 2028 C&I energy consumption of about 13,700 GWh. This is equal to an annual average energy savings of about 115 GWh, or 1.2% of KCP&L's forecast 2007 C&I sales. The peak demand reduction potential is about 19% of KCP&L's forecast 2028 C&I peak demand of 2,700 MW. The total C&I energy efficiency program costs over the 20-year forecast period are estimated at about $220 million, or about $11 million per year on average.

[1] Florida and Georgia, for example, require DSM programs to pass the RIM test.

Table E-4. Summary and Five Year DSM Potential

Commercial	20 Year Total	2008	2009	2010	2011	2012
Lighting						
Achievable Potential Demand Savings (kW)	307,746	3,077	6,155	12,310	15,387	16,926
Achievable Potential Energy Savings (kWh)	1,267,173,588	12,671,736	25,343,472	50,686,944	63,358,679	69,694,547
Measure Costs	$228,317,854	$2,283,179	$4,566,357	$9,132,714	$11,415,893	$12,557,482
Program Costs	$123,098,333	$1,230,983	$2,461,967	$4,923,933	$6,154,917	$6,770,408
HVAC						
Achievable Potential Demand Savings (kW)	145,384	1,454	2,908	5,815	7,269	7,996
Achievable Potential Energy Savings (kWh)	433,712,894	4,337,129	8,674,258	17,348,516	21,685,645	23,854,209
Measure Costs	$67,918,370	$679,184	$1,358,367	$2,716,735	$3,395,919	$3,735,510
Program Costs	$51,742,915	$517,429	$1,034,858	$2,069,717	$2,587,146	$2,845,860
Refrigeration						
Achievable Potential Demand Savings (kW)	220	2	4	9	11	12
Achievable Potential Energy Savings (kWh)	22,881,940	228,819	457,639	915,278	1,144,097	1,258,507
Measure Costs	$2,088,118	$20,881	$41,762	$83,525	$104,406	$114,847
Program Costs	$867,032	$8,670	$17,341	$34,681	$43,352	$47,687
Water Heating						
Achievable Potential Demand Savings (kW)	100	1	2	4	5	6
Achievable Potential Energy Savings (kWh)	1,295,571	12,956	25,911	51,823	64,779	71,256
Measure Costs	$150,991	$1,510	$3,020	$6,040	$7,550	$8,305
Program Costs	$30,081	$301	$602	$1,203	$1,504	$1,654
Custom						
Achievable Potential Demand Savings (kW)	58,163	582	1,163	2,327	2,908	3,199
Achievable Potential Energy Savings (kWh)	538,912,472	5,389,125	10,778,249	21,556,499	26,945,624	29,640,186
Measure Costs	$107,541,101	$1,075,411	$2,150,822	$4,301,644	$5,377,055	$5,914,761
Program Costs	$42,957,364	$429,574	$859,147	$1,718,295	$2,147,868	$2,362,655
Total						
Achievable Potential Demand Savings (kW)	511,613	5,116	10,232	20,465	25,581	28,139
Achievable Potential Energy Savings (kWh)	2,263,976,465	22,639,765	45,279,529	90,559,059	113,198,823	124,518,706
Measure Costs	$406,016,436	$4,060,164	$8,120,329	$16,240,657	$20,300,822	$22,330,904
Program Costs	$218,695,725	$2,186,957	$4,373,914	$8,747,829	$10,934,786	$12,028,265

E.7 Conclusions and Recommendations

The DSM benchmarking analysis results presented in this report should give KCP&L management confidence that a variety of utilities across North America are achieving large- scale results from their C&I DSM programs. Peak demand and energy reductions of 1% of utilities' baseline C&I peak demands and energy sales are being achieved by a variety of utilities across the continent. While the details of large impact DSM program portfolios often differ significantly between utilities, several common elements have been identified by the analysis conducted:

- Large impacts are being realized from both commercial lighting and multi-product energy efficiency programs.

- Significant impacts are being achieved from commercial new construction energy efficiency programs.

- C&I custom rebate energy efficiency programs have been significant impact programs for some utilities.

The largest sources of uncertainty regarding the estimates that Summit Blue and Energy Insights have developed to date for KCP&L stems from using secondary information to profile KCP&L's C&I customers. Energy Insights' secondary data on Midwest customers' energy use and equipment is the best secondary information available, but still profiles KCP&L customers with a number of Midwest regional statistics. Also, the secondary end use estimates for electric use have higher than actual estimates for the amount of electricity that is used for "miscellaneous"

purposes. This is due to the lack of precision in the end use estimates developed by the original sources of the data, such as the Department of Energy's Commercial Building Energy Consumption Survey.

Utilities that choose to significantly invest in DSM programs often make significant periodic investments to develop and update such data to aid their DSM program planning. For example, Xcel Energy in Minnesota conducts large-scale market assessments and DSM potential studies that include significant on-site customer data collection every five to ten years. The Iowa utilities conduct DSM potential studies about every five years to support their periodic DSM program filings with their regulators. These utilities collected significant customer data as part of their current DSM potential study.

If KCP&L wishes to improve its current customer and load data for DSM planning purposes, Summit Blue suggests that the Company conduct market assessment projects for its customers in a multi-phased approach:

1. Start with telephone surveys of representative samples of several hundred customers in each customer sector (residential, commercial, industrial). These surveys should collect both customer awareness and attitude information, as well as appliance and equipment saturation information, as much as possible.

2. Conduct on-site validation surveys that are done in-depth for representative sub-samples of 30-100 telephone survey respondents per sector. The focus of the on-site surveys is to collect detailed customer facility information and energy equipment inventories.

3. Develop building simulation models for representative customers in each building segment of interest, such as office buildings or single-family homes. Calibrate the simulation models to the customers' actual electric and fossil fuel consumption.

4. Conduct end-use metering for very small sub-samples of the on-site survey customers and use the results to further calibrate the building simulation models.

5. Document the results of the study, including:

    a. Billing statistics and customer counts by customer type for each customer sector and key market segment, such as office buildings.

    b. Develop end use peak demand and energy consumption profiles for each customer sector and key market segment.

    c. Develop DSM measure saturation estimates for each customer sector and key market segment.

    d. Develop detailed DSM potential estimates for each customer sector and key market segment.

This information would be very useful for long-term DSM program planning and also to help focus program resources on the key market segments in the near term. This type of market intelligence can also have applications far beyond DSM program planning if broader planning considerations are incorporated into the project designs.

1. INTRODUCTION

Kansas City Power and Light hired Summit Blue Consulting (Summit Blue) and Energy Insights in January 2007 to conduct a Commercial and Industrial (C&I) Energy Efficiency Measures Potential Study. KCP&L issued a request for proposal for this project in December 2006, and Summit Blue and Energy Insights submitted our proposal to KCP&L on January 10, 2007. This study was requested to help fulfill the goals of the DSM aspects of KCP&L's Comprehensive Energy Plan.

1.1 Study Strategy and Tactics

This project was conducted in two phases. Phase I was completed in March 2007, and included the following elements:

4. An avoided cost study, for both residential customers and C&I customers.

5. Baseline market profiles for large and small office buildings, education, and manufacturing.

6. A market potential study for energy efficiency for the C&I sector, based on the results of Summit Blue's DSM benchmarking analysis.

Phase II of the study was completed in July 2007, and included:

- Baseline market profiles for communications, health care, retail, grocery, entertainment, printing, data centers, petroleum, utilities, warehouses, lodging, churches, restaurants, apartments, and transportation.

- Characterization of C&I energy efficiency measures, including energy and peak demand savings, lifetimes, and costs.

- DSMore benefit-cost analysis for the C&I energy efficiency measures.

- Technical, economic, and market DSM potential estimates.

1.2 Current KCP&L Energy Efficiency Programs

KCP&L is currently conducting four C&I energy efficiency programs. These programs are described briefly below. The source of these program descriptions is a KCP&L document titled "Proposed Customer Focused Programs".

1.2.1 Online Energy Information and Analysis Program

The online energy information and analysis program allows all business and non-profit customers with computers to access their billing information and compare their usage on a daily, weekly, monthly or annual basis, analyze what end uses make up what percent of their usage, and access ways to save energy by end use through a searchable resource center. Targeted case studies provide ideas relevant to the customer's industry. This tool also allows the user to analyze why

their bill may have changed from one month to another. A business comparison also displays usage benchmarking data versus similar types of businesses.

1.2.2 C&I Energy Audit

KCP&L offers rebates to customers to cover 50% of the cost of an energy audit. In order to receive the rebate, the customer must implement at least one of the audit recommendations that qualify for a KCP&L C&I custom rebate. The energy audit rebate will be set at 50% of the audit cost up to $300 for customers with facilities less than 25,000 square feet and up to $500 for customers with facilities over 25,000 square feet. Energy audits must be performed by certified commercial energy auditors. Customers may choose their own auditor or KCP&L can recommend one. Customers with multiple buildings will be eligible for multiple audit rebates.

1.2.3 C&I Custom Rebate—Retrofit and New Construction

The C&I Custom Rebate Retrofit program provides rebates to C&I customers that install, replace or retrofit qualifying electric savings measures including HVAC systems, motors, lighting, pumps, etc. All custom rebates are individually determined and analyzed to ensure that they pass the Societal Benefit/Cost Test. Any measure that is pre-qualified (evaluated prior to being installed) must produce a Societal Benefit/Cost test result of 1.0 or higher.

Custom rebates are calculated as the lesser of the following:

- A buydown to a two year payback
- 50% of the incremental cost

One customer may submit multiple rebate applications for different measures. Each individual measure will be evaluated on its own merits. Similar measures that are proposed in different facilities or buildings will be evaluated separately. However, no customer, including those with multiple facilities or buildings, may receive more then $40,000 in incentives for any program year.

Another component of this program is an online new construction guide that will provide information to commercial builders and developers on energy efficiency in new construction. It first allows the builder or developer to identify the type of new construction building that is being planned, i.e. office building, community center, fire station. It then lists a variety of environmental and energy efficiency options and guides the builder or developer in prioritizing investments for the best results. A sample of this software is available for viewing at http://seattle.bnim.com/. KCP&L proposes to build a similar site for the Kansas City metropolitan area but enhance it with features that tie into our rates and will allow developers and builders to plan buildings that can maximize our rates.

1.2.4 Building Operator Certification Program

The Building Operator Certification (BOC) Program is a market transformation effort to train facility operators in efficient building operations and management (O&M), establish recognition of and value for certified operators, support the adoption of resource-efficient O&M as the standard in building operations, and create a self-sustaining entity for administering and marketing the training. In year one of this program, KCP&L will work with the Missouri Department of Natural Resources to build a partnership with other Missouri stakeholders (sponsors). Once this has been accomplished, the program will begin to offer customers the Building Operator Training and Certification (BOC) program. The program will use a portion of

its sponsor's funds (including the funds provided by KCP&L) to license the BOC curriculum from the Northwest Energy Efficiency Council (NEEC), its developer. Building operators that attend the training course will be expected to pay the cost of the course, less a $100 rebate that will be issued upon successful completion of all course requirements. The program is expected to attract customers with large facilities (over 250,000 sq. ft.) that employ full time building operators.

1.3 Organization of Report

This report is divided into the following major sections.

- Executive Summary
- Introduction
- Methodology
- Benchmarking and Best Practice Results
- Avoided Cost Analysis Results
- Baseline KCP&L Customer Profiles
- DSM Measure Summary Characterizations
- DSM Potential Methodology and Results
- DSM Cost Effectiveness Analysis Results

2. METHODOLOGY

This section of the report provides a high-level overview of the project methodology. Detailed descriptions regarding the specific analyses performed are included in each section of the report in which the analytical results are presented. Summit Blue and Energy Insights conducted a seven step process to complete this assignment:

1. **Conduct a project initiation meeting** with KCP&L staff. Summit Blue and Energy Insights held an initial in-person meeting with over 20 KCP&L staff in January 2007. Follow-up conference calls were conducted on a regular basis throughout the project.

2. **Conduct a Midwest-focused DSM benchmarking analysis**. The main purpose of this analysis is to ensure that the DSM potential estimates that Summit Blue develops for KCP&L are reasonable and appropriate, and to identify best practice utility and agency DSM program portfolios. For this analysis, Summit Blue collected information on 25 other utilities' and agencies' 2005 DSM program results. Slightly less than half of these organizations are located in the Midwest, and the other half span North America, from Vermont to California. The sources used for this analysis are generally utilities' 2005 DSM regulatory reports, as well as FERC Form 861 baseline data for 2005.

3. **Conduct an avoided cost analysis**. The goal of the study was to develop a stochastic analysis for future avoided energy and capacity costs, providing a 5% mean and 95% probability that reflect predicted volatility in these costs. The study period is from 2007 to 2027.

4. **Develop baseline market segment profiles and initial building simulation model specifications**. KCP&L supplied considerable input data for this task: customer counts and billing data by market segment, as well as sales forecasts for the Company's overall commercial and industrial customer sectors. Other data sources included Energy Insights' proprietary information. Energy Insights used the results of the market profile analysis to calibrate market segment versions of the eQuest building simulation model. eQuest is a widely used commercial building simulation model based on the DOE-2 model.

5. **Characterize energy efficiency measures that are appropriate for KCP&L's service area**. Characterizing measures includes estimating per unit energy and demand savings, incremental costs compared to standard efficiency measures, and measure lifetimes. Energy and demand savings for climate dependent measures such as insulation are estimated by the eQuest building simulation model for commercial customers. For DSM measures whose savings are not weather dependent, such as efficient water heaters, engineering estimates and other published sources such as the California DEER database were used to characterize those types of measures.

6. **Conduct DSMore benefit-cost analysis**. DSMore was developed by Integral Analytics (IA) in 2003 for application to DSM program design and evaluation within both regulated and deregulated markets. This application is unique in that it values DSM using a risk-based approach, in much the same way that asset planners approach their valuations. The covariance between prices and loads is captured at the hourly level to accurately measure the risk-based DSM value. Benefit-cost ratios were estimated for the participant test, the utility test, the total resource cost (TRC) test, and the rate impact (RIM) test.

7. **Estimate energy efficiency potentials for the 2008-2028 period for commercial/industrial customers** using a spreadsheet model. Summit Blue estimated technical, economic, and market DSM potentials by end use. Economic potential was defined using the TRC test as the criteria for whether DSM measures are cost effective. Summit Blue calibrated the DSM market potential estimates to the results of the benchmarking analysis discussed above.

3. BENCHMARKING AND BEST PRACTICE RESULTS

3.1 Benchmarking 2005 DSM Results

This section compares 2005 energy efficiency (EE) results for commercial and industrial (C&I) sector programs of other utilities and agencies in six regions (the Midwest, Northeast, Florida, Texas & Colorado, California, and Canada) and compares detailed program results of utilities identified as achieving high levels of C&I DSM savings for reasonable costs.

3.1.1 Methodology

This section describes the methodology to collect and analyze benchmark programs and compare levels of DSM achievements and costs of savings for C&I customers. Data and information were collected for 2005 DSM program results for twenty-five utilities and energy agencies (see Table 3-1 below). Many of these data were collected for previous projects with Texas utilities included specifically for this report.

Table 3-1. Benchmarked Utilities and Agencies

Midwest	Florida
Duke Energy Indiana [DUKE (IN)] Duke Energy Kentucky [DUKE (KY)] Interstate Power and Light [IP&L] MidAmerican Energy [MEC] Minnesota Power [MN PWR] Otter Tail Power [OT] Wisconsin Focus on Energy [WECC] Xcel Energy (MN) [XCEL (MN)]	Florida Power & Light [FPL] Gulf Power [GULF] Progress Energy [PROGRESS] Tampa Electric [TECO]
	Texas & Colorado
	AEP-Southwestern Electric Power Co [AEP-SWEPCO] Entergy Gulf States [EGSI] Southwestern Public Service Co – Xcel [SPS XCEL] Xcel Energy (CO) [XCEL (CO)]
Northeast	**California**
Efficiency Maine [EME] Efficiency Vermont [EVT] New Jersey Office of Clean Energy [NJ-OCE] NY State Research & Development Authority [NYSERDA]	Pacific Gas & Electric [PG&E] San Diego Gas & Electric [SDG&E] Southern California Edison [SCE]
	Canada
	British Columbia Hydro [BCH] Manitoba Hydro [MBH]

In North America, DSM is delivered either through central agencies or utilities—either investor or government owned. In the Midwest, DSM is generally provided through vertically integrated investor owned utilities (IOUs); the exception is Wisconsin Focus on Energy, a central agency providing most DSM programs in the state. The utilities examined in the Northeast region all provide DSM through a central agency, except New Jersey which had delivered programs through utilities. In Florida, DSM is delivered through IOUs; most of these are winter peaking due to the high saturation of electric heat. In Canada, both BC Hydro and Manitoba Hydro are vertically integrated Crown corporations and serve the entire provinces. Both have extensive hydro-electric resources and export significant electricity; neither province is deregulated. BC Hydro targets only energy conservation (not demand reduction) as do all of the energy agencies included in this analysis. In the West, as in the Midwest, most DSM is delivered through investor owned utilities such as the several IOUs included in the analysis. Data here exclude demand response programs.

This analysis of DSM program results normalized the reported total program results for utility or agency size, sales to major customer class, and currency, where necessary.

The benchmarking data for these utilities and agencies were prepared as follows:

- For selected utilities and other organizations offering DSM programs, 2005 reported program results for the C&I sector were compiled—program descriptions, energy and demand savings, and costs. The sources for almost all of the data were utilities' and agencies' annual reports on their 2005 DSM program results.

- Normalized results by utility or state sales and peak demands to produce estimates of DSM savings as percentages of sales and peak demand (where data were available) for the C&I sector. The main source for the baseline sales and peak demand data was FERC Form 861 information, from the Energy Information Administration's web site (www.eia.doe.gov).

- Converted program spending to US dollars where needed using the average currency exchange of US$1=CDN$1.21, and divided spending by the DSM program energy and demand savings to determine each utility's cost of conserved energy and demand in terms of $/kWh and $/kW.

Although every effort is made to collect comparable data, given the inherent variation in organizations' evaluation and reporting practices, the results cannot be considered a strictly "apples-and-apples" comparison. The results are useful to provide calibration targets for DSM potential estimates and in identifying key programs and results for top-performing portfolios.

Table 3-2 below provides key characteristics by state or province such as the market structure and DSM targets, as well as the year that DSM programs began.

Table 3-2. DSM Environment in States & Provinces

STATE/ PROVINCE	YEAR BEGAN	MARKET STRUCTURE	DSM TARGETS & AUTHORIZED AMOUNT
British Columbia	2002	Traditional	All DSM that is cheaper than supply options.
California	1974	Partially restructured	Authorized budget based on funding levels necessary for utilities to meet CPUC savings targets by procuring cost-effective efficiency.
Florida	1974	Traditional	DSM programs that pass the RIM Test.
Indiana	1990	Traditional	No formal DSM requirements.
Iowa	1990	Traditional	Maximum achievable DSM potential.
Kentucky	1990	Traditional	No formal DSM requirements.
Maine	2002	Traditional	$1.5 million/year for SBC funded energy efficiency; 2006 budget of $9.6 million.
Manitoba	1979	Traditional	No formal DSM requirements.
Minnesota	1980	Traditional	Minimum spending – Xcel Energy (2% of electric revenues); non-nuclear utilities (1.5%). Also determined by IRP process.
New Jersey	Early 1980's	Deregulated	Balance cost-effective DSM with impact on rates; $1/MWh for economic DR.
New York	1996	Deregulated	$175 million/year for SBC funded energy efficiency.
Texas	2000	Deregulated	Utilities must meet 10% of forecasted growth in demand through efficiency or approved load management.
Vermont	2000	Traditional	Historically funded by a wires charged capped at 3%; cap removed in 2005.
Wisconsin	Mid 1980's	Traditional	Up to 3% of electric revenues.

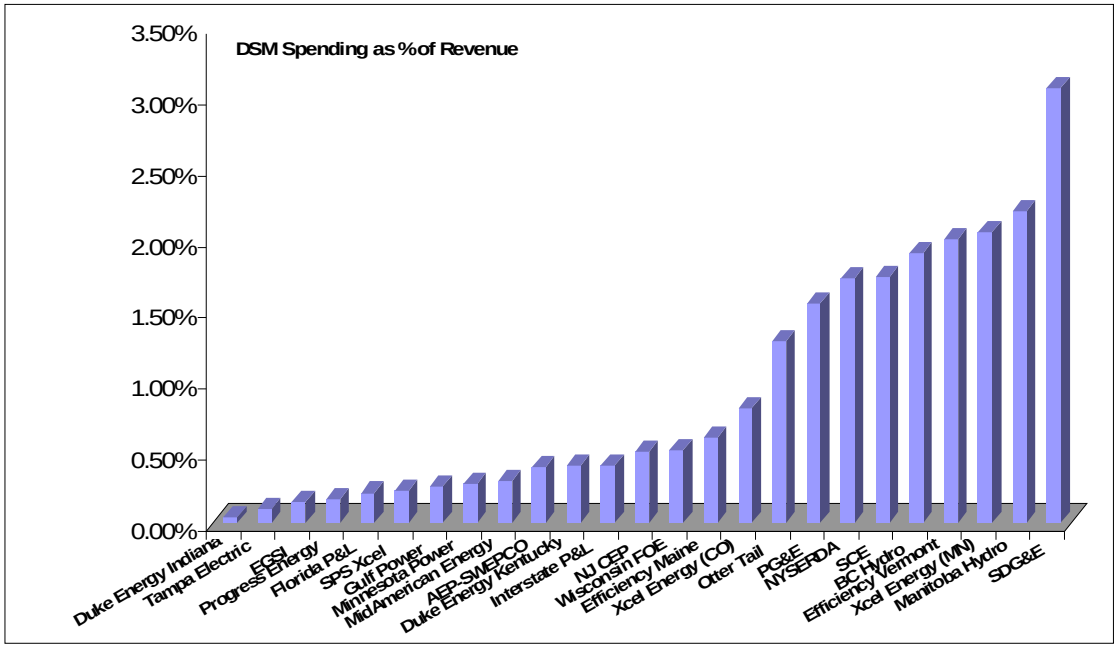
3.2 C&I Results

This section compares 2005 DSM program results for the C&I sector across the various locations. See the Appendix A for complete data and statistics.

3.2.1 C&I Spending as Percent of Revenue

The twenty-five organizations reviewed spent an average of 1% of annual sector revenues on DSM for C&I customers. Figure 3-1 below shows the distribution of spending on DSM as a percentage of annual revenues. Although the sample's distribution is not normal, for the purpose of this discussion, 95% confidence intervals are included which define a range of values within which the population mean is likely to lie (that is, there is a 95 % chance that the population mean will lie somewhere between the upper and lower confidence limits). The 95% confidence interval for C&I spending as a percentage of revenue is from is from 0.6% to 1.4%. In terms of DSM spending, SDG&E has the largest spending as a percentage of sales at about 3%.

Figure 3-1. C&I DSM Spending as % of Revenue



3.2.2 C&I Energy Savings

Figure 3-2 and Figure 3-3 show the energy savings as a percentage of sales and the cost of these savings across the various organizations. The mean energy savings as a percentage of sales is 0.5% (95% confidence interval is 0.3 % to 0.7%) and the mean cost of these energy savings is $0.16 per kWh (95% confidence interval is $0.10 to $0.22 per kWh).

Figure 3-2. C&I Energy Savings as % of Sales

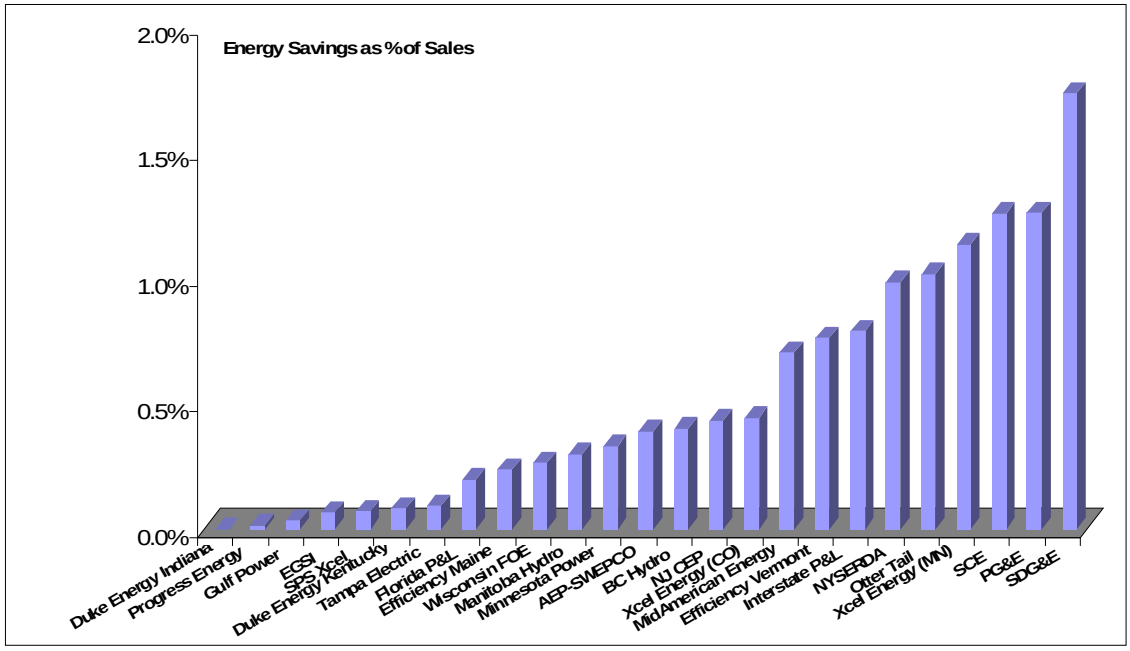
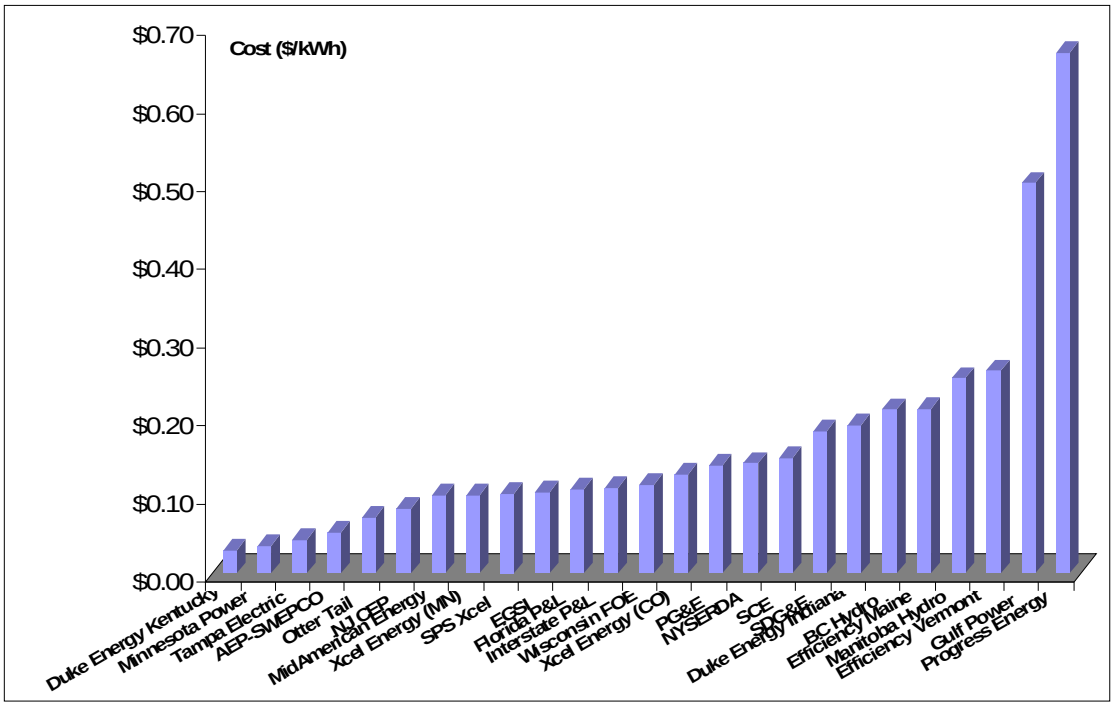


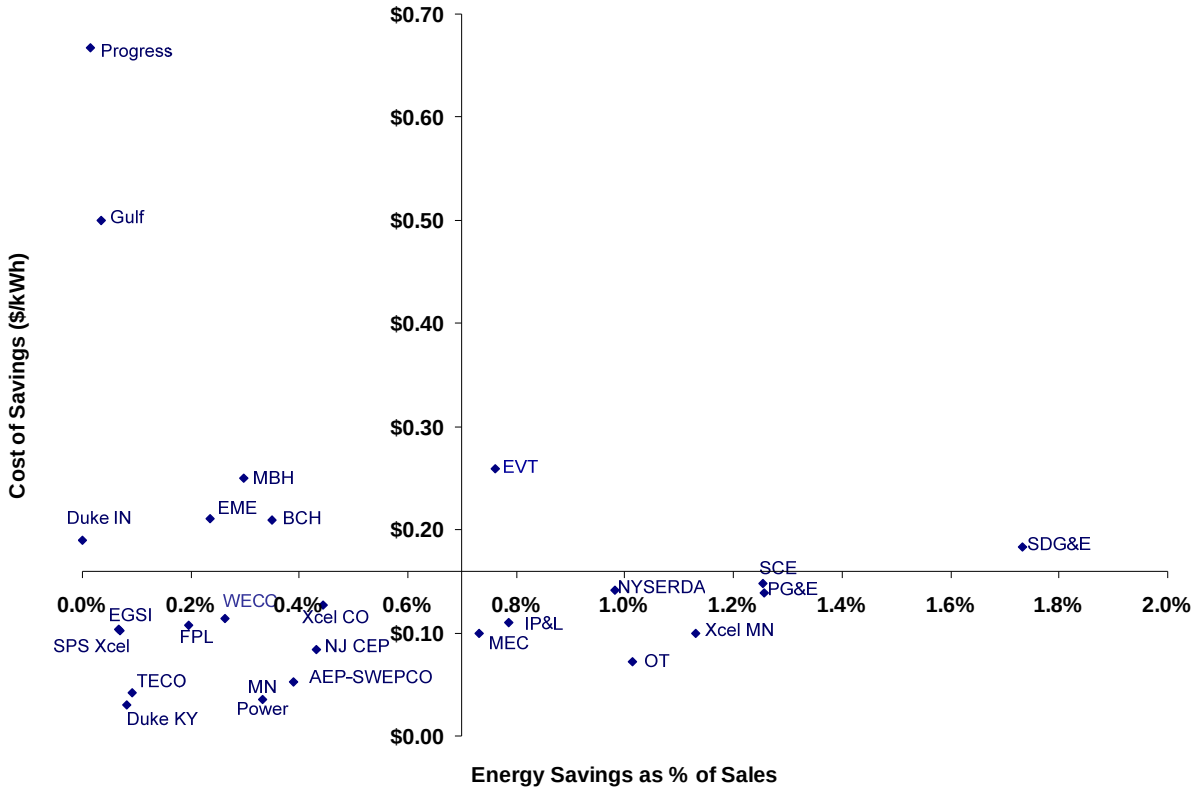
Figure 3-3. Cost of C&I Energy Savings ($/kWh)



The scatter plot shown in Figure 3-4 below illustrates where each organization falls relative to mean energy savings and mean costs. SDG&E achieved the greatest energy savings as percentage of sales, 1.7%, but achieved these savings at $0.18/kWh, costs above the average. The following utilities achieved higher than average energy savings as a percentage of sales at lower than average costs:

- PG&E: 1.3%, $0.14/kWh; SCE: 1.3%, $0.15/kWh
- Xcel Energy (MN): 1.1%, $0.10/kWh; Otter Tail Power: 1.0%, $0.07/kWh; NYSERDA: 1.0%, $0.14/kWh
- Interstate Power & Light: 0.8%, $0.11/kWh; MidAmerican Energy: 0.7%, $0.10/kWh

Figure 3-4 Scatter Plot of C&I Energy Savings and First Year Costs ($/kWh)



The horizontal funnel-like shape of the data illustrates the high variation in costs of energy savings among the organizations that have below average energy savings as a percentage of sales.

Specifically, these data suggest that

- An organization with above average energy savings as a percentage of sales (0.5%) is likely to save at below average costs ($0.16/kWh).

- The greater an organization's energy savings as percentage of sales, the greater the likelihood the savings will be at the average costs (and the converse: the lower the energy savings, the less likely the savings will be at the average costs).

Table 3-3 below shows results for programs delivered by the eight utilities/agencies that achieved a percentage of savings greater than the upper range of the confidence interval for savings as a percentage of sales (0.7%) and that have costs below the upper range of the confidence interval for costs ($0.22/kWh). These program results are not reported on an end use basis, and different organizations target customers in different ways; for example, NYSERDA targets the new construction and existing buildings markets with different portfolios of programs. Otter Tail Power, on the other hand, targets its programs based on DSM measure, e.g. lighting, motors and drives, etc., but achieved most savings from custom projects. Xcel Energy (MN), which had the highest Midwest energy savings as a percentage of sales, has an approach similar to Otter Tail's but also targets new construction, achieving most savings through this program, lighting, and custom projects. The two other high achievers in the Midwest, Interstate Power & Light and MidAmerican Energy, achieved most energy savings from existing buildings and product incentives, respectively. The California utilities achieved most of their savings from product incentives.

Table 3-3. C&I Energy Savings as % of Sales by Type of Program

	California IOUs			Midwest IOUs				
Program/Measures	**SDG&E**	**PG&E**	**SCE**	**Xcel (MN)**	**Otter Tail**	**Int. P& L**	**MEC**	**NYSERDA**
Lighting				0.28%	0.02%			0.01%
Cooling/Roofing/HP		0.04%	0.05%	0.05%	0.01%			
Refrigeration				0.03%	0.03%			
Motors and Drives				0.13%	0.06%			
Compressed Air				0.10%				
Custom/Cooking				0.20%	0.88%	0.14%	0.03%	
New Construction	0.20%	0.26%	0.26%	0.30%	0.04%		0.17%	0.23%
Existing Buildings		0.35%		0.04%		0.60%	0.07%	0.68%
Product Incentive	1.48%	0.62%	0.85%			0.05%	0.45%	
Energy Audits	0.06%		0.10%				0.02%	0.06%
Total Savings (GWh)	**208**	**651**	**719**	**250**	**14**	**93**	**86**	**1,295**
Annual Sales (GWh)	**12,013**	**51,841**	**57,314**	**22,103**	**1,382**	**11,841**	**11,760**	**131,969**
Savings as % of Sales	**1.73%**	**1.25%**	**1.25%**	**1.14%**	**1.05%**	**0.78%**	**0.73%**	**0.98%**

Table 3-4 shows the actual expenditures ($M) to achieve these savings, and Table 3-5 shows the costs in $/kWh. Comparing costs across programs is difficult as the program portfolios and target markets vary widely. For these organizations, spending is generally directly related to energy savings. Notable exceptions are PG&E and MidAmerican Energy which achieved significant energy savings from product incentives with relatively low expenditure and, at $0.05/kWh, well below average costs. Both Interstate Power & Light and NYSERDA achieved their significant

energy savings from existing building programs with relatively low expenditures and below average costs, $0.11/kWh and $0.14/kWh, respectively. Otter Tail achieved its substantial energy savings through custom programs at $0.05/kWh, well below average.

Table 3-4. Expenditures of C&I Energy Savings by Type of Program ($M)

	California IOUs			Midwest IOUs				
Program/Measures	**SDG&E**	**PG&E**	**SCE**	**Xcel (MN)**	**Otter Tail**	**Int. P& L**	**MEC**	**NYSERDA**
Lighting				8.9	0.08			1.1
Cooling/Roofing/ HPs		6.4		1.6	0.01			
Refrigeration				0.4	0.03			
Motors and Drives				1.8	0.07			
Compressed Air				0.9				
Custom/Cooking				3.0	0.50	2.0	0.6	
New Construction	7.2	31.7	13.0	6.0	0.02		4.3	73.2
Existing Buildings		30.0		0.6		1.4	0.6	102.5
Product Incentive	30.0	17.4	93.0			6.4	2.5	
Energy Audits	0.4	4.1		0.2	0.02		0.3	3.1
Total Costs ($M)	**$38**	**$90**	**$106**	**$25**	**$1**	**$10**	**$8**	**$180**

Table 3-5. Costs of C&I Energy Savings by Type of Program ($/kWh)

	California IOUs			Midwest IOUs				
Program/Measures	**SDG&E**	**PG&E**	**SCE**	**Xcel (MN)**	**Otter Tail**	**Int. P& L**	**MEC**	**NYSERDA**
Lighting				$0.18	$0.33			$0.17
Cooling/Roofing/ HPs		$0.35		$0.20	$0.08			
Refrigeration				$0.07	$0.10			
Motors and Drives				$0.07	$0.10			
Compressed Air				$0.05				
Custom/Cooking				$0.08	$0.05	$0.09	$0.19	
New Construction	$0.30	$0.24	$0.09	$0.11	$0.05		$0.21	$0.29
Existing Buildings		$0.17		$0.09		$0.11	$0.15	$0.14
Product Incentive	$0.17	$0.05	$0.16			$0.22	$0.05	
Energy Audits	$0.06						$0.18	$0.05
Total Savings (GWh)	**208**	**651**	**719**	**250**	**14**	**93**	**86**	**1,295**
Total Costs ($m)	**$38**	**90**	**$106**	**$25**	**$1**	**$10**	**$8**	**$180**
Costs of Savings ($/kWh)	**$0.18**	**$0.14**	**$0.15**	**$0.10**	**$0.05**	**$0.11**	**$0.10**	**$0.14**

3.2.3 C&I Peak Demand Savings

Table 3-5 below shows total DSM peak kW savings for C&I customers for twenty-three locations; BC Hydro and Efficiency Maine neither target nor track demand savings. The mean

peak demand savings as a percentage of peak demand is 0.5% with a 95% confidence interval of 0.3% to 0.7% - the same results as for energy savings. The average cost to achieve demand reductions is $803/kW (95% confidence interval $541/kW to $969/kW).

Figure 3-5. C&I Demand Savings as % of Peak Demand

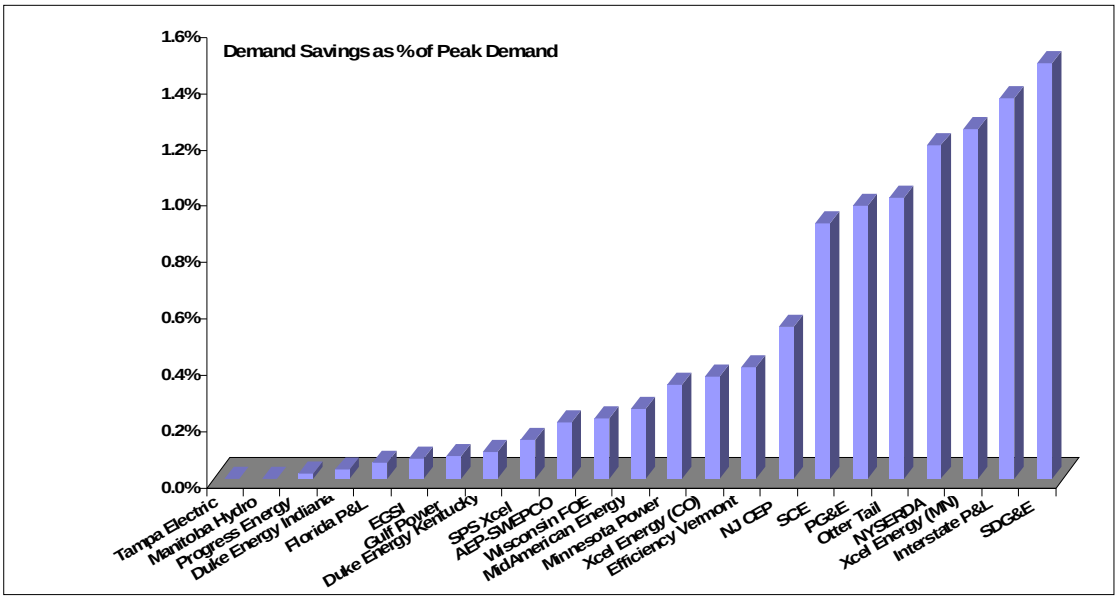
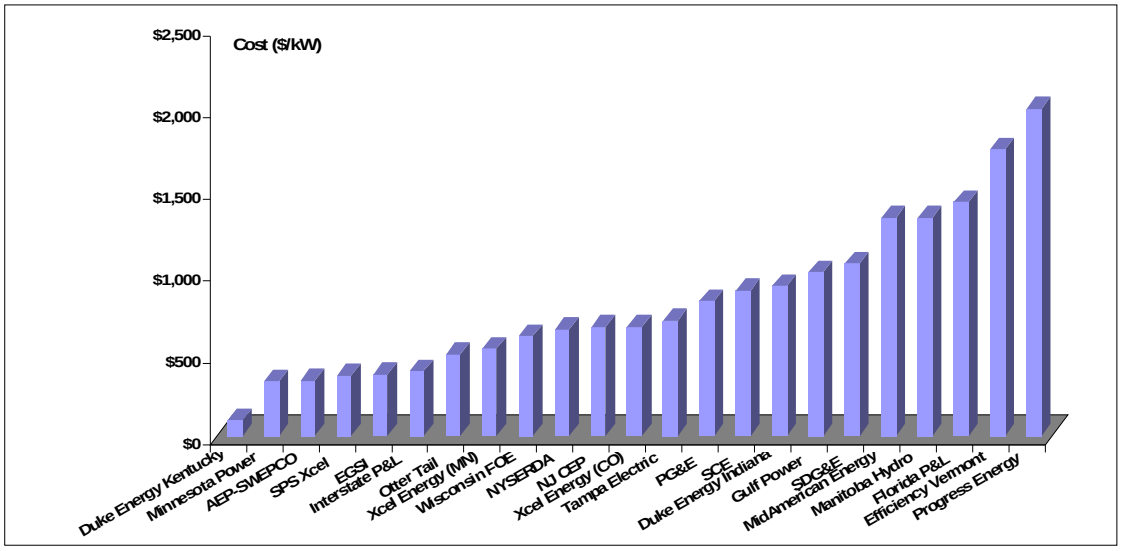


Figure 3-6. Cost of C&I Demand Savings ($/kW)



The scatter plot in Figure 3-7 below shows the distribution of results for demand savings as a percentage of peak demand compared to costs ($/kW) to achieve the savings. SDG&E achieved the greatest demand savings as a percentage of peak demand, 1.5%, but at $1,056/kW, costs above the top range of the confidence interval. The following utilities achieved higher than average demand savings at lower than average costs:

- In the Midwest, IP&L: 1.4%, $396/kW; Xcel Energy (MN): 1.2%, $532/kW; and Otter Tail Power: 1.0%, $500/kW.
- NYSERDA: 1.2%, $654/kW.

Analogous to the distribution of energy savings and first year costs, Figure 3-7 illustrates the high variation in costs of demand savings among the organizations that have below average demand savings as a percentage of peak demand.

Specifically, these data suggest that:

- An organization with above average demand savings as a percentage of peak demand (0.5%) is likely to save at below average costs ($803/kW).

- The greater an organization's demand savings as percentage of peak demand, the greater the likelihood the savings will be at the average costs (and the converse: the lower the energy savings, the less likely the savings will be at the average costs).

Figure 3-7. Scatter Plot of C&I Demand Savings and First Year Costs ($/kW)

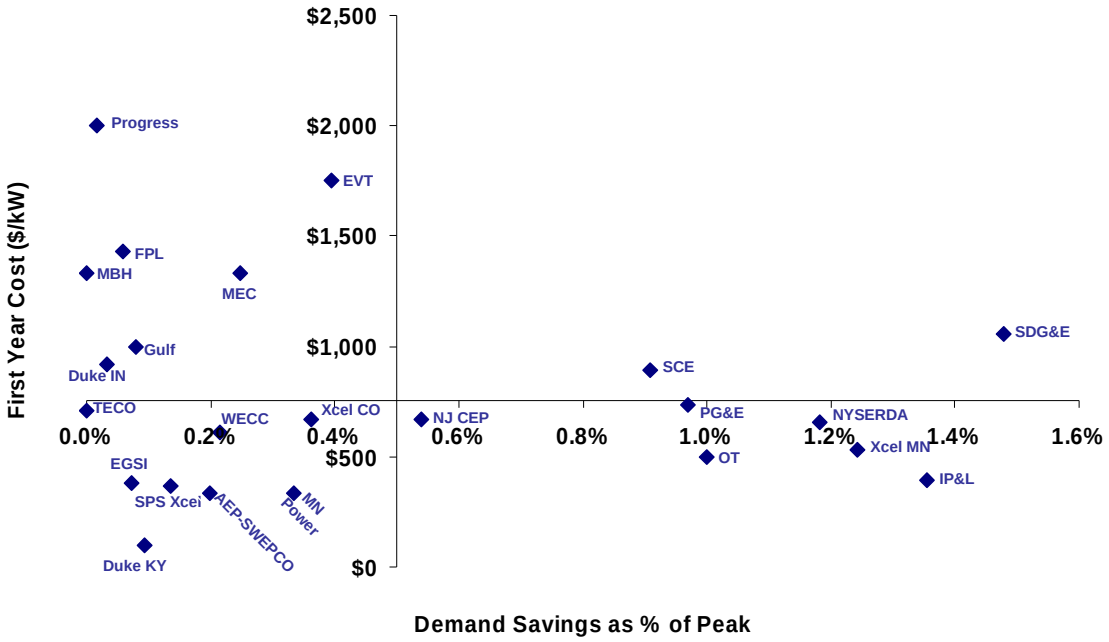


Table 3-6 below compares results by program for the six organizations that exceeded the upper range of the confidence interval for demand savings (0.7%) with costs below the upper range of the confidence interval ($969/kW). These are PG&E and SCE in California, IP&L, Otter Tail Power and Xcel Energy (MN) in the Midwest, and NYSERDA. Table 3-7 shows costs of demand savings in $/kW by program. Product incentive programs provided most of the demand savings for the California IOUs. In the Midwest, Otter Tail obtained most of its results from its custom programs, IP&L from targeting existing buildings and industrial processes, and Xcel Energy (MN) from new construction and lighting initiatives. NYSERDA also achieved significant savings from new construction programs but much more from programs aimed at existing buildings.

Table 3-6. C&I Demand Savings as a % of Peak Demand by Type of Program

Program/Measures	California IOUs		Midwest IOUs			
	PG&E	**SCE**	**IP&L**	**Otter Tail**	**Xcel (MN)**	**NYSERDA**
Lighting				0.15%	0.32%	0.01%
Cooling/Roofing/HPs	0.09%	0.08%		< 0.01%	0.18%	
Refrigeration				0.07%	0.02%	
Motors and Drives				0.05%	0.10%	
Compressed Air					0.07%	
Custom/Cooking				0.73%	0.13%	
Industrial Processes			0.35%			
New Construction	0.28%	0.16%		0.03%	0.41%	0.32%
Existing Buildings	0.21%		0.91%		0.02%	0.86%
Product Incentive	0.38%	0.58%	0.11%			
Energy Audits		0.09%				0.00%
Total Savings (MW)	**109**	**119**	**25**	**2**	**47**	**280**
Peak Demand (MW)	**11,253**	**13,081**	**1,846**	**212**	**3,781**	**23,669**
Savings as % of Peak Demand	**0.97%**	**0.90%**	**1.37%**	**1.03%**	**1.24%**	**1.18%**

Both Interstate Power & Light and NYSERDA achieved their demand savings from existing building programs with relatively low expenditures and, at $463/kW and $534/kW, respectively, below average costs. Although PG&E's overall costs of demand savings is just above average, and its demand savings is mostly from product incentives, its costs for product incentives is, at $405/kW, below average. Xcel's significant savings achieved by its new construction programs were achieved well below average costs at $384/kW. Otter Tail's custom programs achieved their demand savings at $407/kW.

Table 3-7. Costs of C&I Demand Savings by Type of Program ($/kW)

Program/Measures	California IOUs		Midwest IOUs			
	PG&E	SCE	IP&L	Otter Tail	Xcel (MN)	NYSERDA
Lighting				$333	$743	
Cooling/Roofing/HPs	$644			$1,633	$239	
Refrigeration				$261	$637	
Motors and Drives				$797	$485	
Compressed Air					$314	
Custom/Cooking			$220	$407	$621	
Industrial Processes						
Farm Energy Efficiency						
New Construction	$990	$604		$450	$384	$1,027
Existing Buildings	$1,251		$463		$1,037	$534
Product Incentive	$405	$1,168	$646			
Energy Audits						$257
Total Savings (MW)	**109**	**119**	**25**	**2**	**47**	**280**
Total Costs ($M)	**$90**	**$106**	**$10**	**$1**	**$23**	**$180**
Costs of Savings ($/kW)	**$823**	**$891**	**$392**	**$500**	**$532**	**$643**

3.3 Summary

For the twenty-five organizations reviewed, the mean energy savings as a percent of annual sales for 2005 is 0.5% (with a 95% confidence interval of 0.3-0.7%); but a significant number of top-performing organizations achieved energy savings of 1.0% of sales or more. Results are the same for demand savings as a percentage of peak demand; again, demand savings of 1% per year were achieved by the top-performing utilities and agencies.

The mean costs of savings for all organizations are $.016/kWh (95% confidence interval $0.10/kWh to $0.22/kWh) for energy saving and $803/kW (95% confidence interval $541/kW to $969/kW) for demand savings. The top performers achieved their savings at costs below the average costs of the total group, near the lower range of each confidence interval: $0.12/kWh and $630/kWh.

Table 3-8 and Table 3-9 below summarize the percentage of energy savings and peak demand savings by type of program for the top performing organizations in 2005.

Table 3-8. Percent of Energy Savings by Type of Program

	California IOUs			Midwest IOUs				
Program/Measures	**SDG&E**	**PG&E**	**SCE**	**Xcel (MN)**	**Otter Tail**	**Int. P& L**	**MEC**	**NYSERDA**
Custom/Cooking				18%	84%	18%	4%	
New Construction	12%	21%	21%	26%	4%		23%	23%
Product Incentive	85%	53%	72%	52%	12%	6%	62%	1%
Existing Buildings (includes Energy Audits)	3%	28%	8%	4%		77%	12%	76%

Product incentives and new construction initiatives provided most of the energy savings in the C&I sector. In California, SDG&E and SCE achieved most energy savings from product incentives and new construction; PG&E achieved half of its savings from product incentives, 28% from existing buildings, and 21% from new construction. In the Midwest, Xcel Energy (MN) and MidAmerican Energy achieved most savings from product incentives—52% and 62% respectively, and from new construction—26% and 23%. NYSERDA also achieved 23% of its energy savings from new construction and 76% from programs targeting existing buildings, which include product incentive programs such as Smart Equipment Choices. Interstate Power and Light achieved 77% of savings from existing buildings, which includes providing incentives for efficient products, and achieved almost 20% through custom projects. Otter Tail is unique in achieving close to 90% of savings from custom projects.

Table 3-9. Percent of Peak Demand Savings by Type of Program

Program/Measures	**California IOUs**		**Midwest IOUs**			**NYSERDA**
	PG&E	**SCE**	**IP&L**	**Otter Tail**	**Xcel (MN)**	
Custom/Cooking				71 %	10 %	
Industrial Processes			26 %			
New Construction	29 %	18 %		3 %	33 %	27 %
Product Incentive	49 %	73 %	8 %	26 %	56 %	< 1 %
Existing Buildings (includes Energy Audits)	22 %	9 %	66 %		1 %	73 %

Product incentives and existing buildings provided most of the demand savings in the C&I sector. In California, PG&E and SCE achieved most demand savings from product incentives and new construction; SCE achieved 73% of its savings from product incentives, and PG&E earned about half of its savings from product incentives, 29% from new construction, and 22% from existing buildings. In the Midwest, Xcel Energy (MN) also achieved most savings from product incentives, 56%, and achieved 33% of its total demand savings from new construction. IP&L and NYSERDA achieved most of their demand savings, 66% and 73% respectively, from existing buildings. Otter Tail achieved most of its demand savings from custom programs, 71%, and achieved 26% from product incentives.

3.4 Conclusions

Almost all of the benchmarked utilities and agencies have been conducting DSM programs for an extended period. Over the time these utilities have been conducting DSM programs, they have realized savings from a lot of the "low hanging fruit" among DSM measures, such as T12 lighting system conversions to T8 systems.

KCP&L should be able to achieve energy efficiency potential savings at least equal to the 1% of baseline sales and peak demands once its energy efficiency programs have achieved a moderate level of maturity. Summit Blue generally estimates this program ramp-up period to take two to three years. KCP&L has already started this ramp-up for some of its energy efficiency programs.

KCP&L's 2005 C&I energy sales were about 9,540 GWh in Kansas and Missouri combined, from FERC Form 861 information[2]. So KCP&L's full-scale expected energy efficiency program savings are about 95 GWh per year, 1% of the Company's baseline C&I sales. KCP&L's total 2005 summer peak demand was 3,512 MW according to FERC Form 861 information.[3] Assuming that KCP&L C&I customers account for 64% of the Company's peak demand, KCP&L's C&I customers' percentage of the Company's retail sales, the C&I customer's 2005 summer peak demand was 2,248 MW. So the Company's expected full-scale energy efficiency program peak demand savings are about 22 MW per year, 1% of the Company's baseline C&I peak demand.

[2] FERC Form 861 data, File 2 is available on the Energy Information Administration's web site: www.eia.doe.gov.

[3] FERC Form 861 data, File 1 is available on the Energy Information Administration's web site: www.eia.doe.gov.

4. AVOIDED COST ANALYSIS RESULTS

4.1 Introduction

This section presents the methods used and results for the avoided cost study performed by Summit Blue for KCPL, as defined in KCPL's Work Order No. 2, dated January 25, 2007. The goal of the study was to develop a stochastic analysis for future avoided energy and capacity costs, providing a 5% mean and 95% probability that reflect predicted volatility in these costs. The study period is from 2007 to 2027.

As is the case with many utilities, KCP&L utilizes separate models for capacity and energy costs. In this study, separate approaches were taken to estimate avoided capacity and energy costs. The capacity model assesses fixed operation and maintenance (O&M) costs and capital construction costs for new generating plants, and the future least cost resource mix that will meet reserve requirements. The energy model, MIDAS, assesses production costs, dispatch, sales and purchases, weather, and other variables that affect market prices for energy.

Summit Blue and KCP&L personnel worked together to develop avoided capacity costs and avoided energy costs that will be used in a Demand-Side Management (DSM) planning model to assess the cost-effectiveness of different energy efficiency measures and programs.

4.2 Avoided Capacity Costs

4.2.1 General Approach

The approach to avoided capacity costs is that the value of Energy Efficiency (EE) is provided by the ability of EE to defer new additions to the resource mix (i.e., to defer by at least one year the building of new plant), and to avoid the purchase of Purchase Power Agreements (PPAs). The savings can be calculated by comparing a resource plan with EE (i.e., with reduced peak demand due to EE) with a resource plan without EE. This approach was taken in the analysis.

A model for calculating avoided capacity costs was developed by KCPL. The data used in the model is based on a high level review of KCPL's current capacity and load forecast. The model was expanded during this study so that uncertainty in avoided costs could be addressed.

4.2.2 Peak Demand Cases and Addition of EE

There are three different cases in the capacity model, based on forecasted peak demand – low, base, and high peak demand. These peak demand forecasts are weather normalized and were provided by the KCP&L planning department.[4] They represent the uncertainty around the rate of load growth.

Peak demand reductions from energy efficiency programs were added to the three peak demand cases, in a proportion estimated to be reasonable for a wide range of EE programs. The approach taken was to estimate potential savings from EE, as a percentage of total annual energy sales for the system, and then to estimate the demand savings associated with the energy savings.

[4] File named Load Data.xls, provided on accompanying CD of data files.

The amount of energy savings from EE programs was based on a Demand Side Management (DSM) benchmark study for North America.[5] In effect, programs that are aimed at technologies that run during summer peak demand periods will have a higher peak demand to energy savings ratio than technologies that save energy throughout the year, such as building envelope measure. As the development of these avoided costs is part of a DSM screening process, it is not clear exactly which programs will be included in the final DSM portfolio. Therefore, the demand savings associated with the energy savings was calculated based on a ratio between energy and demand savings taken from the results of several different EE programs.[6] The amount of EE added to the capacity spreadsheet model was calculated as follows:

- Energy savings were added at increments of 0.3% of total annual system MWh, ramping up to 3% of total system MWh after 10 years, and staying level at that percentage for the rest of the period.
- Peak demand savings were calculated as 0.0186% of energy savings.
- This resulted in peak demand savings that ranged from 0.2% to 2.5% of system peak demand.

The amounts of peak demand savings added to the model are shown in Table 4-1.

[5] Benchmarking 2005 DSM Results, Randy Gunn, Summit Blue Consulting.

[6] See file Ratio of Demand and EE Savings.xls, provided on accompanying CD of data files

Table 4-1: Peak Demand Savings Added to Capacity Model

Year	Low Peak Demand Case			Base Peak Demand Case			High Peak Demand Case		
	EE Savings as %	Peak Reduction MW	% Reduction in Peak	EE Savings as %	Peak Reduction MW	% Reduction in Peak	EE Savings as %	Peak Reduction MW	% Reduction in Peak
2007	0.3%	9	0.2%	0.3%	9	0.2%	0.3%	9	0.2%
2008	0.6%	19	0.5%	0.6%	19	0.5%	0.6%	19	0.5%
2009	0.9%	28	0.7%	0.9%	29	0.7%	0.9%	29	0.7%
2010	1.2%	39	1.0%	1.2%	39	1.0%	1.2%	39	1.0%
2011	1.5%	49	1.2%	1.5%	50	1.2%	1.5%	50	1.2%
2012	1.8%	60	1.5%	1.8%	61	1.5%	1.8%	61	1.5%
2013	2.1%	71	1.8%	2.1%	72	1.8%	2.1%	73	1.8%
2014	2.4%	82	2.0%	2.4%	84	2.0%	2.4%	85	2.0%
2015	2.7%	94	2.3%	2.7%	96	2.3%	2.7%	97	2.3%
2016	3.0%	106	2.5%	3.0%	108	2.5%	3.0%	110	2.5%
2017	3.0%	107	2.5%	3.0%	110	2.5%	3.0%	112	2.5%
2018	3.0%	108	2.5%	3.0%	111	2.5%	3.0%	113	2.5%
2019	3.0%	109	2.5%	3.0%	113	2.5%	3.0%	115	2.5%
2020	3.0%	110	2.5%	3.0%	114	2.5%	3.0%	116	2.5%
2021	3.0%	111	2.5%	3.0%	115	2.5%	3.0%	118	2.5%
2022	3.0%	112	2.5%	3.0%	117	2.5%	3.0%	120	2.5%
2023	3.0%	113	2.5%	3.0%	118	2.5%	3.0%	121	2.5%

Source: Load Data.xls

4.2.3 Structure of Capacity Model

The capacity model consists of four main analyses, or steps:

Step 1 – Define Capacity Costs

Define the levelized construction costs and fixed O&M costs for coal and gas units, in $/kW-yr.

Step 2 – Analyze Scenarios

In this step, the peak demand, the capacity responsibility, the net accredited capacity, and new Combustion Turbine (CT), Coal Plant, and PPA adds are defined. There are three cases – low, base, and high peak demand. Each case has a "with EE" and "without EE" scenario. The balance of capacity deficit is shown for each case and each scenario. Adjustments to generating unit additions are made so that the capacity responsibility is met in each year (i.e. the deficit is negative or zero). This process requires in-depth knowledge of the KCP&L system and was done by KCP&L personnel.[7]

Step 3 – Define Annual Avoided Costs

In this step, the range in costs for coal plant, gas plant, and PPA capacity are defined on an annual basis. Costs are escalated each year based on the 2007 value (or 2010 in the case of coal) defined in Step 1. Escalation rates are provided by Global Insights. A probability distribution for the range of uncertainty in these costs is implemented with the use of Crystal Ball[8] software. There is one distribution for each of the annual costs for gas, coal, and PPA.

Step 4 – Resource Additions

In this step, the resource additions from the six scenarios are converted to dollar values. Costs are taken from step 3. The total net present value (NPV) cost for each scenario is calculated, and then the cost for the "with EE" scenario is subtracted from the "without EE" scenario cost, for each peak demand case. Finally, this difference in NPV is levelized to an annual cost in 2007 dollars and then divided by the annualized amount of EE peak reductions in each case, to give a $/kW-yr value.

4.2.4 Assumptions Used

Listed here are the assumptions used to create and adjust the scenarios in the model:

- Capacity Responsibility = (Current long-term load forecast - EE contributions) + 12% Capacity Margin.
- Projected Accredited Capacity includes 465 MW share of Iatan-2 in 2010.
- Future resource additions are assumed to be CT's (added in pairs at 154 MW) and/or Coal (added in 400MW increments).

[7] Randy Hughes performed this process of defining PPA, gas plant, and coal plant adds for the six scenarios.

[8] Crystal Ball is a software package that performs Monte Carlo simulations, published by Descisioneering Inc.

- Small annual capacity shortfalls are assumed to be met through purchased capacity and energy contracts priced at expected market costs.

- For annual excess capacity, it is assumed that 50% of the excess is sold at prevailing market prices resulting in additional revenues.

4.2.5 Crystal Ball

Crystal Ball was used to create probability distributions around factors that were deemed to contribute to uncertainty in avoided capacity costs – levelized construction and fixed O&M costs for coal and gas, and cost of PPAs. Ranges for the distributions were provided by KCP&L staff, based on available data. It was assumed that there is only a small chance that construction costs will be less than projected.

Normal distributions were used for the coal and gas costs, truncated at the minimum and maximum shown in the table below. Triangular distributions were used for the PPA prices, based on min, mid, and max values at 10%, 75%, and 15% probabilities, respectively. The ranges for the distributions are shown in Table 4-2. (Note: PPA ranges shown are the average over 20 years, as the range varies in each year).

Table 4-2: Ranges for Crystal Ball Probability Distributions

Capacity Costs	min (below mean)	max (above mean)
Coal	-1%	20%
Gas	-1%	10%
PPA	-17%	170%

Source: Final KCP&L Avoided Capacity Model.xls

A Crystal Ball simulation was run for 10,000 trials, in Monte Carlo mode. The $/kW-yr avoided cost value for each case can be viewed as a distribution of possible costs, or as a single value, which is the mean of the distribution.

4.2.6 Results

Data from the Crystal Ball forecasts for the levelized savings for each case was extracted. This data included the value at 5th percentile increments, plus the standard deviation of the distribution. A weighted average was calculated based on the probability of each peak demand case occurring (15%, 55%, and 30% for the low, base, and high cases, respectively). These probabilities are based on the knowledge of the system of KCP&L staff. Table 4-3 shows a summary of the model results.

Table 4-3: Summary of Capacity Model Results

Case	Probability	Annualized NPV Savings	Annualized MW from EE	Mean	5%	95%	Std. Dev.
Low Demand	15%	$6,092,293	85.1	$71.57	64.59	78.69	4.29
Base Demand	55%	$9,624,582	88.0	$109.32	89.59	129.74	12.13
High Demand	30%	$11,930,391	89.9	$132.75	113.95	151.80	11.46
Weighted Average				110.69	93.15	128.70	10.75

Source: Final KCP&L Avoided Capacity Model.xls

4.2.7 Avoided T&D Costs

At this time, avoided T&D costs have not been included in this study.

4.3 Avoided Energy Costs

4.3.1 General Approach

The simple approach to avoided energy costs is to assume that the costs of serving 1 MW can be avoided due to the implementation of 1 MW of EE. This is true when energy is being purchased from the market by KCP&L – KCP&L can avoid that cost of purchase. Then the market prices produced by the MIDAS model can be used directly as the avoided energy costs for the hour in which the energy is saved due to EE.

However, this approach is not valid when KCP&L is not buying from the market. When it has excess capacity and is selling energy into the market, then the value of energy saved by EE is the market price less the cost of producing the energy. That is, the value of the energy saved is equal to the marginal income that KCP&L gains by selling the energy into the market instead of selling the energy within its own system.

The MIDAS prices will be adjusted to reflect the fact that some of the energy produced is sold. Details of this calculation are given in section 3.5.

4.3.2 MIDAS Model Data

KCP&L uses the MIDAS model, provided by MS Gerber, to forecast energy prices. Data from 35 model runs was provided by the resource planning department, representing 35 different sets of price driver values. Volatility due to weather is included in all the model runs. The model was run for the period 2006 to 2023.

The drivers that were put into MIDAS to create a range of uncertainty are listed below:

- Gas price
- Coal price

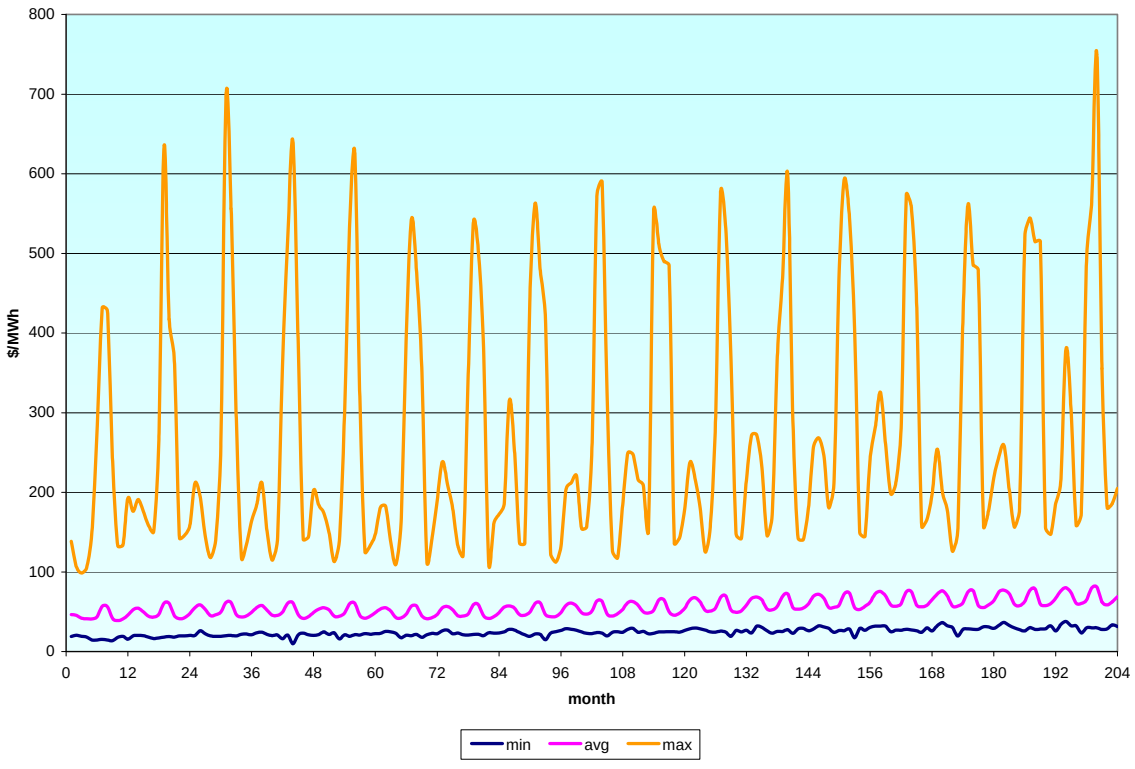
- Nuclear availability
- Coal availability
- Load shape year
- Peak Demand
- Energy Demand

The prices produced by the model in the 35 runs, for each hour of the year, were analyzed. A minimum, maximum, and average price for each hour of the day, for each month of the year, was produced for 2007 to 2023. The ratio of maximum price per month to average price per month varies from 2.2 to 11.27, with the average ratio being 4.75. On an hourly basis, the ratio of maximum price to average (out of the 35 runs) ranges from around 1.2 to around 4.

The Summit Blue team examined the ranges of prices in conjunction with KCP&L personnel, and the ranges were determined to capture what may be viewed as extreme events. As a result, the data was viewed as representing a 95% confidence interval, based on the ranges of the price drivers used in the modeling.

Figure 4-1 shows the minimum, mean, and maximum from the 35 runs for all months in the modeling period. The general trend of the minimum and average is upwards over the years, and the maximum tends downwards after 2009.

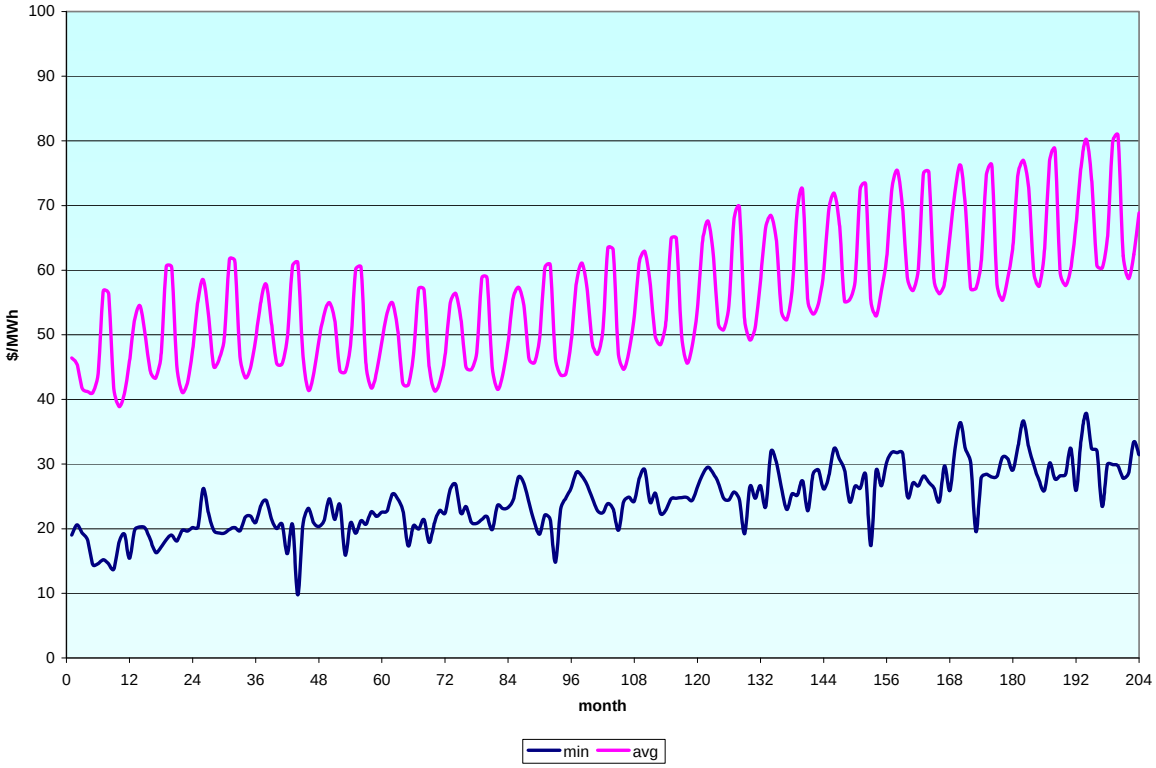
Figure 4-1: Min, Mean, and Max of Prices for 2007 to 2023



Source: All Years Analysis.xls

Figure 4-2 shows the minimum and mean values in more detail. The average prices are always higher in the summer, but the difference between summer and winter is not more than around $20 in each year. Also, the trend in prices over the whole time period of 17 years leads to an increase of approximately 50% of average 2007 prices.

Figure 4-2. Min, Mean, and Max of Prices for 2007 to 2023



4.3.3 Multipliers

There is a unique multiplier value for each month of the modeling period, for each of the drivers. The multipliers are ratios between the base case and the other 35 cases. The multipliers were calculated with a hypercube generator and a normal distribution was used. The correlation of peak and energy is an input to the Latin Hypercube logic, and this correlation affects the resulting peak and energy multipliers. There is no correlation over time in the multipliers.[9] Table 4-4 shows a summary of the ranges of the multipliers for five of the drivers.

[9] Information about the modeling process was provided by Roger Powell of KCPL.

Table 4-4: Ranges of Multipliers for Price Drivers

Year	Gas		Coal		Coal Availability		Energy		Peak	
	min	Max	min	max	Min	max	min	max	min	Min
2007	0.54	2.90	0.93	1.07	0.91	1.08	0.83	1.18	0.73	1.27
2008	0.48	2.99	0.93	1.08	0.90	1.08	0.85	1.19	0.74	1.26
2009	0.50	2.75	0.93	1.06	0.91	1.08	0.82	1.17	0.75	1.27
2010	0.52	2.82	0.94	1.07	0.91	1.09	0.81	1.16	0.75	1.26
2011	0.58	2.91	0.93	1.08	0.91	1.09	0.81	1.15	0.74	1.23
2012	0.58	3.02	0.93	1.08	0.91	1.07	0.79	1.17	0.75	1.25
2013	0.58	3.17	0.93	1.08	0.91	1.09	0.78	1.20	0.64	1.36
2014	0.58	4.28	0.93	1.07	0.91	1.08	0.82	1.18	0.72	1.25
2015	0.58	3.30	0.93	1.07	0.91	1.09	0.82	1.23	0.72	1.31
2016	0.58	3.11	0.94	1.07	0.93	1.09	0.84	1.17	0.75	1.30
2017	0.58	2.78	0.93	1.07	0.91	1.09	0.77	1.16	0.73	1.24
2018	0.58	3.26	0.94	1.08	0.91	1.08	0.81	1.19	0.77	1.26
2019	0.58	3.29	0.93	1.06	0.92	1.09	0.81	1.20	0.69	1.32
2020	0.58	3.01	0.93	1.07	0.92	1.09	0.81	1.15	0.64	1.29
2021	0.58	2.91	0.93	1.08	0.93	1.08	0.79	1.17	0.76	1.29
2022	0.58	3.07	0.93	1.08	0.90	1.10	0.78	1.16	0.71	1.33
2023	0.58	3.49	0.93	1.08	0.91	1.09	0.82	1.21	0.74	1.32

Source: Multipliers.xls

4.3.4 CO2 MIDAS Runs

The MIDAS model was also run with three alternative scenarios that included possible future carbon allowance payments. These three scenarios do not include any uncertainty or volatility; the only difference is the additional requirement that CO2 allowances will need to be obtained –beginning in 2012 in the "Medium CO2" case and in 2010 in the "High CO2" case. The model inputs for the three cases include an estimated price for a carbon allowance in terms of $/Ton of carbon, and the overall emissions cap. A summary of these inputs is shown in Table 4-5.

Table 4-5. Allowances and Emissions Caps for CO2 MIDAS Runs

Year	Low Case		Medium Case		High Case	
	Allowance Price ($/ton)	Emissions Cap (tons)	Allowance Price ($/Ton)	Emissions Cap (tons)	Allowance Price ($/ton)	Emissions Cap (tons)
2007	0	0	0	0	0	0
2008	0	0	0	0	0	0
2009	0	0	0	0	0	0
2010	0	0	0	0	44	11,553,000
2011	0	0	0	0	45	11,553,000
2012	7	0	12	12,392,000	46	11,553,000
2013	7	0	12	12,392,000	47	11,553,000
2014	7	0	13	12,392,000	49	11,553,000
2015	10	0	13	12,392,000	50	11,553,000
2016	10	0	13	12,392,000	51	11,553,000
2017	11	0	14	12,392,000	52	11,553,000
2018	11	0	14	12,392,000	54	11,553,000
2019	11	0	14	12,392,000	55	11,553,000
2020	11	0	15	12,392,000	56	11,553,000
2021	12	0	15	12,392,000	58	11,553,000
2022	12	0	16	12,392,000	59	11,553,000
2023	12	0	16	12,392,000	61	11,553,000

Source: CO2 Prices.xls

A comparison was done between the market prices from the three different CO2 runs and the market prices from the other 35 MIDAS model runs, which used multipliers to address uncertainty across factors other than CO2. It was found that values from the three CO2 cases are not always higher than the maximum of the other 35 cases, because the uncertainties included in the 35 MIDAS model runs are not included in the CO2 runs. The CO2 runs represent additional market price uncertainty, in addition to the uncertainties included in the 35 MIDAS runs, and this uncertainty needs to be added onto the prices from the 35 MIDAS runs. The CO2 scenario runs were used to develop a "price adder" to the price distributions from 35 MIDAS model runs.

Table 4-6 shows a summary of the CO2 data analysis. This table includes the number of hours that the CO2 mid and high case is higher than the maximum of the 35 cases, and the average price increase for those hours in each year.

Table 4-6. Price Increase from Max of 35 Runs to CO2 Runs

Summary of increase from max of 35 runs to Mid and High CO2 cases				
Year	Mid CO2		High CO2	
	Count	Average	Count	Average
2012	646	7%	3536	28%
2013	336	7%	2735	26%
2014	863	9%	3616	23%
2015	53	3%	2196	25%
2016	34	10%	419	12%
2017	44	8%	919	17%
2018	8	11%	667	14%
2019	29	9%	413	15%
2020	34	10%	419	12%
2021	14	3%	474	9%
2022	48	10%	234	9%
2023	32	12%	12	5%
		8%		16%

Source: Max CO2 Scenarios.xls

It should be noted that the prices produced by the model for the low, mid, and high CO2 scenarios are not always ranked in that order. There are instances where price for the low CO2 scenario is higher than the price for the high CO2 case, for a given hour. There are two possible reasons for this:

- The low price scenario grants no emissions cap and trade, so in effect it can be more expensive to system operations than the medium case, as it functions more like a tax on all CO2 emissions. [10]

[10] This insight was provided by Mr. Doug Jasa of KCPL.

- There is an anomaly that occurs in some hours as a result of the model planning (MRX) logic. When generation costs increase dramatically, that will encourage the addition of more low cost generation. This has a tendency to minimize the scarcity premium in higher priced hours and "choke-out" the dispatch of inefficient units in all hours. For instance, in a high CO2 scenario, a coal unit with a very high heat rate could be displaced from the market altogether.[11]

The likely introduction of CO2 emission allowances in the next few years, which will probably include a cap and trade scheme for utilities, is one uncertainty that should be included as a potential price driver. It was decided to combine the basic 35 MIDAS runs with these CO2 runs by adding a percent increase to the 35 runs. The average increases shown above for the mid and high CO2 cases – 8% for the mid case and 16% for the high case – will be used to generate two additional sets of energy prices that reflect these CO2 scenarios.

Thus, three sets of avoided energy costs will be used in the EE screening process:

- base 35 MIDAS runs with multipliers to capture uncertainty in price drivers
- base plus incremental costs from mid CO2 run
- base plus incremental costs from high CO2 run

It was decided to use only the mid and high CO2 scenarios, and not the low CO2 scenario, due to the need to limit the number of scenarios that will eventually be analyzed in the EE cost-effectiveness screening analyses, and also due to the fact that the avoided costs were not expected to change that much for the low CO2 scenario.

4.3.5 Adjustments for Energy Sales

As noted in Section 3.1, the avoided cost for MWh sold by KCP&L into the market is the market price less the cost of producing the energy. Therefore, the MIDAS prices will need to be adjusted to reflect the fact that some of the energy saved by the implementation of EE is sold. This adjustment will be applied to the prices for each hour of the year. Prices for coal generation will be used, as this is the dominant type of generation for the hours in which energy is typically sold.

The following assumptions will be made about the energy saved through EE[12]:

- 75% of the avoided energy is sold, and is generated from coal. Then the avoided cost is the market price less the coal marginal production costs, which is $13.67/MWh in 2007 dollars.

- The remaining 25% of avoided energy is avoided purchases. Then the avoided cost is the full market price

- Coal production costs will be escalated at 3% per year.

The prices will be adjusted as follows:

adjusted cost = 25% * market price + 75% * (market price – production cost)

[11] This insight was provided by Mr. Roger Powell of KCPL.

[12] These assumptions and percentages were provided by Mr. Randy Hughes of KCPL

4.3.6 Format of Avoided Energy Cost Data

The required format for the avoided energy cost data, as used by the DSMore model to be used for the DSM screening is a lognormal probability distribution for each hour of the year, for the entire modeling period (21 years). This data will be generated with the use of Crystal Ball software from the adjusted MIDAS price data. Three sets of these data will be generated:

1. **A Base Uncertainty Case** using the results from the 35 MIDAS model runs incorporating the multipliers to capture uncertainty in electricity prices.

2. **A Medium CO2 Case** where the incremental costs for CO2 from the medium CO2 scenario are added to the prices from the base uncertainty case (this method is described in Section 3.4).

3. **A High CO2 Case** where the incremental costs for CO2 from the high CO2 scenario are added to the prices from the base uncertainty case (this method is described in Section 3.4).

4.4 Summary and Next Steps

4.4.1 Summary

Summaries of the approaches taken to produce avoided costs and some of the results are presented here:

Avoided capacity costs are calculated with a capacity spreadsheet model. There are three cases in the model – low, base, and high peak demand – and each case has a "with EE" and "without EE" scenario. The difference in NPV of capital costs between the two scenarios for each case gives the avoided costs, presented as levelized $/kW-yr. A weighted average of the three cases is calculated to give a final single value, as shown in Table 4-7.

Table 4-7. Summary of Capacity Model Results

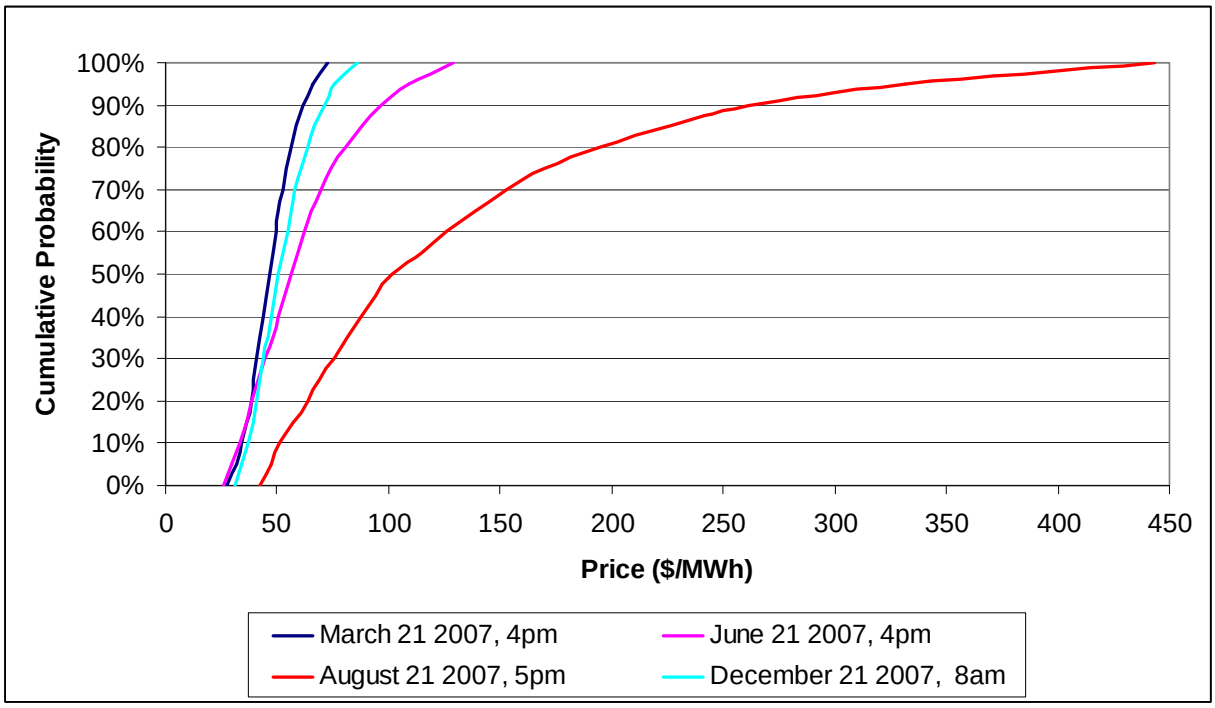
Case	Probability	Annualized NPV Savings	Annualized MW from EE	Mean	5%	95%	Std. Dev.
Low Demand	15%	$6,092,293	85.1	$71.57	64.59	78.69	4.29
Base Demand	55%	$9,624,582	88.0	$109.32	89.59	129.74	12.13
High Demand	30%	$11,930,391	89.9	$132.75	113.95	151.80	11.46
Weighted Average				110.69	93.15	128.70	10.75

Source: Final KCP&L Avoided Capacity Model.xls

Avoided energy costs are derived from the MIDAS market prices, in $/MWh. These prices are adjusted to reflect the fact that a proportion of energy is sold by the system, and then formatted into unique probability distributions for each hour of the year. These distributions represent the 35 cases of price drivers run through the model. Three sets of these distributions will be produced. The values in the 2nd and 3rd sets will be adjusted to reflect the mid CO2 and high CO2 cases from the CO2 MIDAS runs.

As the final data set of avoided energy costs is large (distributions for 8760 hours times 20 years), it is not possible to show the data in this report. Instead, four sample hours are shown here to give an idea of the spread of prices in the 35 values for one hour (Note: these prices have not yet been adjusted to reflect energy sales). Figure 4-3 below shows cumulative probability for four different hours, and the range of possible prices for those hours.

Figure 4-3. Cumulative Probability for Ranges of Prices, for Four Different Hours



4.4.2 Next Steps - Input to the EE Screening Model DSMore

The avoided capacity and avoided energy costs produced in this study will be used during the second phase of this project, in which specific EE measures and EE programs will be screened for cost effectiveness. Avoided capacity costs will be represented by a single annualized value. Avoided energy costs will be added to the model in the form of unique probability distributions for each hour of each year. There will be three sets of the energy price data – base, mid CO2, and high CO2. Details of this process will be provided in later documentation.

5. KCP&L BASELINE ENERGY PROFILES

In this section, we describe the development of baseline market segment profiles and initial building simulation model specifications. KCP&L supplied considerable input data for this task including customer counts and billing data by market segment and sales forecasts for the Company's overall commercial and industrial customer sectors. Other data sources included Energy Insights' proprietary Energy Market Profiles data, available to KCP&L through their Load Analysis Strategies subscription. Energy Insights used the results of the market profile analysis to calibrate market segment versions of the eQuest building simulation model. eQuest is a widely used commercial building simulation model based on the DOE-2 model. The remainder of this section describes each step in more detail.

- **Develop 2006 electricity use by for each customer segment**. KCP&L provided a list of customer segments as well as estimates of energy use for 2006. These data are summarized at the end of this section.

- **Map KCP&L segments to Energy Market Profile segments**. Using analyst judgment, Energy Insights assigned each KCP&L customer segment to the best match among the Energy Market Profile segments. The mapping is presented in Table 5-1 for Phase I segments and Table 5-2 for Phase II segments.

- **Calibrate baseline energy use**. In this step, the energy use estimates by end use were calibrated to total segment electricity use. The calibration variable is building floor space. The resulting calibrated energy use by end use for each segment is presented at the end of this section.

- **Develop eQuest simulation files**. In this final step, Energy Insights calibrated eQuest prototypes for the Phase I segments to the calibrated energy profiles. This involved adjusting the equipment inventories in the eQuest files to be consistent with the annual energy use by end use from the baseline usage profile. This involved adjustments to five end uses: space heating, space cooling, water heating, interior lighting, and miscellaneous use.

Table 5-1. Phase I KCP&L customer segments

KCP&L Segment	# Accounts	2006 MWH	MWH/Account	Energy Market Profile Segment
DTN, OFC, GOV, and PUB accounts with annual use less than 850,000 kWh	8,788	530,700	60	Small office
DTN, OFC, GOV, and PUB accounts with annual use greater than or equal to 850,000 kWh	500	1,980,300	3,961	Large office
Education	1,226	572,800	467	Schools and colleges combined
Manufacturing	216	1,460,800	6,763	Manufacturing total

Table 5-2. Phase II KCP&L customer segments

KCP&L Segment	# Accounts	2006 MWH	MWH/Account	Energy Market Profile Segment
Apartments	2,112	55,517	26.29	Lodging
Churches	429	67,484	157.31	Public assembly
Communications	3,855	446,937	115.94	Small office
Data Centers	53	86,551	1633.04	Large office
Entertainment	341	177,545	520.66	Public assembly
Grocery	246	293,341	1192.44	Grocery
Health	499	473,049	947.99	Hospitals
Lodging	275	131,429	477.92	Lodging
Petroleum	306	104,761	342.36	Petroleum industries
Print	136	210,597	1548.51	Printing
Restaurant	636	185,192	291.18	Restaurant
Retail	1,226	613,652	500.53	Retail
Transportation	317	19,971	63.00	Transportation
Utilities	949	47,374	49.92	Services
Warehousing	224	97,912	437.11	Warehouse
All	11,604	3,011,312	259.51	

5.1 Phase I Baseline Market Profiles

This section presents the baseline market profiles for the Phase I market segments.

5.1.1 Phase I

Table 5-3. Small Office

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	24.6%	4.07	1.00	31.5
Space Cooling	90.1%	2.50	2.26	70.8
Water Heating	54.5%	0.59	0.32	10.1
Ventilation	100.0%	0.36	0.36	11.4
Cooking	1.5%	0.19	0.00	0.1
Lighting	100.0%	2.81	2.81	88.2
Refrigeration	5.1%	0.09	0.00	0.1
Office Equipment (PC)	89.4%	1.30	1.16	36.5
Office Equipment (non-PC)	100.0%	3.13	3.13	98.0
Other Uses	100.0%	5.87	5.87	184.1
Total			16.92	530.7

Table 5-4. Large Office

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	29.7%	2.87	0.85	88.4
Space Cooling	91.1%	2.70	2.46	255.0
Water Heating	53.9%	0.55	0.29	30.6
Ventilation	100.0%	0.75	0.75	77.7
Cooking	19.2%	0.09	0.02	1.8
Lighting	100.0%	3.46	3.46	358.6
Refrigeration	44.9%	0.08	0.03	3.5
Office Equipment (PC)	89.4%	1.64	1.47	152.2
Office Equipment (non-PC)	100.0%	2.63	2.63	272.7
Other Uses	100.0%	7.14	7.14	740.0
Total			19.10	1,980.3

Table 5-5. Education

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	8.3%	4.42	0.37	22.5
Space Cooling	51.5%	1.62	0.83	50.8
Water Heating	21.3%	1.38	0.29	17.9
Ventilation	100.0%	0.46	0.46	27.7
Cooking	20.0%	0.24	0.05	3.0
Lighting	100.0%	3.88	3.88	236.3
Refrigeration	57.9%	0.16	0.09	5.6
Office Equipment (PC)	89.4%	0.46	0.41	24.9
Office Equipment (non-PC)	100.0%	0.73	0.73	44.6
Other Uses	100.0%	2.29	2.29	139.6
Total			9.41	572.8

Table 5-6. Total Manufacturing

End use	Midwest EMP Total GWh	KCP&L GWh
Indirect Uses-Boiler Fuel	1,454	30,785.0
Process Heating	37,128	786,279.0
Process Cooling and Refrigeration	17,093	361,991.5
Machine Drive	134,961	2,858,139.8
Electro-Chemical Processes	19,085	404,172.1
Other Process Use	1,382	29,272.9
Facility HVAC (f)	23,164	490,561.9
Facility Lighting	20,425	432,545.5
Other Facility Support	4,562	96,609.3
Onsite Transportation	515	10,898.0
Conventional Electricity Generation	-	-
Other Nonprocess Use	487	10,312.4
End Use Not Reported	7,897	167,249.7
Total	268,153	5,678,817.2

5.1.2 Phase II Commercial

This section presents the baseline market profiles for the Phase II commercial market segments.

Table 5-7. Churches Segment

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	9.3%	2.28	0.21	1.8
Space Cooling	70.8%	1.11	0.78	6.7
Water Heating	33.7%	0.94	0.32	2.7
Ventilation	100.0%	0.23	0.23	1.9
Cooking	13.6%	0.13	0.02	0.2
Lighting	100.0%	2.77	2.77	23.7
Refrigeration	30.2%	0.07	0.02	0.2
Office Equipment (PC)	89.4%	0.15	0.13	1.1
Office Equipment (non-PC)	100.0%	0.24	0.24	2.0
Other Uses	100.0%	3.18	3.18	27.2
Total			7.89	67.5

Table 5-8. Communications Segment

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	24.6%	4.07	1.00	26.5
Space Cooling	90.1%	2.50	2.26	59.6
Water Heating	54.5%	0.59	0.32	8.5
Ventilation	100.0%	0.36	0.36	9.6
Cooking	1.5%	0.19	0.00	0.1
Lighting	100.0%	2.81	2.81	74.3
Refrigeration	5.1%	0.09	0.00	0.1
Office Equipment (PC)	89.4%	1.30	1.16	30.7
Office Equipment (non-PC)	100.0%	3.13	3.13	82.5
Other Uses	100.0%	5.87	5.87	155.1
Total			16.92	446.9

Table 5-9. Data Centers Segment

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	0.0%	-	-	-
Space Cooling	100.0%	20.00	20.00	30.4
Water Heating	0.0%	-	-	-
Ventilation	100.0%	-	-	-
Cooking	0.0%	-	-	-
Lighting	100.0%	5.00	5.00	7.6
Refrigeration	0.0%	-	-	-
Office Equipment (PC)	100.0%	5.00	5.00	7.6
Office Equipment (non-PC)	100.0%	20.00	20.00	30.4
Other Uses	100.0%	7.00	7.00	10.6
Total			57.00	86.6

Table 5-10. Entertainment Segment

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	9.3%	2.28	0.21	4.8
Space Cooling	70.8%	1.11	0.78	17.6
Water Heating	33.7%	0.94	0.32	7.2
Ventilation	100.0%	0.23	0.23	5.1
Cooking	13.6%	0.13	0.02	0.4
Lighting	100.0%	2.77	2.77	62.3
Refrigeration	30.2%	0.07	0.02	0.5
Office Equipment (PC)	89.4%	0.15	0.13	3.0
Office Equipment (non-PC)	100.0%	0.24	0.24	5.3
Other Uses	100.0%	3.18	3.18	71.5
Total			7.89	177.5

Table 5-11. Grocery Segment

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	26.9%	9.72	2.62	12.4
Space Cooling	82.0%	8.72	7.16	34.0
Water Heating	34.8%	5.54	1.93	9.2
Ventilation	100.0%	2.41	2.41	11.4
Cooking	24.5%	1.54	0.38	1.8
Lighting	100.0%	18.95	18.95	90.0
Refrigeration	98.9%	15.81	15.64	74.3
Office Equipment (PC)	89.4%	1.04	0.93	4.4
Office Equipment (non-PC)	100.0%	1.67	1.67	7.9
Other Uses	100.0%	10.06	10.06	47.8
Total			61.74	293.3

Table 5-12. Health Segment

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	0.9%	7.46	0.07	1.0
Space Cooling	88.8%	3.93	3.49	53.0
Water Heating	4.2%	3.31	0.14	2.1
Ventilation	100.0%	1.54	1.54	23.3
Cooking	28.0%	0.89	0.25	3.8
Lighting	100.0%	5.06	5.06	76.9
Refrigeration	90.4%	0.18	0.16	2.5
Office Equipment (PC)	89.4%	1.13	1.01	15.4
Office Equipment (non-PC)	100.0%	1.81	1.81	27.5
Other Uses	100.0%	17.62	17.62	267.6
Total			31.15	473.0

Table 5-13. Lodging Segment

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	44.0%	2.48	1.09	8.5
Space Cooling	87.8%	1.62	1.42	11.0
Water Heating	14.0%	3.96	0.55	4.3
Ventilation	100.0%	0.53	0.53	4.1
Cooking	13.5%	0.33	0.04	0.3
Lighting	100.0%	5.06	5.06	39.4
Refrigeration	58.9%	0.29	0.17	1.3
Office Equipment (PC)	89.4%	0.26	0.23	1.8
Office Equipment (non-PC)	100.0%	0.41	0.41	3.2
Other Uses	100.0%	7.39	7.39	57.4
Total			16.91	131.4

Table 5-14. Restaurant Segment

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	14.4%	6.60	0.95	4.5
Space Cooling	84.2%	8.44	7.10	33.6
Water Heating	16.4%	19.82	3.25	15.4
Ventilation	100.0%	2.56	2.56	12.1
Cooking	28.7%	7.28	2.09	9.9
Lighting	100.0%	9.47	9.47	44.9
Refrigeration	97.3%	4.83	4.70	22.2
Office Equipment (PC)	89.4%	0.28	0.25	1.2
Office Equipment (non-PC)	100.0%	0.45	0.45	2.1
Other Uses	100.0%	8.28	8.28	39.2
Total			39.10	185.2

Table 5-15. Retail Segment

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	25.3%	4.94	1.25	50.1
Space Cooling	74.9%	2.39	1.79	71.6
Water Heating	46.8%	1.01	0.47	19.0
Ventilation	100.0%	0.57	0.57	23.0
Cooking	17.5%	0.32	0.06	2.3
Lighting	100.0%	4.74	4.74	189.8
Refrigeration	52.4%	0.40	0.21	8.5
Office Equipment (PC)	89.4%	0.54	0.49	19.5
Office Equipment (non-PC)	100.0%	0.87	0.87	34.9
Other Uses	100.0%	4.87	4.87	195.1
Total			15.33	613.7

Table 5-16. Utilities Segment

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	9.7%	3.34	0.32	1.3
Space Cooling	30.7%	2.74	0.84	3.4
Water Heating	34.9%	0.78	0.27	1.1
Ventilation	100.0%	0.44	0.44	1.8
Cooking	3.0%	0.25	0.01	0.0
Lighting	100.0%	4.07	4.07	16.2
Refrigeration	12.4%	0.31	0.04	0.2
Office Equipment (PC)	89.4%	0.52	0.47	1.9
Office Equipment (non-PC)	100.0%	0.84	0.84	3.3
Other Uses	100.0%	4.58	4.58	18.3
Total			11.88	47.4

Table 5-17. Warehousing Segment

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	4.2%	4.58	0.19	2.5
Space Cooling	18.9%	1.21	0.23	3.0
Water Heating	39.8%	0.22	0.09	1.2
Ventilation	100.0%	0.10	0.10	1.3
Cooking	0.9%	0.05	0.00	0.0
Lighting	100.0%	2.26	2.26	29.9
Refrigeration	10.1%	0.39	0.04	0.5
Office Equipment (PC)	89.4%	0.22	0.20	2.6
Office Equipment (non-PC)	100.0%	0.35	0.35	4.7
Other Uses	100.0%	3.95	3.95	52.2
Total			7.41	97.9

Table 5-18. Apartment Segment

End use	Shares of floor space	EUIs (kWh/ conditioned sq. ft.)	Intensities (kWh/sq.ft.)	Sales (GWh)
Space Heating	44.0%	2.48	1.09	3.6
Space Cooling	87.8%	1.62	1.42	4.7
Water Heating	14.0%	3.96	0.55	1.8
Ventilation	100.0%	0.53	0.53	1.7
Cooking	13.5%	0.33	0.04	0.1
Lighting	100.0%	5.06	5.06	16.6
Refrigeration	58.9%	0.29	0.17	0.6
Office Equipment (PC)	89.4%	0.26	0.23	0.7
Office Equipment (non-PC)	100.0%	0.41	0.41	1.3
Other Uses	100.0%	7.39	7.39	24.3
Total			16.91	55.5

5.1.3 Phase II Manufacturing

This section presents the baseline market profiles for the Phase II manufacturing segments.

Table 5-19. Petroleum Segment

End use	Midwest EMP Total GWh	KCP&L GWh
Indirect Uses-Boiler Fuel	51	0.8
Process Heating	571	8.7
Process Cooling and Refrigeration	282	4.3
Machine Drive	5,482	83.8
Electro-Chemical Processes	6	0.1
Other Process Use	23	0.4
Facility HVAC (f)	219	3.3
Facility Lighting	186	2.8
Other Facility Support	28	0.4
Onsite Transportation	0	0.0
Conventional Electricity Generation	-	-
Other Nonprocess Use	2	0.0
End Use Not Reported	3	0.1
Total	6,854	105

Table 5-20. Printing Segment

End use	Midwest EMP Total GWh	KCP&L GWh
Indirect Uses-Boiler Fuel	5	0.2
Process Heating	146	5.6
Process Cooling and Refrigeration	244	9.3
Machine Drive	2,785	106.0
Electro-Chemical Processes	10	0.4
Other Process Use	10	0.4
Facility HVAC (f)	972	37.0
Facility Lighting	648	24.6
Other Facility Support	150	5.7
Onsite Transportation	13	0.5
Conventional Electricity Generation	-	-
Other Nonprocess Use	2	0.1
End Use Not Reported	548	20.9
Total	5,534	211

Table 5-21. Transportation Segment

End use	Midwest EMP Total GWh	KCP&L GWh
Indirect Uses-Boiler Fuel	68	0.0
Process Heating	2,881	1.9
Process Cooling and Refrigeration	1,323	0.9
Machine Drive	12,715	8.6
Electro-Chemical Processes	305	0.2
Other Process Use	394	0.3
Facility HVAC (f)	5,423	3.7
Facility Lighting	4,433	3.0
Other Facility Support	1,030	0.7
Onsite Transportation	179	0.1
Conventional Electricity Generation	-	-
Other Nonprocess Use	72	0.0
End Use Not Reported	738	0.5
Total	29,561	20

6. DSM MEASURE CHARACTERIZATION

6.1 Baseline Consumption Profiles and Initial Building Simulation Model Specifications

This section of the report describes the analysis conducted and the analytical results for the baseline consumption profiles task. Energy Insights conducted this task to provide several deliverables specified in the project RFP as part of the market assessment scope of work, including:

- A reference data base of electric energy usage by customer class created with Kansas City Power & Light specific data. This includes information on the Company's C&I market by market segment.
- Energy usage modeling for estimating electricity sales to these customers, in terms of basic electric energy end uses such as space heat/cooling, lighting, water heating, cooking, clothes washers/dryers, and process energy and other identified measures, etc.

To support this task, Kansas City Power & Light supplied energy sales data by sector for calendar year 2006, which is summarized in the table below.

Table 6-1. KCP&L 2006 Summary C&I Customer Statistics[13]

	Commercial	Industrial
Customers	56,750	2,190
Energy Sales (GWh)	6,163	2,147
Average Energy Use/Customer (kWh)	108,600	980,400

6.1.1 Industrial Sector

KCP&L has a relatively small manufacturing sector, and most of these customers are in the category of light manufacturing. Thus their end-use profile is more like that of commercial customers, particularly warehouses and offices, than heavy manufacturing.[14] Specific measure types are difficult to define for the diverse manufacturing segments and Summit Blue limited the measure to generic motors and variable frequency drive controls, high-bay lighting, and broadly defined 'custom measures.'

6.1.2 Commercial Sector

In order to estimate the savings for climate-dependent or interactive measures for KCP&L's commercial customers, Energy Insights created basic building simulation models using eQUEST v. 3.6. Three models were developed as proxies for the Commercial segment: large office building, small office building and education. Together these three segments represent more than 40% of the GWH sold in the commercial sector.

[13] *Report-1: Comparative Billed Electric Revenues – Year-to-date December 31,* Kansas City Power & Light Company January 11, 2007

[14] *Load Forecast Documentation 2006-2025 Load Forecast*, Kansas City Power and Light, July 2006.

Large Office

The baseline simulation for the large office segment was prepared by Energy Insights based on market profile data they have compiled for the distribution of energy use among end-uses at a typical commercial office building. The baseline large office building simulation has the following attributes:

- Kansas City weather data is used.
- Gross building area is about 250,000 ft^2.
- Square footprint; approximately 176 feet on each side; 8 stories and about 31,250 ft^2 per floor.
- 4000 annual hours of operation.
- Windows are double-pane clear on the north side and tinted on the East, South, and West.
- Lighting systems average efficiency, 1.4 W/ ft^2 lighting power density. This LPD falls between standard T8 and T12 systems for office uses.
- Cooling is provided by a pair of equal-sized centrifugal water cooled chillers – 0.67 kW/ton.
- Chilled and condenser water are pumped by single speed pumps.
- The cooling tower is open-loop with an induced-draft configuration.
- The heating plant is modeled either as an electric boiler or natural gas fired boiler in order to capture the different interactive electric effects of lighting retrofits.
- Air distribution is variable air volume, modulated with dampers
- Air-side economizers are used.

These attributes and others such as load profiles, schedules and system setpoints are largely based on default settings in eQuest. Energy Insights calibrated the simulation against their end-use distribution.

Small Office

The baseline simulation for the small office segment was prepared by Energy Insights based on market profile data they have compiled for the distribution of energy use among end-uses at a typical small commercial office building. The baseline small office building simulation has the following attributes:

- Kansas City weather data is used.
- Gross building area is about 25,000 ft^2.
- Square footprint; approximately 110 feet on each side; 2 stories and about 12,500 ft^2 per floor.
- 3500 annual hours of operation
- Windows are double-pane clear on the north side and tinted on the East, South, and West.
- Lighting systems average 1.2 W/ ft^2 lighting power density. This LPD is slightly higher than typical T8 systems for office uses.
- Packaged split-system air-cooled direct-expansion coolers (9.5 EER) provide air-conditioning.
- The heating plant is modeled either as an electric boiler or natural gas fired boiler in order to capture the different interactive electric effects of lighting retrofits.
- Air distribution is single-zone, constant volume

- Air-side economizers are used.

These attributes and others such as load profiles, schedules and system setpoints are largely based on default settings in eQuest. Energy Insights calibrated the simulation against their end-use distribution.

Education

The baseline simulation for the education segment was prepared by Energy Insights based on market profile data they have compiled for the distribution of energy use among end-uses at a typical Education segment building. The baseline building simulation has the following attributes:

- Kansas City weather data is used.
- Gross building area is about 150,000 ft2.
- An H-shaped footprint; 2 stories and 75,000 ft2 per floor.
- 3050 annual hours of operation.
- Windows are double-pane clear on the north side and tinted on the East, South, and West.
- Lighting systems average 1.6 W/ ft2 lighting power density. This LPD is slightly higher than typical T8 systems for education uses.
- Packaged split-system air-cooled direct-expansion coolers (10.0 EER) provide air-conditioning.
- The heating plant is modeled either as an electric boiler or natural gas fired boiler in order to capture the different interactive electric effects of lighting retrofits.
- Air distribution is single-zone, constant volume
- Air-side economizers are used.

These attributes and others such as load profiles, schedules and system set points are largely based on default settings in eQuest. Energy Insights calibrated the simulation against their end-use distribution.

Summit Blue modified each of the baseline models to simulate various energy efficiency measures (EEMs). If the baseline simulation parameters did not match the measure baseline, Summit Blue modified the baseline twice for the measure –first to estimate energy use from the *in*-efficient technology and the second time to model the efficient technology. For example, if general lighting in the baseline model is 1.5 W/ft^2; typical T12 systems are about 1.8 W/ft^2 and T8 systems with the same illumination require about 1.2W/ft^2. Summit Blue modified the baseline to reflect 1.8 W/ft^2 and then again to reflect 1.2 W/ft^2, and the measure savings is the difference between the model results.

6.2 Commercial and Industrial DSM Measure Characterizations

This section describes the commercial and industrial energy efficiency measures analyzed for this study and the methods used to estimate savings. The section is organized by major end-uses such as HVAC, lighting and hot water. This section focuses on prescriptive measures, which are generally simple measures that have largely uniform energy and demand savings on a per unit basis from application to application. However, even prescriptive measures' savings will have some variability, depending on the specific application and baseline equipment replaced. Custom measures have more variable energy and demand savings on a per unit basis from application to application. Having the energy and demand savings for custom measures calculated on a site-specific basis will significantly improve the accuracy of

the energy and demand savings estimates for these measures, versus developing standard per unit estimates for these measures.

All of the energy and demand savings estimates presented below are generation savings, accounting for transmission and distribution losses between the generator and the end-use.

6.2.1 Lighting Measures

The following lighting measures are often part of utilities' prescriptive commercial and industrial lighting energy efficiency programs. In our potential analysis we assume include operating hours for lighting systems as indicated above unless otherwise noted. We also assume a peak coincidence factor of 90%. Most savings are estimated by calculating the difference between the input watts for the efficient technology and the standard technology and multiplying by coincidence factor for peak demand savings and annual hours of operation for energy savings. Exceptions to this general rule apply in two cases: (1) lighting controls and (2) general lighting systems in areas that are both heated and cooled. In the latter case the high number of connected Watts impacts the heating and cooling loads in the building. In both cases computer simulations are used to determine the combined effects of direct lighting efficiency savings, and the cross-impacts on heating and cooling loads. The size of the electric cross-impacts depend on the heating energy source, i.e. electricity or natural gas.

Measure costs are based on the California DEER database adjusted to the Kansas City area by regional cost factors from *RS Means Mechanical Cost Databook*[15].

T8 Lamps and Electronic Ballasts- Regular

T8 lamps and electronic ballasts are the most common alternative for standard T12 lamp and magnetic ballast tubular fluorescent lighting systems. T8 fluorescent lamps are one inch in diameter, and are thinner than T12 lamps, which are 1.5 inches in diameter. T8 systems are approximately 30% more efficient than standard T12 systems. This measure qualifies under the general lighting category, and direct lighting savings and indirect heating and cooling impacts are estimated by eQuest simulations.

T8 Lamps and Electronic Ballasts- Premium

Premium T8 lamps and electronic ballasts have the same market as regular T8 systems. They gain efficiency over regular T8 systems by the co-development of lamps and ballasts that optimize the efficiency of both when used together. This measure qualifies under the general lighting category, and direct lighting savings and indirect heating and cooling impacts are estimated by eQuest simulations.

T5 Lamps and Electronic Ballasts

T5 lamps and electronic ballasts are a newer alternative tubular fluorescent lighting system. T5 fluorescent lamps are 5/8 of an inch in diameter, thinner than both T8 lamps and T12 lamps. T5 lighting systems are primarily used in new construction, and are not appropriate for most retrofit situations, as the lamps are only generally available in metric lengths. This measure qualifies under the general lighting category, and direct lighting savings and indirect heating and cooling impacts are estimated by eQuest simulations.

[15] R.S. Means, "Mechanical Cost Data 2006" (RS Means Publishing).

Compact Fluorescent Lamp – Screw-in and Fixtures

Compact fluorescent lamps (CFLs) are the most common alternatives to standard incandescent lamps. CFLs are generally about four times as efficient as incandescent lamps, and last about 10 times as long. CFLs can either be screw-in replacements for incandescent lamps or plug-in lamps in fixtures specifically designed around CFL technology. Savings is determined by subtracting the input CFL Wattage from the lamp or fixture Wattage of the incandescent lamps they are replacing. The measure life for a screw-in CFL is the life of the bulb or 2-3 years depending on the application. Plug-in lamps in CFL fixtures are assumed to last the life of the fixture, because failed lamps must be replaced with comparable CFLs.

Occupancy Sensors

Occupancy sensors automatically turn off the lights in a room or an area when the area is unoccupied. Occupancy sensors are an alternative to standard wall mounted on/off lighting switches. Savings were determined by eQuest simulation assuming that 10% of lighting is controlled by occupancy sensors with an average reduction of 4 hours of use per day. HVAC interactions are included in the estimates.

Daylight Sensors

Lighting systems are designed assuming no contribution from ambient daylight. In areas where daylight is available, artificial light is unnecessary and possibly detrimental to occupant comfort. Daylight sensors measure the contribution of ambient daylight and either turn-off or dim the lamps of the artificial lighting system. Savings were determined by eQuest simulations, assuming that perimeter zone (less than 12 feet from an exterior fenestrated wall) lighting is controlled by daylight sensors to maintain required lighting levels with continuous lighting level control. eQuest input data include location specification for the solar incidence angles and hourly cloud cover to describe available sunlight. HVAC interactions are included in the estimates.

Pulse Start Metal Halide / High-Bay T8 / High-Bay T5 / High-Bay CFL

Traditional metal halide lamps are the standard for most high-bay applications, but alternatives are making inroads for several reasons. Fluorescent lamps are less expensive, have better color rendition and lumen maintenance and can be adapted to on/off and dimming controls for photocells and occupancy sensor applications. Pulse start metal halide lamps are a newer type of metal halide systems that use formed body arc tubes and require an ignitor to start the lamps. Pulse start metal halide lamps are more efficient than standard metal halide systems, and also provide better light output maintenance over the lifetime of the lamp, as well as a longer lamp lifetime. Since much high-bay lighting is in un-conditioned space or in temperature-stratified air at the top of the illuminated space, we do not include HVAC interactive effects in the savings estimates. Savings is determined by spreadsheet calculation using efficient system Watts, standard system Watts, 90% peak coincidence and hours of operation.

Delamping

The definition of delamping used for this project is replacing a four lamp, four foot fluorescent lighting fixture with a similar two lamp or three lamp fixtures. This measure is intended for areas that are currently over-lit. Lighting reflectors are often used as part of delamping projects. The measure life for this measure is shorter because the fixture is assumed to have been in place for a period of time already. Savings were determined by eQuest simulation. HVAC interactions are included in the estimates.

LED Exit Signs

LED exit signs are one of the most efficient types of exit signs on the market. They generally only draw about two to three watts of power, compared to 10 watts or more for CFLs, or 20 watts or more for incandescent exit signs.

Table 6-2. Commercial Lighting Measure Characteristics

Meas ID	Meas Name	Segment	Heat Source	Unit Value	Avg Peak Demand Savings Per Unit - Summer (kW)	Avg Annual Energy Savings Per Unit (kWh)	Incremental Measure Cost ($)	Measure Life (yrs)
1000 Series - Lighting								
	CFLs (20W)	Large Office	Electric	lamp	0.059	216	$7	2
	CFL engineered can (27W)	Large Office	Electric	Fixture	0.072	264	$90	15
	T5 w/ EB	Large Office	Electric	Fixture	0.062	141	$45	20
	Regular T8 w/ EB (3-lamp)	Large Office	Electric	Fixture	0.060	193	$44	12
	Premium T8 w/ EB (3-lamp)	Large Office	Electric	Fixture	0.079	290	$51	12
	Delamping w/ Reflectors (2-lamp)	Large Office	Electric	Fixture	0.037	109	$30	12
	LED Exit Signs	Large Office	Electric	Fixture	0.024	170	$40	20
	Occupancy Sensors (8 hrs/day)	Large Office	Electric	sensor	0.098	276	$85	12
	Daylighting (perimeter zone)	Large Office	Electric	sensor	2.174	2775	$800	15
	CFLs (20W)	Large Office	Gas	lamp	0.065	266	$7	2
	CFL engineered can (27W)	Large Office	Gas	Fixture	0.079	325	$90	15
	T5 w/ EB	Large Office	Gas	Fixture	0.039	113	$45	20
	Regular T8 w/ EB (3-lamp)	Large Office	Gas	Fixture	0.064	285	$44	12
	Premium T8 w/ EB (3-lamp)	Large Office	Gas	Fixture	0.081	344	$51	12
	Delamping w/ Reflectors (2-lamp)	Large Office	Gas	Fixture	0.039	132	$30	12
	LED Exit Signs	Large Office	Gas	Fixture	0.025	210	$40	20
	Occupancy Sensors (8 hrs/day)	Large Office	Gas	sensor	0.098	506	$85	12
	Daylighting (perimeter zone)	Large Office	Gas	sensor	1.982	3092	$800	15
	CFLs (20W)	Small Office	Electric	lamp	0.060	178	$7	2
	CFL engineered can (27W)	Small Office	Electric	Fixture	0.073	218	$90	15
	T5 w/ EB	Small Office	Electric	Fixture	0.028	63	$45	20
	Regular T8 w/ EB (3-lamp)	Small Office	Electric	Fixture	0.060	234	$44	12
	Premium T8 w/ EB (3-lamp)	Small Office	Electric	Fixture	0.064	254	$51	12
	Delamping w/ Reflectors (2-lamp)	Small Office	Electric	Fixture	0.029	99	$30	12
	LED Exit Signs	Small Office	Electric	Fixture	0.024	159	$40	20
	Occupancy Sensors (8 hrs/day)	Small Office	Electric	sensor	0.102	253	$85	12
	Daylighting (perimeter zone)	Small Office	Electric	sensor	1.536	2896	$800	15
	CFLs (20W)	Small Office	Gas	lamp	0.060	219	$7	2
	CFL engineered can (27W)	Small Office	Gas	Fixture	0.073	267	$90	15
	T5 w/ EB	Small Office	Gas	Fixture	0.030	101	$45	20
	Regular T8 w/ EB (3-lamp)	Small Office	Gas	Fixture	0.050	266	$44	12
	Premium T8 w/ EB (3-lamp)	Small Office	Gas	Fixture	0.065	313	$51	12
	Delamping w/ Reflectors (2-lamp)	Small Office	Gas	Fixture	0.026	122	$30	12
	LED Exit Signs	Small Office	Gas	Fixture	0.024	195	$40	20
	Occupancy Sensors (8 hrs/day)	Small Office	Gas	sensor	0.102	253	$85	12
	Daylighting (perimeter zone)	Small Office	Gas	sensor	1.515	3660	$800	15
	CFLs (20W)	Education	Electric	lamp	0.049	144	$7	3
	CFL engineered can (27W)	Education	Electric	Fixture	0.060	176	$90	15
	T5 w/ EB	Education	Electric	Fixture	0.038	76	$45	20
	Regular T8 w/ EB (4-lamp)	Education	Electric	Fixture	0.074	204	$42	12
	Premium T8 w/ EB (4-lamp)	Education	Electric	Fixture	0.071	213	$51	12
	Delamping w/ Reflectors (3-lamp)	Education	Electric	Fixture	0.038	79	$30	12
	LED Exit Signs	Education	Electric	Fixture	0.029	147	$40	20
	Occupancy Sensors (8 hrs/day)	Education	Electric	sensor	0.144	407	$85	12
	Daylighting (perimeter zone)	Education	Electric	sensor	1.297	1837	$800	15
	CFLs (20W)	Education	Gas	lamp	0.060	177	$7	3
	CFL engineered can (27W)	Education	Gas	Fixture	0.073	216	$90	15
	T5 w/ EB	Education	Gas	Fixture	0.030	93	$45	20
	Regular T8 w/ EB (4-lamp)	Education	Gas	Fixture	0.050	250	$42	12
	Premium T8 w/ EB (4-lamp)	Education	Gas	Fixture	0.065	262	$51	12
	Delamping w/ Reflectors (3-lamp)	Education	Gas	Fixture	0.026	98	$30	12
	LED Exit Signs	Education	Gas	Fixture	0.024	181	$40	20
	Occupancy Sensors (8 hrs/day)	Education	Gas	sensor	0.102	500	$85	12
	Daylighting (perimeter zone)	Education	Gas	sensor	1.515	2257	$800	15
	PS Metal Halides	Industrial	NA	Fixture	0.020	106	$126	8
	HB T5	Industrial	NA	Fixture	0.057	557	$140	8
	HB CFL	Industrial	NA	Fixture	0.057	557	$277	8

6.2.2 Water Heating Measures

These measures are essentially more efficient replacements for residential water heaters, which are often also installed in commercial facilities. Typical commercial hot water use is much lower than residential

use – about 1.5 gallons per occupant per day. For applications where water use is high, for example in food preparation or clean-up, these measures might be considered custom measures analyzed with site-specific data.

Measure costs are based on the California DEER database adjusted to the Kansas City area by regional cost factors from *RS Means Cost Data.*

Efficient Water Heaters

Traditional electric water heaters have an overall efficiency of about 90% including standby and distribution losses. High efficiency units achieve 95% efficiency with improved insulation and heat traps that minimize convection into under insulated distribution pipes. The savings estimate for the high-efficiency unit is calculated from the total hot water energy use and the unit efficiencies.

Heat Pump Water Heaters

Heat pump water heaters use compressed refrigerants to extract heat from ambient air (or water) and move that heat to stored hot water. During warm weather these machines can move 4 units of heat for every one comparable unit of input energy, thus achieving a coefficient of performance (COP) up to 4.0. COP decreases as ambient air temperature decreases. At about 10-20°F, heat pumps become ineffective. At cold ambient temperatures, traditional electric resistance heating elements back-up the heat pump compressor. Savings was determined using engineering estimates with a linear relationship between COP and outdoor air temperature until 20°F at which point we assumed electric resistance heat would take over.

Tankless Water Heaters

Tankless water heaters are more efficient than standard water heaters since they avoid the energy lost from the hot water that is stored in conventional tanks. Tankless water heaters have "energy factors" of about 98%. The savings estimate for the high-efficiency unit is calculated from the total hot water energy use and the unit efficiencies. The longer measure life for this measure reflects the cost hurdle for re-piping water distribution for reverting to the standard tank water heater.

Table 6-3. Commercial Hot Water Measure Characteristics

Meas ID	Meas Name	Segment	Heat Source	Unit Value	Avg Peak Demand Savings Per Unit - Summer (kW)	Avg Annual Energy Savings Per Unit (kWh)	Incremental Measure Cost ($)	Measure Life (yrs)
4000 Series- Water Heat								
	HE WH (94%)	Large Office	Electric	water heater	0.061	784	$83	10
	HPWH	Large Office	Electric	water heater	0.116	1504	$1,288	10
	Tankless WH (98%)	Large Office	Electric	water heater	0.784	10136	$497	10
	HE WH (94%)	Small Office	Electric	water heater	0.048	627	$83	10
	HPWH	Small Office	Electric	water heater	0.093	1202	$1,288	10
	Tankless WH (98%)	Small Office	Electric	water heater	0.627	8098	$497	10
	HE WH (94%)	Education	Electric	water heater	0.081	1046	$83	10
	HPWH	Education	Electric	water heater	0.155	2008	$1,288	10
	Tankless WH (98%)	Education	Electric	water heater	1.047	13526	$497	10

6.2.3 HVAC Measures

In the Kansas City Power & Light service territory most space heating is done by natural gas. Savings can occur through reducing the amount of heating/cooling required with insulation and setting back thermostat settings or by improving the efficiency of the equipment and/or distribution process.

Since HVAC savings is climate dependent, all of the savings for the following measures were determined with eQuest computer energy simulations. Savings is the difference between the simulation with the efficient technology and the simulation with the standard technology. Incremental costs are mostly based on *RS Means Mechanical Cost Data* adjusted with 'location factors' to reflect Kansas City labor and/or equipment costs.[16]

Efficient Water-Cooled Chilled Water Systems

Standard efficiency units are specified as units with an efficiency rating of 0.67 kW/ton cooling capacity. Efficient units are specified as units with an efficiency rating of 0.52 kW/ton.

Efficient Air-Cooled Chilled Water Systems

Standard efficiency units are specified as units with an efficiency rating of 1.35 kW/ton cooling capacity. Efficient units are specified as units with an efficiency rating of 1.10 kW/ton.

Efficient Packaged Commercial Air Conditioning Systems

Standard efficiency units are specified as units with EER ratings of 9.0. Efficient units are specified as units with EER ratings of 10.4-13.0 depending on the equipment size. Summit Blue characterized a high efficiency unit with an EER of 11.0.

Economizers

Economizers use outside air for cooling instead of operating the air conditioning compressors on mild days, particularly during the spring and early fall seasons. The analysis assumed an integrated economizer where 100% outdoor air is used up to 65°F ambient temperature. During peak summer conditions economizers do not have measurable benefits.

Programmable Thermostats

Programmable thermostats allow temperatures to be automatically set warmer or colder during unoccupied periods to reduce heating and cooling energy use when facilities are unoccupied. We analyzed 5°F setbacks (set-ups in the summer). Since the impact of set-backs is typically off-peak, these thermostats do not have discernable peak benefits.

High Efficiency HVAC Motors

Premium efficiency motors used in HVAC fan and pump applications. These motors typically exceed mandated EPACT efficiencies by 1-3%.

Variable Speed Drives Used in HVAC Fan and Pump Applications

Variable frequency drives (VFDs) or adjustable speed drives (ASDs) vary the speed of motors so that their speeds are proportionate to the loads the motors are serving. This saves energy because motor energy use varies with the cube of the speed for applications such as HVAC fans and pumps. This application of variable speed drives (VFDs) has more predictable energy and demand savings impacts

[16] *RS Means Mechanical Cost Databook, 2006*.

than many VFD applications. So some utilities include this measure as part of prescriptive HVAC programs.

Table 6-4. Commercial HVAC Measure Characteristics

Meas ID	Meas Name	Segment	Heat Source	Unit Value	Avg Peak Demand Savings Per Unit - Summer (kW)	Avg Annual Energy Savings Per Unit (kWh)	Incremental Measure Cost ($)	Measure Life (yrs)
2000 Series - HVAC								
2001	Hi-E Air-Cooled Chillers (1.1 kW.ton)	Large Office	Electric	Ton Cooling	0.266	391	$40	25
	Hi-E Water-Cooled Chillers (0.52 kW/ton)	Large Office	Electric	Ton Cooling	0.148	261	$91	25
	VFD Ventilation Fans	Large Office	Electric	bhp	0.212	1528	$160	20
	VFD Variable primary pumping - chw	Large Office	Electric	bhp	0.333	3112	$180	20
	Programmable Thermostats	Large Office	Electric	1000 sqft	0.000	7388	$50	15
	Integrated economizer control	Large Office	Electric	Ton Cooling	0.000	19	$8	20
	Programmable Thermostats	Large Office	Gas	1000 sqft	0.000	1630	$50	15
	Integrated economizer control	Large Office	Gas	Ton Cooling	0.000	25	$8	20
	Packaged cooling 11.0 EER	Small Office	Electric	Ton Cooling	0.236	207	$101	25
	Programmable Thermostats	Small Office	Electric	1000 sqft	0.000	2250	$50	15
	Integrated economizer control	Small Office	Electric	Ton Cooling	0.000	266	$170	20
	Programmable Thermostats	Small Office	Gas	1000 sqft	0.000	615	$50	15
	Integrated economizer control	Small Office	Gas	Ton Cooling	0.000	237	$170	20
	Packaged cooling 11.0 EER	Education	Electric	Ton Cooling	0.214	163	$101	25
	Programmable Thermostats	Education	Electric	1000 sqft	0.000	2995	$142	15
	Integrated economizer control	Education	Electric	Ton Cooling	0.000	99	$170	20
	Programmable Thermostats	Education	Gas	1000 sqft	0.000	819	$142	15
	Integrated economizer control	Education	Gas	Ton Cooling	0.000	88	$170	20

6.2.4 Process and Custom Measures

Refrigeration measures are the predominant category in this class of measures. The refrigeration measure impacts can be quantified in a prescriptive sense. Non-HVAC and custom application of premium motors and ASDs and other 'custom measures' are more application specific. For these measures we have included reported impacts from midwestern utility custom applications.

High-Efficiency Evaporator Fan Motors

This measure is a specific application of efficient motors. It is broken out separately for its consistent applicability in refrigeration applications.

High-Efficiency Refrigeration Compressors

This measure is comparable to more efficiency packaged HVAC equipment. More efficient compressors and controls reduce waste in the compression cycle. Better heat rejection via evaporative or water-coolers also can be employed to improve efficiency.

Strip Curtains

In grocery and convenience stores open vertical refrigeration cases permit excess cooling loads even when the store is closed. Strip curtains cover the product at night to keep cold air on the product and reduce the cooling loads.

Night Covers

In grocery and convenience stores open horizontal refrigeration cases permit excess cooling loads even when the store is closed. Use of night covers t keeps cold air on the product and reduces the cooling loads.

Premium Efficiency Motors

Unlike HVAC applications of these motors, Custom applications have widely divergent savings depending on the baseline efficiency and hours of use. The estimates used assume 2% efficiency improvements and 5000 annual hours of use.

Non-HVAC VFDs Motors

Unlike HVAC applications of VFDs, Custom applications have widely divergent savings depending on the baseline efficiency and hours of use. HVAC applications are mostly for centrifugal loads such as moving fluids like air and water. VFDs can be applied to many industrial processes such as conveyors and injection molding.

Custom Measures

This measure is a generic name for consumer-specific conservation projects. The magnitude of savings is scaled to kW saved and is based on Midwestern utility custom program results.

Table 6-5. Commercial Refrigeration and Custom Measure Characteristics

Meas ID	Meas Name	Segment	Heat Source	Unit Value	Avg Peak Demand Savings Per Unit - Summer (kW)	Avg Annual Energy Savings Per Unit (kWh)	Incremental Measure Cost ($)	Measure Life (yrs)
3000 Series- refrigeration								
	Hi-E Evaporator Fan Motors	Industrial	NA	HP	0.008	65	$15	15
	Hi-E Refrigeration Compressors	Industrial	NA	HP	0.054	434	$583	15
	Hi-E Ice Makers	Industrial	NA	ton capacity	0.035	375	$173	12
	Strip Curtains	Industrial	NA	lin foot	0.004	414	$18	4
	Night Covers	Industrial	NA	lin foot	0.000	333	$42	4
5000 Series - Custom								
	Premium Efficiency Motors (HP)	Industrial	NA	HP	0.007	48	$10	15
	Variable Frequency Drives (HP)	Industrial	NA	HP	0.000	2198	$278	15
	Custom Efficiency	Industrial	NA	kw	1.064	5319	$1,400	15

7. DSM POTENTIAL METHODOLOGY AND RESULTS

This section presents a summary of the methodology and results for the DSM potential aspect of the project.

7.1 Methodology

This section describes Summit Blue's DSM potential analysis approach and methods. The DSM potential analysis used the results of the customer baseline profiles and the DSM measure characterization, along with the DSM benchmarking results, as inputs to the DSM potential spreadsheets.

The general approach for estimating DSM resource potentials consisted of three steps: (1) estimate technical and economic DSM potential; (2) estimate preliminary market penetrations and the resulting achievable potential for each measure; and (3) calibrate the achievable DSM potential estimates using the benchmarking information described in a previous section. **This third step is the most important step in Summit Blue's DSM potential estimation process.** For this benchmarking analysis, the average annual DSM potential values for each end use and sector were compared to actual program results for corresponding top performing programs and portfolios.

Technical DSM potential means the amount of DSM savings that could be achieved, not considering economic and market barriers to customers installing DSM measures. Technical potential is calculated as the product of the DSM measures' savings per unit, the quantity of applicable equipment in each facility, the number of facilities in KCP&L's service area, and 100% - the measure's current market saturation. Technical potential estimates include DSM measures that are not cost effective, and technical potential does not consider market barriers such as customers' lack of awareness of DSM measures. Therefore, technical DSM potential estimates do not provide a realistic basis for setting DSM program goals.

Economic DSM potential means the amount of technical DSM potential that is "cost-effective," as defined by the results of the Total Resource Cost (TRC) test. Measures had to pass the TRC test in order to be considered to be cost effective, which screened out very few EE measures. The program benefits for the TRC test include the avoided costs of generation, transmission and distribution investments and avoided fuel costs due to the conserved energy caused by the DSM programs. The costs for the TRC test are the DSM measure costs plus the DSM program administration costs. The TRC test does not consider economic or market barriers to customers installing DSM measures. Summit Blue used DSMore to calculate the benefit-cost ratios of DSM measures.

Achievable potential is an estimate of the amount of DSM potential that could be captured by realistic DSM programs over the twenty- year forecast period (2008-2027) covered by this DSM potential analysis. The key parameter that must be estimated to forecast achievable DSM potential is the percentage of economic potential that is likely to be realized for each DSM measure at the end of the forecast period in 2027. This percentage is similar to the ultimate DSM measure saturations at the end of the forecast period. Summit Blue estimated these parameters for each DSM measure based primarily on the DSM benchmarking analysis, as well as our previous DSM potential projects.

For most non-lighting measures, maximum market penetrations of 50% over the forecast period were assumed, while mainstream lighting DSM measure saturations were generally assumed to reach 70%-80% saturation by 2028, as that range of lighting measure saturations are widely expected to be achieved over the long term. However, it is important to emphasize that Summit Blue's assumptions regarding end of period DSM measure saturation estimates were made so as to produce DSM potential estimates for

each sector and end use that are consistent with the utility and agency DSM program benchmarking results discussed in a previous section.

7.2 Commercial/Industrial EE Potential Results

This section provides the DSM potential results for the commercial and industrial sector. The total and annual residential achievable DSM potential results for the first 10 years are shown in Table 7-x below. The energy values shown below are for the DSM measures' first-year generator energy savings, the demand savings are the peak coincident demand savings, and the program costs are the total estimated DSM program budgets for a given year, including rebate or other customer incentive costs, as well as administrative, implementation, and evaluation costs. Therefore, the annual values in the table below are in the same format as the DSM goals that most utilities and agencies propose or report on through their DSM regulatory filings.

Table 7-1. Total 20 Year C&I Achievable Potential Estimates, and Years 1-10

Commercial	20 Year Total	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Lighting											
Achievable Potential Demand Savings (kW)	307,746	3,077	6,155	12,310	15,387	16,926	16,926	16,926	16,926	16,926	16,926
Achievable Potential Energy Savings (kWh)	1,267,173,588	12,671,736	25,343,472	50,686,944	63,358,679	69,694,547	69,694,547	69,694,547	69,694,547	69,694,547	69,694,547
Measure Costs	$228,317,854	$2,283,179	$4,566,357	$9,132,714	$11,415,893	$12,557,482	$12,557,482	$12,557,482	$12,557,482	$12,557,482	$12,557,482
Program Costs	$123,098,333	$1,230,983	$2,461,967	$4,923,933	$6,154,917	$6,770,408	$6,770,408	$6,770,408	$6,770,408	$6,770,408	$6,770,408
HVAC											
Achievable Potential Demand Savings (kW)	145,384	1,454	2,908	5,815	7,269	7,996	7,996	7,996	7,996	7,996	7,996
Achievable Potential Energy Savings (kWh)	433,712,894	4,337,129	8,674,258	17,348,516	21,685,645	23,854,209	23,854,209	23,854,209	23,854,209	23,854,209	23,854,209
Measure Costs	$67,918,370	$679,184	$1,358,367	$2,716,735	$3,395,919	$3,735,510	$3,735,510	$3,735,510	$3,735,510	$3,735,510	$3,735,510
Program Costs	$51,742,915	$517,429	$1,034,858	$2,069,717	$2,587,146	$2,845,860	$2,845,860	$2,845,860	$2,845,860	$2,845,860	$2,845,860
Refrigeration											
Achievable Potential Demand Savings (kW)	220	2	4	9	11	12	12	12	12	12	12
Achievable Potential Energy Savings (kWh)	22,881,940	228,819	457,639	915,278	1,144,097	1,258,507	1,258,507	1,258,507	1,258,507	1,258,507	1,258,507
Measure Costs	$2,088,118	$20,881	$41,762	$83,525	$104,406	$114,847	$114,847	$114,847	$114,847	$114,847	$114,847
Program Costs	$867,032	$8,670	$17,341	$34,681	$43,352	$47,687	$47,687	$47,687	$47,687	$47,687	$47,687
Water Heating											
Achievable Potential Demand Savings (kW)	100	1	2	4	5	6	6	6	6	6	6
Achievable Potential Energy Savings (kWh)	1,295,571	12,956	25,911	51,823	64,779	71,256	71,256	71,256	71,256	71,256	71,256
Measure Costs	$150,991	$1,510	$3,020	$6,040	$7,550	$8,305	$8,305	$8,305	$8,305	$8,305	$8,305
Program Costs	$30,081	$301	$602	$1,203	$1,504	$1,654	$1,654	$1,654	$1,654	$1,654	$1,654
Custom											
Achievable Potential Demand Savings (kW)	58,163	582	1,163	2,327	2,908	3,199	3,199	3,199	3,199	3,199	3,199
Achievable Potential Energy Savings (kWh)	538,912,472	5,389,125	10,778,249	21,556,499	26,945,624	29,640,186	29,640,186	29,640,186	29,640,186	29,640,186	29,640,186
Measure Costs	$107,541,101	$1,075,411	$2,150,822	$4,301,644	$5,377,055	$5,914,761	$5,914,761	$5,914,761	$5,914,761	$5,914,761	$5,914,761
Program Costs	$42,957,364	$429,574	$859,147	$1,718,295	$2,147,868	$2,362,655	$2,362,655	$2,362,655	$2,362,655	$2,362,655	$2,362,655
Total											
Achievable Potential Demand Savings (kW)	511,613	5,116	10,232	20,465	25,581	28,139	28,139	28,139	28,139	28,139	28,139
Achievable Potential Energy Savings (kWh)	2,263,976,465	22,639,765	45,279,529	90,559,059	113,198,823	124,518,706	124,518,706	124,518,706	124,518,706	124,518,706	124,518,706
Measure Costs	$406,016,436	$4,060,164	$8,120,329	$16,240,657	$20,300,822	$22,330,904	$22,330,904	$22,330,904	$22,330,904	$22,330,904	$22,330,904
Program Costs	$218,695,725	$2,186,957	$4,373,914	$8,747,829	$10,934,786	$12,028,265	$12,028,265	$12,028,265	$12,028,265	$12,028,265	$12,028,265

The total estimated commercial and industrial energy efficiency potential over the 20 year forecast period is about 2,300 GWh and 510 peak MW. Slightly more than half of this energy efficiency potential is projected to come from energy efficient lighting products, about 20% is projected to come from energy efficient HVAC equipment and controls, and about 25% of the total potential is expected to come from custom and motors measures. The total C&I energy efficiency potential amounts to approximately 17% of KCP&L's forecast 2028 C&I energy consumption of about 13,700 GWh. This is equal to annual average energy savings of about 115 GWh, or 1.2% of KCP&L's forecast 2007 C&I sales. The peak demand reduction potential is about 19% of KCP&L's forecast 2028 C&I peak demand of 2,700 MW. The total C&I energy efficiency program costs over the 20 year forecast period are estimated at about $220 million, or about $11 million per year on average.

The calibration target for C&I energy conservation potential from the benchmarking analysis that Summit Blue used to estimate KCP&L's EE potential was about 1% of KCP&L's annual baseline energy and peak demands, which were achieved in the short-term by the top C&I DSM portfolios reviewed. The slightly lower impacts are mainly due to the fact that Summit Blue estimates that a four year ramp-up period will be required until the full-scale annual EE impacts will be able to be achieved by KCP&L. It takes utilities that are new to DSM and their customers several years until they become most effective and receptive to implementing DSM measures. This assessment is based on the histories of the benchmark utilities and energy agencies. It is estimated that the annual achievements of the total DSM potential will

follow an s-shaped curve, with impacts of 1% of the total DSM potential in the first year, 2% in the second year, 4% in the third year, 5% in the fourth year, and 5.5% in the fifth year and beyond to the end of the 20-year forecast period.

7.2.1 C&I Energy Efficiency Results by End Use

C&I lighting measures account for about half of the total estimated C&I energy conservation potential, a total of about 307 MW of coincident peak demand reduction and 1,267 GWh of first year energy savings over the twenty-year forecast period. This amounts to an average of about 15 peak MW and 63 GWh per year.

T8 lamps and electronic ballasts in regular and high-bay applications are expected to account for the largest share of C&I lighting energy efficiency potential, about 80% of the total. CFL lamps and fixtures, T5 lamps and electronic ballasts, LED exit signs, and simple lighting controls such as occupancy sensors are expected to account for most of the other C&I lighting potential.

Custom measures such as energy management systems, and process motor measures are expected to account for the second largest share of C&I energy savings at about 539 GWh of first year energy savings and 58 MW of peak demand reduction in total over the 20 year forecast period. Variable speed drives in process applications are expected to account for the largest amount of energy efficiency potential in this category, at about one-third of the total.

Efficient HVAC and control systems are estimated to account for the third largest share of C&I energy efficiency potential, 433 GWh of first year energy savings, and 145 MW of peak demand reduction, over the 20 year forecast period. Efficient chillers and packaged cooling systems such as rooftop units are expected to account for the largest amount of energy savings in this category at about one-third of the total potential. Variable speed drives in ventilation fan applications are also expected to account for about one-third of the energy efficiency potential in this category. Programmable thermostats are expected to account for the largest share of energy savings from HVAC control measures.

Efficient refrigeration and water heating equipment are expected to account for relatively small amounts of energy efficiency potential over the forecast period due to the limited baseline saturations and energy consumptions for these end uses in the C&I market, and the limited impacts that these types of measures have realized in regional and national energy efficiency programs.

8. COST-EFFECTIVENESS ANALYSIS

The cost-effectiveness analysis of C&I energy conservation measures involved developing a list of possible measures, quantifying the necessary data inputs for the DSMore model, placing this information within the model, and running the model. The model produces four types of cost-effectiveness test values for each measure. This section of the report summarizes this procedure and presents the results of the cost-effectiveness analysis.

8.1 Key General Inputs

Key general inputs (i.e., inputs that are common across all measures) in the cost-effectiveness analysis include the following:

- Base Energy Price
- Avoided transmission and distribution costs
- Ask adder above wholesale and base charge
- Supply, load following, and risk management fee
- Reserve margin adder
- Avoided Market-based ancillary service charges
- Bills, Generation, and T&D annual escalators

Other general inputs include such information as C&I electricity rates, tax rate, line losses, and the utility discount rate. The values for these general inputs are presented in the table below.

Table 8-1. Key General Cost-Effectiveness Inputs

Input	Value
Base Energy Price Year 1	 $52.51/MWh
Avoided T&D	$25.00/kW
Ask Adder	5%
Supply, Load, Risk Adder	40%
Reserve Margin Adder (summer)	13.6%
Avoided Market-Based Ancillary Service Charges All months Peak Months Off-Peak Months	 $1.00 /kW $1.00 /kW $1.00 /kW

Several measure-level values were created as inputs to the model, to define the measures that were evaluated. These inputs are presented in the measure characterization chapter. The key inputs for each measure were:

- Demand savings
- Energy savings
- Measure lifetime
- Measure cost
- Percentage of savings achieved in each month

Program-level inputs that were added to the model included program administrative costs. These cost assumptions are given in the table below for each group of measures.

Table 8-2. KCP&L C&I EE Program Costs—2005 Basis

	Total Cost	Admin Cost	Incentive
Program Type	**Peak kW**	**Peak kW**	**Peak kW**
Lighting	$400	$100	$300
HVAC	$300	$45	$255
Motors/Compressed Air	$500	$150	$350
Refrigeration	$650	$325	$325
Custom	$600	$300	$300
Water Heating	$400	$98	$302

8.2 Cost-Effectiveness Results – Measures

This section summarizes the measure-level results of the cost-effectiveness analysis. DSMore produces the following four cost-effectiveness test results:

- **Utility Test (UT)** – The benefits for the utility test are the avoided costs of generation, transmission, and distribution investments, and avoided fuel costs from the conserved energy due to the DSM programs. The costs for the UT are just the DSM program costs.
- **Total Resource Cost Test (TRC)** – The benefits for the TRC test are the avoided costs of generation, transmission, and distribution investments, and avoided fuel costs from the conserved energy due to the DSM programs. The costs for the TRC test are the DSM measure costs plus the DSM program administration costs.
- **Ratepayer Impact Test (RIM)** – The benefits for the RIM test are the avoided costs of generation, transmission, and distribution investments, and avoided fuel costs from the conserved energy due to the DSM programs. The costs for the RIM test are the DSM program costs plus the "lost revenues" due to the DSM programs.
- **Participant Test (PT)** – The benefits for the participant test include the reduction in the customer's utility bill(s), any incentive paid by the utility or other third parties, and any federal, state, or local tax credit received. The costs for the PT are all out-of-pocket expenses incurred as a result of participating in a program, plus any increases in the customer's utility bill(s).

The results for each measure, classified as Large Office, Small Office, Educational, or Other, are presented in the tables below.

Table 8-3. Small Office Measures Cost-Effectiveness Results

Measure	Utility	TRC	RIM	Participant Test
SmOff CFL engineered can (27W) Elec	10.01	3.02	2.16	1.43
SmOff CFL engineered can (27W) Gas	12.29	3.70	2.25	1.70
SmOff CFLs (20W) Elec	1.85	3.42	1.11	4.88
SmOff CFLs (20W) Gas	2.27	4.20	1.25	5.41
SmOff Daylighting (perimeter zone) Elec	6.38	4.11	1.93	2.35
SmOff Daylighting (perimeter zone) Gas	8.16	5.20	2.06	2.81
SmOff Delamping w Reflectors (2-lamp) Elec	9.96	3.49	2.16	1.68
SmOff Delamping w Reflectors (2-lamp) Gas	13.88	4.35	2.30	1.97
SmOff LED Exit Signs Elec	27.06	6.01	2.49	2.49
SmOff LED Exit Signs Gas	33.22	7.37	2.54	3.02
SmOff T5 w EB Elec	8.84	2.09	2.10	0.99
SmOff T5 w EB Gas	13.54	3.37	2.29	1.50
SmOff Occupancy Sensors (8 hrs day) Elec	7.22	3.09	2.00	1.61
SmOff Occupancy Sensors (8 hrs day) Gas	7.22	3.09	2.00	1.61
SmOff Premium T8 w EB (3-lamp) Elec	11.47	5.18	2.22	2.50
SmOff Premium T8 w EB (3-lamp) Gas	13.89	6.35	2.30	2.99
SmOff Regular T8 w EB (3-lamp) Elec	11.25	5.49	2.21	2.69
SmOff Regular T8 w EB (3-lamp) Gas	15.25	6.33	2.33	2.92
SmOff Integrated economizer control Elec	46.59	2.47	2.59	0.95
SmOff Integrated economizer control Gas	46.53	2.21	2.59	0.85
SmOff Packaged cooling 11.0 EER Elec	5.33	3.39	1.83	1.94
SmOff Programmable Thermostats Elec	39.19	49.29	2.56	23.49
SmOff Programmable Thermostats Gas	39.18	15.62	2.56	6.42
SmOff HE WH (94%) Elec	32.66	7.22	2.53	2.96
SmOff HPWH Elec	32.67	0.94	2.53	0.37
SmOff Tankless WH (98%) Elec	32.67	14.66	2.53	6.39

Table 8-4. Large Office Measures Cost-Effectiveness Results

Measure	Utility	TRC	RIM	Participant Test
LgOff CFL engineered can (27W) Elec	11.54	3.44	2.56	1.37
LgOff CFL engineered can (27W) Gas	12.99	4.20	2.63	1.65
LgOff CFLs (20W) Elec	2.13	3.92	1.29	4.74
LgOff CFLs (20W) Gas	2.40	4.62	1.39	5.48
LgOff Daylighting (perimeter zone) Elec	4.08	3.49	1.80	2.20
LgOff Daylighting (perimeter zone) Gas	4.98	3.95	1.96	2.27
LgOff Delamping w Reflectors (2-lamp) Elec	8.06	3.54	2.33	1.58
LgOff Delamping w Reflectors (2-lamp) Gas	9.26	4.23	2.43	1.84
LgOff Occupancy Sensors (8 hrs day) Elec	7.69	3.18	2.30	1.43
LgOff Occupancy Sensors (8 hrs day) Gas	14.05	5.80	2.68	2.30
LgOff Premium T8 w EB (3-lamp) Elec	9.99	5.41	2.48	2.37
LgOff Premium T8 w EB (3-lamp) Gas	11.54	6.39	2.57	2.73
LgOff T5 w EB Elec	8.58	4.14	2.37	1.85
LgOff T5 w EB Gas	10.96	3.46	2.53	1.40
LgOff LED Exit Signs Elec	26.17	6.03	2.94	2.11
LgOff LED Exit Signs Gas	31.00	7.40	3.00	2.56
LgOff Regular T8 w EB (3-lamp) Elec	8.82	4.25	2.39	1.88
LgOff Regular T8 w EB (3-lamp) Gas	12.15	6.22	2.60	2.60
LgOff Hi-E Air-Cooled Chillers (1.1 kW.ton) Elec	8.32	12.80	2.33	6.85
LgOff Hi-E Water-Cooled Chillers (0.52 kwton) Elec	9.99	4.53	2.45	1.91
LgOff Integrated economizer control Elec	43.48	3.38	3.10	1.09
LgOff Integrated economizer control Gas	43.82	4.49	3.10	1.46
LgOff Programmable Thermostats Elec	36.81	106.26	3.06	60.47
LgOff Programmable Thermostats Gas	36.82	35.38	3.06	13.34
LgOff Tankless WH (98%) Elec	30.69	16.77	3.00	6.30
LgOff HE WH (94%) Elec	30.68	8.37	3.00	2.92
LgOff HPWH Elec	30.69	1.10	3.00	0.36
LgOff VFD Variable primary pumping - chw Elec	28.04	20.31	2.97	8.46
LgOff VFD Ventilation Fans Elec	21.68	11.97	2.88	4.79

Table 8-5. Educational Measures Cost-Effectiveness Results

Measure	Utility	TRC	RIM	Participant Test
Edu CFL engineered can (27W) Elec	9.78	2.46	2.14	1.16
Edu CFL engineered can (27W) Gas	9.88	2.98	2.15	1.42
Edu CFLs (20W) Elec	2.64	4.37	1.35	4.84
Edu CFLs (20W) Gas	2.67	4.93	1.35	5.92
Edu Daylighting (perimeter zone) Elec	4.79	2.67	1.75	1.61
Edu Daylighting (perimeter zone) Gas	5.04	3.21	1.78	1.95
Edu Delamping w Reflectors (3-lamp) Elec	6.09	2.72	1.89	1.49
Edu Delamping w Reflectors (3-lamp) Gas	11.02	3.46	2.19	1.62
Edu LED Exit Signs Elec	20.00	5.47	2.41	2.36
Edu LED Exit Signs Gas	30.63	6.80	2.51	2.81
Edu Occupancy Sensors (8 hrs day) Elec	8.14	4.73	2.05	2.52
Edu Occupancy Sensors (8 hrs day) Gas	14.14	6.05	2.29	2.84
Edu Regular T8 w EB (4-lamp) Elec	7.93	4.81	2.04	2.60
Edu Regular T8 w EB (4-lamp) Gas	19.09	6.58	2.39	2.84
Edu Premium T8 w EB (4-lamp) Elec	8.68	4.28	2.08	2.20
Edu Premium T8 w EB (4-lamp) Gas	11.60	5.30	2.22	2.57
Edu T5 w EB Elec	10.62	2.59	2.18	1.19
Edu T5 w EB Gas	16.58	3.20	2.35	1.37
Edu Integrated economizer control Elec	46.31	0.92	2.58	0.36
Edu Integrated economizer control Gas	46.51	0.82	2.58	0.32
Edu Packaged cooling 11.0 EER Elec	4.63	2.69	1.74	1.60
Edu Programmable Thermostats Elec	39.03	25.43	2.55	10.95
Edu Programmable Thermostats Gas	39.02	7.48	2.55	2.99
Edu HE WH (94%) Elec	32.53	11.59	2.52	4.94
Edu HPWH Elec	32.53	1.55	2.52	0.61
Edu Tankless WH (98%) Elec	32.53	22.70	2.52	10.67

Table 8-6. Other Measures Cost-Effectiveness Results

Measure	Utility	TRC	RIM	Participant Test
Other HB CFL Elec	17.11	1.39	2.01	0.68
Other HB T5 Elec	17.11	2.69	2.01	1.35
Other PS Metal Halides Elec	9.48	0.59	1.84	0.31
Other LED traffic signals Elec	16.58	1.20	2.00	0.59
Other Hi-E Evaporator Fan Motors Elec	17.89	4.45	2.02	2.30
Other Hi-E Ice Makers Elec	15.78	1.95	1.99	0.98
Other Hi-E Refrigeration Compressors Elec	13.77	0.80	1.96	0.39
Other Strip Curtains Elec	67.72	8.34	2.20	3.97
Other Night Covers Elec	5.25	2.37	1.59	1.64
Other Premium Efficiency Motors (HP) Elec	14.83	4.83	1.98	2.60
Other Variable Frequency Drives (HP) Elec	19.46	7.73	2.04	4.17
Other Custom Efficiency Elec	9.30	3.45	1.83	2.08

These results show that most of the measures are very cost-effective from all aspects (utility, TRC, RIM, and Participant). Eighty measures pass all four tests and 13 measures have at least one test that did not pass.

This result is common for the utility test and the TRC test results, but is uncommon for the RIM test results, which often are less than one for energy conservation measures. These results indicate that there are many clearly cost-effective DSM measures that KCP&L can implement.

8.3 Cost-Effectiveness Results – Program-Level

This section summarizes the program-level results of the cost-effectiveness analysis.

To find total cost effectiveness for each program, the results of the potential by measure runs were rolled up using the DSMore Roll-Up tool. This tool recalculates the tests based on the "rolled-up" dollar numbers. The costs and savings are aggregated across the measures and the cost-effectiveness tests (e.g., TRC test) are calculated again.

In addition, DSMore was used to evaluate a New Construction program, with estimated totals from the program entered into the model, in terms of savings and costs. The model was run with the Large Commercial load shape.

The table below shows the aggregated cost-effectiveness tests for each program.

Table 8-7. Results of Roll-up By Program

Program-level (From Roll- up Files)	Custom	Lighting	HVAC	New Construction
Utility Test	20.48	14.33	10.82	12.37
TRC Test	6.62	6.01	7.36	4.86
RIM Test	2.25	2.47	2.37	2.60
RIM (Net Fuel)	2.25	2.47	2.37	2.60
Societal Test	7.52	6.74	8.20	5.44
Participant Test	3.05	2.49	3.20	2.08

The roll-up procedure produced results for each program that are well above cost-effectiveness and that are higher than the average of the tests for individual measures.

APPENDIX A: 2005 C&I DSM RESULTS BY REGION

Region	Utility/Agency	DSM Results			Customers	Annual GWh	Peak MW	Revenue ($M)	Spending as % of Revenue	Energy Savings as % of Sales	Demand Savings as % of Peak	Cost of Savings	
		GWh	MW	Costs ($M)								$/kWh	$/kW
Midwest	Duke Energy Indiana	2	0.434	< 1	84,527	5,448	1,308	97	< 0.1%	< 0.1%	< 0.1%	0.19	917
	Duke Energy Kentucky	2	0.5	< 1	14,247	2,470	535	139	0.4%	0.1%	0.1%	0.03	97
	Interstate P&L	93	25	11	82,234	11,841	1,846	484	1.4%	0.8%	1.4%	0.11	396
	MidAmerican Energy	86	6	8	83,009	11,760	2,424	675	1.2%	0.7%	0.2%	0.10	1,333
	Minnesota Power	28	3	1	2,000	8,457	899	361	0.3%	0.3%	0.3%	0.04	333
	Otter Tail	14	2	1	11,745	1,382	212	78	1.3%	1.0%	1.0%	0.07	500
	Wisconsin (WECC)	123	23	14	311,259	46,784	10,648	2,754	0.5%	0.3%	0.2%	0.11	609
	Xcel Energy (MN)	250	47	25	128,815	22,103	3,781	1,220	2.0%	1.1%	1.2%	0.10	532
Northeast	Efficiency Maine	19	N/A	4	94,291	8,037	1,294	671	0.6%	0.2%	N/A	0.21	-
	Efficiency Vermont	27	4	7	46,978	3,554	1,013	351	2.0%	0.8%	0.4%	0.26	1,750
	NJ CEP	288	36	24	472,641	66,695	6,665	4,782	0.5%	0.4%	0.5%	0.08	667
	NYSERDA	1,295	280	183	1,083,954	131,969	23,669	10,640	1.7%	1.0%	1.2%	0.14	654
Florida	Florida P&L	93	7	10	490,367	47,364	12,114	4,738	0.2%	0.2%	0.1%	0.11	1,429
	Gulf Power	2	1	1	53,696	5,897	1,274	396	0.3%	0.0%	0.1%	0.50	1,000
	Progress Energy	3	1	2	196,002	19,283	6,079	1,232	0.2%	0.0%	0.0%	0.67	2,000
	Tampa Electric	8	0.48	< 1	71,249	8,700	2,455	681	0.1%	0.1%	0.0%	0.04	706
Canada	BC Hydro	124	N/A	26	190,716	35,391	N/A	1,395	1.9%	0.4%	N/A	0.21	-
	Manitoba Hydro	40	7.5	10	62,826	13,411	2,488	457	2.2%	0.3%	0.0%	0.25	1,333
California	PG&E	651	109	90	617,603	51,841	11,253	5,835	1.5%	1.3%	1.0%	0.14	826
	SCE	719	119	106	588,742	57,314	13,081	6,118	1.7%	1.3%	0.9%	0.15	891
	SDG&E	208	36	38	145,066	12,013	2,435	1,244	3.1%	1.7%	1.5%	0.18	1,056
Texas & Colorado	AEP-SWEPCO	20	3	1	31,127	5,059	1,544	262	0.4%	0.4%	0.2%	0.05	337
	EGSI	5	2	1	46,865	8,248	2,082	392	0.1%	0.1%	0.1%	0.10	377
	SPS Xcel	7	2	1	59,620	9,704	1,398	313	0.2%	0.1%	0.1%	0.10	369
	Xcel Energy (CO)	79	15	10	209,941	17,857	4,156	1,241	0.8%	0.4%	0.4%	0.13	667

APPENDIX B: DSM PROGRAM DESCRIPTIONS

KCP&L Commercial and Industrial Lighting DSM Program

Program Concept and Description

The Commercial and Industrial (C&I) Lighting DSM Program provides prescriptive incentives to C&I customers for the installation of energy-efficiency lighting equipment and controls. Prescriptive incentives are offered for a schedule of measures in each of these categories. Innovative lighting energy efficiency measures will be covered as part of the separate Custom Rebate Program. This program will pertain to existing facilities only. New construction lighting measures will be covered by the separate C&I New Construction Program.

The viability of each of the prescriptive measures covered by the program has been assessed through a cost-effectiveness analysis using the DSMore model that evaluated the Total Resource Cost (TRC), Utility Cost (UC), Ratepayer Impact Measure (RIM), and Participant (PT) tests. The cost-effectiveness tests account for the energy and demand savings of each measure, the associated avoided costs and net benefits to KCP&L, the incremental or installed measure costs, and the program costs.

The program includes customer educational and promotional pieces designed to assist facility owners, operators and decision makers with the information necessary to improve the energy efficiency of the lighting systems in their facilities. The program also includes customer and trade ally education to assist with understanding the technologies that are being promoted, the incentives that are offered, and how the program functions.

Program Objectives

The primary goal of the program is to encourage KCP&L's C&I customers to install energy efficient lighting measures in existing facilities. More specifically, the program is designed to:

- Provide incentives to facility owners and operators for the installation of high-efficiency lighting equipment and controls.
- Provide a marketing mechanism for electrical contractors, lighting contractors, and lighting distributors to promote energy efficient lighting equipment to end users.
- Overcome market barriers, including:
  - Customers' lack of awareness and knowledge about the benefits and costs of lighting energy efficiency improvements.
  - Performance uncertainty associated with energy efficiency lighting projects.
  - Additional first costs for energy efficient lighting measures.
- Ensure that the participation process is clear, easy to understand and simple.

Program Rationale

Certain barriers exist to the adoption of lighting energy efficiency measures, including lack of investment capital, competition for funds with other capital improvements, lack of awareness/knowledge about the

benefits and costs of energy efficiency measures, high transaction and information search costs, and technology performance uncertainties. This program is designed to help overcome these market barriers and encourage greater adoption of lighting energy efficiency measures in the C&I market.

In addition to helping customers reduce and manage their energy costs, this program provides other societal and customer benefits. These include reduced greenhouse gas emissions, improved levels of service from energy expenditures, and lower overall rates and energy costs compared to other resource options.

The program is structured as a broadly applicable C&I prescriptive rebate program since the energy and demand savings for many common lighting energy efficiency measures are similar across many C&I market segments. Having a simple program structure and rebate schedule provides customers with certainty and ease of use regarding the incentives they will receive for installing a wide variety of lighting measures.

The program's actual energy and demand savings will be determined through the program evaluation strategy discussed in a subsequent section. Evaluation activities should be planned at the same time as overall program planning, and implemented when the overall program is implemented, as will be discussed in more detail in the evaluation section.

Target Market and Eligibility Requirements

All KCP&L commercial and industrial customers are eligible for the program. However, the main target markets are:

- Customers in existing buildings. New construction applications are covered by the separate New Construction program.
- Other utilities have found that the following types of larger commercial customers participate with the highest frequency in their C&I lighting DSM programs: large office buildings, education facilities, grocery stores, health care facilities, and warehouses.
- Small business customers are the most difficult market segment to reach with DSM programs in general, but such customers tend to more readily participate in lighting DSM programs than other types of DSM programs.

Products and Services Provided

The C&I Lighting DSM Program is a customer incentive program that provides rebates for the installation of lighting energy efficiency measures in existing non-residential facilities. More specifically, the program offers the following products and services:

- Education and promotional materials aimed at building owners and operators about the benefits of energy efficiency improvements and improved systems performance, including educational brochures, program promotional material, and website content.

- Educational and promotional efforts aimed at trade allies such as electrical contractors, building supply firms, and lighting distributors to help them promote efficient lighting measures to their customers.
- Rebates for building owners and managers to adopt the measures recommended by the program. Rebates will be approximately $300/kW for each measure provided by the program. Specific rebates for each size and type of lighting DSM measure will be developed.
- The majority of program impacts are expected to come from customers replacing standard efficiency fluorescent lighting systems (T12 lamps and magnetic ballasts) with T8 lamps and electronic ballasts.
- Other eligible lighting retrofits include:
    - Replacing standard fluorescent lighting systems with T5 lamps and electronic ballasts.
    - Replacing incandescent lamps with compact fluorescent lamps or efficient HID systems.
    - Replacing mercury vapor systems with metal halide or high pressure sodium systems.
    - Replacing incandescent exit signs with LED exit signs.
    - Installing lighting occupancy sensors.

Delivery Strategy and Administration

- Designated KCP&L staff person(s) will provide program administration, marketing, vendor referrals, application and incentive processing, coordination of education and training activities, participation tracking and reporting, quality control, and technical support.
- KCP&L account representatives are expected to promote the program to their customers.
- Alternatively, KCP&L could outsource the program to an "implementation contractor" such as Honeywell DMC or ICF.

Program Marketing and Communications Strategy

The marketing and communications strategy will be designed to inform customers of the availability and benefits of the program and how they can participate in the program. The strategy will include outreach to key partners and trade allies including the architecture/engineering and contractor community, relevant professional and trade associations and other parties of interest in the market. An important part of the marketing plan will be content and functionality on the KCP&L website, which will direct customers to information about the program. More specifically, the marketing and communications plan will include:

- Education seminars implemented in each market to provide details about how to participate in the Program. The seminars will be tailored to the needs of business owners, building managers, architects, engineers, vendors, and contractors;
- A combination of strategies including major media advertising, outreach and presentations at professional and community forums and events, and through direct outreach to key customers and customer representatives. Marketing activities will include:
    - Brochures that describe the benefits and features of the program including program application forms and worksheets. The brochures will be mailed upon demand and distributed through the call center and www.KCPL.com and will be available for various public awareness events (presentations, seminars etc).

  - Targeted direct mailings used to educate customers on the benefits of the program and explaining how they can apply.
  - Customer and trade partner outreach and presentations (e.g. BOMA and other customer organizations) informing interested parties about the benefits of the program and how to participate.
  - Print advertisements to promote the program placed in selected local media including the Kansas City area newspapers and trade publications.
  - KCP&L website content providing program information resources, contact information, downloadable application forms and worksheets, and links to other relevant service and information resources.
  - KCP&L customer account representatives trained to promote the program to their customers.
  - Presence at conferences and public events used to increase general awareness of the program and distribute program promotional materials.
  - Presentations by the program manager to key customers and customer groups to actively solicit their participation in the program.
- The marketing strategy will identify key customer segments and groups for target marketing, and will prepare specific outreach activities for these customers.
- KCP&L will design and develop the content, messaging, branding, and calls to action of all of the marketing and collateral materials used to promote the program.

Evaluation, Measurement and Verification (EM&V)

KCP&L has already adopted Summit Blue's suggested integrated data collection EM&V strategy that is designed to provide a quality data resource for program tracking, management and evaluation. This approach integrates program evaluation planning with overall program planning, and starts program evaluation activities at the same time as the program is implemented. This approach entails the following primary activities:

- **Database management** - As part of program operation, KCP&L's evaluation contractor will collect the necessary data elements to populate the tracking database and provide periodic reporting.
- **Integrated implementation data collection** – KCP&L will work with the evaluation contractor to establish systems to collect the data needed to support effective program management and evaluation through the implementation and customer application processes. The database tracking system will be integrated with implementation data collection processes.
- **Field verification** – KCP&L's evaluation contractor will conduct field verification of the installation of a sample of measures throughout the implementation of the program.
- **Tracking of savings using deemed savings values** – KCP&L will develop deemed savings values for each measure and technology promoted by the program and periodically review and revise the savings values to be consistent with program participation and accurately estimate the savings being achieved by the program.

This approach will provide KCP&L with ongoing feedback on program progress and enable management to adjust or correct the program measures to be more effective, provide a higher level of service, and be more cost beneficial. Integrated data collection will provide a high quality data resource for evaluation activities.

Budget and Staffing

- The total 2008 program budget is approximately $954,000.
- The total 2009 program budget is approximately $1.91 million.
- Approximately 75% of program budgets are for customer rebates and 25% of the program budgets are for program delivery, administration, marketing, and evaluation.
- Suggested initial KCP&L staffing includes a full-time program manager, a half-time program administrative/data support person, a half-time trade ally liaison, and the equivalent of about 1 FTE of account reps time to promote the program to their customers.
- Program design and set-up costs will be approximately $25,000.
- Program evaluation costs will be about five percent of the total budget.

Program Impact Summaries

- Total estimated program peak demand reductions are 2.4 MW in 2008 and 4.8 MW in 2009.
- The estimated peak coincidence-loss factor is 90%.
- The estimated average annual operating hours are 4,100, except for exit signs, which operate 8,760 hours per year.
- The annual generator energy savings are 9.8 GWh in 2008 and 19.6 GWh in 2009.

Program Benefit-Cost Results

Based on the September 2007 DSMore results, the program level benefit cost ratios for each of the five main California Standard Practice tests are:

- Participant Test: 2.50.
- Utility Test: 11.65.
- RIM Test: 2.28
- TRC Test: 5.53.
- Societal Test: 6.21.

KCP&L Commercial and Industrial HVAC DSM Program

Program Concept and Description

The Commercial and Industrial (C&I) HVAC DSM Program provides prescriptive incentives to C&I customers for the installation of energy-efficiency heating, ventilation and air conditioning (HVAC) equipment and controls. Prescriptive incentives are offered for a schedule of measures in each of these categories. Innovative HVAC energy efficiency measures will be covered as part of the separate Custom Rebate Program. This program will pertain to existing facilities only. New construction HVAC measures will be covered by the separate C&I New Construction Program.

The viability of each of the prescriptive measures covered by the program has been assessed through a cost-effectiveness analysis using the DSMore model that evaluated the Total Resource Cost (TRC), Utility Cost (UC), Ratepayer Impact Measure (RIM), and Participant (PT) tests. The cost-effectiveness tests account for the energy and demand savings of each measure, the associated avoided costs and net benefits to KCP&L, the incremental or installed measure costs, and the program costs.

The program includes customer educational and promotional pieces designed to assist facility owners, operators and decision makers with the information necessary to improve the energy efficiency of the HVAC systems in their facilities. The program also includes customer and trade ally education to assist with understanding the technologies that are being promoted, the incentives that are offered, and how the program functions.

Program Objectives

The primary goal of the program is to encourage KCP&L's C&I customers to install energy efficient HVAC measures in existing facilities. More specifically, the program is designed to:

- Provide incentives to facility owners and operators for the installation of high-efficiency HVAC equipment and controls.
- Provide a marketing mechanism for mechanical and HVAC contractors and HVAC distributors to promote energy efficient equipment to end users.
- Overcome market barriers, including:
  - Customers' lack of awareness and knowledge about the benefits and costs of HVAC energy efficiency improvements.
  - Performance uncertainty associated with energy efficient HVAC projects.
  - Additional first costs for energy efficient HVAC measures.
- Ensure that the participation process is clear, easy to understand and simple.

Program Rationale

Certain barriers exist to the adoption of HVAC energy efficiency measures, including lack of investment capital, competition for funds with other capital improvements, lack of

awareness/knowledge about the benefits and costs of energy efficiency measures, high transaction and information search costs, and technology performance uncertainties. This program is designed to help overcome these market barriers and encourage greater adoption of HVAC energy efficiency measures in the C&I market.

In addition to helping customers reduce and manage their energy costs, this program provides other societal and customer benefits. These include reduced greenhouse gas emissions, improved levels of service from energy expenditures, and lower overall rates and energy costs compared to other resource options.

The program is structured as a broadly applicable C&I prescriptive rebate program since the energy and demand savings for many common HVAC energy efficiency measures are similar across many C&I market segments. Having a simple program structure and rebate schedule provides customers with certainty and ease of use regarding the incentives they will receive for installing a wide variety of measures.

The program's actual energy and demand savings will be determined through the program evaluation strategy discussed in a subsequent section. Evaluation activities should be planned at the same time as overall program planning, and implemented when the overall program is implemented, as will be discussed in more detail in the evaluation section.

Target Market and Eligibility Requirements

All KCP&L commercial and industrial customers are eligible for the program. However, the main target markets are:

- Customers in existing buildings. New construction applications are covered by the separate New Construction program.
- Other utilities have found that the following types of larger commercial customers participate with the highest frequency in their C&I HVAC DSM programs: large office buildings, education facilities, and health care facilities.

Products and Services Provided

The C&I HVAC DSM Program is a customer incentive program that provides rebates for the installation of HVAC energy efficiency measures in existing non-residential facilities. More specifically, the program offers the following products and services:

- Education and promotional materials aimed at building owners and operators about the benefits of energy efficiency improvements and improved systems performance, including educational brochures, program promotional material, and website content.
- Educational and promotional efforts aimed at trade allies such as mechanical contractors and distributors to help them promote efficient HVAC measures to their customers.
- Rebates for building owners and managers to adopt the measures recommended by the program. Rebates will be approximately $250/kW for each measure provided by the program. Specific rebates for each size and type of HVAC DSM measure will be developed.

- Eligible HVAC retrofits include:
  - Efficient air cooled and water cooled chillers.
  - Efficient packaged (rooftop) air conditioners.
  - Variable speed drives in ventilation fan and variable pumping applications.
  - Efficient motors in HVAC applications.
  - Integrated economizer controls.
  - Programmable thermostats.

Delivery Strategy and Administration

- Designated KCP&L staff person(s) will provide program administration, marketing, vendor referrals, application and incentive processing, coordination of education and training activities, participation tracking and reporting, quality control, and technical support.
- KCP&L account representatives are expected to promote the program to their customers.
- Alternatively, KCP&L could outsource the program to an "implementation contractor" such as Honeywell DMC or ICF.

Program Marketing and Communications Strategy

The marketing and communications strategy will be designed to inform customers of the availability and benefits of the program and how they can participate in the program. The strategy will include outreach to key partners and trade allies including the architecture/engineering and contractor community, relevant professional and trade associations and other parties of interest in the market. An important part of the marketing plan will be content and functionality on the KCP&L website, which will direct customers to information about the program. More specifically, the marketing and communications plan will include:

- Education seminars implemented in each market to provide details about how to participate in the Program. The seminars will be tailored to the needs of business owners, building managers, architects, engineers, vendors, and contractors;
- A combination of strategies including major media advertising, outreach and presentations at professional and community forums and events, and through direct outreach to key customers and customer representatives. Marketing activities will include:
  - Brochures that describe the benefits and features of the program including program application forms and worksheets. The brochures will be mailed upon demand and distributed through the call center and www.KCPL.com and will be available for various public awareness events (presentations, seminars etc).
  - Targeted direct mailings used to educate customers on the benefits of the program and explaining how they can apply.
  - Customer and trade partner outreach and presentations (e.g. BOMA and other customer organizations) informing interested parties about the benefits of the program and how to participate.
  - Print advertisements to promote the program placed in selected local media including the Kansas City area newspapers and trade publications.

  - KCP&L website content providing program information resources, contact information, downloadable application forms and worksheets, and links to other relevant service and information resources.
  - KCP&L customer account representatives trained to promote the program to their customers.
  - Presence at conferences and public events used to increase general awareness of the program and distribute program promotional materials.
  - Presentations by the program manager to key customers and customer groups to actively solicit their participation in the program.
- The marketing strategy will identify key customer segments and groups for target marketing, and will prepare specific outreach activities for these customers.
- KCP&L will design and develop the content, messaging, branding, and calls to action of all of the marketing and collateral materials used to promote the program.

Evaluation, Measurement and Verification (EM&V)

KCP&L has already adopted Summit Blue's suggested integrated data collection EM&V strategy that is designed to provide a quality data resource for program tracking, management and evaluation. This approach integrates program evaluation planning with overall program planning, and starts program evaluation activities at the same time as the program is implemented. This approach entails the following primary activities:

- **Database management** - As part of program operation, KCP&L's evaluation contractor will collect the necessary data elements to populate the tracking database and provide periodic reporting.
- **Integrated implementation data collection** – KCP&L will work with the evaluation contractor to establish systems to collect the data needed to support effective program management and evaluation through the implementation and customer application processes. The database tracking system will be integrated with implementation data collection processes.
- **Field verification** – KCP&L's evaluation contractor will conduct field verification of the installation of a sample of measures throughout the implementation of the program.
- **Tracking of savings using deemed savings values** – KCP&L will develop deemed savings values for each measure and technology promoted by the program and periodically review and revise the savings values to be consistent with program participation and accurately estimate the savings being achieved by the program.

This approach will provide KCP&L with ongoing feedback on program progress and enable management to adjust or correct the program measures to be more effective, provide a higher level of service, and be more cost beneficial. Integrated data collection will provide a high quality data resource for evaluation activities.

KCP&L Commercial and Industrial HVAC DSM Program

Budget and Staffing

- The total 2008 program budget is approximately $401,000.
- The total 2009 program budget is approximately $802,000.
- Approximately 85% of program budgets are for customer rebates and 15% of the program budgets are for program delivery, administration, marketing, and evaluation.
- Program design and set-up costs will be approximately $25,000.
- Program evaluation costs will be about five percent of the total budget.
- Suggested initial KCP&L staffing includes a half-time program manager, a part-time program administrative/data support person, a part time trade ally liaison, and the equivalent of less than one FTE of account reps time to promote the program to their customers.

Program Impact Summaries

- Total estimated program peak demand reductions are 1.1 MW in 2008 and 2.3 MW in 2009.
- The annual generator energy savings are 3.4 GWh in 2008 and 6.7 GWh in 2009.

Program Benefit-Cost Results

Based on the September 2007 DSMore results, the program level benefit cost ratios for each of the five main California Standard Practice tests are:

- Participant Test: 3.20.
- Utility Test: 10.82.
- RIM Test: 2.37
- TRC Test: 7.36.
- Societal Test: 8.20.

KCP&L Commercial and Industrial Custom and Motors DSM Program

Program Concept and Description

The Commercial and Industrial (C&I) Custom and Motors DSM Program provides mainly custom incentives to C&I customers for the installation of innovative and non-standard energy-efficiency equipment and controls. Prescriptive incentives are also offered for energy efficient motors. This program will pertain to existing facilities only. Standard lighting and HVAC measures are covered by the separate Lighting and HVAC DSM programs. New construction measures will be covered by the separate C&I New Construction Program.

The viability of each of the prescriptive measures covered by the program has been assessed through a cost-effectiveness analysis using the DSMore model that evaluated the Total Resource Cost (TRC), Utility Cost (UC), Ratepayer Impact Measure (RIM), and Participant (PT) tests. The cost-effectiveness tests account for the energy and demand savings of each measure, the associated avoided costs and net benefits to KCP&L, the incremental or installed measure costs, and the program costs.

The program includes customer educational and promotional pieces designed to assist facility owners, operators and decision makers with the information necessary to improve the energy efficiency of the process, refrigeration and other energy using systems in their facilities. The program also includes customer and trade ally education to assist with understanding the technologies that are being promoted, the incentives that are offered, and how the program functions.

Program Objectives

The primary goal of the program is to encourage KCP&L's C&I customers to install energy efficient process, refrigeration, and controls measures in existing facilities. More specifically, the program is designed to:

- Provide incentives to facility owners and operators for the installation of high-efficiency process, refrigeration and other equipment and controls.
- Provide a marketing mechanism for consulting engineers, process and refrigeration vendors and distributors to promote energy efficient equipment to end users.
- Overcome market barriers, including:
  - Customers' lack of awareness and knowledge about the benefits and cost of energy efficiency improvements.
  - Performance uncertainty associated with energy efficiency projects.
  - Additional first costs for energy efficient measures.
- Ensure that the participation process is clear, easy to understand and simple.

Program Rationale

Certain barriers exist to the adoption of energy efficiency measures, including lack of investment capital, competition for funds with other capital improvements, lack of awareness/knowledge about the benefits and costs of energy efficiency measures, high transaction and information search costs, and technology performance uncertainties. This program is designed to help overcome these market barriers and encourage greater adoption of process, refrigeration, and other types of energy efficiency measures in the C&I market.

In addition to helping customers reduce and manage their energy costs, this program provides other societal and customer benefits. These include reduced greenhouse gas emissions, improved levels of service from energy expenditures, and lower overall rates and energy costs compared to other resource options.

The program is structured as a broadly applicable C&I custom rebate program since the energy and demand savings for many common energy efficiency measures vary considerably across C&I market segments and between customers. Having a simple program structure and rebate schedule provides customers with ease of use regarding the incentives they will receive for installing a wide variety of efficiency measures.

The program's actual energy and demand savings will be determined through the program evaluation strategy discussed in a subsequent section. Evaluation activities should be planned at the same time as overall program planning, and implemented when the overall program is implemented, as will be discussed in more detail in the evaluation section.

Target Market and Eligibility Requirements

All KCP&L commercial and industrial customers are eligible for the program. However, the main target markets are:

- Customers in existing buildings. New construction applications are covered by the separate New Construction program.
- Industrial customers, grocery stores, and other large commercial customers are expected to be the primary target markets for this program.

KCP&L Commercial and Industrial Custom and Motors DSM Program

Products and Services Provided

The C&I Custom and Motors DSM Program is a customer incentive program that provides rebates for the installation of energy efficiency measures in existing non-residential facilities. More specifically, the program offers the following products and services:

- Education and promotional materials aimed at building owners and operators about the benefits of energy efficiency improvements and improved systems performance, including educational brochures, program promotional material, and website content.
- Educational and promotional efforts aimed at trade allies such as consulting engineers, process and refrigeration vendors distributors to help them promote efficiency measures to their customers.
- Rebates for building owners and managers to adopt the measures recommended by the program. Rebates will be approximately $300/kW for each measure provided by the program.
- The largest impact measures covered by the program are expected to be:
    - Adjustable speed drives.
    - Energy management systems.
    - Innovative lighting systems replacements.
- Other eligible energy efficiency measures include:
    - Energy efficient motors.
    - Innovative process efficiency measures.
    - Efficient refrigeration measures.
    - Efficient HVAC system measures, not component replacements.
    - Specialized control systems.

Delivery Strategy and Administration

- Designated KCP&L staff person(s) will provide program administration, marketing, vendor referrals, application and incentive processing, coordination of education and training activities, participation tracking and reporting, quality control, and technical support.
- KCP&L account representatives are expected to promote the program to their customers.
- Alternatively, KCP&L could outsource the program to an "implementation contractor" such as Honeywell DMC or ICF.

Program Marketing and Communications Strategy

The marketing and communications strategy will be designed to inform customers of the availability and benefits of the program and how they can participate in the program. The strategy will include outreach to key partners and trade allies including consulting architects and engineering firms, process and refrigeration contractors and distributors, relevant professional and trade associations and other parties of interest in the market. An important part of the marketing plan will be content and functionality on the

KCP&L website, which will direct customers to information about the program. More specifically, the marketing and communications plan will include:

- Education seminars implemented in each market to provide details about how to participate in the Program. The seminars will be tailored to the needs of business owners, building managers, architects, engineers, vendors, and contractors;
- A combination of strategies including major media advertising, outreach and presentations at professional and community forums and events, and through direct outreach to key customers and customer representatives. Marketing activities will include:
  - Brochures that describe the benefits and features of the program including program application forms and worksheets. The brochures will be mailed upon demand and distributed through the call center and www.KCPL.com and will be available for various public awareness events (presentations, seminars etc).
  - Targeted direct mailings used to educate customers on the benefits of the program and explaining how they can apply.
  - Customer and trade partner outreach and presentations (e.g. BOMA and other customer organizations) informing interested parties about the benefits of the program and how to participate.
  - Print advertisements to promote the program placed in selected local media including the Kansas City area newspapers and trade publications.
  - KCP&L website content providing program information resources, contact information, downloadable application forms and worksheets, and links to other relevant service and information resources.
  - KCP&L customer account representatives trained to promote the program to their customers.
  - Presence at conferences and public events used to increase general awareness of the program and distribute program promotional materials.
  - Presentations by the program manager to key customers and customer groups to actively solicit their participation in the program.
- The marketing strategy will identify key customer segments and groups for target marketing, and will prepare specific outreach activities for these customers.
- KCP&L will design and develop the content, messaging, branding, and calls to action of all of the marketing and collateral materials used to promote the program.

Evaluation, Measurement and Verification (EM&V)

KCP&L has already adopted Summit Blue's suggested integrated data collection EM&V strategy that is designed to provide a quality data resource for program tracking, management and evaluation. This approach integrates program evaluation planning with overall program planning, and starts program evaluation activities at the same time as the program is implemented. This approach entails the following primary activities:

- **Database management** - As part of program operation, KCP&L's evaluation contractor will collect the necessary data elements to populate the tracking database and provide periodic reporting.

- **Integrated implementation data collection** – KCP&L will work with the evaluation contractor to establish systems to collect the data needed to support effective program management and evaluation through the implementation and customer application processes. The database tracking system will be integrated with implementation data collection processes.
- **Field verification** – KCP&L's evaluation contractor will conduct field verification of the ex ante and ex post conditions for at least the largest projects and a sample of medium sized projects throughout the implementation of the program.
- **Tracking of savings using estimated savings values** – The participating customers or their consultants or vendors will develop estimated savings values for each application submitted through the program. The M&V process will verify or revise the initial estimated savings values.

This approach will provide KCP&L with ongoing feedback on program progress and enable management to adjust or correct the program measures to be more effective, provide a higher level of service, and be more cost beneficial. Integrated data collection will provide a high quality data resource for evaluation activities.

Budget and Staffing

- The total 2008 program budget is approximately $406,000.
- The total 2009 program budget is approximately $812,000.
- Approximately 50% of program budgets are for customer rebates and 50% of the program budgets are for program delivery, administration, marketing, and evaluation.
- Suggested initial KCP&L staffing includes a full-time program manager, a half-time program administrative/data support person, a half-time trade ally liaison, and the equivalent of about 1 FTE of account reps time to promote the program to their customers.
- Program design and set-up costs will be approximately $25,000.
- Program evaluation costs will be about five percent of the total budget.

Program Impact Summaries

- Total estimated program peak demand reductions are 0.5 MW in 2008 and 1.1 MW in 2009.
- The annual generator energy savings are 5.2 GWh in 2008 and 10.4 GWh in 2009.

Program Benefit-Cost Results

Based on the September 2007 DSMore results, the program level benefit cost ratios for each of the five main California Standard Practice tests are:

- Participant Test: 3.05.
- Utility Test: 20.48.
- RIM Test: 2.25
- TRC Test: 6.62.
- Societal Test: 7.52.

KCP&L Commercial and Industrial New Construction DSM Program

Program Concept and Description

The Commercial and Industrial (C&I) New Construction DSM Program provides design assistance and custom incentives to C&I customers for building more efficient new buildings and installing energy-efficiency equipment and controls that are not required by building energy codes. This program will pertain to new buildings and major remodeling projects only. Standard lighting and HVAC measures for existing buildings are covered by the separate Lighting and HVAC DSM programs.

The viability of each of the measures covered by the program has been assessed through a cost-effectiveness analysis using the DSMore model that evaluated the Total Resource Cost (TRC), Utility Cost (UC), Ratepayer Impact Measure (RIM), and Participant (PT) tests. The cost-effectiveness tests account for the energy and demand savings of each measure, the associated avoided costs and net benefits to KCP&L, the incremental or installed measure costs, and the program costs.

The program includes customer educational and promotional pieces designed to assist facility owners, operators and decision makers with the information necessary to improve the energy efficiency of the lighting, HVAC, building envelope, refrigeration, and other energy using systems in their new facilities. The program also includes customer and trade ally education to assist with understanding the technologies that are being promoted, the incentives that are offered, and how the program functions.

Program Objectives

The primary goal of the program is to encourage KCP&L's C&I customers to build more efficient new buildings and to install energy efficient lighting, HVAC, building envelope, refrigeration, and controls measures in new buildings. More specifically, the program is designed to:

- Provide design assistance to the architects and engineers that are designing new buildings. The key design assistance tool is building simulation modeling of more efficient building designs.
- Provide incentives to new facility owners for the installation of high-efficiency lighting, HVAC, building envelope, refrigeration and other equipment and controls.
- Provide a marketing mechanism for architects and engineers to promote energy efficient new buildings and equipment to end users.
- Overcome market barriers, including:
  - Customers' lack of awareness and knowledge about the benefits and costs of energy efficiency improvements.
  - Performance uncertainty associated with energy efficiency projects.
  - Additional first costs for energy efficient measures.
- Ensure that the participation process is clear, easy to understand and simple.

KCP&L Commercial and Industrial New Construction DSM Program

Program Rationale

Certain barriers exist to the adoption of energy efficiency measures, including lack of investment capital, competition for funds with other capital improvements, lack of awareness/knowledge about the benefits and costs of energy efficiency measures, high transaction and information search costs, and technology performance uncertainties. This program is designed to help overcome these market barriers and encourage greater adoption of energy efficiency measures in the new construction C&I market.

In addition to helping customers reduce and manage their energy costs, this program provides other societal and customer benefits. These include reduced greenhouse gas emissions, improved levels of service from energy expenditures, and lower overall rates and energy costs compared to other resource options.

The program is targeted towards larger C&I new construction facilities. Customer rebates are calculated on a custom $/kW basis, since the energy and demand savings for many common energy efficiency measures vary considerably between customers. Having a simple program and rebate structure provides customers with ease of use regarding the incentives they will receive for installing a wide variety of efficiency measures.

The program's actual energy and demand savings will be determined through the program evaluation strategy discussed in a subsequent section. Evaluation activities should be planned at the same time as overall program planning, and implemented when the overall program is implemented, as will be discussed in more detail in the evaluation section.

Target Market and Eligibility Requirements

All KCP&L commercial and industrial customers that are building new facilities or extensively remodeling existing facilities are eligible for the program. However, the main target markets are:

- Larger new commercial and institutional customers of KCP&L.
- Primary target markets are expected to be office buildings, educational buildings, and health care facilities. Other building types are eligible to participate as well.

KCP&L Commercial and Industrial New Construction DSM Program

Products and Services Provided

The C&I New Construction DSM Program is a customer incentive program that provides design assistance for architects and engineers designing new buildings and customer rebates for the installation of energy efficiency measures in new C&I facilities. More specifically, the program offers the following products and services:

- Education and promotional materials aimed at building owners and operators about the benefits of energy efficiency improvements and improved systems performance, including educational brochures, program promotional material, and website content.
- Educational and promotional efforts aimed at trade allies such as architect and engineers to help them promote efficiency measures to their customers.
- Rebates for building owners and managers to adopt the measures recommended by the program. Rebates will be approximately $250/kW for each measure covered by the program.
- DSM measures that will be covered by the program include:
    - Efficient lighting systems.
    - Efficient HVAC and controls systems, including energy management systems.
    - Efficient motors and variable speed drives, primarily for HVAC applications.
    - Building envelope measures such as insulation and efficient windows.
    - Efficient electric water heating measures.
    - Efficient refrigeration systems.

Delivery Strategy and Administration

- Designated KCP&L staff person(s) will provide program administration, marketing, vendor referrals, application and incentive processing, coordination of education and training activities, participation tracking and reporting, quality control, and technical support.
- KCP&L account representatives are expected to promote the program to their customers.
- KCP&L should strongly consider outsourcing building simulation modeling to a firm that specializes in providing this service. Several of the top-performing utility new construction DSM programs in the Midwest also outsource a lot of program promotion and marketing to architects and engineers at the modeling firm.

Program Marketing and Communications Strategy

The marketing and communications strategy will be designed to inform customers of the availability and benefits of the program and how they can participate in the program. The strategy will include outreach to key partners and trade allies including architects and engineering firms, contractors and distributors, relevant professional and trade associations and other parties of interest in the market. An important part of the marketing plan will be content and functionality on the KCP&L website, which will direct

customers to information about the program. More specifically, the marketing and communications plan will include:

- Education seminars implemented in each market to provide details about how to participate in the Program. The seminars will be tailored to the needs of business owners, building managers, architects, engineers, vendors, and contractors;
- A combination of strategies including major media advertising, outreach and presentations at professional and community forums and events, and through direct outreach to key customers and customer representatives. Marketing activities will include:
  - Brochures that describe the benefits and features of the program including program application forms and worksheets. The brochures will be mailed upon demand and distributed through the call center and www.KCPL.com and will be available for various public awareness events (presentations, seminars etc).
  - Targeted direct mailings used to educate customers on the benefits of the program and explaining how they can apply.
  - Customer and trade partner outreach and presentations (e.g. BOMA and other customer organizations) informing interested parties about the benefits of the program and how to participate.
  - Print advertisements to promote the program placed in selected local media including the Kansas City area newspapers and trade publications.
  - KCP&L website content providing program information resources, contact information, downloadable application forms and worksheets, and links to other relevant service and information resources.
  - KCP&L customer account representatives trained to promote the program to their customers.
  - Presence at conferences and public events used to increase general awareness of the program and distribute program promotional materials.
  - Presentations by the program manager to key customers and customer groups to actively solicit their participation in the program.
- The marketing strategy will identify key customer segments and groups for target marketing, and will prepare specific outreach activities for these customers.
- KCP&L will design and develop the content, messaging, branding, and calls to action of all of the marketing and collateral materials used to promote the program.

Evaluation, Measurement and Verification (EM&V)

KCP&L has already adopted Summit Blue's suggested integrated data collection EM&V strategy that is designed to provide a quality data resource for program tracking, management and evaluation. This approach integrates program evaluation planning with overall program planning, and starts program evaluation activities at the same time as the program is implemented. This approach entails the following primary activities:

- **Database management** - As part of program operation, KCP&L's evaluation contractor will collect the necessary data elements to populate the tracking database and provide periodic reporting.

- **Integrated implementation data collection** – KCP&L will work with the evaluation contractor to establish systems to collect the data needed to support effective program management and evaluation through the implementation and customer application processes. The database tracking system will be integrated with implementation data collection processes.
- **Field verification** – KCP&L's evaluation contractor will conduct field verification of the ex post conditions compared to the modeled conditions for at least the largest projects and a sample of medium sized projects throughout the implementation of the program.
- **Tracking of savings using estimated savings values** – The building simulation modeling process will develop estimated savings values for each application and measure submitted through the program. The M&V process will verify or revise the initial estimated savings values.

This approach will provide KCP&L with ongoing feedback on program progress and enable management to adjust or correct the program measures to be more effective, provide a higher level of service, and be more cost beneficial. Integrated data collection will provide a high quality data resource for evaluation activities.

Budget and Staffing

- The total 2008 program budget is approximately $430,000.
- The total 2009 program budget is approximately $850,000.
- Approximately 50% of program budgets are for customer rebates and 50% of the program budgets are for program delivery, administration, marketing, and evaluation.
- Suggested initial KCP&L staffing includes a half-time program manager, a part-time program administrative/data support person, a part-time trade ally liaison, and less than one FTE of account reps time to promote the program to their customers.
- Program design and set-up costs will be approximately $25,000.
- Program evaluation costs will be about five percent of the total budget.

Program Impact Summaries

- Total estimated program peak demand reductions are 1.1 MW in 2008 and 2.1 MW in 2009.
- The annual generator energy savings are 4.2 GWh in 2008 and 8.5 GWh in 2009.

Program Benefit-Cost Results

Based on the September 2007 DSMore results, the program level benefit cost ratios for each of the five main California Standard Practice tests are:

- Participant Test: 2.08.
- Utility Test: 12.37.
- RIM Test: 2.60.
- TRC Test: 4.86.
- Societal Test: 5.44.