

MMP

Morgan Marketing Partners

KANSAS CITY POWER & LIGHT

C&I ENERGY EFFICIENCY PROGRAMS

FINDINGS AND DOCUMENTATION

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Introduction

Morgan Marketing Partners (MMP) and its subcontractors Architectural Energy Corporation (AEC) and Franklin Energy Services (FES), were retained by Kansas City Power and Light (KCPL) to determine cost effective Commercial and Industrial (C&I) programs and measures for its energy efficiency programs. This report is the summary of that effort with the main purpose of documenting the assumptions and results of the study.

This study had several steps. The first was to review the initial high level work of Summit Blue. Their task was to develop a high level market potential analysis and high level programs for the C&I sector. While this work provided great insights and direction, it required additional definition and program design to get the results to an implementation and filing level.

Step two was to develop more detailed program designs that included incentives for the measures and more refined guidelines for implementation. These recommended programs were developed based on the Summit Blue report, review of other programs nationally, and the experience of MMP in designing and implementing efficiency programs for more than 30 years.

Step three was to determine what technologies and measures might fit into each of these program designs, specifically the prescriptive program where specific measures are analyzed for inclusion. Each of these technologies then needed an engineering analysis to determine savings over a baseline, potential incentives and incremental costs for the cost effectiveness analysis.

Step four is a cost effectiveness analysis looking at the individual measures and programs to determine if they can be cost effectively offered by KCPL when incentives and program implementation/administration costs are included. Four scenarios were developed looking at both standard and high incentive levels and expected and aggressive participation rates. Using the DSMore tool with KCPL specific prices, weather and loads, each measure and program was analyzed to determine the cost effectiveness scores utilizing the California Standard Practice Manual guidelines. Results are then used to fine tune which measures are included and the incentive amounts available to the customers. Probabilities were then assigned to each scenario to develop the expected outcome.

Step five is the consolidation of all the results including budgets and savings into the programs overall for a final portfolio of programs to be recommended to KCPL. This document is a part of that final step.

The balance of this report provides the summary of this work. Section 1 describes the programs and why they were designed in a specific way. Section 2 provides the DSMore cost effectiveness results. Section 3 provides the documentation for the HVAC savings modeling used for measure savings determination and Section 4 provides the

documentation for the non weather sensitive loads. Appendix A & B provide further detail by measure.

Section 1: Program Designs

There are four C&I program designs proposed to be included within the KCPL portfolio. MMP believes that these four programs are broad enough to cover the primary market opportunities yet give KCPL control over the budgets and results. These four programs are described below.

Prescriptive Incentive Program

Program Concept and Description

The Commercial and Industrial (C&I) Prescriptive Incentive Program provides prescriptive incentives to C&I customers for the installation of energy-efficiency equipment for numerous applications including lighting equipment, controls, heating, ventilation and air conditioning (HVAC) equipment, motors, refrigeration, and food service equipment. Prescriptive incentives are offered for a schedule of measures in each of these categories. Innovative energy efficiency measures or measures with large variability in application will be covered as part of the separate Custom Rebate Program. Application to existing facilities and/or new facilities will vary by measure depending on the codes and standards within new construction. New construction design assistance 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), Societal (ST) 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. Measures will be added or eliminated from the program based on cost effectiveness, market acceptance and standard practice. Measures will also be added as new products/measures emerge in the market.

The key to program success is the engagement of the market actors throughout the delivery channel that currently exists. These actors include manufacturers, distributors, consultants, engineers and contractors. The program will have staff specifically dedicated to educating, partnering and engaging these important players in the program. Through these existing market actors who have relationships with C&I customers, the new high efficient technology will be offered to customers as a viable option. To support the market actors, the program also 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 systems in their facilities.

Program Objectives & Rationale

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

- Provide incentives to facility owners and operators for the installation of high-efficiency equipment and controls.
- Provide a marketing mechanism for electrical contractors, mechanical contractors, and their 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 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.

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 C&I market. The theory of the program is that through engagement and education with the market actors and through customer incentives to reduce first costs, the risks to energy efficiency will be reduced and the rewards from the savings will become more apparent thus increasing adoption.

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 incentive program since the energy and demand savings for many common energy efficiency measures are similar across many C&I market segments. Having a simple program structure and incentive 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. 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 retail customers are eligible for the program. However, the main target markets are:

- Customers in both existing buildings and new construction depending on the technology and code requirements. New construction design incentives 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 EE 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 EE programs in general, but such customers tend to more readily participate in the lighting EE programs than other types of EE programs.

Technology Categories

The C&I Lighting EE Program is a customer incentive program for the installation of energy efficiency measures in non-residential facilities. More specifically, the program offers incentives for the following technology categories. Specific listings of technologies will change over time based on codes & standards, market need, introduction of new technologies and market adoption.

- High efficiency lighting
- HVAC equipment
- Motors/Pumps
- Refrigeration Equipment
- Food Service Equipment
- Controls
- Other

Market Barriers

Market barriers vary by technology and customer segment. They include but are not limited to:

- Lack of investment funds or high costs
- Competition for funds with other projects
- Lack of awareness/knowledge by both customers and contractors
- Lack of time
- Increased perceived risk from a newer technology in performance
- High transaction and information search costs

Working with the market actors and providing incentives, KCP&L expects to reduce many of these barriers and stimulate installation of these measures.

Components of Delivery

Incentives:

Incentives for each technology will vary based on cost effectiveness and market response. A full listing of the current proposed technologies and their incentives is attached in Appendix A. The program strives to cover at least 50% of the incremental cost of the measure to stimulate the market if it is cost effective. Additional guidelines may be established such as total incentives available per customer per year to assure that funds are allocated across all customer opportunities.

Ed/Instructions:

Education and promotional materials will be developed for building owners and operators on the benefits of energy efficiency improvements and improved systems performance, including educational brochures, program promotional material, and website content. Specific educational and promotional efforts aimed at market actors such as electrical contractors, building supply firms, and distributors to help them promote efficient measures to their customers. This education will be through a combination of mailings and direct meetings with key market actors in the area.

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 market actors 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.KCP&L.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.

Delivery

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. There will be specific staff assigned to work with the market actors/channels to promote the program and support the markets sales efforts. As well KCP&L account representatives will be expected to promote the program to their customers directly and cross promote other programs. Based on the ultimate size of the program and other issues KCP&L may outsource the program to an “implementation contractor”.

Evaluation, Measurement and Verification (EM&V) (Quality Control & Monitoring)

KCP&L has already adopted an 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. The verification protocol will be a random sample of 5% of the applications up to \$10,000 and a 10% sampling of projects from \$10,000 to \$30,000. All projects over \$30,000 will be verified. If a contractor has unresolved or ongoing problems, their next three projects will be verified. If these are not corrected, they can be removed from the program at KCP&L’s discretion.
- **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.

Materials

Materials will be developed for both the market actors and the customers. They will include but not be limited to:

- Incentive Forms and Guidelines
- Brochures
- Technology information
- Case Studies
- Web Support Materials
- Direct Mail pieces

Budget and Staffing

- The total five year program budget is approximately \$8 - \$12.5 million depending on the expected or aggressive participation scenario adopted.
- Approximately 65% of program budgets are for customer incentives and 35% of the program budgets are for program delivery, administration, marketing, and evaluation.
- Suggested initial KCP&L staffing includes a full-time program manager, a full time program administrative/data support person, three trade ally liaisons one each for lighting, HVAC and other technologies, and the equivalent of about 1 FTE of account reps time to promote the program to their customers.
- Program monitoring, verification and evaluation costs will be about five percent of the total budget.

Program Impact Summaries

- Total estimated program peak demand reductions are 18.8 – 31.8 MW in year five.
- Total estimated lifetime kWh savings from the 5 year program are 670,000,000 – 1,103,000,000 kWh.

Program Benefit-Cost Results

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

- Utility Test: 8.21
- TRC Test: 3.80
- RIM Test: 2.08
- Societal Test: 4.25
- Participant Test: 1.98

C&I Custom Incentive Program

Program Concept and Description

The Commercial and Industrial (C&I) Custom Incentive Program provides custom incentives to C&I customers for the installation of innovative and non-standard energy-efficiency equipment and controls. This program will pertain to existing facilities only. Standard high efficiency measures are covered by the separate Prescriptive Incentive program. New construction design measures will be covered by the separate C&I New Construction Program.

The incentive levels set for the custom measures covered by the program have 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), Societal Test (ST) and Participant (PT) tests. The cost-effectiveness tests account for the energy and demand savings, the associated avoided costs and net benefits to KCP&L, the incremental or installed 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 & Rationale

The primary goal of the program is to encourage KCP&L's C&I customers to install energy efficient process, refrigeration, and other efficient equipment & controls 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 equipment contractors 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.

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 custom measures that are not easily covered in a prescriptive program such as process, refrigeration, compressed air systems and other types of unique 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 incentive 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 incentive 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 retail customers are eligible for the program. However, the main target markets are:

- Customers in existing buildings. New construction design 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.

Technology Categories

With a custom program, flexibility is the key. Technologies that are unique to that customer, new to the market or have a wide range of savings based on their application cannot be included in a prescriptive program due to their variability. However these variable energy savings technologies can be significant and encouraged through a custom incentive program.

Market Barriers

Market barriers vary by technology and customer segment. They include but are not limited to:

- Lack of investment funds or high costs
- Cost to analyze potential savings from a project through assessments/audits
- Competition for funds with other projects
- Lack of awareness/knowledge by customers, engineers and contractors
- Lack of time
- Increased perceived risk from a newer technology in performance
- High transaction and information search costs

Working with the market actors, increasing awareness and providing incentives, KCP&L expects to reduce many of these barriers and stimulate installation of these measures.

Components of Delivery

Incentives:

The C&I Custom Incentive Program is a financial assistance and education program that provides incentives for the installation of energy efficiency measures in existing non-residential facilities. Customers/Contractors will submit their project savings estimates during the planning process prior to project initiation. KCP&L staff or its subcontractor will review these savings estimates and confirm the savings prior to committing to the incentive levels. This check on the savings analysis helps assure that KCP&L funds are being cost effectively used to promote efficiency.

Incentives will be set using a per kWh and per kW basis so that both energy and demand savings will be rewarded. Levels of incentives will vary over time based on costs and market need but will typically be established in one year increments. KCP&L will use a two tier custom incentive approach. The first tier is at a lower rate for technologies that are established and known in the market but need financial help to get them implemented. The second tier will be technologies that are newer to the market or have more significant risk or other barriers that need higher stimulation and awareness. Most new technologies will start at the second higher incentive tier and migrate to the first lower incentive tier over time as they get accepted within the market. This approach gives appropriate signals to the market about new technologies or riskier technologies that have significant savings potential. The initial tier levels proposed and the technology categories that fit within these tiers are outlined in Appendix A. Other guidelines to reduce free ridership will also be established. These include years of payback, total incentive dollars per customer per year and percent of total project cost.

One barrier to getting measures identified and installed is getting customers to spend funds to analyze the opportunity and savings. To help address this issue, *assessment/audit grants* will be available to customers for up to 25% of the analysis cost not to exceed \$300 for facilities less than 25,000 square feet and not to exceed \$500 for larger facilities. If the customer implements that project an additional bonus will be included in the incentive to cover an additional 25% of the assessment cost using the same caps.

Education & Instruction:

Education and promotional materials will be developed for building owners and operators on the benefits of energy efficiency improvements and improved systems performance, including educational brochures, program promotional material, and website content. Specific educational and promotional efforts aimed at market actors such as electrical contractors, building supply firms, and distributors to help them promote efficient measures to their customers. This education will be through a combination of mailings and direct meetings with key market actors in the area.

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. Certain key customer segments will be targeted based on energy savings potential and technology. Initial market segments will include hospitality, food service, health care, grocery, large industrial and large office. The strategy will also include outreach to key equipment 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. Restaurant Association, 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 target market segment 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.

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. There will be specific staff assigned to work with the market actors/channels to promote the program and support the markets sales efforts. This market channel work crosses over with the Prescriptive Program activities so that both are promoted to these key market actors. As well KCP&L account representatives will be expected to promote

the program to their customers directly and cross promote other programs. Initially these target market segments will include hospitality, food service, health care, grocery, large industrial and large office. Based on the ultimate size of the program and other issues KCP&L may outsource the program to an “implementation contractor”.

Evaluation, Measurement and Verification (EM&V)

KCP&L has already adopted an 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** – For the custom program all projects will be reviewed by KCP&L’s staff engineers or subcontractors for determining the incentives each project will receive. This will help assure cost effectiveness of the projects. It will also act in the first step of quality control. After project completion 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. The verification protocol will be a random sample of 5% of the applications up to \$10,000 and a 10% sampling of projects from \$10,000 to \$30,000. All projects over \$30,000 will be verified. If a contractor has unresolved or ongoing problems, they can be removed from the program at KCP&L’s discretion.
- **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. These will be reviewed prior to the project implementation and entered in the database as pending. After project completion the actual installed information will be entered and compared to the initial project estimate. Further, 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 five year Custom, New Construction and RFP program budget is approximately \$11.5 - \$17.9 Million depending on whether the expected or aggressive participation is adopted. These three programs cannot at this time be separated as the participant mix can't be determined between them.
- Approximately 50% of program budgets are for customer incentives and 50% of the program budgets are for program delivery, administration, marketing, and evaluation.
- Suggested initial KCP&L staffing for the Custom program only includes a full-time program manager, a full time program administrative/data support person, a full time trade ally liaison, four market segment managers to develop relationships with the market and the equivalent of about 1 FTE of account reps time to promote the program to their customers.
- Program monitoring, verification and evaluation costs will be about five percent of the total budget.

Program Impact Summaries

- Total estimated program peak demand reductions for the combined Custom, New Construction and RFP programs are 11.8 – 18.4 MW in year five.
- Total estimated lifetime kWh savings for the combined Custom, New Construction and RFP programs for the 5 year program are 711,000,000 – 1,106,000,000 kWh.

Program Benefit-Cost Results

Based on the DSMore results, the expected Custom, New Construction and RFP program level benefit cost ratios for each of the five main California Standard Practice tests are:

- Utility Test: 5.62
- TRC Test: 3.80
- RIM Test: 1.92
- Societal Test: 4.22
- Participant Test: 2.48

C&I New Construction Program

Program Concept and Description

The Commercial and Industrial (C&I) New Construction 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 and are above standard construction practices. This program will pertain to new buildings and major remodeling projects only. It will have two components to the program. Standard high efficiency technologies that are upgraded beyond code or standard practices, such as standard lighting and HVAC measures, are covered within the separate Prescriptive program. The second component of the program will be design assistance and the upgrade of the whole building. Incentives will be based on the percent improvement above Kansas building code and for Missouri above the ASHRAE 90.1 standards as determined by DOE 2 or equivalent building simulation modeling.

The viability of the incentives 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), Societal Test (ST) 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 & Rationale

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. Standard high efficiency equipment will be covered through the Prescriptive Program when no modeling is completed. When modeling is completed, they will be considered within the total savings percent and provided incentives as a total package.
- 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.
- Lack of time, resources and motivation by the designer/engineer to consider efficient alternatives and model these results for the owner's consideration.
- Ensure that the participation process is clear, easy to understand and simple.

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. If the building is not designed and constructed with electric efficiency in mind, there might not be the opportunity to make these improvements until many years later when the equipment fails or further building remodeling occurs. Avoiding this lost opportunity at the time of design and construction allows energy efficiency to be optimized and is usually less costly than equipment replacement or redesign. 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 incentives are calculated on a custom \$/kW and \$/kWh basis, since the energy and demand savings for many common energy efficiency measures vary considerably between customers. Having a simple program and incentive structure provides customers with ease of use regarding the financial rewards 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 retail 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.

Technology Categories

The technologies to be included within this program are flexible and include all that will save electrical energy and demand. Participants can choose to use the existing Prescriptive technologies without going through the design modeling process. These technologies applicable to new construction will be processed through normal prescriptive incentive application forms. For those who are willing to complete design modeling comparisons, any electrical improvements will be included.

Market Barriers

Market barriers vary by technology and customer segment. They include but are not limited to:

- Lack of investment funds or high costs
- Competition for funds with other projects
- Lack of awareness/knowledge by both customers and architects/engineers
- Lack of time and resources during the design process
- Increased perceived risk from a newer technology in performance
- High transaction and information search costs

Working with the building owners and the architects/engineers and providing incentives, KCP&L expects to reduce many of these barriers and stimulate installation of these measures.

Components of Delivery

Incentives:

The incentives for the program can come through two different options. The first option is a prescriptive incentive for technologies above code that are within the Prescriptive program listing. This situation will be used if the building simulation modeling is not used. These technologies will receive incentives at the same levels as the prescriptive program. This keeps the communications with the market actors and suppliers clear and makes processing easy. To get architects and engineers to model and encourage efficiency in their buildings, incentives will be provided for the initial design comparisons and building simulation modeling. Incentives will also be available for the building owner to install the high efficiency equipment. These installation incentives will be based on three levels of performance above Kansas building code or ASHRAE 90.1 standards; 10-20% above baseline code, 20-30% above code and 30% or more and will change over the program life as the market responds. The initial incentive levels are described in Appendix A.

Ed/Instructions:

Education and promotional materials will be developed for building owners, architects, engineers and operators on the benefits of energy efficiency improvements and improved

systems performance, including educational brochures, program promotional material, and website content. Specific educational and promotional efforts aimed at architects and engineers to help them promote efficient measures to their customers. This education will be through a combination of mailings, workshops and direct meetings with key market actors in the area.

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. They will also be available through 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.

Delivery

The C&I New Construction Program is a customer incentive program that provides design assistance for architects and engineers (A&E) designing new buildings and customer incentives 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 architect and engineers to help them promote efficiency measures to their customers through workshops and direct visits.
- Incentives for building owners and managers to adopt the measures recommended by the program.
- Incentives for design modeling to consider energy efficiency in the building and building systems. When appropriate the program will help with LEED certification requirements.
- EE measures that will be covered by the program include:
 - Efficient lighting systems and controls.
 - 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.

To deliver these services, KCP&L will hire or subcontract with energy efficiency design and engineering experts to talk with the A&E community about the program and educate them on its benefits. These experts will also provide technical assistance to the designers concerning the building simulation modeling of the high efficient alternatives. In addition, 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. To help promote the program to building owners KCP&L account representatives will promote the program during their normal contacts.

Evaluation, Measurement and Verification (EM&V) (Quality Control & Monitoring)

KCP&L has already adopted an 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** – All the modeling design projects will be reviewed by KCP&L's staff engineers or subcontractors to determine the incentives each project will receive based on the building simulations. This will help assure cost effectiveness of the projects. It will also act in the first step of quality control. After project completion KCP&L's evaluation contractor will conduct field verification of the ex ante and ex post conditions for all projects of a new A&E involved in the program to determine as built conditions. After successful participation by an A&E, the field verifications will occur on the largest projects and a sample of medium sized projects throughout the implementation of the program to determine as built conditions. The verification protocol will be a random sample of 5% of the applications up to \$10,000 and a 10% sampling of projects from \$10,000 to \$30,000. All projects with over \$30,000 in incentives will be verified. If a A&E or contractor has unresolved or ongoing problems, they can be removed from the program at KCP&L's discretion. Prescriptive measures will be inspected and verified using the Prescriptive protocols.
- **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 five year Custom, New Construction and RFP program budget is approximately \$11.5 - \$17.9 Million depending on whether the expected or aggressive participation is adopted. These three programs cannot at this time be separated as the participant mix can't be determined between them.

- Suggested initial KCP&L staffing for the New Construction program includes a half-time program manager, a part-time program administrative/data support person, a full time trade ally liaison, and less than one FTE of account reps time to promote the program to their customers.
- Approximately 50% of program budgets are for customer incentives and 50% of the program budgets are for program delivery, administration, marketing, and evaluation.
- Program monitoring, verification and evaluation costs will be about five percent of the total budget.

Program Impact Summaries

- Total estimated program peak demand reductions for the combined Custom, New Construction and RFP programs are 11.8 – 18.4 MW in year five.
- Total estimated lifetime kWh savings for the combined Custom, New Construction and RFP programs for the 5 year program are 711,000,000 – 1,106,000,000 kWh.

Program Benefit-Cost Results

Based on the DSMore results, the expected Custom, New Construction and RFP program level benefit cost ratios for each of the five main California Standard Practice tests are:

- Utility Test: 5.62
- TRC Test: 3.80
- RIM Test: 1.92
- Societal Test: 4.22
- Participant Test: 2.48

Targeted RFP Program

Program Concept and Description

The Commercial and Industrial (C&I) RFP Program provides custom incentives to C&I customers on a very targeted and limited time basis for the installation of innovative and non-standard energy-efficiency equipment and controls. This program will pertain to existing facilities only. This program will be offered through Requests for Proposals (RFP) to targeted customer and markets with very specific criteria. The purpose of the program is to have special offers that stimulate larger package projects, not just measures or specific systems. It will have a limited time with a specific max budget. Through having limited offerings, customers and contractors are more motivated to move stalled projects. It also allows KCP&L to throttle projects and spending up and down based on other program spending and results towards goals. The RFP program also has the flexibility to push specific technologies or types of projects. As well this flexibility

permits KCP&L to provide incentives at higher levels if required without disturbing the other programs and their communications with the market.

The incentive levels set for the custom measures covered by the program will be assessed for each RFP response through a cost-effectiveness analysis using the DSMore model that evaluates the Total Resource Cost (TRC), Utility Cost (UC), Ratepayer Impact Measure (RIM), Societal Test (ST) and Participant (PT) tests. The cost-effectiveness tests account for the energy and demand savings, the associated avoided costs and net benefits to KCP&L, the incremental or installed 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 respond to the RFP with proposals. 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 & Rationale

The primary goal of the program is to encourage KCP&L's C&I customers to install energy efficient process, refrigeration, and other efficient equipment & controls in existing facilities beyond what they would have installed without the program. More specifically, the program is designed to:

- Stimulate the market and move stalled efficiency projects within a certain timeframe.
- 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 equipment contractors and distributors to promote energy efficient equipment to end users.
- Allow KCP&L to increase spending and activity to reach goals.
- Allow KCP&L the flexibility to promote certain technologies or systems, or market to certain market sub segments.
- 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.

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 custom measures that are not easily covered in a prescriptive program such as process, refrigeration, compressed air systems and other types of unique 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 very specific offer for a limited time to motivate C&I customers to take action by offering incentives. Having a specific RFP structure with a limited time will push projects sooner improving the efficiency of the facility.

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 retail customers are eligible for the program. However, the RFP's will only be issued to certain sub segments and with certain types of projects/technologies accepted. Some sample targets include:

- Hospitals and Health Care institutions HVAC equipment and controls.
- Printing industry process projects.

Technology Categories

These RFP measures will not include prescriptive technologies unless they are bundled together with custom measures and/or controls. All other cost effective electric efficiency improvements will be considered.

Market Barriers

Market barriers vary by technology and customer segment. They include but are not limited to:

- Lack of investment funds or high costs
- Cost to analyze potential savings from a project through assessments/audits
- Competition for funds with other projects
- Lack of awareness/knowledge by customers, engineers and contractors
- Lack of time
- Increased perceived risk from a newer technology in performance
- High transaction and information search costs

Working with the market actors, increasing awareness and providing incentives, KCP&L expects to reduce many of these barriers and stimulate installation of these measures.

Components of Delivery

Incentives:

The C&I RFP Program is a financial assistance and education program that provides incentives for the installation of energy efficiency measures in existing non-residential facilities in response to the unique specifications of the RFP. Customers/Contractors will submit their project proposals in response to the RFP including savings estimates.

KCP&L staff or its subcontractor will review these proposals and savings estimates and determine if they qualify for a financial award. This review of the savings analysis helps assure that KCP&L funds are being cost effectively used to promote efficiency.

Incentives will be identified within the RFP on a per kWh and per kW basis so that both energy and demand savings will be rewarded. Levels of incentives will vary depending on the specific RFP. The initial incentives will be established for each RFP separately based on DSM cost effectiveness modeling. Other guidelines to reduce free ridership will also be established. These include years of payback, total incentive dollars per customer per year and percent of total project cost.

Education & Instruction:

Education and promotional materials will be developed for building owners and operators on the RFP program, including educational brochures, program promotional material, and website content. Specific educational and promotional efforts aimed at market actors such as electrical contractors, building supply firms, and distributors to help them promote the RFP efficient measures to their customers. This education will be through a combination of mailings and direct meetings with key market actors in the area.

Program Marketing and Communications Strategy

The marketing and communications strategy will be designed to inform customers of the availability and benefits of the RFP program and how they can participate in the program. Certain key customer segments will be targeted based on their qualifications in the targeted market segment, energy savings potential and technology. The strategy will also include outreach to key equipment 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 targeted by the RFP 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 submit a proposal.
 - Customer and trade partner outreach and presentations (e.g. Restaurant Association, BOMA and other customer organizations) informing targeted 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 RFP 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 target market segment 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.

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. There will be specific staff assigned to work with the market actors/channels to promote the program and support the markets sales efforts. This market channel work crosses over with the Prescriptive Program activities so that both are promoted to these key market actors. As well KCP&L account representatives will be expected to promote the program to their customers directly and cross promote other programs. Based on the

ultimate size of the program and other issues KCP&L may outsource the program to an “implementation contractor”.

Evaluation, Measurement and Verification (EM&V)

KCP&L has already adopted an 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** – For the RFP program all projects will be reviewed by KCP&L’s staff engineers or subcontractors for determining qualification under the RFP guidelines and the incentives for each project. This will help assure cost effectiveness of the projects. It will also act in the first step of quality control. After project completion 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. The verification protocol will be a random sample of 5% of the applications up to \$10,000 and a 10% sampling of projects from \$10,000 to \$30,000. All projects over \$30,000 will be verified. If a contractor has unresolved or ongoing problems, they can be removed from the program at KCP&L’s discretion.
- **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. These will be reviewed prior to the project implementation and entered in the database as pending. After project completion the actual installed information will be entered and compared to the initial project estimate. Further, 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 five year Custom, New Construction and RFP program budget is approximately \$11.5 - \$17.9 Million depending on whether the expected or aggressive participation is adopted. These three programs cannot at this time be separated as the participant mix can't be determined between them.
- Approximately 50% of program budgets are for customer incentives and 50% of the program budgets are for program delivery, administration, marketing, and evaluation.
- Suggested initial KCP&L staffing for the RFP program includes a half-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 monitoring, verification and evaluation costs will be about five percent of the total budget.

Program Impact Summaries

- Total estimated program peak demand reductions for the combined Custom, New Construction and RFP programs are 11.8 – 18.4 MW in year five.
- Total estimated lifetime kWh savings for the combined Custom, New Construction and RFP programs for the 5 year program are 711,000,000 – 1,106,000,000 kWh.

Program Benefit-Cost Results

Based on the DSMore results, the expected Custom, New Construction and RFP program level benefit cost ratios for each of the five main California Standard Practice tests are:

- Utility Test: 5.62
 - TRC Test: 3.80
 - RIM Test: 1.92
 - Societal Test: 4.22
 - Participant Test: 2.48
-

Section 2: Cost Effectiveness Analysis

Methodology

KCP&L wants to assure its ratepayers, its shareholders, the regulatory agencies and the whole community that its programs are cost effective. There are many perspectives from which to judge cost effectiveness and with this analysis MMP is providing all the California Standard Practice Manual tests showing these different perspectives.

- Utility Cost Test (UCT)
- Total Resource Cost Test (TRC)
- Ratepayer Impact Test (RIM)
- Participant Test
- Societal Test

To make this analysis, MMP used the DSMore modeling tool. The leading cost effectiveness modeling tool in the country. . DSMore was developed by Integral Analytics (IA) 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. This model was also used by Summit Blue in its high level studies.

The DSMore model was used to analyze individual measures that might be included within the program, groups of measures, measures rolled up into programs and finally the portfolio of programs for KCPL. For the measure analysis, engineering estimates and modeling of savings was completed by Architectural Energy Corporation (AEC) and Franklin Energy Services (FES) under subcontract to MMP. The basic inputs needed for the modeling of each measure include:

- Energy Savings
- Demand savings
- Effective Useful Life
- Incremental Cost for the Efficient Measure
- Proposed Incentives
- Administrative & Implementation Costs for the Program
- Operating Hours
- Participation/Installation Rates per Year
- Expected Net Results (net of free riders and spillover)

MMP also worked with KCPL to develop the utility inputs required. These inputs include the rates, prices, escalation rates. Those assumptions will be provided under a separate document due to the potential sensitive and proprietary information within.

One of the most sensitive assumptions within the model is the participation rates for the programs. MMP used the Summit Blue analysis, experience from other similar programs in the Midwest, and its experience in designing and implementing these programs to determine potential participation by measure. There were four scenarios developed, a baseline “expected” scenario and an “aggressive” scenario at both high and normal incentive levels. The aggressive scenario assumed additional focus, resources, marketing and other influencers that might increase the amount of program participation over the five year planning period. This aggressive scenario assumed a 25% increase over the baseline in year one and a 20% increase in participation per year (versus a 10% increase in the expected scenario). While the aggressive scenario is still achievable, it would be a stretch in MMP’s professional opinion to reach that level of participation. The normal incentive levels are based on what other similar programs are doing elsewhere in the country and the judgments of the planners on what level of incentives are needed to stimulate the market. The higher incentives were based on increasing the incentives until they supply 50% of the incremental cost of the measure or the customer has a two year payback on that incremental cost whichever is less. It is anticipated that this will help increase participation to the aggressive participation levels modeled. By having this range of results and costs, KCPL can better make a judgment on the range of expectations from the programs and the risks involved in achievement. Probabilities were applied to each scenario on the expected results.

To verify the assumed participation was realistic, Franklin Energy Services compared these projections to actual results from two existing programs in Wisconsin; the Focus on Energy program and the WE Energies program. As FES implements all or portions of each of those two programs, their experience provides added validity to the assumptions used for KCPL.

Results

The results of the analysis by measure are included in Appendix A. Over 130 C&I technologies of various sizes and configurations were analyzed under both the expected and aggressive scenarios for cost effectiveness. Proposed incentive levels for the prescriptive program were adjusted within each measure to be cost effective yet move the market. The results show all measures to be cost effective. Note that over time measures offered within a prescriptive program should change as new technologies are developed and as market acceptance changes so this technology listing should be considered the initial offerings and reviewed annually for updates or changes.

To better understand cost effectiveness of all technologies these individual test results were “rolled-up” into a program portfolio using DSMore to get their aggregate cost effectiveness scores across all four programs. You can see below the results for each of the four scenarios, High Incentives/Aggressive Participation, Normal Incentives/Aggressive Participation, High Incentives/Expected Participation and Low Incentives/Expected Participation.

		ALL			
		ALL - HIGH AGG	ALL - Normal AGG	ALL - High Expected	ALL Normal Expected
Utility Test		6.66	8.38	6.52	8.36
TRC Test		4.41	4.41	4.35	4.35
RIM Test		2.00	2.13	1.99	2.13
Societal Test		4.91	4.91	4.84	4.84
Participant Test		2.46	2.30	2.44	2.26

These results clearly show that a cost effective portfolio of measures/programs and their recommended incentives have been developed and should be implemented by KCPL.

As part of the portfolio, the Custom program incentive levels were developed using DSMore to assure cost effectiveness. Custom measures by definition cannot have their energy savings defined so that measure level cost effectiveness cannot be determined and cannot be included within the Prescriptive program. Two levels of incentives are proposed within the Custom program. Based on DSMore analysis both are cost effective, however, two incentive levels are provided to respond to market need while being sensitive to potential free rider levels and budget constraints. The higher level incentives are to be used on technologies that are newer to the marketplace, have higher perceived risk, higher market barriers or higher costs and thus need higher incentives to stimulate the participation. The lower incentives are to be used for technologies that have been proven in the marketplace but need the incentives to improve cost effectiveness or to help stimulate the market.

The New Construction program will use the two Custom incentive levels plus an intermediate level between the two to give more range to the incentive options. Based on our analysis, this as well is cost effective.

The RFP program incentives are not yet defined. MMP recommends that KCPL utilize the DSMore model as part of the review of various proposals when received to determine cost effectiveness and the final incentive levels. This process will insure cost effectiveness of the program.

Budgets & Savings

Also during the DSMore analysis, total expected savings based on participation, incentives and the program designs were developed. These budgets/costs and energy savings are used as part of the determination of the tests. We have summarized the results below for all four scenarios.

	ALL			
	ALL - HIGH AGG	ALL - Normal AGG	ALL - High Expected	ALL Normal Expected
kWh Gross - Lifetime	3,268,350,121	3,268,350,121	2,037,845,892	2,037,845,892
kW Gross Yr 5	71,565	71,565	43,872	43,872
Program Costs	\$ 34,072,381	\$ 27,175,909	\$ 21,474,058	\$ 16,843,878

MMP then assigned probabilities to each scenario occurring based on experience and the planning process results. The probability assigned to each are:

High Incentive/Expected Participation = 90%

Normal Incentive/Expected Participation = 80%

High Incentive/Aggressive Participation = 70%

Normal Incentive/Aggressive Participation = 60%

Given all these weightings of probability the results are:

Average Probability Weighted Results

kWh Gross - Lifetime	2,571,064,391
kW Gross	55,872
Program Costs	\$ 24,319,322

KCPL will need to finalize this program budgets based on its strategic goals, regulatory and management needs. MMP stands ready to help with this process.

Section 3: Weather Sensitive/ HVAC Measures

Study Methodology

HVAC measure energy and demand savings were established by using a set of prototypical building models developed for the DOE-2.2 building energy simulation program. Prototype models were developed for small retail, big-box retail, small office, large office, fast food restaurant, full service restaurant, school, assembly and light industrial buildings. These buildings represent the types of customers that are expected to participate in the program. The prototypes are based on the models used in the California DEER study, with appropriate modifications to adapt these models to local design practices and climate. Energy savings estimates were developed from the prototype models for entry into the DSMore cost-effectiveness tool.

The HVAC measures for small commercial buildings include single package rooftop air conditioners and heat pumps, split system air conditioners and heat pumps, packaged terminal air conditioners and heat pumps, and ground source and water loop heat pumps. The HVAC measures for the large office building include air cooled chillers, water cooled chillers, variable frequency drives (VFD) applied to fans and pumps, and chilled water temperature reset controls. The program baseline is defined by the National Appliance Energy Conservation Act (NAECA) minimum efficiency for single phase equipment and ASHRAE 90.1 – 2004 minimum efficiency for three phase equipment. HVAC measures cover the upgrade of standard efficiency packaged HVAC systems with high efficiency versions of the same equipment. The calculations do not address HVAC system type changes (e.g. the energy savings from changing from a rooftop AC system to a ground-source heat pump system).

Measure Efficiency Assumptions

The equipment covered, the size ranges, and the program baseline and measure efficiency assumptions are shown in Table .

Table 1. HVAC Equipment Efficiency Assumptions

Equipment Category	Capacity Range Btu/hr	Baseline Efficiency		Source	Measure Efficiency	
		Value	Units		Value	Units
Packaged Terminal A/C	All	8.9	EER	ASHRAE 90.1-2004	9.2	EER
Packaged Terminal HP	All	8.7	EER	ASHRAE 90.1-2004	9	EER
Rooftop A/C (1) phase	<65,000 1 Ph	13	SEER	NAECA	14	SEER
Rooftop A/C (3) phase	<65,000 3 Ph	12	SEER	ASHRAE 90.1-2004	13	SEER
Rooftop A/C (3) phase	65,000 - 135,000	10.1	EER	ASHRAE 90.1-2004	11	EER
Rooftop A/C (3) phase	135,000 - 240,000	9.5	EER	ASHRAE 90.1-2004	11	EER
Rooftop A/C (3) phase	240,000 - 760,000	9.3	EER	ASHRAE 90.1-2004	10	EER
Rooftop A/C (3) phase	>760,000	9	EER	ASHRAE 90.1-2004	10	EER
Rooftop HP (1) phase	<65,000 1 Ph	13	SEER	NAECA	14	SEER
Rooftop HP (3) phase	<65,000 3 Ph	12	SEER	ASHRAE 90.1-2004	13	SEER
Rooftop HP (3) phase	65,000 - 135,000	9.9	EER	ASHRAE 90.1-2004	11	EER
Rooftop HP (3) phase	135,000 - 240,000	9.1	EER	ASHRAE 90.1-2004	10	EER
Rooftop HP (3) phase	>240,000	8.8	EER	ASHRAE 90.1-2004	10	EER
Ground Source HP Closed Loop	<135,000 & 59 F EWT	16.2	EER	ASHRAE 90.1-2004	16.5	EER
Ground Source HP Closed Loop	<135,000 & 77 F EWT	13.4	EER	ASHRAE 90.1-2004	13.7	EER
Water Source Heat Pump	<17,000	11.2	EER	ASHRAE 90.1-2004	11.5	EER
Water Source Heat Pump	17,000 - 65,000	12	EER	ASHRAE 90.1-2004	12.3	EER
Water Source Heat Pump	65,000 - 135,000	12	EER	ASHRAE 90.1-2004	12.3	EER
Air Cooled Chillers	All	1.33	kW/ton	ASHRAE 90.1-2004	1.16	kW/ton
Water Cooled Chillers	< 150 ton	0.835	kW/ton	ASHRAE 90.1-2004	0.78	kW/ton
Water Cooled Chillers	150 - 300 ton	0.74	kW/ton	ASHRAE 90.1-2004	0.56	kW/ton
Water Cooled Chillers	> 300 ton	0.69	kW/ton	ASHRAE 90.1-2004	0.54	kW/ton

Additional measure modeling assumptions are summarized in Table.

Table 2. Measure Assumptions for Controls ,Tune-up and Economizer Measures

Measure	Baseline Assumption	Measure Assumption	Comments
Economizer	Fixed outdoor air.	Dual sensor enthalpy economizer	Maximum efficiency economizer control strategy assumed.
AC tuneup	14% degradation in efficiency for un-tuned unit	Unit runs at rated efficiency (EER=8)	Tuneup applied to existing equipment only
VFD fan motor	Central VAV system with inlet vane air volume control	Central VAV system with VFD air volume control	Applied to large office prototype only
VFD pump control	Constant volume chilled water system with 3-way control valves at cooling coils	Variable volume chilled water system with 2 way control valves at cooling coils	Applied to chilled water pumps in large office prototype only
Chilled water reset control	Constant chilled water temperature setpoint control	Chilled water temperature controlled by coil demanding the most cooling	Applied to large office prototype only

Secondary Research Review

Secondary research review was conducted to obtain estimates of engineering parameters used to develop the simulation models. The review incorporated research conducted in support of the California Database for Energy Efficiency Resources (DEER) study and the US Energy Information Agency (EIA) Commercial Building Energy Consumption Study (CBECS). Building characteristics data from the CBECS study for the West North Central census region were used to update the DEER prototype model. Insulation levels and glazing properties for existing buildings were set according to the provisions of ASHRAE Standard 90A-1980. Insulation levels, glazing properties and lighting power densities for new construction were set according to ASHRAE Standard 90.1-2004. A description of each prototype simulation model follows.

Small Retail

A prototypical building energy simulation model for a small retail building was developed using the DOE-2.2 building energy simulation program. The characteristics of the small retail building prototype are summarized in Table .

Table 3. Small Retail Prototype Description

Characteristic	Value
Vintage	Existing (1980s) vintage and new construction
Size	6400 square foot sales area 1600 square foot storage area

Characteristic	Value
	8000 square feet total
Number of floors	1
Wall construction and R-value	Concrete block with brick veneer. Insulation R-value = 5.7
Roof construction and R-value	Wood frame with built-up roof Existing building insulation: R- 8.4 New construction insulation R-15
Glazing type	Existing building: Double pane clear (SC=0.84, U-value=0.72) New construction: Double low-e tint (SC=0.45, U-value=0.57)
Lighting power density	Existing building: Sales area: 3.4 W/SF Storage area: 0.9 W/SF New construction: Sales area: 1.7 W/SF Storage area: 0.9 W/SF
Plug load density	Sales area: 1.2 W/SF Storage area: 0.2 W/SF
Operating hours	10 – 10 Monday-Saturday 10 – 8 Sunday
HVAC system type	Packaged single zone, no economizer
HVAC system size	Existing building: Sales floor: 221 SF/ton Storage area: 349 SF/ton New building Sales floor: 275 SF/ton Storage area: 460 SF/ton
Thermostat setpoints	Occupied hours: 76 cooling, 72 heating Unoccupied hours: 81 cooling, 67 heating

A computer-generated sketch of the small retail building prototype is shown in Figure 1.

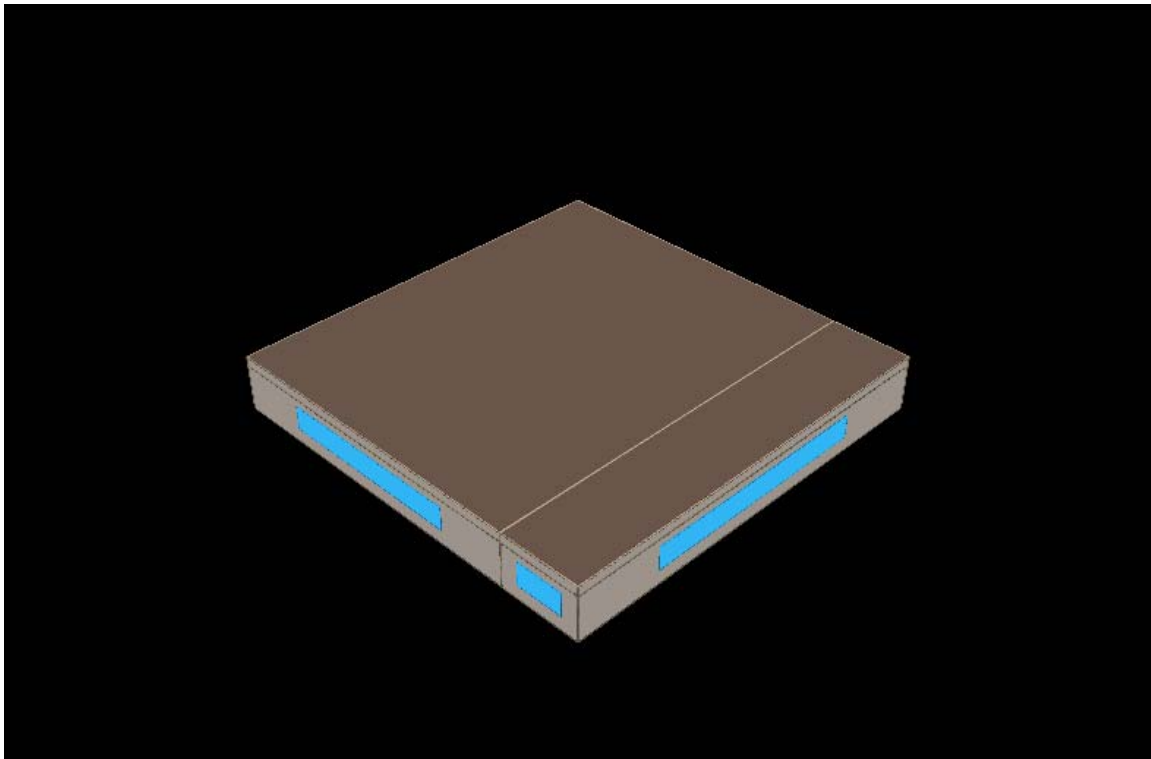


Figure 1. Small Retail Prototype Building Rendering

Full-service Restaurant

A prototypical building energy simulation model for a full-service restaurant was developed using the DOE-2.2 building energy simulation program. The characteristics of the full service restaurant prototype are summarized in Table .

Table 4. Full Service Restaurant Prototype Description

Characteristic	Value
Vintage	Existing (1980s) vintage and new construction
Size	2000 square foot dining area 600 square foot entry/reception area 1200 square foot kitchen 200 square foot restrooms
Number of floors	1
Wall construction and R-value	Concrete block with brick veneer. Insulation R-value = 5.7
Roof construction and R-value	Wood frame with built-up roof Existing building insulation: R- 8.4 New construction insulation R-15
Glazing type	Existing building: Double pane clear (SC=0.84, U-value=0.72) New construction: Double low-e tint (SC=0.45, U-value=0.57)

Characteristic	Value
Lighting power density	Existing building: Dining area: 1.7 W/SF Entry area: 2.5 W/SF Kitchen: 4.3 W/SF Restrooms: 1.0 W/SF New construction: Dining area: 2.1 W/SF Entry area: 1.1 W/SF Kitchen: 1.2 W/SF Restrooms: 0.9 W/SF
Plug load density	Dining area: 0.6 W/SF Entry area: 0.6 W/SF Kitchen: 3.1 W/SF Restrooms: 0.2 W/SF
Operating hours	9am – 12am
HVAC system type	Packaged single zone, no economizer
HVAC system size	Existing building: Dining area: 136 SF/ton Entry area: 76 SF/ton Kitchen: 189 SF/ton Restrooms: 159 SF/ton New construction: Dining area: 144 SF/ton Entry area: 84 SF/ton Kitchen: 239 SF/ton Restrooms: 173 SF/ton
Thermostat setpoints	Occupied hours: 77 cooling, 72 heating Unoccupied hours: 82 cooling, 67 heating

A computer-generated sketch of the full-service restaurant prototype is shown in Figure 2.

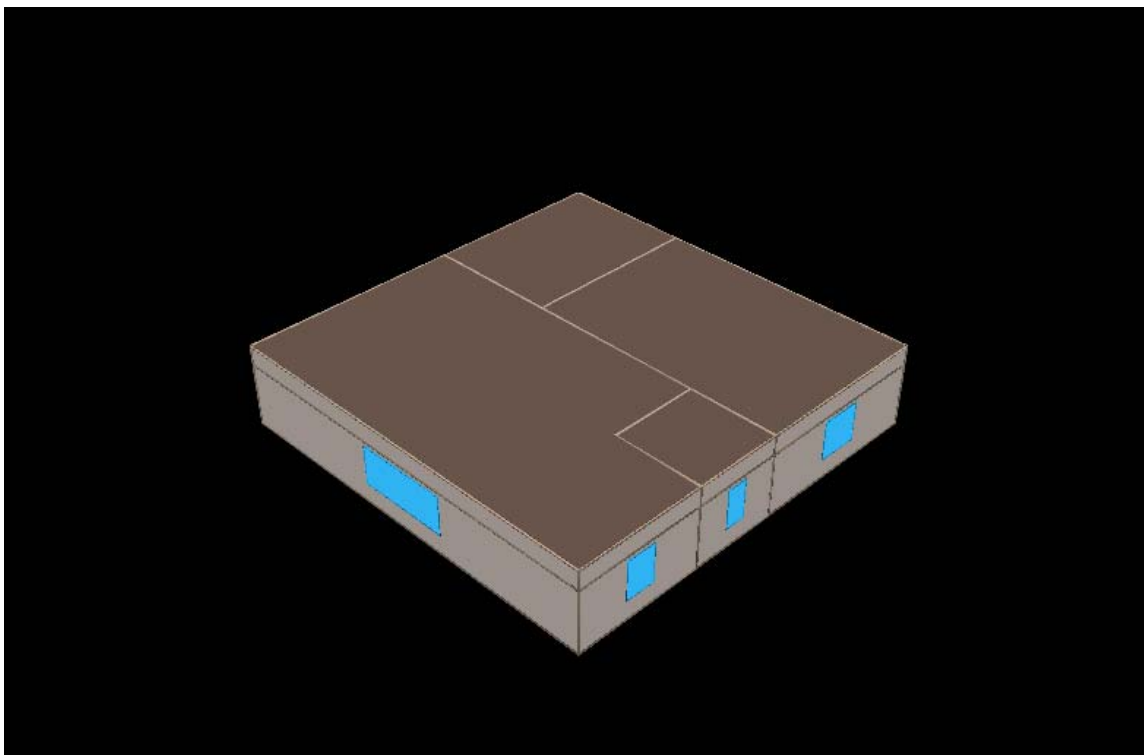


Figure 2. Full Service Restaurant Prototype Rendering

Small Office

A prototypical building energy simulation model for a small office was developed using the DOE-2.2 building energy simulation program. The characteristics of the small office prototype are summarized in Table .

Table 5. Small Office Prototype Building Description

Characteristic	Value
Vintage	Existing (1980s) vintage and new construction
Size	10,000 square feet
Number of floors	2
Wall construction and R-value	Concrete block with brick veneer. Insulation R-value = 5.7
Roof construction and R-value	Wood frame with built-up roof Existing building insulation: R- 8.4 New construction insulation R-15
Glazing type	Existing building: Double pane clear (SC=0.84, U-value=0.72) New construction: Double low-e tint (SC=0.45, U-value=0.57)

Characteristic	Value
Lighting power density	Existing building: Perimeter offices: 2.2 W/SF Core offices: 1.5 W/SF New construction: Perimeter offices: 1.1 W/SF Core offices: 1.1 W/SF
Plug load density	Perimeter offices: 1.6 W/SF Core offices: 0.7 W/SF
Operating hours	Mon-Sat: 9am – 6pm Sun: Unoccupied
HVAC system type	Packaged single zone, no economizer
HVAC system size	Existing building: 171 SF/ton New construction: 236 SF/ton
Thermostat setpoints	Occupied hours: 76 cooling, 72 heating Unoccupied hours: 81 cooling, 67 heating

A computer-generated sketch of the small office prototype is shown in Figure 3.

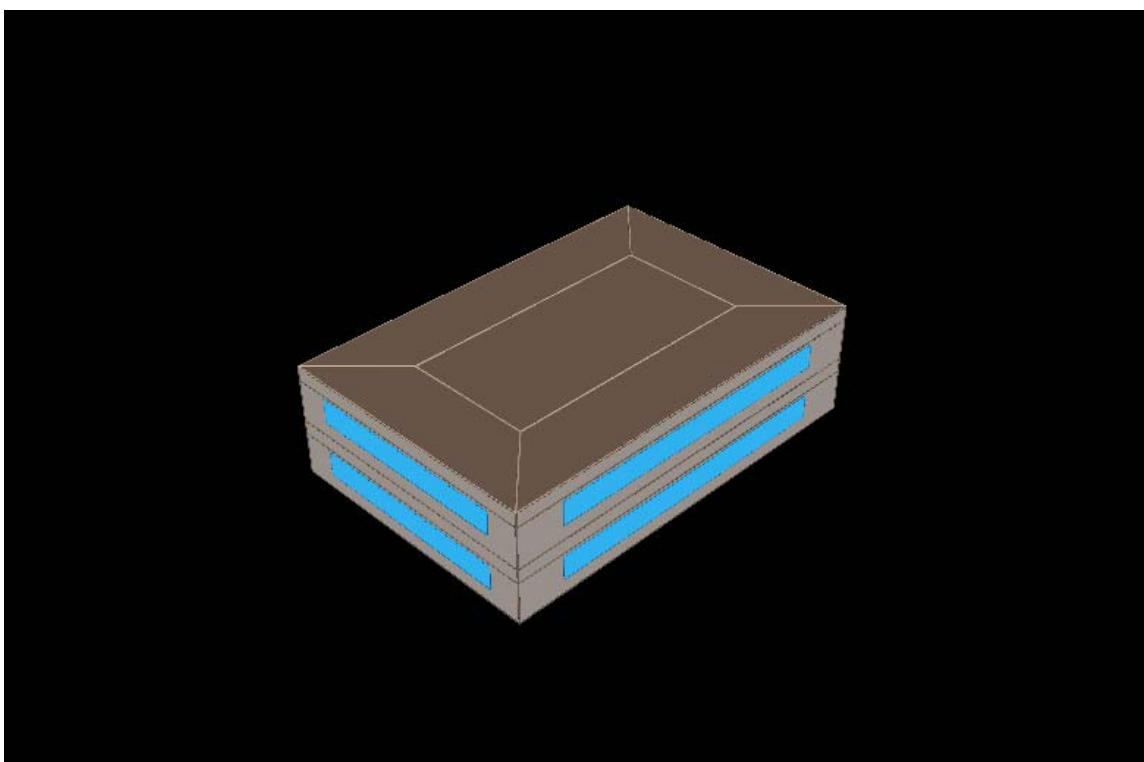


Figure 3. Small Office Prototype Building Rendering

Light Industrial

A prototypical building energy simulation model for a light industrial building was developed using the DOE-2.2 building energy simulation program. The characteristics of the prototype are summarized in Table .

Table 6. Light Industrial Prototype Building Description

Characteristic	Value
Vintage	Existing (1980s) vintage and new construction
Size	100,000 square feet total 80,000 SF factory 20,000 SF warehouse
Number of floors	1
Wall construction and R-value	Concrete block with brick veneer. Insulation R-value = 5.7
Roof construction and R-value	Wood frame with built-up roof Existing building insulation: R- 8.4 New construction insulation R-15
Glazing type	Existing building: Double pane clear (SC=0.84, U-value=0.72) New construction: Double low-e tint (SC=0.45, U-value=0.57)
Lighting power density	Existing building: Factory – 2.1 W/SF Warehouse – 0.9 W/SF New construction: Factory – 1.7 W/SF Warehouse – 0.9 W/SF
Plug load density	Factory – 1.2 W/SF Warehouse – 0.2 W/SF
Operating hours	Mon-Fri: 6am – 6pm Sat Sun: Unoccupied
HVAC system type	Packaged single zone, no economizer
HVAC system size	Existing building: 478 SF/ton New construction: 523 SF/ton
Thermostat setpoints	Occupied hours: 78 cooling, 70 heating Unoccupied hours: 83 cooling, 65 heating

A computer-generated sketch of the prototype is shown in Figure 4.

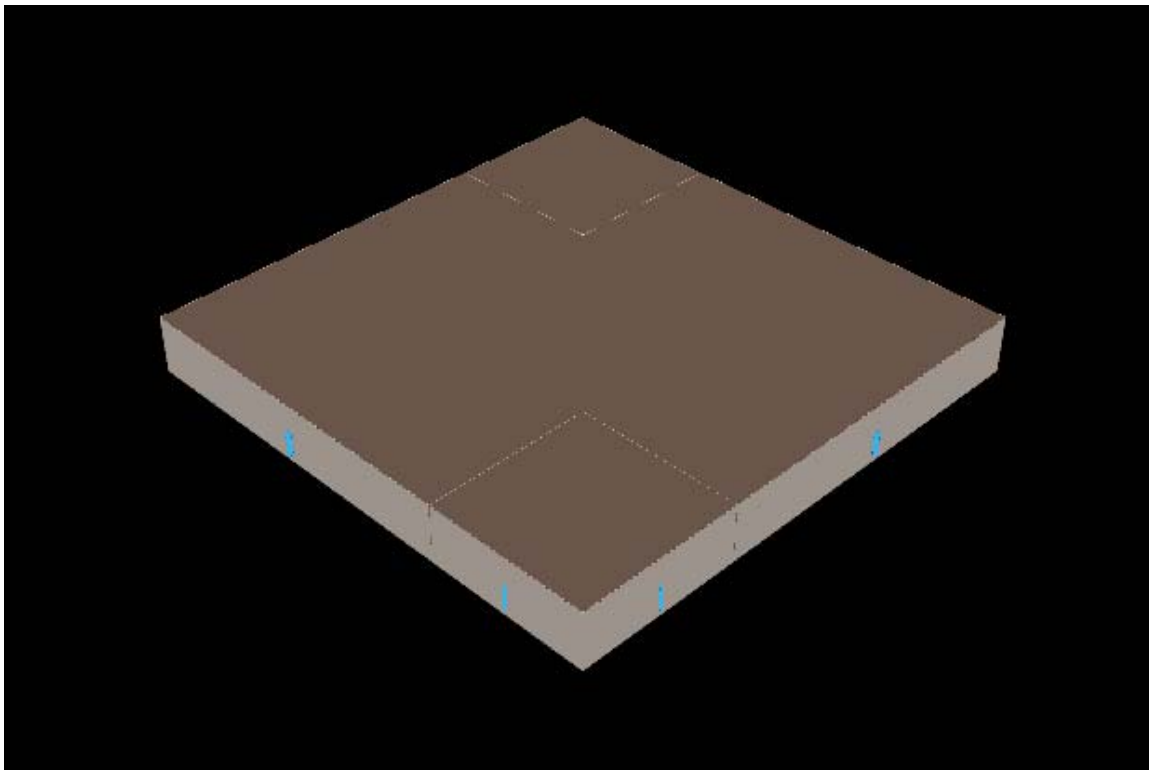


Figure 4. Light Industrial Building Rendering

Big Box Retail

A prototypical building energy simulation model for a big box retail building was developed using the DOE-2.2 building energy simulation program. The characteristics of the prototype are summarized in Table .

Table 7. Big Box Retail Prototype Building Description

Characteristic	Value
Vintage	Existing (1980s) vintage and new construction
Size	130,500 square feet Sales: 107,339 SF Storage: 11,870 SF Office: 4,683 SF Auto repair: 5,151 SF Kitchen: 1,459 SF
Number of floors	1
Wall construction and R-value	Concrete block with brick veneer. Insulation R-value = 5.7
Roof construction and R-value	Wood frame with built-up roof Existing building insulation: R- 8.4 New construction insulation R-15

Characteristic	Value
Glazing type	Existing building: Double pane clear (SC=0.84, U-value=0.72) New construction: Double low-e tint (SC=0.45, U-value=0.57)
Lighting power density	Existing building: Sales: 3.36 W/SF Storage: 0.88 W/SF Office: 2.2 W/SF Auto repair: 2.15 W/SF Kitchen: 4.3 W/SF New construction: Sales: 1.7 W/SF Storage: 0.9 W/SF Office: 1.1 W/SF Auto repair: 0.7 W/SF Kitchen: 1.2 W/SF
Plug load density	Sales: 1.15 W/SF Storage: 0.23 W/SF Office: 1.73 W/SF Auto repair: 1.15 W/SF Kitchen: 3.23 W/SF
Operating hours	Mon-Sun: 10am – 9pm
HVAC system type	Packaged single zone, no economizer
HVAC system size	Existing building: 256 SF/ton New construction: 309 SF/ton
Thermostat setpoints	Occupied hours: 76 cooling, 72 heating Unoccupied hours: 81 cooling, 67 heating

A computer-generated sketch of the prototype is shown in Figure 5.

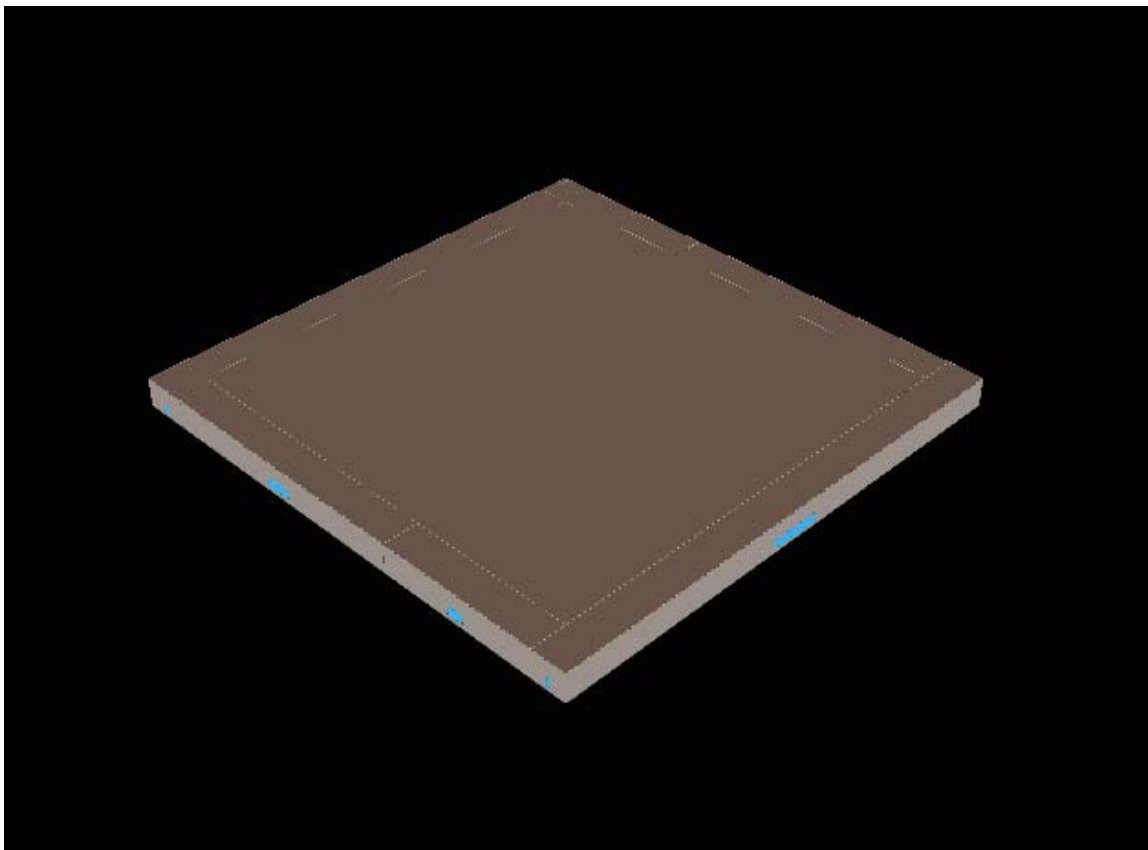


Figure 5. Big Box Retail Building Rendering

Fast Food Restaurant

A prototypical building energy simulation model for a fast food restaurant was developed using the DOE-2.2 building energy simulation program. The characteristics of the prototype are summarized in Table .

Table 8. Fast Food Restaurant Prototype Building Description

Characteristic	Value
Vintage	Existing (1980s) vintage and new construction
Size	2000 square feet 1000 SF dining 600 SF entry/lobby 300 SF kitchen 100 SF restroom
Number of floors	Concrete block with brick veneer. Insulation R-value = 5.7
Wall construction and R-value	Wood frame with built-up roof Existing building insulation: R- 8.4 New construction insulation R-15

Characteristic	Value
Roof construction and R-value	Existing building: Double pane clear (SC=0.84, U-value=0.72) New construction: Double low-e tint (SC=0.45, U-value=0.57)
Glazing type	Single pane clear
Lighting power density	Existing building: 1.7 W/SF dining 2.5 W/SF entry/lobby 4.3 W/SF kitchen 1.0 W/SF restroom New construction: 0.9 W/SF dining 1.1 W/SF entry/lobby 1.2 W/SF kitchen 0.9 W/SF restroom
Plug load density	0.6 W/SF dining 0.6 W/SF entry/lobby 4.3 W/SF kitchen 0.2 W/SF restroom
Operating hours	Mon-Sun: 6am – 11pm
HVAC system type	Packaged single zone, no economizer
HVAC system size	Existing building: 89 SF/ton New construction: 105 SF/ton
Thermostat setpoints	Occupied hours: 77 cooling, 72 heating Unoccupied hours: 82 cooling, 67 heating

A computer-generated sketch of the prototype is shown in Figure 6.

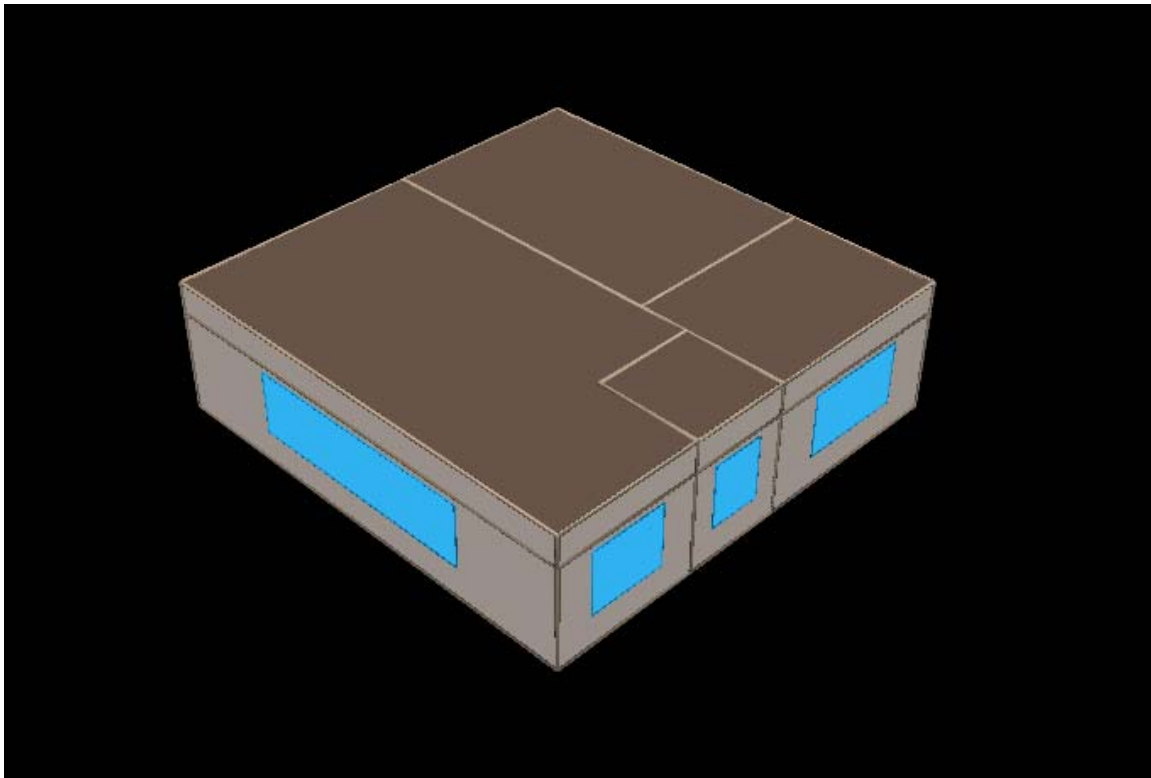


Figure 6. Fast Food Restaurant Building Rendering

School

A prototypical building energy simulation model for an elementary school was developed using the DOE-2.2 building energy simulation program. The model is really of two identical buildings oriented in two different directions. The characteristics of the prototype are summarized in Table .

Table 9. Elementary School Prototype Building Description

Characteristic	Value
Vintage	Existing (1980s) vintage and new construction
Size	2 buildings, 25,000 square feet each; oriented 90° from each other Classroom: 15,750 SF Cafeteria: 3,750 SF Gymnasium: 3,750 SF Kitchen: 1,750 SF
Number of floors	1
Wall construction and R-value	Concrete block with brick veneer. Insulation R-value = 5.7
Roof construction and R-value	Wood frame with built-up roof Existing building insulation: R- 8.4 New construction insulation R-15

Characteristic	Value
Glazing type	Existing building: Double pane clear (SC=0.84, U-value=0.72) New construction: Double low-e tint (SC=0.45, U-value=0.57)
Lighting power density	Existing building: Classroom: 4.4 W/SF Cafeteria: 1.7 W/SF Gymnasium: 2.1 W/SF Kitchen: 4.3 W/SF New construction: Classroom: 1.4 W/SF Cafeteria: 0.9 W/SF Gymnasium: 1.4 W/SF Kitchen: 1.2 W/SF
Plug load density	Classroom: 1.2 W/SF Cafeteria: 0.6 W/SF Gymnasium: 0.6 W/SF Kitchen: 4.2 W/SF
Operating hours	Mon-Fri: 8am – 6pm Sun: 8am – 4pm
HVAC system type	Packaged single zone, no economizer
HVAC system size	Existing building: 195 SF/ton average New construction: 235 SF/ton average
Thermostat setpoints	Occupied hours: 76 cooling, 72 heating Unoccupied hours: 81 cooling, 67 heating

A computer-generated sketch of the prototype is shown in Figure 7.

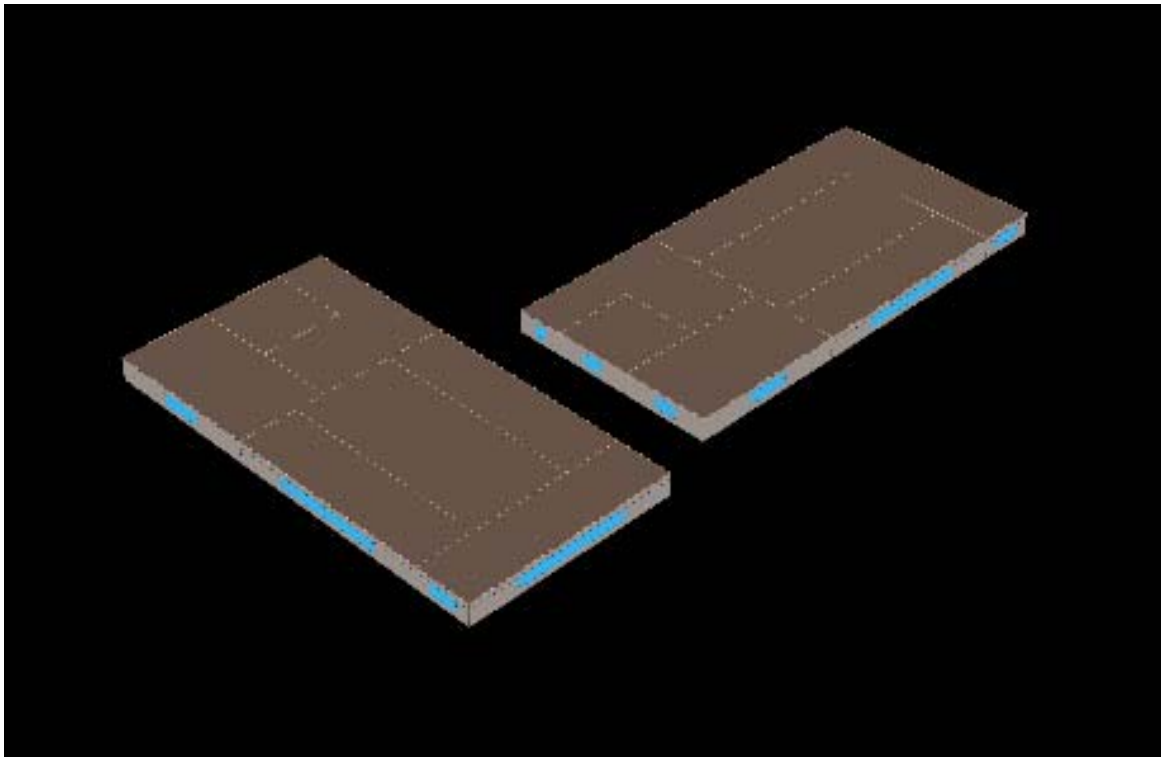


Figure 7. School Building Rendering

Assembly

A prototypical building energy simulation model for an assembly building was developed using the DOE-2.2 building energy simulation program. The characteristics of the prototype are summarized in Table .

Table 10. Assembly Prototype Building Description

Characteristic	Value
Vintage	Existing (1980s) vintage and new construction
Size	34,000 square feet Auditorium: 33,240 SF Office: 760 SF
Number of floors	1
Wall construction and R-value	Concrete block with brick veneer. Insulation R-value = 5.7
Roof construction and R-value	Wood frame with built-up roof Existing building insulation: R- 8.4 New construction insulation R-15
Glazing type	Existing building: Double pane clear (SC=0.84, U-value=0.72) New construction: Double low-e tint (SC=0.45, U-value=0.57)

Characteristic	Value
Lighting power density	Existing building: Auditorium: 3.4 W/SF Office: 2.2 W/SF New construction: Auditorium: 1.7 W/SF Office: 1.1 W/SF
Plug load density	Auditorium: 1.2 W/SF Office: 1.7 W/SF
Operating hours	Mon-Sun: 8am – 9pm
HVAC system type	Packaged single zone, no economizer
HVAC system size	Existing building: 91 SF/ton New construction: 98 SF/ton
Thermostat setpoints	Occupied hours: 76 cooling, 72 heating Unoccupied hours: 81 cooling, 67 heating

A computer-generated sketch of the prototype is shown in Figure 8.

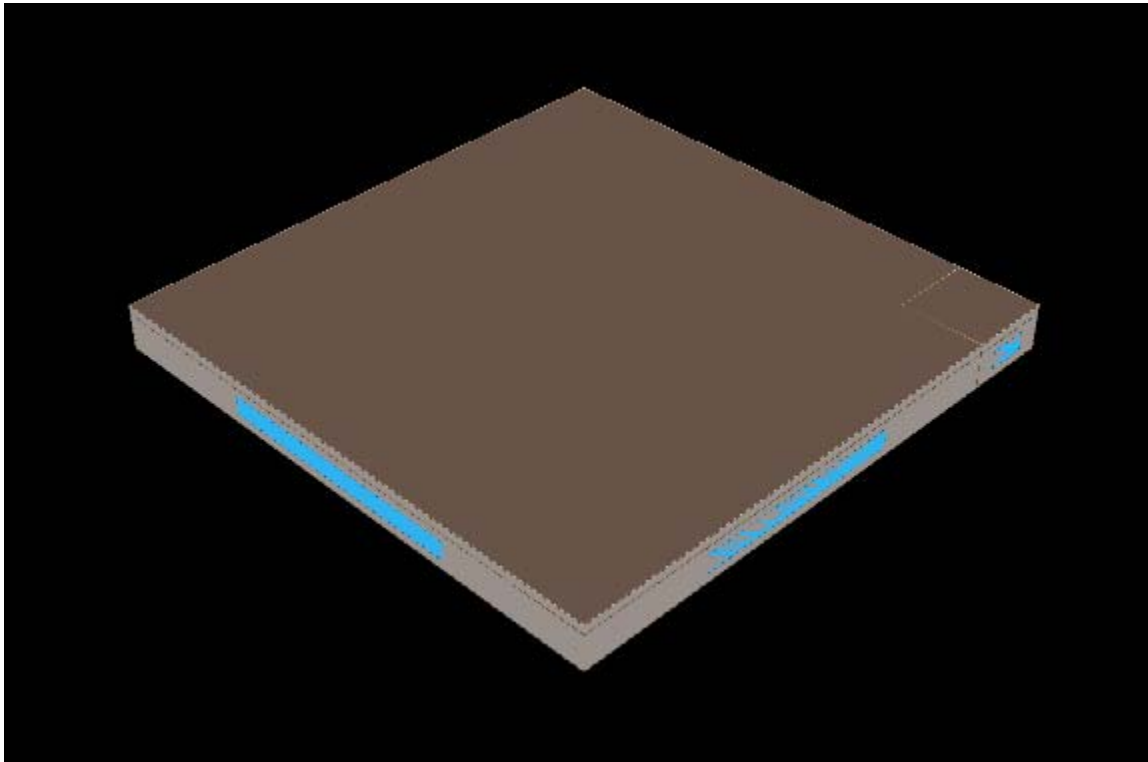


Figure 8. Assembly Building Rendering

Large Office

A prototypical building energy simulation model for a small office was developed using the DOE-2.2 building energy simulation program. The characteristics of the large office prototype are summarized in Table .

Table 11. Large Office Prototype Building Description

Characteristic	Value
Vintage	Existing (1980s) vintage and new construction
Size	175,000 square feet
Number of floors	10
Wall construction and R-value	Concrete block with brick veneer. Insulation R-value = 5.7
Roof construction and R-value	Wood frame with built-up roof Existing building insulation: R- 8.4 New construction insulation R-15
Glazing type	Existing building: Double pane clear (SC=0.84, U-value=0.72) New construction: Double low-e tint (SC=0.45, U-value=0.57)
Lighting power density	Existing building: Perimeter offices: 2.2 W/SF Core offices: 1.5 W/SF New construction: Perimeter offices: 1.1 W/SF Core offices: 1.1 W/SF
Plug load density	Perimeter offices: 1.6 W/SF Core offices: 0.7 W/SF
Operating hours	Mon-Sat: 9am – 6pm Sun: Unoccupied
HVAC system type	Central built-up VAV system with water cooled centrifugal chiller and boiler.
HVAC system size	Existing building: 235 SF/ton New construction: 284 SF/ton
Thermostat setpoints	Occupied hours: 76 cooling, 72 heating Unoccupied hours: 81 cooling, 67 heating

Energy and Peak Demand Savings Estimates

Energy and peak demand savings estimates were developed based on difference the simulated HVAC energy consumption and peak demand at the baseline and the measure efficiency levels. Energy and demand savings were normalized per ton of cooling capacity. The simulations used TMY2 long-term average weather data for Kansas City, Missouri. The results for each of the prototype building and HVAC system type and size combinations are shown in Table through Table .

Table 12. Assembly Building HVAC Measure Savings

	Existing		New	
	kW/ton	kWh/ton	kW/ton	kWh/ton
AC <65,000 1 Ph	0.079	74	0.079	71
AC <65,000 3 Ph	0.059	56	0.059	53
AC 65,000 - 135,000	0.081	77	0.082	74
AC 135,000 - 240,000	0.144	136	0.144	130
AC 240,000 - 760,000	0.076	71	0.076	68
AC >760,000	0.112	105	0.112	101
HP <65,000 1 Ph	0.085	138	0.085	140
HP <65,000 3 Ph	0.059	77	0.059	77
HP 65,000 - 135,000	0.103	149	0.103	150
HP 135,000 - 240,000	0.101	175	0.101	179
HP >240,000	0.139	211	0.139	213
GSHP <135,000	0.009	7	0.009	6
WLHP <17,000	0.024	32	0.024	31
WLHP 17,000-65,000	0.021	28	0.021	27
WLHP 65,000-135,000	0.021	28	0.021	27
Economizer	0.081	96	0.000	13
AC Tuneup	0.175	165		

Table 13. Big Box Retail HVAC Measure Savings

	Existing		New	
	kW/ton	kWh/ton	kW/ton	kWh/ton
AC <65,000 1 Ph	0.077	83	0.077	76
AC <65,000 3 Ph	0.058	62	0.058	56
AC 65,000 - 135,000	0.171	184	0.079	76
AC 135,000 - 240,000	0.141	152	0.140	135
AC 240,000 - 760,000	0.074	80	0.074	71
AC >760,000	0.109	117	0.109	105
HP <65,000 1 Ph	0.082	113	0.082	116
HP <65,000 3 Ph	0.058	71	0.058	69
HP 65,000 - 135,000	0.100	130	0.100	129
HP 135,000 - 240,000	0.098	140	0.098	145
HP >240,000	0.135	180	0.135	181
Economizer	0.080	166	0.079	118
Tuneup	0.171	184		

Table 14. Fast Food Restaurant HVAC Measure Savings

	Existing		New	
	kW/ton	kWh/ton	kW/ton	kWh/ton
AC <65,000 1 Ph	0.077	67	0.073	57
AC <65,000 3 Ph	0.058	50	0.058	44
AC 65,000 - 135,000	0.080	69	0.080	60
AC 135,000 - 240,000	0.141	122	0.141	106
AC 240,000 - 760,000	0.074	64	0.074	56
AC >760,000	0.109	94	0.109	82
HP <65,000 1 Ph	0.083	116	0.083	119
HP <65,000 3 Ph	0.058	66	0.058	64
HP 65,000 - 135,000	0.101	126	0.101	126
HP 135,000 - 240,000	0.098	146	0.099	151
HP >240,000	0.136	178	0.136	179
GSHP <135,000	0.009	10	0.008	8
Economizer	0.080	95	0.080	67
AC tuneup	0.171	148		

Table 15. Light Industrial HVAC Measure Savings

	Existing		New	
	kW/ton	kWh/ton	kW/ton	kWh/ton
AC <65,000 1 Ph	0.077	49	0.076	50
AC <65,000 3 Ph	0.058	37	0.057	37
AC 65,000 - 135,000	0.079	51	0.079	51
AC 135,000 - 240,000	0.140	90	0.140	91
AC 240,000 - 760,000	0.073	47	0.073	48
AC >760,000	0.108	69	0.108	70
HP <65,000 1 Ph	0.081	90	0.081	89
HP <65,000 3 Ph	0.057	51	0.057	50
HP 65,000 - 135,000	0.099	97	0.099	96
HP 135,000 - 240,000	0.097	114	0.097	113
HP >240,000	0.134	138	0.133	137
Economizer	0.079	75	0.079	77
AC tuneup	0.170	109		

Table 16. Nursing Home HVAC Measure Savings

	Existing		New	
	kW/ton	kWh/ton	kW/ton	kWh/ton
AC <65,000 1 Ph	0.077	67	0.076	59
AC <65,000 3 Ph	0.057	50	0.057	44
AC 65,000 - 135,000	0.079	69	0.079	60
AC 135,000 - 240,000	0.140	123	0.139	107
AC 240,000 - 760,000	0.073	64	0.073	56
AC >760,000	0.108	95	0.108	83
HP <65,000 1 Ph	0.082	121	0.082	129
HP <65,000 3 Ph	0.058	69	0.057	68
HP 65,000 - 135,000	0.100	131	0.100	135
HP 135,000 - 240,000	0.098	153	0.098	166
HP >240,000	0.135	186	0.135	194
Economizer	0.079	88	0.079	62
Tuneup	0.170	149		

Table 17. School HVAC Measure Savings

	Existing		New	
	kW/ton	kWh/ton	kW/ton	kWh/ton
AC <65,000 1 Ph	0.075	25	0.075	21
AC <65,000 3 Ph	0.056	18	0.056	16
AC 65,000 - 135,000	0.078	25	0.077	21
AC 135,000 - 240,000	0.138	45	0.137	38
AC 240,000 - 760,000	0.072	24	0.072	20
AC >760,000	0.106	35	0.106	29
HP <65,000 1 Ph	0.080	50	0.080	53
HP <65,000 3 Ph	0.056	27	0.056	27
HP 65,000 - 135,000	0.098	53	0.098	54
HP 135,000 - 240,000	0.096	64	0.096	68
HP >240,000	0.132	76	0.132	78
GSHP <135,000	0.009	3	0.009	2
WLHP <17,000	0.024	11	0.024	10
WLHP 17,000-65,000	0.021	10	0.021	9
WLHP 65,000-135,000	0.021	10	0.021	9
PTAC	0.006	13	0.006	11
PTAC-HP	0.007	28	0.007	30
Economizer	0.078	55	0.077	36
Tuneup	0.167	54		

Table 18. Full Service Restaurant HVAC Measure Savings

	Existing		New	
	kW/ton	kWh/ton	kW/ton	kWh/ton
AC <65,000 1 Ph	0.077	62	0.077	58
AC <65,000 3 Ph	0.058	46	0.058	43
AC 65,000 - 135,000	0.080	64	0.079	60
AC 135,000 - 240,000	0.141	113	0.140	105
AC 240,000 - 760,000	0.074	59	0.074	55
AC >760,000	0.109	88	0.109	82
HP <65,000 1 Ph	0.082	117	0.082	118
HP <65,000 3 Ph	0.058	65	0.058	64
HP 65,000 - 135,000	0.100	125	0.100	125
HP 135,000 - 240,000	0.098	148	0.098	151
HP >240,000	0.135	178	0.135	179
GSHP <135,000	0.009	9	0.009	8
Economizer	0.080	82	0.079	66
AC tuneup	0.171	137		

Table 19. Small Retail Building HVAC Measure Savings

	Existing		New	
	kW/ton	kWh/ton	kW/ton	kWh/ton
AC <65,000 1 Ph	0.078	82	0.077	71
AC <65,000 3 Ph	0.058	61	0.057	53
AC 65,000 - 135,000	0.080	84	0.079	73
AC 135,000 - 240,000	0.142	149	0.140	129
AC 240,000 - 760,000	0.075	78	0.073	68
AC >760,000	0.110	115	0.108	100
HP <65,000 1 Ph	0.083	120	0.082	123
HP <65,000 3 Ph	0.058	73	0.057	70
HP 65,000 - 135,000	0.101	135	0.100	134
HP 135,000 - 240,000	0.099	149	0.097	155
HP >240,000	0.136	188	0.134	189
GSHP <135,000	0.011	13	0.009	10
PTAC	0.006	40	0.006	35
PTAC-HP	0.006	63	0.007	67
Economizer	0.080	149	0.079	99
Tuneup	0.172	181		

Table 20. Small Office Building HVAC Measure Savings

	Existing		New	
	kW/ton	kWh/ton	kW/ton	kWh/ton
AC <65,000 1 Ph	0.072	62	0.072	55
AC <65,000 3 Ph	0.054	47	0.054	41
AC 65,000 - 135,000	0.074	64	0.074	57
AC 135,000 - 240,000	0.131	114	0.132	101
AC 240,000 - 760,000	0.069	60	0.069	53
AC >760,000	0.101	88	0.102	78
HP <65,000 1 Ph	0.076	83	0.076	86
HP <65,000 3 Ph	0.053	52	0.053	51
HP 65,000 - 135,000	0.092	95	0.093	96
HP 135,000 - 240,000	0.091	102	0.091	108
HP >240,000	0.125	131	0.125	134
GSHP <135,000	0.011	11	0.010	9
WLHP <17,000	0.025	29	0.024	25
WLHP 17,000-65,000	0.022	25	0.021	22
WLHP 65,000-135,000	0.022	25	0.021	22
PTAC	0.005	31	0.005	27
PTAC-HP	0.005	44	0.006	48
Economizer	0.074	189	0.074	134
Tuneup	0.159	138		

Weights were developed for each of the buildings above that utilize packaged HVAC systems from customer data supplied by KCP&L. The KCP&L data show number of accounts by building type. Weights for the buildings addressed by this study were derived from the KCP&L customer account data and are shown in Table .

Table 21. Weights for Buildings with Packaged HVAC Systems

Building Type	Weight
Assembly	0.065
Big Box Retail	0.093
Fast Food	0.048
Light Industrial	0.021
Nursing Home	0.020
School	0.030
Full Service Restaurant	0.048
Small Retail	0.093
Small Office	0.583

The weights were applied to the results for each of the prototypes to estimate the average savings for each packaged HVAC system measure. The average savings are shown in Table .

Table 22. Weighted Packaged HVAC System Measure Savings

	Existing		New	
	kW/ton	kWh/ton	kW/ton	kWh/ton
AC <65,000 1 Ph	0.074	66	0.074	59
AC <65,000 3 Ph	0.056	49	0.056	44
AC 65,000 - 135,000	0.085	77	0.076	60
AC 135,000 - 240,000	0.135	120	0.135	107
AC 240,000 - 760,000	0.071	63	0.071	56
AC >760,000	0.105	93	0.105	83
HP <65,000 1 Ph	0.079	96	0.079	99
HP <65,000 3 Ph	0.055	58	0.055	57
HP 65,000 - 135,000	0.096	108	0.096	108
HP 135,000 - 240,000	0.094	119	0.094	124
HP >240,000	0.129	150	0.129	153
GSHP <135,000	0.010	9	0.009	7
WLHP <17,000	0.024	24	0.024	22
WLHP 17,000-65,000	0.021	21	0.021	19
WLHP 65,000-135,000	0.021	21	0.021	19
PTAC	0.006	28	0.006	24
PTAC-HP	0.006	45	0.006	48
Economizer	0.076	159	0.071	109
Tuneup	0.164	145		

Energy and demand savings for built up HVAC system measures calculated from the large office building prototype are shown in Table .

Table 23. Large Office Building HVAC Measure Savings

	Existing		New	
	kW/ton	kWh/ton	kW/ton	kWh/ton
Chillers and controls				
Air-cooled Chiller	0.150	154	0.143	136
Water-Cooled Chiller < 150 ton	0.049	56	0.049	53
Water-Cooled Chiller 150-300 ton	0.158	187	0.159	177
Water-Cooled Chiller >300 ton	0.131	156	0.133	148
Chilled water reset	0.030	87	0.040	86
VFDs on HVAC motors	kW/hp	kWh/hp	kW/hp	kWh/hp
VFD Fan Motor (per hp)	0.001	868	0.005	969
VFD chilled water pump (per hp)	0.496	1430	0.615	1398

Typical HVAC Unit sizes

For the DSMore runs, typical HVAC unit sizes were chosen from each of the unit size categories above to estimate a “per unit” savings. The typical unit size assumed in the DSMore runs is summarized in Table 1.

Table 1. Typical HVAC Unit Sizes by Type and Size Category

HVAC Measure Type and Size Category	Typical Unit Size
AC <65,000 1 Ph	5 ton
AC <65,000 3 Ph	5 ton
AC 65,000 - 135,000	10 ton
AC 135,000 - 240,000	20 ton
AC 240,000 - 760,000	25 ton
AC >760,000	65 ton
HP <65,000 1 Ph	5 ton
HP <65,000 3 Ph	5 ton
HP 65,000 - 135,000	10 ton
HP 135,000 - 240,000	20 ton
HP >240,000	65 ton
GSHP <135,000	10 ton
WLHP <17,000	1 ton
WLHP 17,000-65,000	3 ton
WLHP 65,000-135,000	7.5 ton
PTAC	1 ton
PTAC-HP	1 ton
Economizer	10 ton
Tuneup	10 ton
Air-cooled Chiller	200 ton
Water-Cooled Chiller < 150 ton	80 ton
Water-Cooled Chiller 150-300 ton	230 ton
Water-Cooled Chiller >300 ton	1000 ton

Section 4: Non-Weather Sensitive Measures

Study Methodology

This section addresses measures which are affected by operating practice and hours rather than the weather. These measures savings estimates are made using standard engineering practice operating comparisons versus an interactive weather building model such as DOE 2. The non weather sensitive measures include lighting (46 measures), motors/drives/pumps (24 measures), refrigeration (13 measures) and an “other” category (14 measures). Appendix B provides a written description, the assumptions used, the sources or reference baselines and spreadsheets with the calculations for future reference.

A key component of each calculation is determining an appropriate baseline assumption. Some technologies lend themselves more to a baseline assumption of “existing equipment” while “new equipment” may be a better baseline assumption for others. For example for one-for-one replacement of light fixtures the analysis used fixture, ballast, lamp combinations that are typically in current operation in the commercial market. The theory being that light fixtures have a long life and don’t wear out all at once. Energy and cost savings are usually a large component of the decision making process.

For equipment such as air compressors the analysis generally assumed standard new equipment as a baseline, not existing/old equipment. The theory here is that equipment failure, maintenance costs and added plant capacity requirements are often key decision making factors in addition to energy savings. Looking at the incremental cost and savings of new efficient equipment compared to new standard equipment is a better baseline than old, likely worn out equipment. Individual projects, technologies and customer situations vary, and we attempt to take a likely mixture of projects into account in the calculations.

FES used a variety of information sources including Energy Star, ASHRAE and numerous others to establish baselines and develop calculations. Equipment specifications, testing data and other web based information were also utilized. A benefit of using an organization like FES to do this analysis is that their staff of engineers has processed thousands of incentive applications and visited thousands of customer sites reviewing energy efficiency projects for various other utility programs. This history provides very practical information based on real conditions for validation of savings, equipment cost and other variables.

Appendix A: DSMore Measure Cost Effectiveness Results

Reference File:

DSMore Batch Tool run six by state ALL only new rate Old Inc.xls

DSMore Batch Tool run six by state AGG ALL only new rate.xls

Appendix B: Non-Weather Sensitive Measures Detail Analysis

This appendix provides the detailed information on the energy savings and other assumptions used as input into the DSMore model. Technologies that are very similar except for size or configuration are grouped together such as T-8 lighting which varies in length and number of bulbs per fixture. Calculations are either explained in the text or in a separate spreadsheet within this document. The technologies included are:

- FES-C1 Energy Star Commercial Clothes Washers.doc
- FES-C1 Energy Star Commercial Clothes Washers.xls
- FES-C2 Occupancy Sensors for document stations.doc
- FES-C2 Plug Load Occupancy Sensors for Document Stations.xls
- FES-C3 Cold Beverage Vending Machine Controllers.doc
- FES-C4 Window Film.doc
- FES-C5 80Plus Desktop and Server Units.doc
- FES-G1 Multiplex Compressors.doc
- FES-G1 Multiplex Compressors.xls
- FES-G2 Anti-sweat Heater Controls.doc
- FES-G3 Efficient Condensers.xls
- FES-G3 Efficient Refrigeration Condenser.doc
- FES-G4 Night Covers.doc
- FES-G5 Head Pressure Control.doc
- FES-G5 Head Pressure Control.xls
- FES-G6 ENERGY STAR Refrig and Freezer.doc
- FES-G6 Refrigerators Freezers.xls
- FES-G7 Ice Machines.doc
- FES-H1 Room AC.doc
- FES-H1 Room AC.xls
- FES-H2B CI Heat Pump Water Heaters.doc
- FES-H2B CI Heat Pump Water Heaters.xls
- FES-I1 EngineeredNozzles.xls
- FES-I1 - Engineered Nozzles.doc
- FES-I2 - Barrel Wraps.xls
- FES-I2 - Barrel Wraps.doc
- FES-I3 - Pellet Dryer Duct Insulation.xls
- FES-I3 - Insulated Pellet Dryer Ducts.doc
- FES-L1 T8 Replacement of T12s.doc
- FES-L1 T8sforT12s.xls
- FES-L10 centralized lighting controls.doc
- FES-L11 Multilevel Lighting Control.doc
- FES-L12 Daylight Sensor lighting control.doc
- FES-L2 - Replace T12s with T5s.doc
- FES-L2 - T5sforT12s.xls

- FES-L3 - HighBay Fluorescents.doc
- FES-L3- Hi Bay Fluorescents.xls
- FES-L5 LED Exit Signs.doc
- FES-L6 CFLs.doc
- FES-L6 Compact Fluorescent Lamps and Fixtures.xls
- FES-L7 Occupany Sensors.doc
- FES-L8 LED Traffic Lights.doc
- FES-L9 Light Tubes.doc
- FES-M1 Premium Eff Motors.xls
- FES-M1 - Premium Efficiency Motors.doc
- FES-M2 VFDs.xls
- FES-M2 - VFD's for Pumps.doc
- FES-M3 HE Pumps.xls
- FES-M3 - High Efficiency Pumps.doc

FILES ATTACHED.