LARGE FILING SEPARATOR SHEET

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SECTION: 25 OF 25

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DESCRIPTION OF DOCUMENT:

APPLICATION & SCHEDULES

Implementation Strategy

The implementation strategy for each program will be spelled out in the specific function of the program. The implementer and AEP will agree upon strategy and budget during the program agreement discussions.

Implementation-related administrative requirements will be handled by AEP Ohio, who will be responsible for:

- Overseeing the work of any sub contractors
- Overseeing the work of the energy education contractor
- Data tracking and reporting
- Budget tracking and reporting
- Managing public relations
- Customer satisfaction/Problem resolution

Marketing Strategy

Each program component will have a specific marketing strategy that will be stated in the description of the program and agreed upon by AEP Ohio.

Milestones

Tasks	Timeframe
Selection of sub Contractors	1 month
Program planning and materials developed	3 months
Program launch – marketing begins	3 months

EM&V Strategy & Requirements

All evaluation activities will be conducted by a third party contractor selected through a competitive bidding process. An integrated evaluation approach will be taken which includes: addressing evaluation at the onset of program design, collecting evaluation data as part of program administration, assessing and documenting baseline conditions, establishing tracking metrics, developing and refining deemed savings measure databases, as well as, conducting primary and secondary research as part of impact and process evaluations.

The overall goal of the impact evaluation will be to validate/calibrate the deemed savings values, verify installation and determine program cost-effectiveness. Primary impact metrics are savings per unit, program participants, net-to-gross ratio and program cost-effectiveness. Validation/calibration of deemed savings values for the measures will be determined by primary field research. Self-report surveys with both participants and nonparticipants will be used to assess free riders/spillover, installation and retention rates, as well as the satisfaction with the various measures. Interviews with program managers, the implementation contractor and relevant organizations will be conducted to assess the operational conditions of the program and to identify ways to improve the program. These surveys will be enhanced by collecting market data and assessing trends.

The process evaluation will be conducted during the first program year and then coordinated with impact evaluation work to be performed once program-approved measures have been installed and operating for a sufficient time to enable a robust impact evaluation.

AEP Ohio Administrative Requirements

It is estimated that a 1.0 full-time equivalent ("FTE") will be required for program management. AEP Ohio will be responsible for general administrative oversight of each supported program, which will include the following to address:

- Recruitment, selection, and management of the subcontractor(s)
- Coordination of marketing strategy/public relations among programs and market sectors
- Coordination of all media and educational services
- Data warehousing
- Recruitment, selection, and management of the evaluation contractor
- Goal achievement within budget

Participation

N/A

Budget

Incremental Annual Budget (2008$) - Total			
2009	2010	2011	Total 2009 – 2011
$7,527,000	$3,822,000	$3,651,000	$15,000,000

Savings Targets

N/A

Benefit-Cost Test Results

N/A

6.3.3 New Pilots/Emerging Technology Program

New Pilots/Emerging Technology Program

Objective

To identify and learn more about new energy efficient technologies and program strategies with potential to capture additional electric and gas energy savings.

Target Market

Dependent on specific technology/program.

Program Duration

AEP Ohio will initially focus on the successful start-up and delivery of other well-established pilot programs that have been proven to capture significant energy savings in similar regions throughout the country. Beginning in the second year of the portfolio, AEP Ohio will initiate research and analysis of other innovative technologies and strategies to reduce residential energy consumption. These efforts will be ongoing and pilot programs rolled out as appropriate.

Program Description

The following pilot programs represent new initiatives and technology approaches AEP Ohio could, among others, pursue to capture additional energy savings:

- Residential Power-Management to address the rapidly growing plug-load; education through monitoring devices and management tools such as advanced power strips and the whole-house switch
- Residential-sized HVAC equipment optimized for performance in cold-climate (may include new developments in heat-pump technology)
- Focus greater attention on performance and installation quality, particularly in the areas of insulation, HVAC, lighting controls, and retrocommissioning. In addition, align contractor training with consumer outreach through existing high efficiency trained contractor websites, such as MEEA's Participating Energy Efficiency Contractor network.
- Coordinated development of integrated program design such as green building and Zero-Energy New Homes that deliver multiple resource benefits to expand the market share for energy efficiency and enhance the program's overall cost-effectiveness
- Promotion of LED lighting technology in consumer and commercial applications, both indoors and out. Participate in the support of the DOE TINSSL program and L-Prize program for the support of new LED applications
- Encourage the use of new technologies for lighting control and daylighting such as high-efficacy light fixtures or controls such as

dimmers and vacancy sensors. New technologies are coming on the market and industry initiatives are renewing interest in home automation. Wireless lighting control protocols have been developed and are becoming increasingly economical, which will greatly increase their market penetration

- Participation in statewide initiatives to reward manufacturers for highest efficiency appliance design and push for a broader array of attractive and energy-efficient fixture designs
- Neighborhood initiatives that motivate energy conservation through better information and normalized comparative energy use-data
- Partner with local government and regional agencies and non-profits to sponsor a local efficiency awareness raising events, such as the Change-A-Light Challenge that encourages residents to change out a light bulb in their home

AEP Ohio Administrative Requirements

It is estimated that a 1.0 full-time equivalent ("FTE") will be required for program management. AEP Ohio will be responsible for general administrative oversight of the program which will include the following to address:

- Recruitment, selection, and management of the implementation contractor(s)
- Coordination of marketing strategy among programs and market sectors
- Data warehousing
- Recruitment, selection, and management of the evaluation contractor
- Goal achievement within budget

Participation

N/A

Budget

Incremental Annual Budget (2008$) - Total			
2009	2010	2011	Total 2009 - 2011
$500,000	$1,000,000	$1,000,000	$2,500,000

Savings Targets

N/A

Benefit-Cost Test Results

N/A

6.4 Program Cost Summary

The estimated investment for these programs, which would realize the EE/PDR program potential consistent with meeting SB 221 requirements, in 2009 dollars, would be approximately $36.8 million in 2009, $53.8 million in 2010, and $71.3 million in 2011, for a total $161.9 million, as shown in Table 6-1. The projected investments include one-time startup costs for the first year of program implementation.

Table 6-1. Estimated Annual Total Investments by Program for AEP Ohio (2009$)

Consumer Sector	2009	2010	2011	2009-2011	% of Portfolio Total
Products	$3,441,732	$5,616,033	$6,434,867	$15,492,632	9.6%
Recycling	$1,193,527	$2,028,309	$3,462,740	$6,684,577	4.1%
Retrofit	$990,308	$1,273,138	$1,576,956	$3,840,402	2.4%
Low Income	$4,236,236	$5,485,211	$7,234,834	$16,956,281	10.5%
New Construction	$0	$2,430,906	$1,667,011	$4,097,916	2.5%
Consumer Sector Total	**$9,861,803**	**$16,833,596**	**$20,376,408**	**$47,071,808**	**29.1%**
Business Sector	**2009**	**2010**	**2011**	**2009-2011**	**% of Portfolio Total**
Prescriptive	$8,861,266	$12,906,212	$17,978,141	$39,745,619	24.5%
Custom	$6,958,741	$8,588,662	$11,724,734	$27,272,137	16.8%
New Construction	$0	$296,938	$246,016	$542,954	0.3%
LED Traffic Signals	$310,257	$326,164	$358,669	$995,090	0.6%
Demand Response	$0	$3,371,250	$3,545,625	$6,916,875	4.3%
Business Sector Total	**$16,130,264**	**$25,489,227**	**$33,853,185**	**$75,472,675**	**46.6%**
Other Costs	**2009**	**2010**	**2011**	**2009-2011**	**% of Portfolio Total**
AEP Ohio EE/PDR Department	$1,800,000	$3,200,000	$3,400,000	**$8,400,000**	5.2%
General Education/ Training/Media	$2,527,000	$3,822,000	$3,651,000	**$10,000,000**	6.2%
Energy Conservation Kits	$500,000	$500,000	$500,000	**$1,500,000**	0.9%
Behavior Modification	$500,000	$1,000,000	$1,500,000	**$3,000,000**	1.9%
Self Direct	$5,000,000	$2,000,000	$2,000,000	**$9,000,000**	5.6%
Pilot Program Fund	$500,000	$1,000,000	$6,000,000	**$7,500,000**	4.6%
Other Costs Total	**$10,827,000**	**$11,522,000**	**$17,051,000**	**$39,400,000**	**24.3%**
PORTFOLIO TOTAL	**$36,819,067**	**$53,844,823**	**$71,280,593**	**$161,944,483**	**100.0%**

7 PORTFOLIO IMPLEMENTATION

AEP Ohio plans to implement the proposed portfolio of programs through a combination of in-house utility staff and competitively selected third-party implementation contractors. AEP Ohio will issue Requests for Proposals ("RFP"s) to qualified firms related to RFPs for the delivery of similar programs targeting specific sectors. AEP Ohio believes that by issuing multiple RFPs, it will be possible to obtain more competitive, cost-effective and qualified implementation responses. Implementation contractors are eligible to respond to one or all of the RFPs. From start to finish, AEP Ohio anticipates the process of issuing RFPs, evaluating responses and negotiating contracts along with associated program start-up time will result in 2009 launch date for most programs. The remaining programs will begin later due to a need for longer preparation time prior to launch.

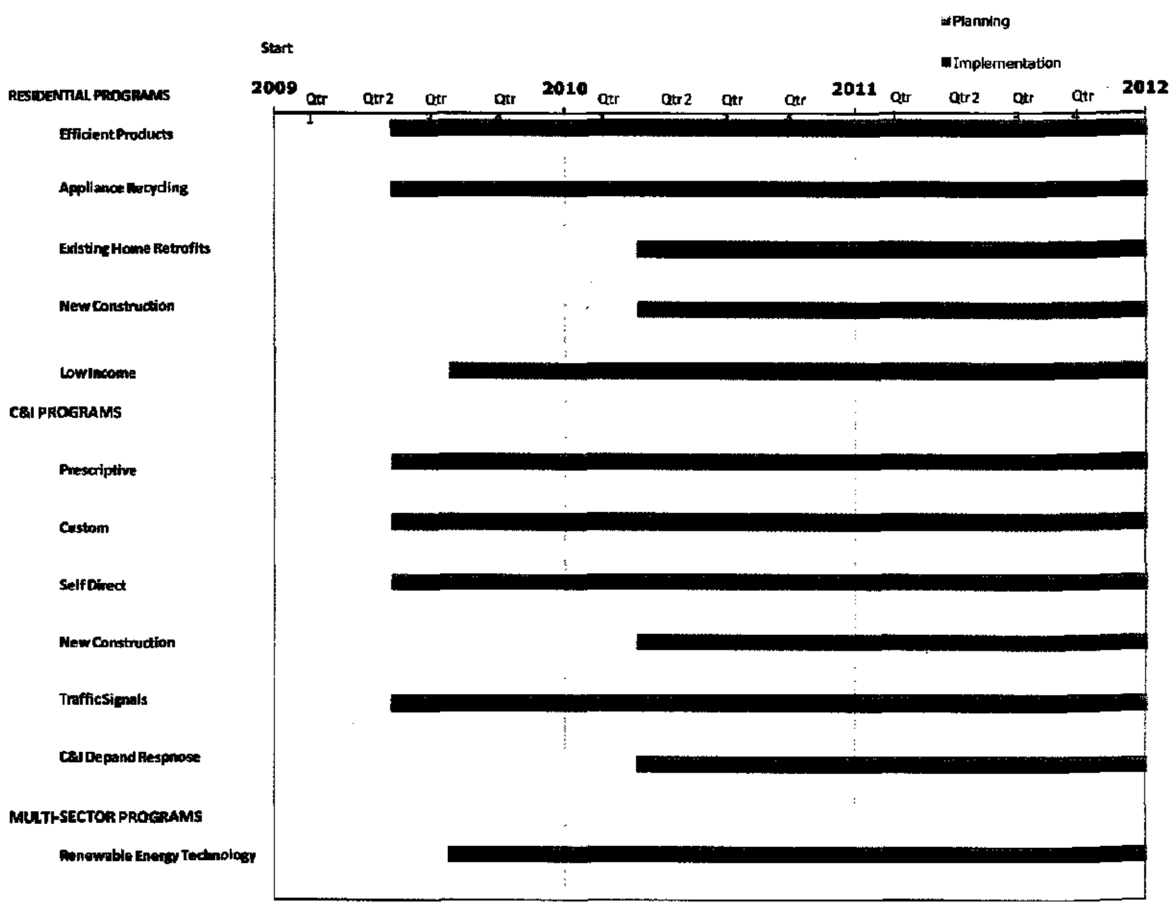
7.1 Finalizing Implementation Plans

Once contracts are finalized with the selected implementation contractors, the first major task will be preparation of detailed implementation plans. AEP Ohio will ask the implementation contractors to draft in-depth start-up plans, procedures manuals, and other program implementation planning and delivery guideline documentation, detailing key milestones, measures, incentive levels and overarching launch and communication strategies.

7.2 Portfolio Implementation Schedule

As shown in Figure 7-1, the majority of the programs are scheduled for a public launch in June to September 2009, with several programs starting later due to a need for longer launch preparation.

Figure 7-1. Program Planning and Implementation Timeline



8 PORTFOLIO MANAGEMENT

8.1 Portfolio Management

AEP Ohio will serve as the overall program administrator for delivery of the Energy Efficiency Portfolio. To expedite a quick launch of the programs, and to take advantage of cutting-edge program implementation experience from other parts of the country, AEP Ohio plans to engage third-party implementation contractors. Contractors will be selected through a competitive request for proposal process for delivery of programs.

AEP Ohio anticipates providing high-level administrative, contract management, program design and marketing oversight of the selected implementation contractors. A portfolio of this proposed size and scope will require careful management oversight. AEP Ohio will have a small and dedicated group of energy efficient program staff overseeing third-party implemented programs and promotion of cross-sector education and awareness activities.

AEP Ohio will also develop a comprehensive tracking database to ensure accurate and comprehensive recording of all program participation Additionally, the database will allow AEP Ohio to research and track participation by customer class and geographic area, to identify trends and untapped opportunities to advance program goals. Additionally, AEP Ohio staff will take primary responsibility for general energy efficiency education and awareness strategies and activities, including the corporate Web site, online energy audit software, mass-market media, general education, and efficiency awareness promotions.

In summary, AEP Ohio will provide comprehensive program contract oversight, including management, financial planning and budgeting, regulatory and legal support, as well as:

- High-level guidance and direction to the implementation contractors, including review and revision of proposed annual implementation plans and proposed milestones, and, additionally, engage with the contractor team on a daily basis when working through strategy and policy issues.
- Review and approval of implementation contractor invoices and ensure program activities are within investment and on schedule.
- Review of implementation contractor operational databases for accuracy, ensuring incorporation of data into AEP Ohio's comprehensive portfolio tracking database to be used for overall tracking and regulatory reporting.
- Review of measure saving estimates maintained by the implementation contractor.
- Oversight and coordination of evaluation, measurement, and verification contractors.
- Public education and outreach to community groups, trade allies and trade associations.
- Provide guidance and direction on new initiatives or strategies proposed by the implementation contractors.
- Communicate to implementation contractors other AEP Ohio initiatives that may provide opportunities for cross-program promotion.
- Review and approve printed materials and advertising plans.

- Evaluate portfolio and program effectiveness and recommend modifications to programs and approach as needed.
- Perform periodic review of program metrics, conduct investment analysis, and review evolving program design.

Investment Comparison

The range of investments for the best practice programs identified for the most recent program period available for different EE/PDR programs. Table 8-1 lists the investment range for administrative (non-incentive) and incentive-related costs.

Table 8-1. Best Practice Programs Investment Range

Consumer Sector	% Administrative Costs	% Incentive Costs
Efficient Products	42-67%	33-58%
Home Retrofit	60%	40%
Low Income	7-27%	73-93%
New Construction	74%	26%
Business Sector	**% Administrative Costs**	**% Incentive Costs**
Prescriptive Incentive	13-25%	75-87%
Custom	27-60%	40-73%
New Construction	11-44%	56-89%

Table 8-2 lists the investment range for administrative (non-incentive) and incentive-related costs for AEP Ohio for 2009 to 2011. For the 2009-2011 period, overall AEP Ohio spending as a percent of administrative and incentive costs compares favorably to that of the other jurisdictions, notwithstanding that the best practice jurisdictions have been operating EE/PDR programs for several years. AEP Ohio's costs are reasonable in light of the need to spend more initially in the early years to set up EE/PDR programs.

Table 8-2. AEP Ohio 2009-2011 Portfolio Investment Range

Consumer Sector	% Administrative Costs	% Incentive Costs
Efficient Products	51%	49%
Appliance Recycling	50%	50%
Home Retrofit	51%	49%
Low Income	51%	49%
New Construction	51%	49%
Business Sector	**% Administrative Costs**	**% Incentive Costs**
Prescriptive Incentive	38%	62%
Custom	47%	53%
New Construction	50%	50%
LED Traffic Signals	46%	54%
Demand Response	23%	77%

8.2 Survey of Existing Utility Programs Staffing

In an effort to better assist AEP Ohio in preparing for the launch and maintaining of efficiency programs, a survey was created and several utilities that are running efficiency programs were contacted to help guide planning efforts for AEP Ohio's staffing and departmental. The utilities that completed the survey are:

- AEP Texas
- Alliant Energy
- AmerenIL
- AmerenUE
- APS
- Integrys
- Minnesota Power
- National Grid
- Otter Tail Power

From these surveys, information has been gathered that looks at utility staffing, its handling of efficiency programs and lessons learned.

Structuring the Efficiency Department

There are a few main findings with regard to the structuring of the utility in preparation for the efficiency programs. The first is what department of the utility the efficiency operations are housed. Table 8-3 represents the results received.

Table 8-3. Efficiency Department Structuring Survey Results

Energy Efficiency Department Name	Department Reports to	Sub-Departments Under Efficiency Department	
DSM Compliance	Administrative Services	Customer Services	New Product Development
DSM Programs Department	Business Support	Demand Response	None (4 responses)
Energy Efficiency and Distributed Resources	Customer Info and Programs	Distributed Resources	Product Delivery
Energy Efficiency Programs & New Product Development	Customer Service	Energy Efficiency Implementation	Program Development
Energy Efficiency	Customer Service & Marketing	Evaluation and Regulatory	Program Management
Energy Security	Customers and Markets	Market Development	
Market Planning	Regulatory Affairs	Market Research	

The results show a diversity amongst surveyed utilities with regard to what department the efficiency programs fall under as well as the name/function of the actual efficiency area. Some information is more prevalent than others, however. The first is that many energy efficiency program areas are subordinated to the Customer Service area of the utility. Another is that in most cases the program area is named Energy Efficiency and thus has its own identity showing its efficiency function. Within the structure of the utility it is also worth noting that in almost one half of the utilities there were no departments under the efficiency area. Of those with subordinate departments the added functions were diverse but focused on market, programs, and delivery of services. It is worth noting that only the largest (and most long standing) of efficiency departments had subordinate areas, and thus it may be that these subordinate departments were added after the efficiency efforts are matured. Another final note is the prevalence of combining of efficiency with demand response and new products. It seems natural that demand side services would fall under one department, whether they are subordinate or above the efficiency area.

With regard to the staffing of the efficiency offices, the results vary. Table 8-4 shows the staffing levels as compared to the size of the efficiency portfolio (measured in dollars).

Table 8-4. Efficiency Department Staffing Survey Results

Energy Department Staffing	Portfolio Size ($)	Full Time Equivlents (FTEs) Managing Contractors	Utility Role
191	$114 million	NA	Manages programs and implements many of the energy efficiency programs
4.5	$1.8 million	0.5	Mix (audits, market research, low income, some lighting by contractors)
40	$91 million	5	Mix of outsource/implement (Education, Shared Savings, Prescriptive and Custom Rebates, New Construction done by utility)
5	$3.5 million	NA	Mix. 50% outsourced, 50% implemented by utility
8	$17 million	8	Outsourced
1	$2.8 millions	1	Outsourced
6	$7.6 million	6	Outsourced
11	~$7.5 million	6	Outsourced (Prime contractors has ~36 FTEs to programs)
8	$25.5 million	7	Outsourced (residential new construction done by utility)

There is a wide variation in staffing and funding for efficiency programs. The most obvious distinction is in whether the utility implements their own programs or if contractors are used to implement. If implementing there seems to be a much larger staffing need. If contracting, most of the energy efficiency staff seems to be used to manage the chosen contractor(s). The key considerations in choosing to self-implement or outsourcing includes delivery cost, professional experience, separation of verification and implementation, legislative/regulatory mandates and program launch timing. In the surveys completed, only one utility manages their own portfolio, while five contract out the entire portfolio. In addition, three of the utilities have a blended approach where some are self-implemented the rest contracted. With regard to staff size, the second major distinction seems to lie in the total funding of the portfolio. For small (few million dollars) the staffing needs seem to require one or two people to manage the contractor(s). For portfolios in the low tens of millions of dollars, staffing levels seem to average around $1-3 million in portfolio budget per FTE (if programs are largely outsourced to implementation contractors).

Lessons Learned

Most utilities surveyed are new to efficiency programs, having created efficiency areas given legislation or regulatory changes (rate cases, energy efficiency portfolio standards, etc). Most of the utilities face the initial decision to self-implement or contract out their programs, but in most cases in the Midwest the programs are implemented by contractors. Most of the utilities do not have the institutional experience or expertise to quickly (which is most often the case with legislated programs) design and launch programs. In most cases, the utilities employed organizations to assist in designing programs and assisting in the administration of the programs. In addition, implementers are employed to launch the programs themselves. Utilities, however, must still keep close contact with the implementers and also stakeholders as the programs progress.

The other main lesson learned from the surveys was that all utilities did staff up in order to ensure the proper execution of their efficiency requirements. The average figures seem to be one full time employee for each $1-3 million in efficiency programs. These staff requirements are largely program managers who interact with contractors day-to-day and ensure the utility is in lock-step with the implementer in making sure all targets are achieved.

8.3 Marketing and Outreach Strategy

The marketing and outreach strategy for this portfolio of programs will encourage participation among customers, key market players and trade allies. The objective of the marketing and communications strategy is to make customers and key market actors aware of program offerings and benefits, and to influence their decision making when purchasing or installing energy systems or equipment in favor of more energy efficient options.

The specifics of the marketing strategy will depend on the program and the demographics of the group being engaged. Depending on the market to be reached, marketing will generally include a mix of broadcast, Internet, print media, radio, direct contact, direct mail, bill inserts, or presentations. The program descriptions describe the proposed marketing approach for each program.

Additionally, AEP Ohio will work with regional, state, and national programs and partners to optimize cooperative marketing programs and campaigns. Marketing efforts will be designed to dovetail with the Governor's efforts to achieve energy efficiency, other statewide or regional efficiency programs and campaigns, including those of the Commission.

8.4 Tracking and Reporting

AEP Ohio plans to build a comprehensive internal tracking and reporting system to record all activities from the EE/PDR portfolio of programs. Data tracking systems are being used successfully in numerous other states, and AEP Ohio intends to benefit from the learning that has occurred there. Implementation contractors will be responsible for tracking and reporting energy efficiency program activities by entering details of each project into the comprehensive data tracking system. The system will allow customized reporting to meet any reporting requirements in a quick, transparent and accurate manner.

8.5 Midstream Adjustments

While this plan presents detailed information on approach, energy efficiency measures and proposed incentive levels, the state of the Ohio economy, along with unforeseen changing market conditions, will require regular review and revisions of portions of this plan to reflect new information. As such, adjustments to these programs will likely be necessary. When this is the case, the PUCO and Collaborative will be updated in a timely manner and given opportunity to provide input.

8.6 Inter-Utility Coordination

AEP Ohio is working with other Ohio utilities to identify synergies that can maximize the effectiveness of its programs. Regular communication and coordination will be necessary. Ohio utilities are working together in a number of ways including initiatives to develop a technical reference manual, common ground on rules, program design and identifying opportunities to work with the PUCO and ODOD on ways to utilize federal stimulus funding in conjunction with utility funding for energy efficiency programs. AEP Ohio has had preliminary discussions with gas utility providers to determine if joint programs have merit. AEP Ohio intends to continue to collaborate with others to provide effective programs, reporting and evaluation processes, as well as exchange ideas for the benefit of its customers.

8.7 Stakeholder Participation

AEP Ohio established a Collaborative in October 2008 to provide key stakeholders the opportunity to provide input on program development and implementation. Members include regulatory, consumer advocates, state, business, industry, environmental, educational, low income and others. AEP Ohio has held six meetings to date with ongoing meetings planned. Key information shared and discussed to date include the market potential study, program development, action plan and program implementation progress. AEP Ohio is committed to the Collaborative process and has gained valuable insight from its members over the last seven months. The Collaborative has been instrumental in the shaping of this Plan and AEP Ohio believes it has established effective and positive working relationships.

8.8 Leveraging Other Efficiency Initiatives

Within Ohio, several entities are promoting energy efficiency including: the state government; Midwest Energy Efficiency Alliance ("MEEA"); U.S. Environmental Protection Agency and U.S. Department of Energy's "ENERGY STAR" brand; other State of Ohio programs; as well as Federal tax credits. AEP Ohio and its implementation contractors will work diligently to remain aware and up to date, and to cooperate with efficiency efforts being directed at Ohio energy users. Wherever feasible, co-marketing efforts will be employed in an attempt to send a clear and consistent message on the benefits of energy efficiency and the resources available to help achieve it. AEP Ohio intends to help its customers maximize the energy efficiency incentives available.

8.9 Trade Ally Coordination

Trade allies are essential to effective implementation of energy efficiency programs. Trade allies are considered program partners and will be treated accordingly. Relationships with trade allies will be cultivated and nurtured through numerous methods to ensure effective communication in both directions. Trade allies will be regularly informed of program progress. Changes and feedback from trade allies about "what is working and what is not" in the field are essential. To ensure good two-way communication, we will emphasize coordination, "listening sessions," and frequent communications with these key partners to advance program goals. A schedule of meetings, workshops, educational seminars, program update breakfasts, and clear and concise program descriptions will be distributed to the trade allies at the program kick off meetings. Ongoing training and program updates also will be a key part of program delivery.

9 EVALUATION, MEASUREMENT AND VERIFICATION ("EM&V")

9.1 Overview

Program evaluation, measurement, and verification ("EM&V") activities are central to the success of AEP Ohio's portfolio and will be used to verify program savings impacts and monitor program performance. These activities serve as a way to determine the actual program level savings being delivered and to maximize energy efficiency investments.

Effective EM&V ensures that expected results are measurable, achieved results are robust and defensible, program delivery is effective in maximizing participation, and the overall portfolio is cost-effective.

Definition of Evaluation, Measurement and Verification

Evaluation encompasses process, impact and market evaluation activities as defined below:

Process evaluations are directed at addressing whether the programs were implemented as designed, examining perceived market barriers and opportunities, measuring participant satisfaction, documenting the program process, and exploring opportunities for efficiency improvements. Process evaluations are generally performed by using a combination of interviews with program managers, implementation contractors, trade allies, participants, program drop-outs and non-participants. They often include a detailed review of program documents, application forms, and policies and procedures, including record keeping and data collection. Sometimes, they include surveys with non-participants to examine program awareness and market barriers to participation. Process evaluations often document each significant component of the programs, including program accomplishments, administrative processes, participant experiences, customer satisfaction, and successes and failures.

Impact evaluations validate the energy and demand savings produced by a program. These evaluations validate program-reported savings by verifying the type, quantity and efficiency of measures installed, examining the measures replaced by the program for retrofit applications, or estimating the normal or standard baseline equipment for new construction applications. Impact evaluations calculate net savings by adjusting program-reported savings to account for measures that would have been installed even if the program had not existed (defined as free ridership) and for measures that were inspired by the program, but not captured by the tracking system (typically called spillover). These evaluations use data from program tracking databases, interviews with participants, on-site inspection and monitoring, and occasionally, secondary sources, such as program evaluations done for similar programs. Methods for impact evaluations include engineering calculations, simulation modeling calibrated to site billing data, and statistical/regression analysis of energy use data.

Market evaluations examine program and market assessment "indicators" developed for each program and assess how these indicators change over time. The indicators are typically derived from a program logic formulation developed during program design and early implementation. The program logic model is a simple representation of the program and the underlying hypotheses that are expected to account for the program's success in the market. Typically, program logic models are organized around the program inputs, processes, and outputs. From this formulation, a set of key market indicators that can be tracked over time is developed (and modified over time, as needed). These indicators are designed to measure the progress of a program across specified time periods in terms of affecting key touch points in the market. This might include the change over time in the number of qualified contractors. The indicators are designed to reflect significant changes in how the market operates, the information absorbed and used by the market, choices key market actors make on a routine basis, and the attitudes and beliefs of key market actors. Data to support market evaluations are typically gathered through surveys with trade allies, manufacturers, participants, and nonparticipants, as well as from secondary sources, such as national databases.

- **Measurement** includes developing a program data tracking system to support the evaluation effort; i.e., measuring of results and verifying the installation and retention of measures and equipment promoted by the EE/PDR program where appropriate
- **Verification** includes a review, audit, and verification of claimed program savings and recommendations for improvement

Framework for Evaluation

Appropriate EM&V requires that a framework be established that encompasses both planned EM&V efforts and data collected as part of program implementation. This section provides an overview of the monitoring, verification, and evaluation efforts recommended to support appropriate EM&V. The basic requirements and approaches for planning program-specific evaluations, including the allocation of funds across evaluation efforts, are also discussed in this section. Importantly, EM&V efforts evolve over time and change as programs move from initial roll-out with few participants to full-scale implementation.

All evaluation activities will be conducted by third-party evaluation consultants selected through a competitive bid process. This approach ensures the program evaluation effort is fair and objective. Impact evaluations are most often performed by organizations independent of those responsible for designing and implementing programs to ensure objectivity. Process evaluations and market effects studies typically are also prepared by independent evaluators, but process evaluations in particular are used less to verify performance than to help improve performance and, as such, require active participation by the program administrator/implementer.

Although some of these activities are inherently program management activities and, therefore, the responsibility of AEP Ohio, we believe that all parties are best served by establishing a forum for ongoing stakeholder participation that provides the opportunity for parties to shape the structure of the evaluation process initially and as a function of the evaluation results.

9.2 Approach to Evaluation

The overall evaluation approach is based on an **integrated cross-disciplinary model** that includes evaluators as members of "project teams" involved in the various stages of program planning, design, monitoring and evaluation. This is a very cost-effective method that has been very successful for other program administrators (such as NYSERDA).

Timing of EM&V activities and reporting can have a significant effect on the accuracy and usefulness of findings. Data collection done months or years after a program intervention can be weakened by fading memories, lost data, and confounding events that have happened in the intervening time. EM&V reports that come well after program intervention can arrive too late to provide input at key program implementation stages.

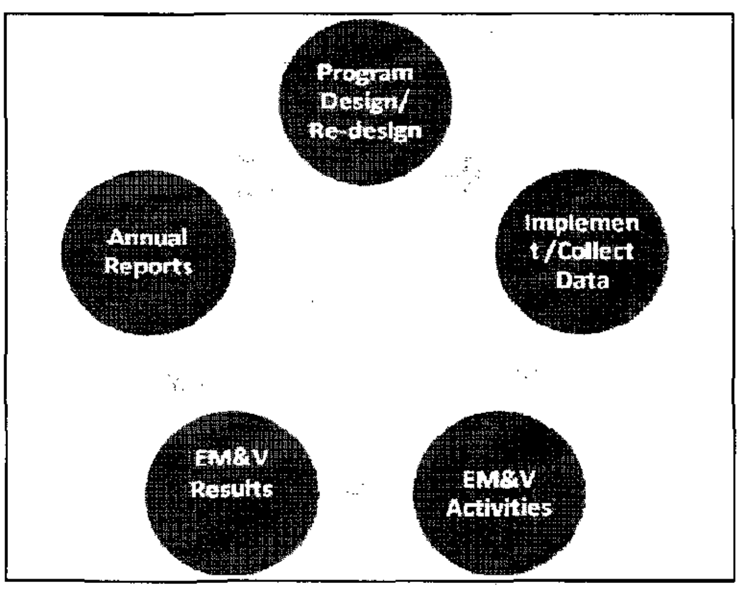
EM&V plans are designed to mitigate these problems. The process by which this is done is to integrate select data collection within the program implementation process and to provide near real-time feedback on key indicators of program progress. EM&V processes that take an "integrated data collection" ("IDC") approach to planning seek out opportunities in the program implementation process where evaluation data can be collected efficiently, cost-effectively, accurately, and produce timely results. One example is program application forms. Other interactions with customers where important data can be collected include initial customer contact (questions on where the customer heard about the program) during implementation (where data on the equipment baseline can be collected) and payment of incentives (questions on what measures were installed due to the program may best be collected at this time). Of course, this approach will be highly dependent of the program design and the points where the program interacts with the customer or trade ally.

The IDC approach requires the EM&V and implementation staff to work closely together to develop a protocol for collecting data as part of the standard program implementation practices and customer correspondence associated with the program. It also is important for the program implementation staff to see successful M&V as part of their responsibility; i.e., the program will get credit for the savings that can be verified and program implementers can have a dramatic influence on how accurately this in-field verification can be accomplished.

This IDC protocol garners participant feedback in near real-time to support process, market, and impact analyses. Examples include exit surveys with training participants designed by evaluation staff, but administered by program implementation staff: evaluation inputs on program application forms so key baseline data is collected before existing equipment is replaced, and regular transfer of program data to evaluators, so follow-up surveys can be implemented soon after program participation.

Figure 9-1 below shows the program evaluation cycle.

Figure 9-1. Steps of the EM&V process



Approximately three to five percent of overall portfolio program costs will be allocated to the following activities, further described in the following sections:

- EM&V related activities

- Project savings verification and due diligence
- Provide independent program evaluations
- Independent assessment of annual program impacts
- Provide internal quality assurance and control
- Coordinate evaluation activities with other players

9.3 Examples of EM&V Related Activities

Implementation and/or evaluation support contractors will assist in the development of key program and evaluation related components. These include:

Development of an AEP Ohio specific Measures Database savings estimates for prescriptive measures in a Technical Reference Manual ("TRM"). The TRM will detail all measure savings assumptions, including base efficiency, high efficiency, measure size, measure life, free ridership, and spillover estimates.

Review the portfolio tracking system database that captures measure and/or project data, develops initial estimates of savings, and retains participant information to assist with subsequent EM&V activities.

Direct market baseline research and market characterization to support improved Plan implementation.

Review program and measure cost-effectiveness.

9.4 Project Savings Verification and Due Diligence

AEP Ohio will work with implementation contractors to develop and implement quality assurance/quality control ("QA/QC"), inspection, and due diligence procedures for those programs for which deemed savings are not appropriate. These procedures will vary by program and are necessary to assure customer eligibility, completion of installations, and the reasonableness and accuracy of savings. The activities that AEP Ohio will undertake in performing EM&V procedures may include, but are not limited to, the following:

- Review of custom incentive applications and project proposals for eligibility and completeness
- Inspect and verify a statistically valid sample of installations for purposes of ensuring compliance with program requirements
- Prepare and facilitate EM&V plans where needed based on the project, and assure adherence to IPMVP protocols.

9.5 Independent Program Evaluations

Descriptions of proposed evaluations for each program are included in the program plans.

The key components of the process and impact evaluations include:

- Evaluations conducted by an independent, EE/PDR evaluation consultant obtained through an RFP process

- Verification, by an appropriate sample, that efficiency measures are installed as expected
- In-field measure performance measurement and data collection
- Energy and demand savings analysis to compute the results that are being achieved
- Cost-effectiveness analysis by program and overall EE/PDR portfolio
- Process evaluation to indicate how well programs are working to achieve objectives
- Identification of important opportunities for improvement

9.6 Assessment of Annual Impacts

AEP Ohio's EM&V contractor will prepare an annual report of energy efficiency program results, which will incorporate findings from evaluation activities completed that year, changes to programs, and new programs implemented, as well as gross and net savings and costs and cost-effectiveness results by program and portfolio. It is anticipated that the EM&V contractor's work, as well as participation in the process by the implementation contractor, will result in numerous areas where improvements and refinements to the AEP Ohio deemed measure database are necessary.

In addition to the procedures outlined above for verifying savings from AEP Ohio's proposed portfolio, AEP Ohio will implement appropriate internal controls to assure the quality of program design and implementation and establish a consistent and integrated tracking and reporting system for all programs in the portfolio. AEP Ohio plans to produce monthly reports on all customer interactions, including customers recruited, incentive applications, incentives processed, and installations verified, and will establish procedures for ongoing verification.

AEP Ohio will require implementation contractors or staff to routinely contact or visit a sample of participating customers to assess the quality of program delivery and the installation of measures for which incentives were claimed. AEP Ohio intends to also track on an on-going basis incentive fulfillment time, technical services delivery times (how long between customer request and audit completion for example), incentive documentation, and customer complaints among other metrics of program performance.

10 Glossary of Terms

Achievable Potential: the amount of energy use that efficiency can realistically be expected to displace assuming the most aggressive program scenario possible (such as providing end-users with payments for the entire incremental cost of more efficient equipment). This is often referred to as maximum achievable potential. Achievable potential takes into account real-world barriers to convincing end-users to adopt efficiency measures, the non-measure costs of delivering programs (for administration, marketing, tracking systems, monitoring and evaluation, etc.), and the capability of programs and administrators to ramp up program activity over time.

Applicability Factor: the fraction of the applicable dwelling units that are technically feasible for conversion to the efficient technology from an **engineering** perspective (e.g., it may not be possible to install CFLs in all light sockets in a home because the CFLs may not fit in every socket in a home).

Base Case Equipment End Use Intensity: the electricity used per customer per year by each base-case technology in each market segment. This is the consumption of the electric energy using equipment that the efficient technology replaces or affects. For example purposes only, if the efficient measure were a high efficiency lamp ("CFL"), the base end use intensity would be the annual kWh use per bulb per household associated with an incandescent light bulb that provides equivalent lumens to the CFL.

Base Case Factor: the fraction of the end use electric energy that is applicable for the efficient technology in a given market segment. For example, for residential lighting, this would be the fraction of all residential electric customers that have electric lighting in their household.

Coincidence Factor: the fraction of connected load expected to be "on" and using electricity coincident with the system peak period.

Cost-effectiveness: a measure of the relevant economic effects resulting from the implementation of an energy efficiency measure. If the benefits outweigh the cost, the measure is said to be cost-effective.

Cumulative Annual: refers to the overall savings occurring in a given year from both new participants and savings continuing to result from past participation with measures that are still in place. Cumulative annual does not always equal the sum of all prior year incremental values as some measures have relatively short measure lives and, as a result, their savings drop off over time.

Demand Response: the ability to provide peak load capacity through demand management (load control) programs. This methodology focuses on curtailment of loads during peak demand times thus avoiding the requirement to find new sources of generation capacity.

Early Replacement: refers to an efficiency measure or efficiency program that seeks to encourage the replacement of functional equipment before the end of its operating life with higher-efficiency units

Economic Potential: the subset of the technical potential screen that is economically cost-effective as compared to conventional supply-side energy resources. Both technical and economic potential screens are theoretical numbers that assume immediate implementation of efficiency measures, with no regard for the gradual "ramping up" process of real-life programs. In addition, they ignore market barriers to ensuring actual implementation of efficiency. Finally, they only consider the costs of efficiency measures themselves, ignoring any programmatic costs (such as marketing, analysis, administration) that would be necessary to capture them.

Effective Useful Life ("EUL"): the number of years (or hours) that the new energy efficient equipment is expected to function. Useful life is also commonly referred to as "measure life."

End-use: a category of equipment or service that consumes energy (e.g., lighting, refrigeration, heating, process heat).

Energy Efficiency: using less energy to provide the same or an improved level of service to the energy consumer in an economically efficient way. Sometimes "conservation" is used as a synonym, but that term is usually taken to mean using less of a resource even if this results in a lower service level (e.g., setting a thermostat lower or reducing lighting levels). This recognizes that energy efficiency includes using less energy at any time, including at times of peak demand through demand response and peak shaving efforts.

Free Driver: individuals or businesses that adopt an energy efficient product or service because of an energy efficiency program, but are difficult to identify either because they do not receive an incentive or are not aware of exposure to the program.

Free Rider: participants in an energy efficiency program who would have adopted an energy efficiency technology or improvement in the absence of a program of financial incentive.

Incremental: savings or costs in a given year associated only with new installations happening in year.

Impact Evaluation: is the estimation of gross and net effects from the implementation of one or more energy efficiency programs. Most program impact projections contain ex-ante estimates of savings. These estimates are what the program is expected to save as a result of its implementation efforts and are often used for program planning and contracting purposes and for prioritizing program funding choices. In contrast the impact evaluation focuses on identifying and estimating the amount of energy and demand the program actually provides.

Integrated Data Collection ("IDC"): an approach in which surveys of key market actors and end-use customers ("EUCs") are conducted in "real time" as close to the key intervention points as possible; usually integrated as part of the standard program implementation or other program paperwork process.

Lost-opportunity: refers to an efficiency measure or efficiency program that seeks to encourage the selection of higher-efficiency equipment or building practices than would typically be chosen at the time of a purchase or design decision.

Market Characterization: refers to evaluations focused on the evaluation of program-induced market effects when the program being evaluated has a goal of making longer-term lasting changes in the way a market operates. These evaluations examine changes within a market that are caused, at least in part, by the energy efficiency programs attempting to change that market.

Market Transformation: an approach in which a program attempts to influence "upstream" service and equipment provider market channels and what they offer end customers, along with educating and informing end customers directly. The emphasis is on influencing market channels and key market actors other than end customers.

Measure: any action taken to increase efficiency, whether through changes in equipment, control strategies, or behavior. Examples are higher-efficiency central air conditioners, occupancy sensor control of lighting, and retro-commissioning. In some cases, bundles of technologies or practices may be modeled as single measures. For example, an ENERGY STAR™ home package may be treated as a single measure.

MegaWatt ("MW"): a unit of electrical output, equal to one million watts or one thousand kilowatts. It is typically used to refer to the output of a power plant.

MegaWatt-hour ("MWh"): one thousand kilowatt-hours, or one million watt-hours. One MWh is equal to the use of 1,000,000 watts of power in one hour.

Net-to-gross ("NTG") Ratio: a factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts

Portfolio: either a collection of similar programs addressing the same market, technology, or mechanisms; or the set of all programs conducted by one organization.

Process Evaluation: is a systematic assessment of an energy efficiency program for the purposes of documenting program operations at the time of the examination and identifying improvements that can be made to increase the program's efficiency or effectiveness for acquiring energy resources.

Program: a mechanism for encouraging energy efficiency. May be funded by a variety of sources and pursued by a wide range of approaches. Typically includes multiple measures.

Program Potential: the efficiency potential possible given specific program funding levels and designs. Often, program potential studies are referred to as "achievable" in contrast to "maximum achievable."

Remaining Factor: the fraction of applicable units that have not yet been converted to the electric energy efficiency measure; that is, one minus the fraction of units that already have the energy efficiency measure installed.

Replace on Burnout ("ROB"): a EE/PDR measure is not implemented until the existing technology it is replacing fails. An example would be an energy efficient water heater being purchased after the failure of the existing water heater.

Resource Acquisition: an approach in which end customers are the primary target of program offerings (e.g., using rebates to influence customers' purchases of end use equipment).

Retrofit: refers to an efficiency measure or efficiency program that seeks to encourage the replacement of functional equipment before the end of its operating life with higher-efficiency units (also called "early retirement") or the installation of additional controls, equipment, or materials in existing facilities for purposes of reducing energy consumption (e.g., increased insulation, low flow devices, lighting occupancy controls, economizer ventilation systems).

Savings Factor: the percentage reduction in electricity consumption resulting from application of the efficient technology used in the formulas for technical potential screens.

Technical Potential: the theoretical maximum amount of energy use that could be displaced by efficiency, disregarding all non-engineering constraints such as cost-effectiveness and the willingness of end-users to adopt the efficiency measures. It is often estimated as a "snapshot" in time assuming immediate implementation of all technologically feasible energy saving measures, with additional efficiency opportunities assumed as they arise from activities such as new construction.

VOLUME 2:

AEP OHIO®

A unit of American Electric Power

2009 TO 2028

ENERGY EFFICIENCY/ PEAK DEMAND REDUCTION (EE/PDR) POTENTIAL STUDY

November 5, 2009

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AEP Ohio, comprised of Columbus Southern Power ("CSP") and Ohio Power Company ("OPC") is Ohio's 2nd largest provider of electric service with a mix of 1.45 million residential, commercial and diversified industrial customers. AEP Ohio provides among the lowest electric rates in Ohio, ensures high levels of customer satisfaction, and provides reliable utility service to its customers, which include more than 920 communities located in 61 of Ohio's 88 counties.

Ohio recently passed comprehensive energy legislation, which includes an advanced energy portfolio standard ("AEPS"), 2008 Senate Bill ("SB") 221, signed into law by Governor Ted Strickland on May 1, 2008.[1] The law directs Ohio utilities to implement programs to help their customers use electricity more efficiently, and requires electric utilities to achieve energy savings of 22.2% by the end of 2025 through energy efficiency programs. Utilities must also implement programs to reduce peak energy demand one percent beginning in 2009, and an additional 0.75% per year through 2018, for a total of 7.75%.

In response to the new legislative requirements, AEP Ohio is offering this three-year Energy Efficiency/Peak Demand Reduction ("EE/PDR") Action Plan ("Plan").[2] The EE/PDR Action Plan details a diverse portfolio of electric energy efficiency and demand response programs AEP Ohio intends to offer. Programs are available for all customer classes, including low-income residential.

This portfolio of electric EE/PDR programs was developed with the experienced and expert guidance of two outside consultants, Summit Blue Consulting and the Midwest Energy Efficiency Alliance ("MEEA"). AEP Ohio, Summit Blue and MEEA drew upon successful programs from other AEP operating utilities in other states, as well as other states, particularly the Midwest, and their combined program design and implementation experience with other utilities, in crafting AEP Ohio's program portfolio. AEP Ohio also convened a Collaborative group of interested parties to provide input to this EE/PDR Action Plan.

AEP Ohio believes it has an excellent portfolio of proven programs that will directly help its customers save money on their energy bills. AEP Ohio is committed to moving forward with the implementation of this EE/PDR Action Plan.

Note: due to the current economic downturn, AEP Ohio is not projecting peak demand savings from the Commercial & Industrial Interruptible Program in 2009 since the 2009 SB 221 target for peak demand savings likely will be satisfied without implementing this program in 2009.

[1] http://www.legislature.state.oh.us/bills.cfm?ID=127_SB_221

[2] The analysis conducted for this report largely was completed before the March 18, 2009 PUCO Order on AEP Ohio's Electric Security Plan.

E EXECUTIVE SUMMARY

Energy efficiency and peak demand reduction ("EE/PDR") represents an important resource for AEP Ohio, one growing increasingly important as fuel and commodity prices become more volatile and greenhouse gas regulation becomes more likely. Estimates of EE/PDR potential are a key input to the integrated resource planning process, which considers the load forecast and both supply- and demand-side resources. This study presents the results of an analysis of the EE/PDR potential in AEP Ohio's service territory by Summit Blue Consulting and the Midwest Energy Efficiency Alliance, in support of meeting the Electric Security Plan requirements of Senate Bill 221.

SB 221 requires electric utilities to achieve energy savings of 22.2% by the end of 2025 through energy efficiency programs. Utilities must also implement programs designed to reduce peak energy demand one percent beginning in 2009, and an additional 0.75% per year through 2018, for a total of 7.75%.[3] Table E-1 presents SB 221 requirements for 2009 to 2011, which is the focus of this EE/PDR Action Plan.

Table E-1. SB 221 Savings Requirements (at Meter) – 2009 to 2011

	SB 221 Requirements			
at Meter	Energy Savings		Peak Demand Savings	
year	incremental	cumulative	incremental	cumulative
2009	0.3%	0.3%	1.00%	1.00%
2010	0.5%	0.8%	0.75%	1.75%
2011	0.7%	1.5%	0.75%	2.50%

AEP Ohio plans to meet the SB 221 savings requirements, while ensuring that all customer classes have energy saving opportunities. This EE/PDR Action Plan presents detailed information on the approach, energy efficiency and demand response measures and proposed incentive levels. We anticipate that portions of the EE/PDR Action Plan will need to be revised upon implementation to reflect better information or changing market conditions. AEP Ohio will update the Public Utilities Commission of Ohio ("PUCO") and the Collaborative regarding any substantive revisions to this EE/PDR Action Plan.

EE/PDR Action Plan Portfolio Summary

AEP Ohio is proposing to invest a total of $161.9 million (2009$) on energy efficiency and demand response programs and projects 842 GWh and 201 MW cumulative annual net savings at meter over a three-year period during calendar years 2009 to 2011. The division of EE/PDR program investment between residential and business customers is commensurate with the relative contribution to the portfolio.

[3] Energy and peak demand savings of preceding 3 years annual average, normalized kWh and kW sales.

Table E-2 provides the projected savings and associated funding for 2009 to 2011.

Table E-2. Savings Goals and Efficiency Portfolio Investment – 2009 to 2011

Consumer Sector (incremental annual net savings at meter)	2009	2010	2011	2009-2011 Total
Energy Savings (GWh) (1)	62.8	109.9	135.9	**308.7**
% Savings of Sector Sales	0.41%	0.70%	0.87%	**1.98%**
Demand Savings (MW) (1)	7.3	15.1	17.6	**40.0**
% Savings of Sector Sales	0.21%	0.43%	0.50%	**1.15%**
Total Cost (2009$ million) (2)	$9.9	$16.8	$20.4	**$47.1**

Business Sector (incremental annual net savings at meter)	2009	2010	2011	2009-2011 Total
Energy Savings (GWh) (1)	107.2	176.5	249.9	**533.6**
% Savings of Sector Sales	0.30%	0.50%	0.70%	**1.50%**
Demand Savings (MW) (1)	24.7	73.7	93.5	**161.4**
% Savings of Sector Sales	0.36%	1.07%	1.35%	**2.34%**
Total Cost (2009$ million)	$16.1	$25.5	$33.9	**$75.5**

Note: C&I Demand Response Program demand savings are not cumulative

Total (incremental annual net savings at meter)	2009	2010	2011	2009-2011 Total
Energy Savings (GWh) (1)	170.0	286.4	385.8	**842.3**
% Savings of Sector Sales	0.33%	0.56%	0.75%	**1.65%**
Demand Savings (MW) (1)	32.0	88.8	111.1	**201.4**
% Savings of Total Sales	0.31%	0.86%	1.07%	**1.93%**
Total Cost (2009$ million)	$26.0	$42.3	$54.2	**$122.5**
Other Costs (2009$ million) (2)	$10.8	$11.5	$17.1	**$39.4**
Portfolio Total Investment (2009$)	**$36.8**	**$53.8**	**$71.3**	**$161.9**

(1) Savings are not projected for: Low Income Energy Conservation Kits, Behavior Modification, Self Direct Program, and Renewable Energy Technology Program. AEP Ohio will also conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables and portfolio cost-benefit analysis. Some of the factors affecting the calculation of the baseline are pending subject to final PUCO order.

(2) Other Costs include support and other services, including: AEP Ohio EE/PDR Department, General Education/Training/Media, Low Income Energy Conservation Kits, Behavior Modification, Self Direct Program, Pilot Program Fund and Renewable Energy Technology Program.

Incentive levels and other program elements will be reviewed and adjusted to reflect changes in market conditions or implementation processes in order to maximize cost-effective savings. Such modifications will be reported in the annual reports submitted to the PUCO.

Figure E-1 presents the proposed portfolio structure, including five consumer sector and five commercial and industrial sector programs, as well as three multi-sector programs: renewable energy technology, education and training, and new pilots/emerging technology. AEP Ohio will also conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables and portfolio benefit-cost analysis.

Figure E-1. EE/PDR Action Plan Portfolio Structure – 2009 to 2011

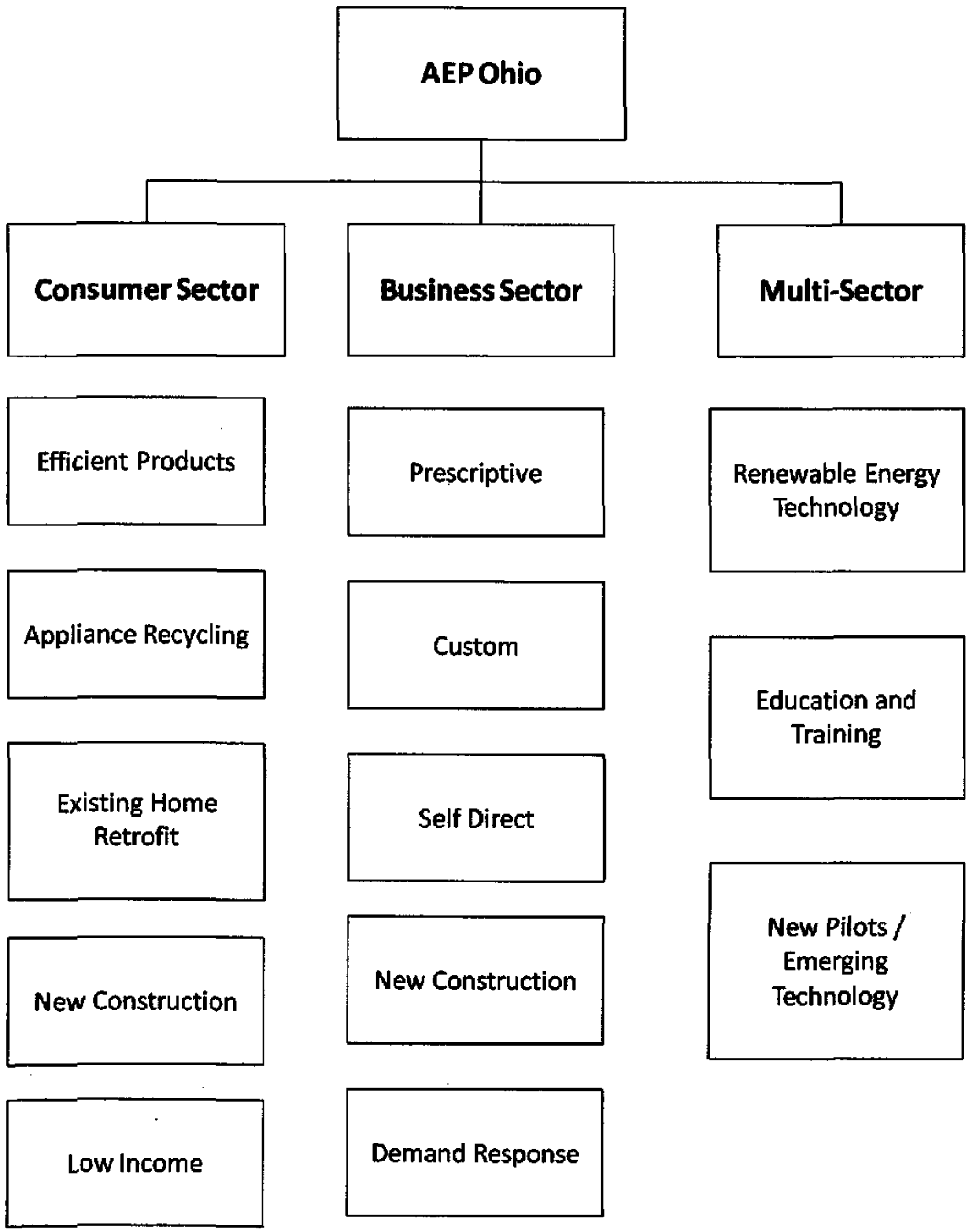

Table E-3 presents the projected MWh energy savings, Total Resource Cost ("TRC") Test results, Net Present Value Benefits in 2009$ million, Lifetime MWh Energy Saved and Lifetime Cost of Saved Energy in 2009$ per kWh over the three-year period from 2009 to 2011.

Table E-3. Annual Incremental Net Energy (MWh) Savings at Meter – 2009 to 2011

Consumer Sector	2009	2010	2011	2009-2011 Total	Percent of Portfolio Total	Total Resource Cost Test Ratio (TRC)	Net Present Value Net Benefits (2009$ million)	Lifetime Energy Saved (thousand MWh)	Lifetime Cost of Saved Energy (2009$/kWh)
Products	40,838	70,759	83,766	**195,364**	23.2%	2.2	$34.3	1,282	$0.012
Recycling	4,665	8,324	14,211	**27,200**	3.2%	1.4	$1.1	133	$0.030
Retrofit	5,194	7,558	10,447	**23,200**	2.8%	1.3	$2.9	277	$0.016
Low Income	12,149	17,640	23,400	**53,190**	6.3%	1.5	$8.6	720	$0.015
New Construction	0	5,663	4,081	**9,745**	1.2%	1.3	$2.7	195	$0.022
Consumer Sector Total	**62,846**	**109,944**	**135,906**	**308,697**	**36.7%**	**1.7**	**$49.6**	**2,608**	**$0.015**
% Total of Sector Sales	0.41%	0.70%	0.87%	Note: savings from Low income Energy Conservation Kits, Behavior Modification, Renewable Energy Technology are not projected.					
Business Sector	**2009**	**2010**	**2011**	**2009-2011 Total**	**Percent of Portfolio Total**	**Total Resource Cost Test Ratio (TRC)**	**NPV Net Benefits (2009$ million)**	**Lifetime Energy Saved (thousand MWh)**	**Lifetime Cost of Saved Energy (2009$/kWh)**
Prescriptive	68,244	123,778	177,348	**369,371**	43.9%	2.1	$66.9	3,373	$0.012
Custom	37,565	49,750	69,622	**156,936**	18.6%	1.1	$3.9	2,226	$0.013
New Construction	0	1,496	1,382	**2,879**	0.3%	1.5	$0.8	69	$0.014
LED Traffic Signals	1,369	1,439	1,583	**4,391**	0.5%	1.8	$0.3	66	$0.005
Demand Response	0	0	0	**0**	0.0%	10.7	$24.5	-	-
Business Sector Total	**107,178**	**176,464**	**249,935**	**533,577**	**63.3%**	**1.8**	**$103.0**	**5,734**	**$0.014**
% Total of Sector Sales	0.30%	0.50%	0.70%	Note: savings from Self Direct Program are not projected.					
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Table E-4 presents the projected summer peak demand kW savings levels over the three-year period from 2009 to 2011.

Table E-4. Annual Incremental Net Summer Peak Demand (kW) Savings at Meter – 2009 to 2011

Consumer Sector	2009	2010	2011	2009-2011 Total	Percent of Portfolio Total
Products	4,702	8,270	9,865	**22,837**	10.9%
Recycling	563	1,004	1,714	**3,280**	1.6%
Retrofit	616	892	1,225	**2,733**	1.3%
Low Income	1,433	2,084	2,764	**6,282**	3.0%
New Construction	0	2,845	2,051	**4,897**	2.3%
Consumer Sector Total	**7,314**	**15,095**	**17,620**	**40,029**	**19.1%**
% Total of Sector Sales	0.21%	0.43%	0.50%	Conservation Kits, Behavior Modification and Renewable Energy Technology are not projected.	
Business Sector	**2009**	**2010**	**2011**	**2009-2011 Total**	**Percent of Portfolio Total**
Prescriptive	21,409	38,744	55,462	**115,615**	55.2%
Custom	2,915	3,863	5,413	**12,190**	5.8%
New Construction	0	259	242	**500**	0.2%
LED Traffic Signals	331	348	382	**1,061**	0.5%
Demand Response	0	35,490	40,215	**40,215**	19.2%
Business Sector Total	**24,655**	**78,703**	**101,713**	**169,581**	**80.9%**
% Total of Sector Sales	0.36%	1.14%	1.47%	Note: savings from Self Direct Program are not projected.	
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Note: Demand Response Program demand savings are not cumulative

% of Portfolio Total Sales	0.31%	0.90%	1.15%	incremental
	0.31%	1.21%	2.01%	cumulative

Table E-5 presents the estimated total emissions reductions in pounds based on the projected energy savings over the three-year period from 2009 to 2011.[4]

Table E-5. Total Emissions Reductions – 2009 to 2011

Cumulative Annual Emissions Reductions – 2009 to 2011						
Consumer Sector	**NO_x (tons)**	**SO_2 (tons)**	**CO_2 (tons)**	**CH_4 (lbs.)**	**N_2O (lbs.)**	**H_g (lbs.)**
Products	438	2,158	190,334	4,349	6,412	14.1
Recycling	61	300	26,499	605	893	2.0
Retrofit	52	256	22,602	516	761	1.7
Low Income	119	587	51,820	1,184	1,746	3.8
New Construction	22	108	9,494	217	320	0.7
Consumer Sector Total	**692**	**3,409**	**300,750**	**6,872**	**10,131**	**22.3**
	Note: emissions reductions from Low income Energy Conservation Kits, Behavior Modification, Renewable Energy Technology are not projected.					
Business Sector	**NO_x (tons)**	**SO_2 (tons)**	**CO_2 (tons)**	**CH_4 (lbs.)**	**N_2O (lbs.)**	**H_g (lbs.)**
Prescriptive	828	4,080	359,861	8,222	12,123	26.6
Custom	352	1,733	152,896	3,493	5,151	11.3
New Construction	6	32	2,805	64	94	0.2
LED Traffic Signals	10	49	4,278	98	144	0.3
Demand Response	0	0	0	0	0	0.0
Business Sector Total	**1,196**	**5,893**	**519,840**	**11,877**	**17,512**	**38.5**
	Note: emissions reductions from Self Direct Program are not projected.					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[4] Emissions factors from eGRIDweb, Year 2005 Data, Location (Operator)-based: Columbus Southern Power, http://cfpub.epa.gov/egridweb/view_egcl.cfm; Ohio Power Company, http://cfpub.epa.gov/egridweb/view_egcl.cfm.

EE/PDR Investment

The estimated investment for these programs, which would realize the EE/PDR program potential consistent with meeting SB 221 requirements for 2009 to 2011, in 2009 dollars, would be approximately $36.8 million in 2009, $53.8 million in 2010, and $71.3 million in 2011, for a total $161.9 million, as shown in Table E-6. The projected investments include one-time startup costs of 10% of administrative costs for the first year of program implementation.

Table E-6. Estimated Annual Total Investments by Program for AEP Ohio (2009$)

Consumer Sector	2009	2010	2011	2009-2011	% of Portfolio Total
Products	$3,441,732	$5,616,033	$6,434,867	$15,492,632	9.6%
Recycling	$1,193,527	$2,028,309	$3,462,740	$6,684,577	4.1%
Retrofit	$990,308	$1,273,138	$1,576,956	$3,840,402	2.4%
Low Income	$4,236,236	$5,485,211	$7,234,834	$16,956,281	10.5%
New Construction	$0	$2,430,906	$1,667,011	$4,097,916	2.5%
Consumer Sector Total	**$9,861,803**	**$16,833,596**	**$20,376,408**	**$47,071,808**	**29.1%**
Business Sector	**2009**	**2010**	**2011**	**2009-2011**	**% of Portfolio Total**
Prescriptive	$8,861,266	$12,906,212	$17,978,141	$39,745,619	24.5%
Custom	$6,958,741	$8,588,662	$11,724,734	$27,272,137	16.8%
New Construction	$0	$296,938	$246,016	$542,954	0.3%
LED Traffic Signals	$310,257	$326,164	$358,669	$995,090	0.6%
Demand Response	$0	$3,371,250	$3,545,625	$6,916,875	4.3%
Business Sector Total	**$16,130,264**	**$25,489,227**	**$33,853,185**	**$75,472,675**	**46.6%**
Other Costs	**2009**	**2010**	**2011**	**2009-2011**	**% of Portfolio Total**
AEP Ohio EE/PDR Department	$1,800,000	$3,200,000	$3,400,000	**$8,400,000**	5.2%
General Education/ Training/Media	$2,527,000	$3,822,000	$3,651,000	**$10,000,000**	6.2%
Energy Conservation Kits	$500,000	$500,000	$500,000	**$1,500,000**	0.9%
Behavior Modification	$500,000	$1,000,000	$1,500,000	**$3,000,000**	1.9%
Self Direct	$5,000,000	$2,000,000	$2,000,000	**$9,000,000**	5.6%
Pilot Program Fund	$500,000	$1,000,000	$6,000,000	**$7,500,000**	4.6%
Other Costs Total	**$10,827,000**	**$11,522,000**	**$17,051,000**	**$39,400,000**	**24.3%**
PORTFOLIO TOTAL	**$36,819,067**	**$53,844,823**	**$71,280,593**	**$161,944,483**	**100.0%**

To firm up cost estimates and make any necessary budget and schedule changes, AEP Ohio will issue RFP(s) for implementation contractors to bid on the work, and require them to submit detailed budgets along with estimated savings and implementation schedules. Any adjustments to the cost recovery mechanism will be trued up on an annual basis.

Job Creation

To capture the full economic impacts of the investments in energy efficiency, three separate effects (direct, indirect, and induced) must be examined for each change in expenditure. The sum of these three effects yields the total effect resulting from a single expenditure.

- The **direct effect** refers to the on-site or immediate effects produced by expenditures. In the case of installing energy efficiency upgrades in a home or business, the direct effect is the on-site expenditures and jobs of the construction or trade contractors hired to carry out the work.
- The **indirect effect** refers to the increase in economic activity that occurs when a contractor or vendor receives payment for goods or services delivered and is able to pay others who support their businesses. This includes the equipment manufacturer or wholesaler who provided the new technology. It also includes the bank that provides financing to the contractor, the vendor's accountant, and the building owner where the contractor maintains its local offices.
- The **induced effect** derives from the change in spending that energy efficiency investments enable. Businesses and households are able to meet their energy, heating, cooling, and lighting needs at a lower total cost, due to efficiency investments. This lower cost of doing business and operating households makes greater wealth available for businesses and families to spend or invest in other goods and services such as food, clothing, entertainment, or marketing (in the case of businesses).

Table E-7 shows the total number of jobs—direct, indirect, and induced—that are estimated would be created from investing $161.9 million in electric energy efficiency in AEP Ohio customer homes and businesses in 2009 through 2011. AEP Ohio estimates the number of jobs that will be created at approximately 1,500 direct jobs, 900 indirect jobs, and 750 induced jobs, for a total of approximately 3,500 total jobs created during the three-year period.[5] On average, one job will be created for approximately $51,500 in spending.

Table E-7. Number of Jobs Created (2009 through 2011)

2009 to 2011	Direct	Indirect	Induced	Total
Jobs Created	1,500	900	750	3,150

[5] Job creation estimates based on data from Green Recovery: A New Program to Create Good Jobs and Start Building a Low-Carbon Economy, pages 9 and 27, http://www.americanprogress.org/issues/2008/09/pdf/green_recovery.pdf

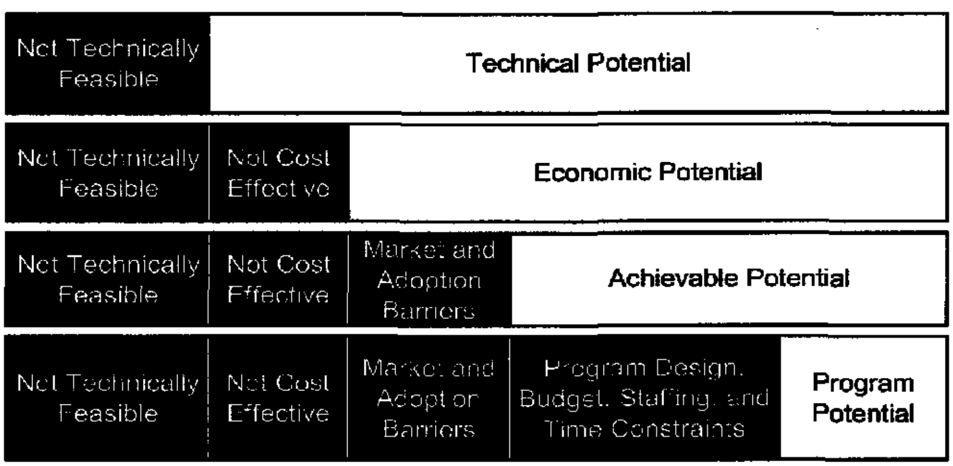
The next section discusses the approach to estimating EE/PDR potential. After that, there is an overview of EE/PDR Potential results for 2009 to 2028, followed by program plans, and finally conclusions and recommendations.

E.1 Approach to Estimating EE/PDR Potential

AEP Ohio's program portfolio was developed by incorporating elements of the most successful energy efficiency programs across North America into program plans designed for the Ohio market and AEP Ohio customers in particular. AEP Ohio used a benchmarking process to review the selected programs, with a focus on successful Midwest programs to help shape the portfolio.

As detailed in Figure E-2, there are four major types of energy efficiency potential: (1) *technical* potential for all technologies, (2) *economic* potential, the amount of energy efficiency available that is cost effective, (3) *achievable* potential, the amount of energy efficiency available under current market conditions and available investments, and (4) *program* potential, the amount of energy efficiency available given limited resources, available time and duration of the efficiency program planning period. AEP Ohio's EE/PDR Action Plan is focused on capturing cost-effective *program potential* in its service territory while achieving SB 221 requirements for 2009 to 2011. Energy efficiency measures that were known not to be cost-effective were pre-screened out of consideration from all potential scenarios.

Figure E-2. The Four Stages of Energy Efficiency Potential



Reproduced from "Guide to Resource Planning with Energy Efficiency November 2007" written by the US EPA. Figure 2-1

Summit Blue undertook the EE/PDR potential study with the following key tasks:

- Develop baseline consumption profiles, and develop initial building simulation model specifications
- Characterize the EE/PDR measures
- Conduct a EE/PDR benchmarking and best practices analysis
- Conduct benefit-cost analysis
- Estimate EE/PDR potentials
- Develop EE/PDR program plans
- Each of these tasks is summarized below.

E.1.1 Develop Baseline Consumption Profiles and Develop Initial Building Simulation Model Specifications

- Summit Blue conducted this task to characterize the AEP Ohio service territory, including Columbus Southern Power ("CSP") and Ohio Power Company ("OPC"), in terms of customer numbers, as well as age and size of the household/housing stock. Segment-level commercial and industrial sales data delivered by AEP Ohio provide a good starting point to determine customer energy use in broad end-use categories, such as lighting, heating, and cooling. These profiles were the calibration points in developing hourly computer models of energy consumption. The models are used to estimate savings from EE/PDR measures.

E.1.2 Characterize the EE/PDR Measures

Characterization of EE/PDR measures requires:

1) Estimating the baseline energy consumption for each end-use (heating, cooling, cooking, hot water, etc.) or unit energy consumption ("UEC")
2) Estimating the incremental savings from each measure – improving from the baseline to the new technology
3) Determining the incremental costs and lifetimes for each of the new technologies

In addition, the baselines must consider that different classes of buildings have different penetrations of technologies, such as existing homes compared to new construction.

Summit Blue used a combination of approaches to characterize the EE/PDR measures for this study. For the EE/PDR measures having impacts that do not vary with climate, we used engineering estimates and publicly available and well-respected sources, such as the California Database on Energy-Efficiency Resources ("DEER") database. We adjusted the DEER energy and demand impacts for AEP Ohio's customer operating parameters as necessary based on the local weather. For climate-dependent measures, Summit Blue used a combination of building simulation modeling and engineering estimates specifically developed for AEP Ohio to estimate EE/PDR measure per unit savings.

For EE/PDR measure costs, Summit Blue primarily used the California DEER database, adjusted by geographic multiplier factors contained in industry sources, such as the RS Means Mechanical Cost Data. For EE/PDR measure lifetimes, a combination of resources was used, including manufacturer data, typical economic depreciation assumptions, and the California DEER database.

E.1.3 EE/PDR Benchmarking and Best Practices Assessment

To ensure that the EE/PDR potential estimates that Summit Blue developed for AEP Ohio are reasonable and appropriate, and to identify the best practices regarding EE/PDR programs, we conducted a benchmarking assessment on other utilities' and agencies' EE/PDR programs. We also collected information on selected national EE/PDR programs that previous studies have identified as top performers. To identify common best practices of top performers, the analysis compares detailed program results by customer sector of those utilities identified as achieving high levels of EE/PDR savings for below median costs.

For the 14 electricity EE/PDR programs of the IOUs and agencies reviewed, the overall median energy savings as a percentage of annual sales for 2007 is 0.9% and the median first year costs for energy savings is $0.15/kWh, but the organizations with the largest relative energy savings and below median costs achieved their energy savings at about 1.3% of annual sales. The results for peak demand savings as a percentage of peak demand are similar: the median savings is 0.6% of peak demand and the median cost is $725/kW.

Most of the benchmarked organizations have been conducting electricity EE/PDR programs for an extended period. Since these organizations have been conducting electricity EE/PDR programs, savings have been realized from a lot of the "low hanging fruit" among EE/PDR measures, such as T12 lighting system conversions to T8 systems. A new EE/PDR program can reasonably be expected to achieve these results after an initial ramp up period of three to four years.

E.1.4 Benefit-Cost Analysis

The measures were evaluated with respect to each of the four main standard benefit-cost tests.[6]

Participant test: measures are cost effective from this perspective if the reduced electric costs to the participating customer from the measure exceed the after-incentive cost of the measure to the customer.

Utility (or program administrator) ("UCT") cost test: measures are cost effective from this perspective if the costs avoided by the measures' energy and demand savings are greater than the utility's EE/PDR program costs to promote the measure, including customer incentives.

Ratepayer impact measure ("RIM") test: measures are cost effective from this perspective if their avoided costs are greater than the sum of the EE/PDR program costs and the "lost revenues" caused by the measure.

Total resource cost ("TRC") test: measures are cost effective from this perspective if their avoided costs are greater than the sum of the measure costs and the EE/PDR program administrative costs.

In line with standard industry practice, Summit Blue used the TRC test to determine which EE/PDR programs to include in AEP Ohio's portfolio of EE/PDR programs. The RIM test is a more restrictive test that is only used as the main EE/PDR benefit-cost test in very few states.[7] All of the measures passed the TRC test. The portfolio of EE/PDR programs that Summit Blue developed is quite cost effective by industry standards with a total resource cost test ratio of 1.8. Table E-8 presents the overall benefit cost ratios for the consumer sector, the commercial and industrial sector, and the overall portfolio.[8]

[6] California Public Utilities Commission. California Standard Practice Manual Economic Analysis of Demand-Side Programs and Projects, October 2001, http://drrc.lbl.gov/pubs/CA-SPManual-7-02.pdf.

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

[8] The analysis conducted for this report largely was completed before the March 18, 2009 PUCO Order on AEP Ohio's Electric Security Plan.

Table E-8. Cost-effectiveness Ratios – 2009 to 2011

Consumer Sector	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Rate Impact Measure Test (RIM)
Products	2.2	3.2	6.3	0.5
Recycling	1.4	0.8	NA	0.3
Retrofit	1.3	2.0	3.9	0.5
Low Income	1.5	2.1	N/A	0.5
New Construction	1.3	2.0	2.6	0.7
Consumer Sector Total	**1.7**	**2.4**	**5.2**	**0.5**
Business Sector	**Total Resource Cost Test (TRC)**	**Utility Cost Test (UCT)**	**Participant Cost Test (PCT)**	**Rate Impact Measure Test (RIM)**
Prescriptive	2.1	3.3	3.4	0.7
Custom	1.1	2.2	2.5	0.5
New Construction	1.5	2.4	3.4	0.5
LED Traffic Signals	1.8	2.6	4.8	0.6
Demand Response	10.7	2.9	N/A	2.5
Business Sector Total	**1.8**	**2.8**	**3.1**	**0.7**
PORTFOLIO TOTAL	**1.8**	**2.7**	**3.6**	**0.6**

E.1.5 Estimate EE/PDR Program Potentials

Summit Blue developed estimates of EE/PDR measure potentials in terms of technical, economic, and "achievable" potential (the program results that are realistic for AEP Ohio to achieve through cost-effective EE/PDR programs). Economic potential was estimated using the TRC test as described above as the economic "screen" to apply to technical potential estimates in order to determine whether the measures are "cost-effective" or not.

To estimate achievable potential, a computer model was used to estimate conversion rates from inefficient products to more efficient products for retrofit and replacement measures, as well as installation rates in new buildings for new construction markets. These conversion, replacement, and new construction penetration rates will be based on other utilities' actual experiences with these types of programs. Summit Blue developed three achievable potential estimates:

1. A base case or expected EE/PDR potential estimates. These estimates assume that adequate funding is available to achieve the EE/PDR potentials and that AEP Ohio is able to achieve "best practice" EE/PDR program performance within three to four years, over the short term, from 2009 to 2011.

2. A high case estimate based on the experience of the best of the best utilities' EE/PDR program results, to meet the SB 221 requirements over the long term, through 2028.

3. A low case estimate, assuming that either the available funding for EE/PDR programs is constrained, or that the EE/PDR program performance is such that average EE/PDR program results are achieved over the forecast period.

E.2 EE/PDR Potential Results

The cumulative net annual EE/PDR potential savings (Base Case Scenario Market Potential) in 2028 is estimated to be approximately 8 thousand GWh at meter, about 14% of forecast sales, and approximately 1,400 MW at meter, about 12% of peak summer demand, as shown in Table E-9. Table E-9 also presents the projected savings in 2028 for the technical, economic, and high and low market potential scenarios. The technical and economic potential estimates are more unceratin than the market potential results since surveys of AEP Ohio's customers were not conducted.

These results assume a net-to-gross impact ratio of 1.0 in most instances whereby free ridership is assumed for this analysis to be offset by spillover impacts, except for the recycling of second refrigerators and freezers. The Base Case market potential meets the SB 221 savings targets over the short term, from 2009 to 2011. The high case market potential meets the SB 221 cumulative savings targets over the long term, through 2028. The Base Case market potential includes incentives at 50% of incremental measure costs in most instances. The High Case market potential includes incentives at 75% of incremental measure costs, while the Low Case includes incentives at 25% of incremental measure costs.

Table E-9. Projected Cumulative Annual Net Savings at Meter and Costs – 2028

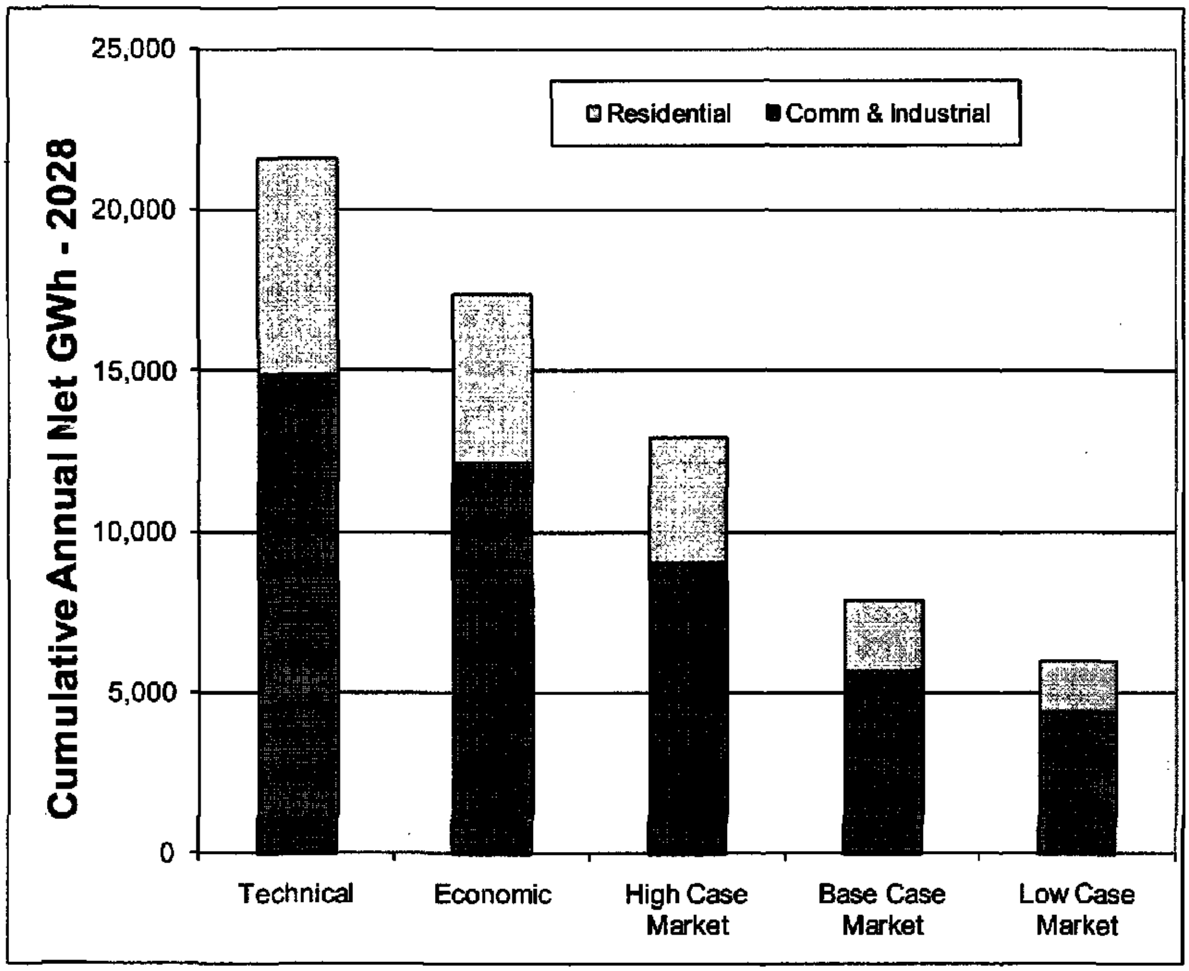
Potential Scenario	Cumulative Annual Net Energy Savings (1) at Meter (2028)		Cumulative Annual Net Summer Peak Demand Savings (1) at Meter (2028)		Total Cost (Energy Efficiency Only) (2)
Residential	GWh	% of 2028 Forecast Sales	MW	% of 2028 Forecast Sales	20 Year Cost (2009 to 2028) - 2009$ million
Technical	6,678	38%	1,222	30%	-
Economic	5,218	30%	719	18%	-
High Case	3,888	22%	699	17%	$1,050
Base Case	2,200	13%	328	8%	$414
Low Case	1,573	9%	221	5%	$255
Comm & Industrial					
Technical	14,892	36%	2,404	30%	-
Economic	12,163	29%	1,920	24%	-
High Case	9,024	22%	1,536	19%	$1,577
Base Case	5,692	14%	1,110	14%	$801
Low Case	4,425	11%	883	11%	$502
Total					
Technical	21,570	37%	3,626	30%	-
Economic	17,381	29%	2,639	22%	-
High Case	12,912	22%	2,235	18%	$2,627
Base Case	7,893	14%	1,438	12%	$1,214
Low Case	5,998	10%	1,104	9%	$757

(1) Savings are not included for: Demand Response, Low Income Energy Conservation Kits, Behavior Modification, Self Direct Program, and Renewable Energy Technology Program. AEP Ohio will also conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables and portfolio cost-benefit analysis.

(2) Costs are not included for: AEP Ohio EE/PDR Department, General Education/Training/Media, Demand Response, Low Income Energy Conservation Kits, Behavior Modification, Self Direct Program, Pilot Program Fund and Renewable Energy Technology Program.

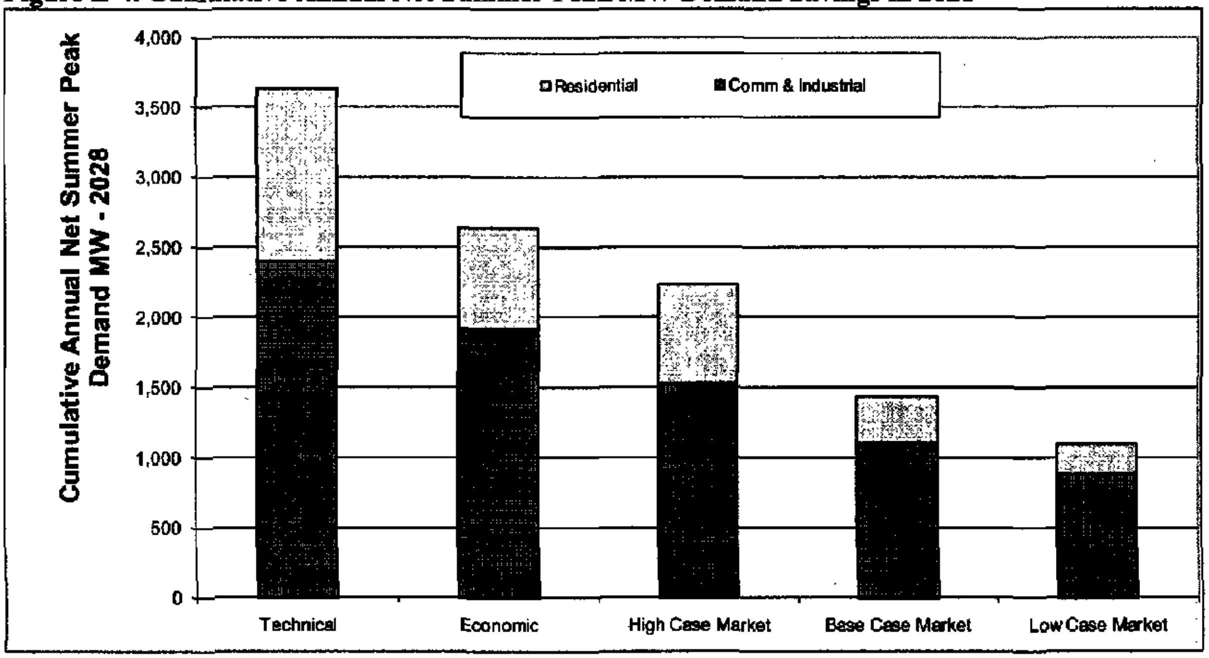
Figure E-3 and Figure E-4 show the cumulative annual net energy and summer peak demand savings in 2028 for each of the five potential analysis scenarios.

Figure E-3. Cumulative Annual Net GWh Energy Savings in 2028



(1) Savings are not included for: Demand Response, Low Income Energy Conservation Kits, Behavior Modification, Self Direct Program, and Renewable Energy Technology Program. AEP Ohio will also conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables and portfolio cost-benefit analysis.

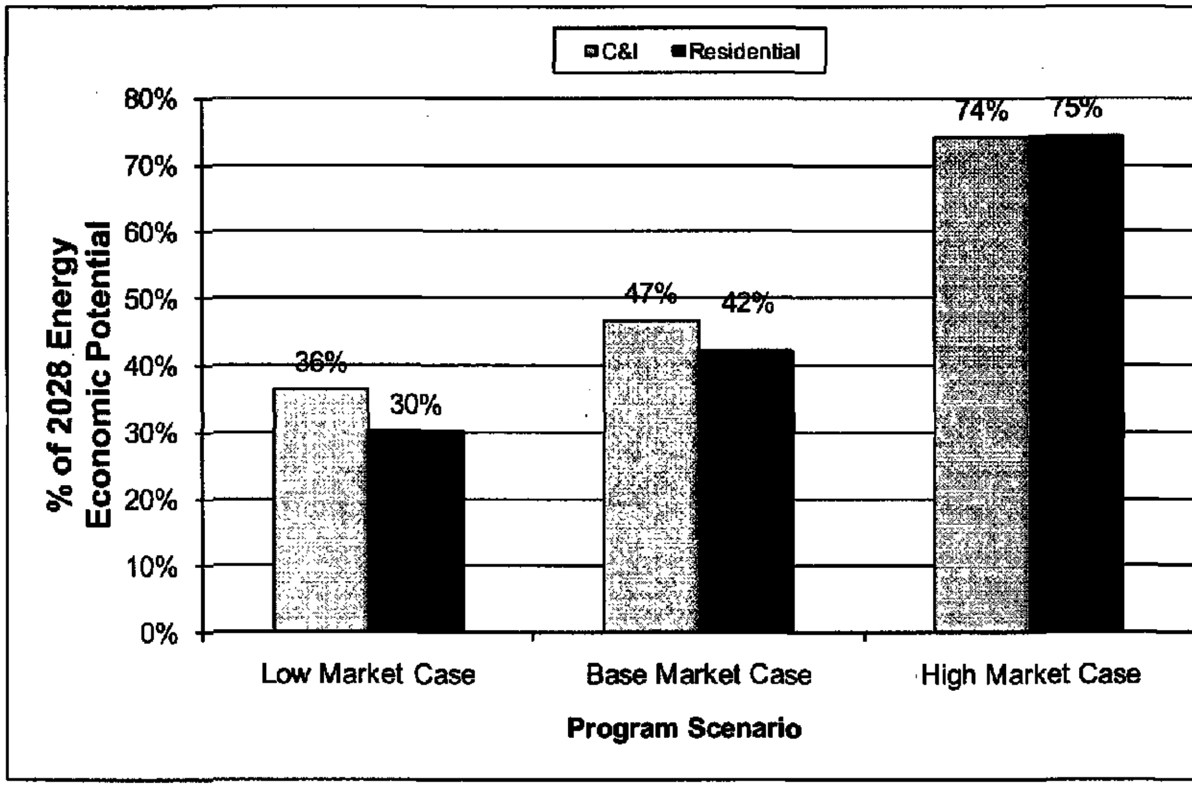
Figure E-4. Cumulative Annual Net Summer Peak MW Demand Savings in 2028



(1) Savings are not included for: Demand Response, Low Income Energy Conservation Kits, Behavior Modification, Self Direct Program, and Renewable Energy Technology Program. AEP Ohio will also conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables and portfolio cost-benefit analysis.

Figure E-5 and Figure E-6 show the cumulative Market Potential[9] as a percent of the Economic Potential for energy efficiency.

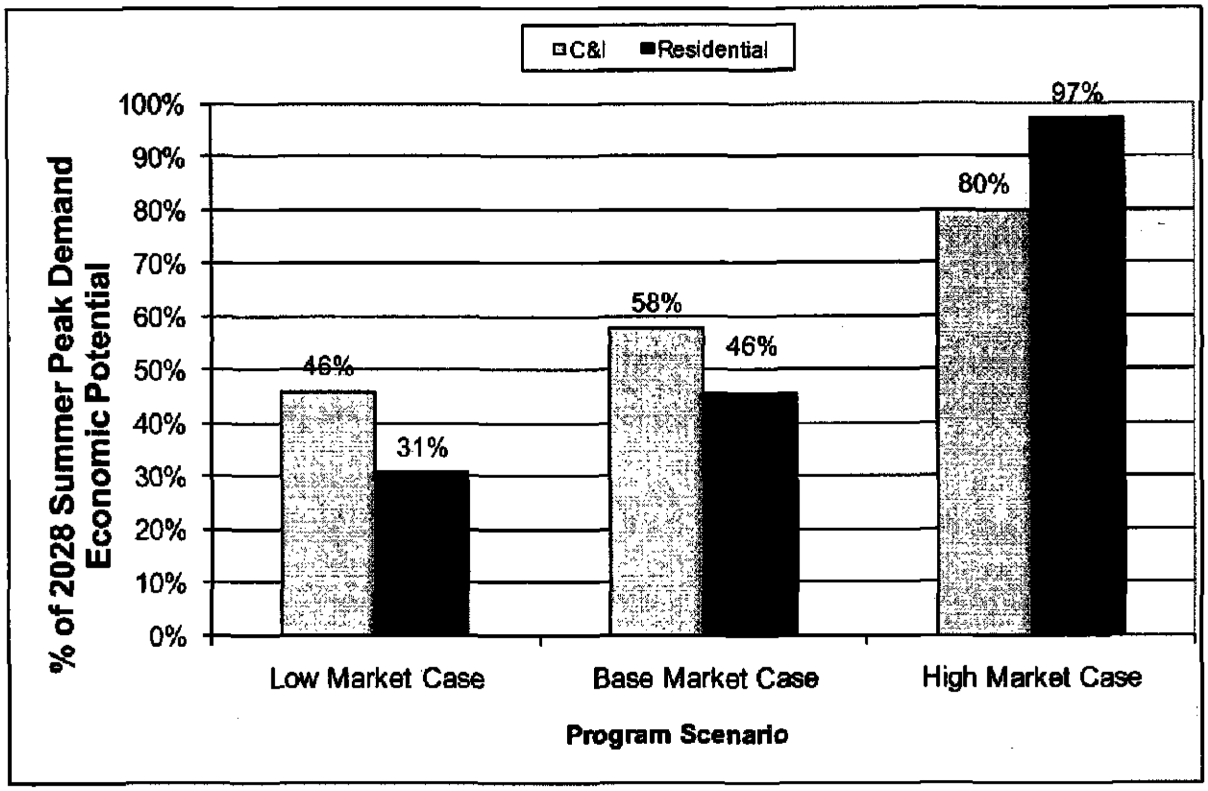
Figure E-5. Market Potential Net Annual Energy Savings at Meter as Percent of Economic Potential in 2028



(1) Savings are not included for: Demand Response, Low Income Energy Conservation Kits, Behavior Modification, Self Direct Program, and Renewable Energy Technology Program. AEP Ohio will also conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables and portfolio cost-benefit analysis.

[9] Defined here as the potential achievable in real-world market risk situations.

Figure E-6. Market Potential Net Summer Peak Demand Savings at Meter as Percent of Economic Potential in 2028



(1) Savings are not included for: Demand Response, Low Income Energy Conservation Kits, Behavior Modification, Self Direct Program, and Renewable Energy Technology Program. AEP Ohio will also conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables and portfolio cost-benefit analysis.

E.3 Overview of Program Plans

The plans developed for this study are based on best-practice programs, with the concepts outlined in a strategic manner. The plans are not intended to be operational per se, but are proposed as guidelines for more detailed program planning. The intent of the portfolio presented here is to provide a sense of scope and scale and to convey the general schedule and resources needed to quickly gain a foothold in the various markets in which the programs will operate.

Overall, a portfolio is presented that covers a broad range of demographic, business, facility and end-use markets. AEP Ohio's portfolio of programs can be divided into consumer, business and multi-sectors with utility administrative functions providing support across for all program areas. AEP Ohio will maintain as part of its functionality the education, training and emerging technology budgets. These efforts will leverage existing AEP corporate connections and efforts to maximize impact of these outreach and education efforts.

Consumer Sector

Efficient Products: will provide incentives and marketing support through retailers to build market share and usage of ENERGY STAR® lighting and other standardized equipment not requiring substantial engineering. Customer incentives encourage increased purchases of high-efficiency products while in-store signage, sales associate training, and support make provider participation easier. The program also will promote convenient recycling for CFLs at local retailers.

For appliances, the program will use a retail channel-based strategy to influence the purchase of high-efficiency appliances and electronics. Since appliance standards, as well as the market share of high-efficiency appliances, are gradually increasing, the program will be specific in its list of qualifying models, as well as marketing emphasis.

Appliance Recycling: Many of the refrigerators and freezers being replaced are still functioning, and, often end up as energy guzzling back-up appliances in basements and garages or are sold in a used appliance market. The Appliance Recycling Program will target these "second" refrigerators and freezers, providing the dual benefit of cutting energy consumption and keeping the appliances out of the used market. The program will provide incentives to remove working units from service and fully recycle their materials. The program offers an environmentally responsible turnkey pick-up and recycling service.

Home Retrofit: will produce long-term electric energy savings in the consumer sector by helping customers analyze and reduce their energy use through the installation of upgraded shell measures, such as air sealing, insulation and high efficiency equipment. A free online analysis will be offered followed by the option of a walk-through audit costing the customer between $25 and $150, (subject to reimbursement for those implementing at least $1,000 in efficiency improvements). The plan is to start with a "captive contractor" model to increase completion rates of recommended measures, eventually leading to a more traditional market-based Home Performance Retrofit with ENERGY STAR program in the later years. The three program phases are: Phase 1: On-line Energy Analysis; Phase 2: Home Walk-Through Energy Analysis; Phase 3: Home Performance Retrofit with ENERGY STAR.

Low Income: will provide recommendations to encourage low-income consumers to install efficient equipment, provide financial assistance to cover the full cost of implementation, and educate customers with limited income to reduce their energy use and manage their utility costs. The program will coordinate low-income services with local weatherization providers to provide comprehensive assistance at lower administrative costs.

Energy Conservation Kits: provides a free or reduced cost package of energy saving do it yourself measures for a variety of programs that are evaluated to be cost effective such as school programs to educate students who take the package home to install the measures with their parents and other programs to distribute the kits to educate customers and provide energy savings. The kits include the following: four CFL lamps, switch and outlet gaskets, furnace filter whistle, hot water temperature card, self-stick energy use gauge thermometer, close-cell foam weather-strip, self-stick door sweep, flow meter bag, low-flow showerhead, and refrigerator thermometer card.

ENERGY STAR® New Homes: will produce long-term electric energy savings by encouraging the construction of single-family homes and duplexes to meet the ENERGY STAR National Performance Path efficiency standard. The program will identify and recruit key builders who do not consistently (or seldom) build homes to meet the ENERGY STAR standard. Builders who choose to participate in the program will gain access to cash-back incentives designed to cover approximately 30% of the cost to upgrade and certify each home. Guidance for design and construction of high-efficiency homes will be provided.

Business Sector

Prescriptive Incentive: will generate energy savings for all business customers through the promotion of high-efficiency standardized equipment not requiring substantial engineering. Three primary objectives will focus on increasing: market share, installation rates, and operating efficiency. Incentives typically ranging from 20% to 50% of the incremental cost to purchase energy efficient products, including, lighting, HVAC, motors, etc., will be offered to customers. LED Traffic Signals are included in this program.

Custom: will assist larger commercial and industrial customers with the analysis and selection of high-efficiency equipment or processes not covered under the Prescriptive Incentive program. The program approach will identify more complex energy savings projects, provide economic analysis and aid in the completion of the incentive application. Incentives will be based on energy savings on a per kWh and per kW basis for installed measures.

Self Direct: As specified in Senate Bill 221 of the 127th Ohio General Assembly ("SB 221"), commercial and industrial "mercantile" customers that consume more than 700,000 kWh per year of AEP Ohio electricity or are part of a national account involving multiple facilities in one or more states are eligible to request participation in the Self Direct Program. The Self Direct Program allows mercantile customers to commit their energy efficiency and demand response resources to AEP Ohio.

C&I New Construction: provides design assistance to the architects and engineers that are designing new buildings. The key design assistance tool is building simulation modeling of more efficient building designs. Provide incentives to new facility owners for the installation of high-efficiency lighting, HVAC, building envelope, refrigeration and other equipment and controls. Provide a marketing mechanism for architects and engineers to promote energy efficient new buildings and equipment to end users.

Demand Response: includes a Commercial and Industrial Interruptible/Curtailable Rates Program for non-residential customers in the AEP Ohio service territory that includes fixed rate discounts for non-residential customers who contract to reduce their loads to a specific and pre-determined level during peak demand periods. For 2009 to 2011, the program will be available to Columbus Southern Power customers only, based on AEP Ohio interpretation of allowance of existing interruptible contracts.

Multi-Sector

Renewable Energy Technology: Residential and commercial grid-connected customers in new or existing single family and multifamily homes and duplexes, as well as commercial applications up to 100 kW will be eligible for incentives for the installation of photovoltaic solar electric and wind electric systems.

General Energy Education: This program will coordinate AEP Ohio's efforts to create customer awareness for the programs, enhance demand and educate customers on energy efficiency.

Training: The program will coordinate the C&I training programs offered, or supported, by AEP Ohio. Initial trainings would likely include commercial and industrial facility engineers. The goal is to broaden AEP Ohio's reach to its customers and to provide assistance for customers seeking higher efficiency equipment.

New Pilots/Emerging Technology: The program objective is to identify and learn more about new energy efficient technologies to capture additional electric energy savings. There are numerous pilot program potentials addressing all classes of customers. Initially the program will focus on proven programs that capture significant energy savings. Later other innovative technologies, including solid state lighting, plug load and consumer electronics, will be explored.

Portfolio Implementation

AEP Ohio plans to implement the proposed portfolio of programs through a combination of in-house utility staff and competitively selected third-party implementation contractors. AEP Ohio will issue Requests for Proposals ("RFP"s) to qualified firms related to multiple RFPs for the delivery of similar programs targeting specific sectors. AEP Ohio believes that by issuing multiple RFPs, it will be possible to obtain more competitive, cost-effective and qualified implementation responses. Implementation contractors are eligible to respond to one or all of the RFPs. From start to finish, AEP Ohio anticipates the process of issuing RFPs, evaluating responses and negotiating contracts along with associated program start-up time will result in 2009 launch date for most programs. The remaining programs will begin later due to a need for longer preparation time prior to launch.

Evaluation, Measurement and Verification

Program evaluation, measurement, and verification ("EM&V") activities are central to the success of the AEP Ohio portfolio. EM&V will be used to validate program savings impacts, monitor program performance and ensure that incentives paid are proportionate to expected savings in order to make adjustments for future expected savings. These activities serve as a way to audit, both internally and independently, the actual level of savings being delivered and to maximize the savings achieved for the given program investment.

Appropriate EM&V requires that a framework be established that encompasses both planned EM&V efforts and data collected as part of program implementation. EM&V efforts evolve over time and change as programs move from initial rollout with few participants to full-scale implementation. The AEP Ohio EM&V budget is expected to be approximately 3-5% of the overall portfolio investment.

All evaluation activities will be conducted by third-party, evaluation consultants selected through a competitive bidding process. To ensure objectivity, impact evaluations are most often performed by organizations independent of those responsible for designing and implementing programs. Process evaluations and market effects studies typically are also prepared by independent evaluators. This approach ensures the program evaluation effort is fair and objective. Process evaluations in particular are used less to verify performance than to help improve program implementation processes and thus require active participation by the program administrator/implementer.

Implementation and/or evaluation support contractors will assist in the development of key program and evaluation related components including:

- Validation of deemed savings estimates for prescriptive measures in a Technical Reference Manual ("TRM"). The TRM will detail all measure savings assumptions, including base efficiency, high efficiency, measure size, measure life, free ridership, and spillover estimates.
- Review of the EE/PDR Action Plan Portfolio tracking system that captures measure and/or project data, develops initial estimates of savings, and retains participant information to assist with subsequent EM&V activities
- Direct market baseline research and market characterization to support improved implementation
- Review of program and measure cost-effectiveness

The overall evaluation approach is based on an *integrated cross-disciplinary model* that includes evaluators as members of "project teams" involved in the various stages of program planning, design, monitoring and evaluation. This is a cost-effective method that has been highly successful for other utilities. Although some of these activities are inherently program management and therefore the responsibility of AEP Ohio, we believe all parties are best served by including the established Collaborative group in the evaluation process. This will allow all parties to shape the structure of the evaluation process both initially and as a function of the evaluation results.

Program and Portfolio Risk

In summer 2009, the Ohio economy remains in the midst of a severe economic recession. In this economic environment, AEP Ohio's ability to convince business customers to voluntarily take on additional debt for the installation of cost-effective measures, even with very short pay-back periods, will likely be challenging. AEP Ohio recognizes this challenge and we have striven to develop a balanced portfolio of programs that provides opportunities for participation at multiple levels. By proposing a multi-faceted and broad portfolio of programs, we will be able to capitalize on those sectors of the market willing to invest in energy efficiency, regardless of the challenging economic landscape. This portfolio plan is designed to allow us to meet overall legislative efficiency goals.

AEP Ohio plans to use the following strategies to minimize the risks associated with its portfolio of energy efficiency programs:

- Implementing primarily "tried and true" programs that have been successfully implemented by many utilities in the Midwest and across the country
- Hiring program implementation contractors with significant experience in implementing EE/PDR programs in the Midwest and other regions
- Initiating program evaluation activities at the start of program implementation to get real-time feedback on program progress, and to allow any needed fine-tuning to occur as soon as possible
- Setting up post installation inspection procedures and data to collect before inspections begin

- Anticipating and preparing for stronger than expected market response
- Conducting adequate market checks on standard practices and energy efficient product availability
- Developing incentive structures that are simple to understand
- Creating simple participation rules
- Monitoring and responding to rapidly dropping equipment prices quickly
- Setting appropriate qualifying efficiency levels
- Setting appropriate incentive levels
- Roll out targeted marketing to contractors focusing on what's in it for them and how they participate
- Adequately training account managers on program rules
- Carefully establishing documentation, analysis methods and reporting requirements for technical studies
- Managing the pipeline of projects and establishing decision deadlines so the response time to those waiting for decisions is reasonable

E.4 Conclusions and Recommendations

The EE/PDR potential (Base Case Scenario Market Potential) identified in this study represents energy reductions of approximately 13% for AEP Ohio residential customers and 14% for commercial and industrial customers below forecasted levels and known enacted energy codes and standards by 2028, or approximately 0.7% per year. This magnitude of savings has been achieved by best practice program portfolios in the Midwest, Northeast and Western U.S. Summer peak demand and annual energy reductions of the magnitudes found for the Base Market Potentials case are being achieved by a variety of utilities. Meeting the SB 221 targets over the long term, through 2028, will require energy reductions on the order projected in the High Case Scenario Market Potential, which have been achieved by few jurisdictions to date.

Over time, AEP Ohio will need to increase EE/PDR activities beyond the Base Case Scenario Market Potential for 2009 to 2011 to achieve the projected long term savings in the High Case Scenario Market Potential. Based on the results from the initial three-year period and consideration of additional program and measure offerings, in 2011, AEP Ohio will propose EE/PDR efforts beyond the initial three-year period, 2009 to 2011, to meet the SB 221 savings goals for 2012 to 2015.

The EE/PDR benchmarking analysis results presented in this report should give AEP Ohio management confidence that a variety of utilities in the region and throughout the country are achieving large-scale results from their EE/PDR programs. It should be noted, however, that this level of impact is based on historical economic conditions; going forward, economic uncertainties are likely to negatively affect the market potential.

The largest sources of uncertainty regarding the estimates that Summit Blue has developed to date for AEP Ohio stem from using secondary information to profile AEP Ohio's customers. It is uncertain how well the primarily regional and national estimates used for current EE/PDR measure saturations apply to AEP Ohio's customers. This is particularly the case for commercial and industrial customers, where the secondary sources used included Department of Energy customer surveys such as the Commercial Building Energy Consumption Survey.

The EE/PDR program plans that Summit Blue developed are based on the best practice results from the analysis of utility EE/PDR program results. These program plans build on several common elements that have been identified by the analysis conducted:

- Large impacts are being realized from both lighting and multi-product energy efficiency programs for both consumer and commercial sectors
- Significant impacts are being achieved from new construction energy efficiency programs
- Custom incentive energy efficiency programs have produced significant impacts for some utilities

Utilities that choose to significantly invest in EE/PDR programs often make significant periodic investments to develop and update secondary best-practice and primary market research data to aid their EE/PDR program planning. For example, Xcel Energy in Minnesota conducts large-scale market assessments and EE/PDR potential studies that include significant on-site customer data collection every five to ten years. The Iowa utilities conduct EE/PDR potential studies about every five years to support their periodic EE/PDR program filings with their regulators. These utilities collected significant customer data as part of their 2008 EE/PDR potential study.

Recommendations to consider include the following:

- Move the results into operational planning
- Utilize an outsourcing strategy to jump-start key aspects of the portfolio and associated infrastructure and internal organizational development
- Engage in long-term organizational development to assure performance and AEP Ohio brand continuity, as well as strong internal oversight over the life of the portfolio

1 INTRODUCTION

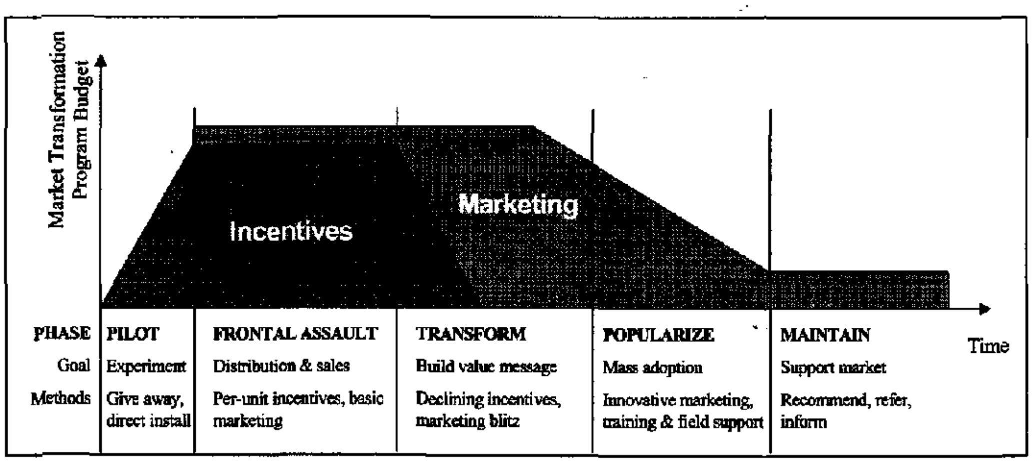
AEP Ohio, comprised of Columbus Southern Power ("CSP") and Ohio Power Company ("OPC"), and based in Columbus, is Ohio's 2nd largest provider of electric service with a mix of 1.45 million residential, commercial and diversified industrial customers. Pursuant to the requirements in 2008 Senate Bill ("SB") 221, AEP Ohio has developed this EE/PDR Action Plan for calendar years 2009 to 2011.

The following EE/PDR Action Plan presents a detailed overview of the proposed electric efficiency programs targeted at the consumer, business sectors, and associated implementation costs, savings, and benefit-cost results. This plan presents detailed information on the approach, energy efficiency measures, and proposed incentive levels, though AEP Ohio anticipates that, upon implementation, portions of this plan will need to be revised to reflect better information or changing market conditions. AEP Ohio will update the PUCO accordingly regarding any substantive revisions to the Plan.

Together with stakeholders and industry experts Summit Blue Consulting and the Midwest Energy Efficiency Alliance ("MEEA"), AEP Ohio has designed a comprehensive portfolio of EE/PDR programs to deliver significant electric efficiency savings. These programs include incentive and buy down approaches for energy efficient products and services, educational and marketing approaches to raise awareness and enhance demand, and partnerships with trade allies to apply as much leverage as possible to augment the rate-payer dollars invested. Proper coordination between the programs is essential to maximizing this leverage.

As detailed in Figure 1-1, AEP Ohio anticipates that over time investment in energy efficiency measures will follow a predictable path of market transformation that has been experienced in other jurisdictions. With sustained levels of investment, promotion of efficient measures will in the early years focus on immediate up-front incentives to stimulate the marketplace. Overtime, funds will be transitioned to marketing, training, education, and awareness to sustain program participation. Furthermore, as certain markets become transformed, and the baseline conditions become the efficient options, program resources will be transferred to new program areas and new technologies, and the process will repeat. Each series of the market transformation process will result in greater and more efficient opportunities for residential and business customers.

Figure 1-1. Phases of Energy Efficiency Promotion



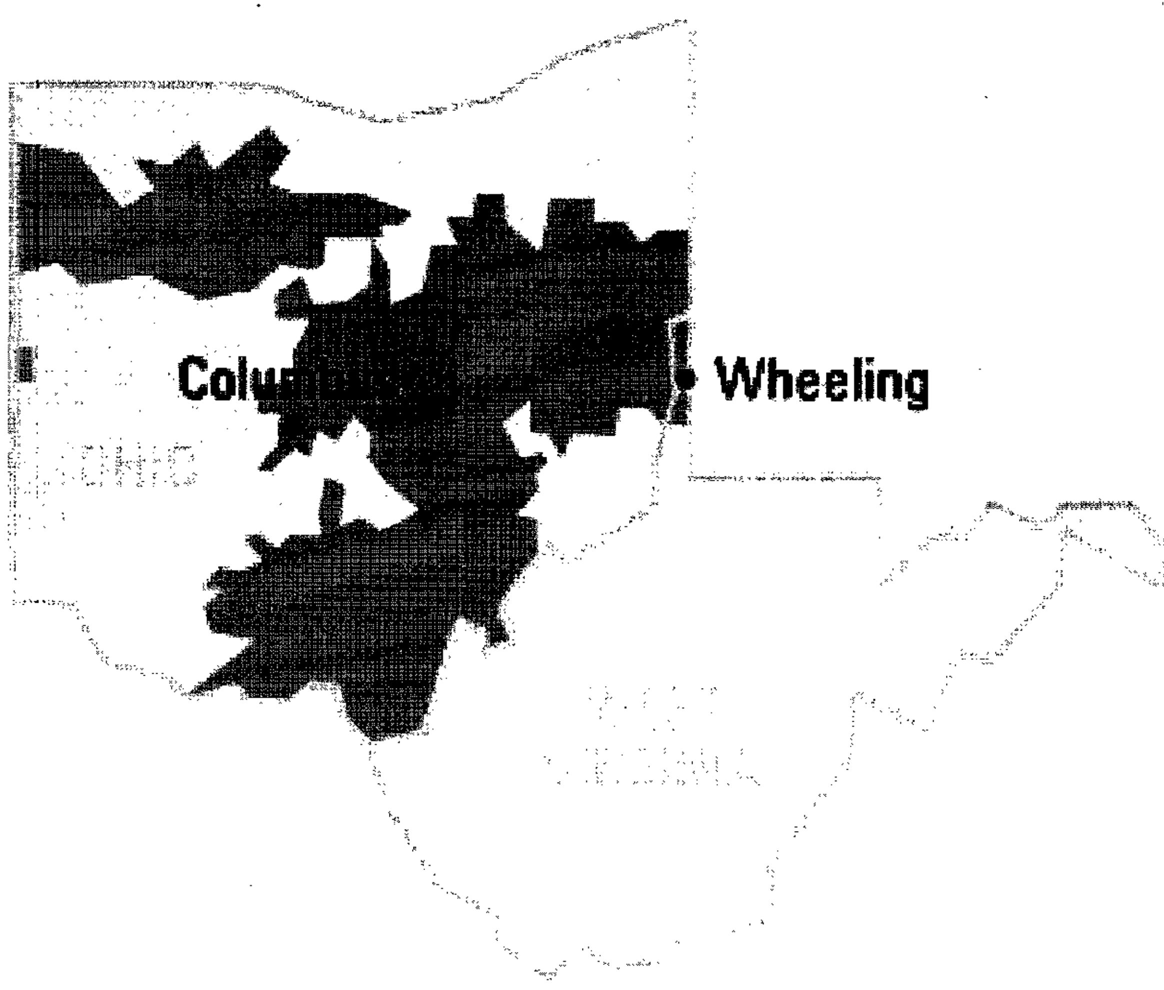
Source: ENERGY STAR® YEAR 3 AND BEYOND, Presentation by Anne Wilkins, NRCAN, 2005

Demand Side Management ("DSM") is the planning and implementation of programs and services that help and encourage customers to use electricity as efficiently as possible. DSM represents an important resource for AEP Ohio, one growing increasingly important as fuel and commodity prices become more volatile and greenhouse gas regulation becomes more likely. Estimates of DSM or (EE/PDR) potential are a key input to the integrated resource planning process, which considers the load forecast and both supply and demand-side resources. This study presents the results of an analysis of the EE/PDR potential in AEP Ohio's service territory by Summit Blue Consulting and the Midwest Energy Efficiency Alliance.

1.1 AEP Ohio Overview

As described on AEP Ohio's website, the Company is a significant utility in the Midwest. With about 1.45 million customers and over 11,000 megawatts of generation, AEP Ohio has a strong market presence. Figure 1-2 presents AEP Ohio's service territory, which spans a large geographic area in Ohio, as well as a small portion of West Virginia[10]. AEP Ohio provides power to more than 920 communities located in 61 of Ohio's 88 counties.

Figure 1-2. AEP Ohio's Service Territories



[10] AEP Ohio's West Virginia service territory is not included in this report.

Table 1-1 outlines key statistics for Columbus Southern Power and Ohio Power Company.

Table 1-1. AEP Ohio Key Statistics[11]

AEP Ohio's Business Profile 2006 Statistics	
Operating Information	
Total Customers	1,450,161
Residential	1,269,776
Commercial	166,575
Industrial	10,884
Other	2,926
2006 electrical sales in megawatt-hours	44,829,240
Size of service area (asset)	11,425 square miles
Communities served	901
Net plant in service	$7.5 billion
Size of distribution system	44,866 miles
Size of transmission system	8,938 circuit miles
Total number of AEP Ohio employees	1,540
Financial Information	
2006 Operating Revenue	$4.4 billion
2006 Net for Common	$413 million
2006 Ohio Taxes Paid	$159.3 million
2006 Local Taxes Paid	$145.3 million
Top 10 Customers (by revenue)	
The Ohio State University	The Timken Company
Eramet Marietta Inc.	Wheeling Pittsburgh - WHX HQ
State of Ohio	Premcor Refining Group, Inc.
The Kroger Company	Republic Engineered Products, LLC
Nationwide Insurance Enterprise	Globe Metallurgical, Inc.

[11] http://www.aepohio.com/about/serviceTerritory/docs/AEPOhioFactSheets08.pdf

Study Goals and Approach

The overall goals of the EE/PDR potential study are to:

- Assess the technical, economic, and achievable potential for the residential, commercial and industrial sectors
- Develop high-level EE/PDR program plans

Summit Blue undertook the EE/PDR potential study in the following key tasks:

- Develop baseline consumption profiles, and develop initial building simulation model specifications
- Characterize the EE/PDR measures
- Conduct a EE/PDR benchmarking and best practices analysis
- Conduct benefit-cost analysis
- Estimate EE/PDR potentials
- Develop program plans

These steps are discussed in more detail in chapters of the report.

1.2 Volume 2 2009 to 2028 DSM Potential Study Report Organization

The remainder of AEP Ohio's Volume 2 2009 to 2028 DSM Potential Study is divided into the following sections:

Section 2 and 3: Baseline Consumptions Profiles discusses baseline consumption profiles and initial building simulation model specifications for CSP and OPC, respectively.

Section 4: DSM Measure Characterizations provides details on the DSM measures.

Section 5: Benchmarking and Best Practice Results provides a discussion of benchmarking and best practice results.

Section 6: EE/PDR Measure Cost-effectiveness Analysis presents the cost effectiveness analysis.

Section 7: EE/PDR Potential Methodology and Results presents the approach used to conduct the EE/PDR potential analysis and the results of different scenarios. Detailed data are provided in a set of separately bound and electronic appendices.

Section 8: Glossary defines key terms used in the report.

Volume 1 – 2009 to 2028 EE/PDR Action Plan: presents the EE/PDR plan for the first three years, 2009 to 2011.

Volume 3 – Appendix: includes several detailed appendices are provided in the report, including overall Benchmarking results (Appendix A), Best Practice Residential Programs (Appendix B), Best Practice Commercial and Industrial Programs (Appendix C), EE/PDR Measure Descriptions and Characterizations (Appendix D), and References (Appendix E).

2 BASELINE CONSUMPTION PROFILES - CSP

In this section, we describe the development of baseline market profiles and baseline technology profiles.

2.1 Baseline Market Profiles

Summit Blue developed profiles for each sector — residential, commercial and industrial — for the Columbus Southern Power Company (CSP) service territory. Key data sources included:

- Electricity sales data provided by CSP.
- 2006 Residential Appliance Saturation Survey Data for CSP.
- Utility-level electricity sales data by sector from Form EIA-861, Annual Electric Power Industry Report, file 2. http://www.eia.doe.gov/cneaf/electricity/page/eia861.html.
- *Midwest Residential Market Assessment and DSM Potential Study*, Midwest Energy Efficiency Alliance, March 2006. http://www.mwalliance.org/image/docs/resources/MEEA-Resource-5.pdf.
- 2007 Buildings Energy Data Book, U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy. http://buildingsdatabook.eere.energy.gov/.
- 2005 Residential Energy Consumption Survey (RECS), Energy Information Administration. http://www.eia.doe.gov/emeu/recs/recs2005/hc2005_tables/detailed_tables2005.html East North Central[12] census division.
- 2003 Commercial Buildings Energy Consumption Survey (CBECS), by census division produced by the Energy Information Agency (EIA), US Department of Energy (US-DoE), http://www.eia.doe.gov/emeu/cbecs/ East North Central[1] census division.
- 2002 Manufacturing Energy Consumption Survey (MECS), by census region produced by the Energy Information Agency (EIA), US Department of Energy (US-DoE), http://www.eia.doe.gov/emeu/mecs/ Midwest Census Region.[13]
- 2008 Building America Benchmark (BABM). http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/42662.pdf.

The methodology used started with sales and customer count data from CSP. The sales data were cross verified and adjusted with 2007 EIA reported data. The tables below are based on CSP sales data for 2007.

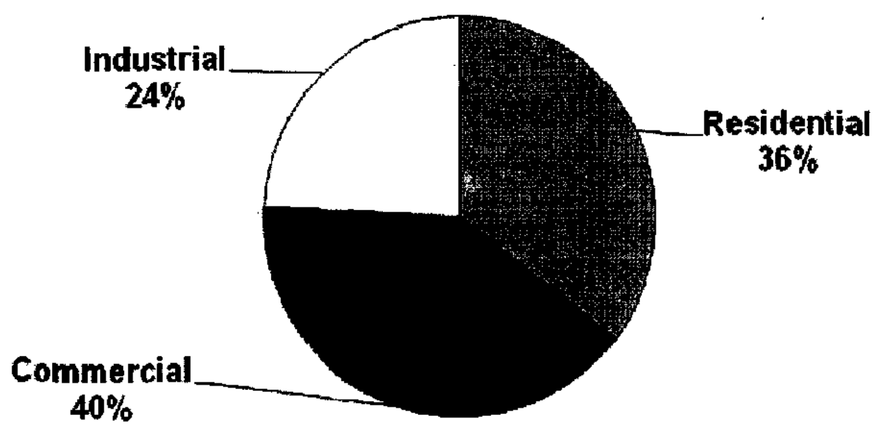
[12] Includes the states of WI, IL, IN, OH and MI

[13] Includes the states of WI, IL, IN, OH, MI, ND, SD, NE, KS, MO, IA and MN.

Table 2-1. Market Profile – Electricity (2007)

Market Sector	Sales MWh	Customers	kWh per Customer
Residential	7,740,901	682,615	11,340
Commercial	8,821,158	75,648	116,608
Industrial	5,283,287	4,248	1,243,712
Total Billed	**21,845,346**	**762,511**	

Figure 2-1. Market Profile – Electricity Use



2.1.1 Residential Sector Market Profile

The residential sector market profiles are built up out of four major sources. CSP total consumption and customer number data for 2006-2007 were used for baseline annual electricity and gas consumption. CSP monthly residential load data for 2006-2007 was used to generate the monthly electricity consumption profile. The 2006 CSP Residential Appliance Saturation Survey data was used for technology saturation data. The 2008 Building America Benchmark (BABM) and a California lighting survey were used for generating annual end use estimates and seasonal electricity consumption profiles.

Residential Electricity Market Profile

The derivation of the residential electricity market profile relied on monthly consumption data and benchmark monthly profiles of end uses to derive annual electricity consumption for seasonal and non-seasonal uses. The starting point in this exercise was the CSP system-level residential electricity consumption by month for 2006-2007. The household total electricity consumption by month was calculated from this data. There are four seasonal end uses that were tabulated (heating, cooling, hot water, and lighting) in addition to the non-seasonal end uses (includes appliances, plug loads, and other).

Hot Water. Seasonal hot water end use was calculated using the hot water end use profiles from the 2008 Building America Benchmark (BABM) multiplied by the saturations of the various hot water end uses. Monthly electricity consumption for homes with electric domestic hot water was then calculated using seasonally-adjusted mains water temperatures. This monthly domestic hot water electricity profile was then multiplied by the electric domestic hot water saturation to derive the average household monthly domestic hot water electricity profile.

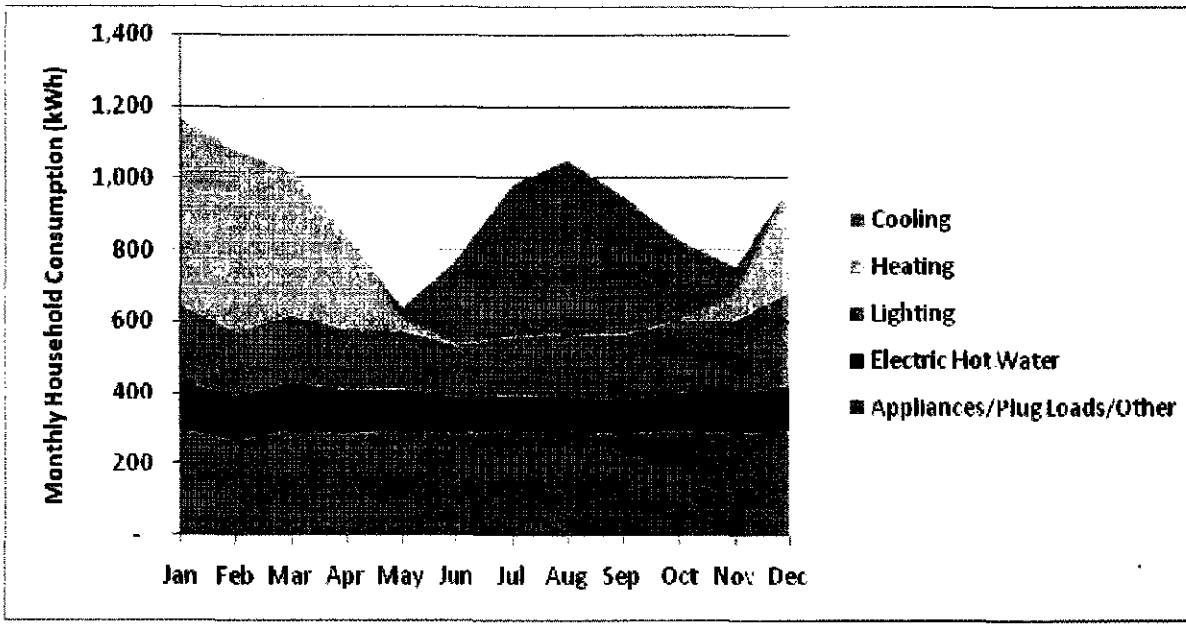
Lighting. Annual lighting consumption per household was estimated using the BABM. Lighting use increases during the winter months when there is less daylight. The seasonal lighting variation profile was derived from a recent California CFL monitoring study, with an addition to December for holiday lighting. The average household monthly lighting electricity consumption was calculated by multiplying the profile by the annual lighting consumption estimate.

Non-Seasonal End uses (Appliances, Plug Loads, Other). After subtracting the hot water and lighting end uses from the annual household electricity consumption profile, the remaining profile has two local minima, one in the spring and one in the fall. It was assumed that during the minimum consumption month (May), heating and cooling each make up 5% of the total electricity consumed for that month. The base, non-seasonal monthly electricity consumption was then calculated as the total consumption for May minus the seasonal end uses for May. This includes all appliances, plug loads, and other non-seasonal end uses.

Heating and Cooling. Summit Blue's experience has shown that heating and cooling energy make up 10% of total electricity consumption in typical homes in the minimum consumption month. After assuming that the minimum consumption month included 5% heating and 5% cooling, the monthly heating and cooling electricity was calculated by subtracting the hot water, lighting, and base end uses from the total for each month. For June to September, all of the heating and cooling electricity is assumed to be cooling. For December to March, all of the heating and cooling electricity is assumed to be heating. For the last month, November, it is assumed that half the heating and cooling electricity is used for cooling and half is used for heating. The annual heating and cooling end uses were then calculated by summing the monthly heating and cooling end uses.

The resulting annual end use profiles are shown in the figure below.

Figure 2-2. Residential Monthly Electricity End use Breakdown

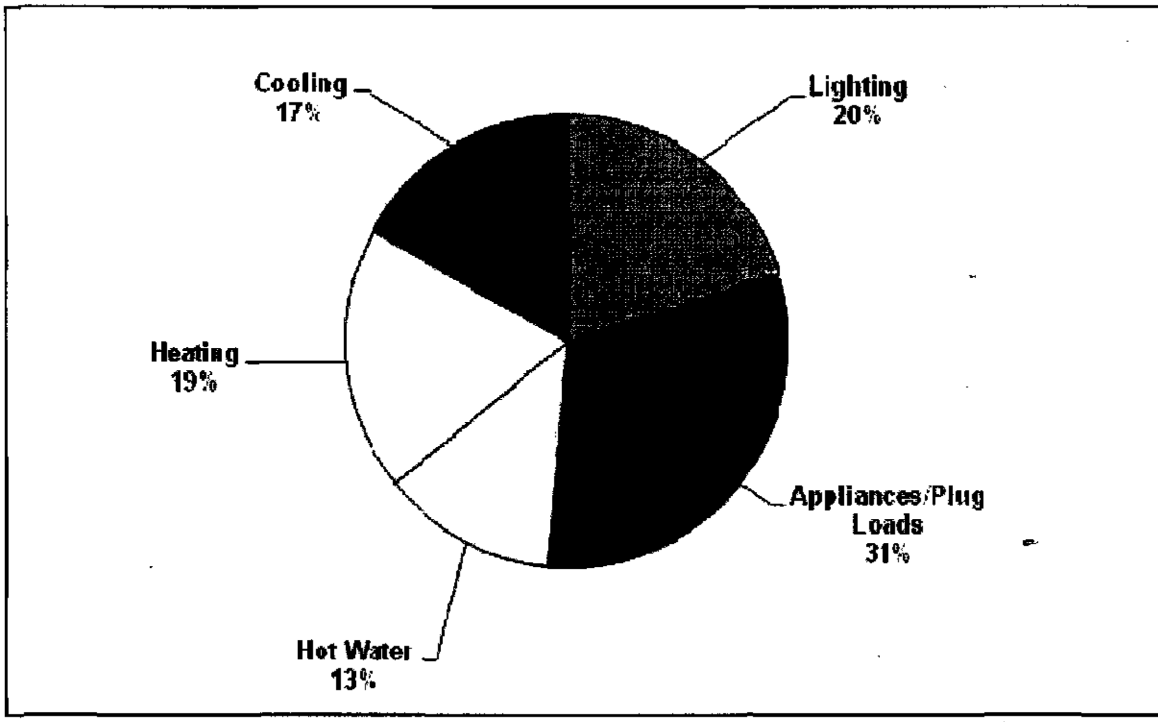


The saturation rates of electric end uses among electricity customers are indicated in the table below. These reflect the saturation rate of an end use among only CSP residential electricity customer households (HH below). The intensity of each electric end use was calculated by multiplying the Unit Energy Consumption (UEC) for each end use by the saturation rates among CSP *residential electricity* customers. Ultimately, this gives the amount of electricity sold by CSP that is used for a given end use.

Table 2-2. Residential Market Profile – Electricity

End use	Saturation (% of electric customer HH)	UECs (kWh/SQFT)	Intensity (kWh/SQFT)	CSP Sales (GWh)
Lighting	100.0%	1.25	1.25	1,532
Appliances/Plug Loads	100.0%	1.92	1.92	2,358
Hot Water	34.2%	2.29	0.78	962
Heating	22.8%	5.11	1.16	1,429
Cooling	97.0%	1.07	1.04	1,283
Total			**6.16**	**7,564**

Figure 2-3. Residential Market Profile – Electricity



2.1.2 Commercial and Industrial Sector Market Profiles

Commercial and Industrial sector profiles were built starting with segment-level sales data provided by CSP. The data were generated by CSP to illuminate the demand response potential in the commercial and industrial sectors. As a result, the detailed data represent all industrial customers and the largest commercial customers. The data represent 31% of all commercial customers, but more than 80% of all commercial sales when compared to 2006 EIA data. Summit Blue assumed the rest of the commercial sector was represented proportionally with the data provided for demand response. The detail of these data provides good insight into the size and consumption of these sectors.

For the commercial sector the CSP and EIA sales data were used in conjunction with the 2007 Buildings Energy Data Book (BEDB). This resource is national in scope and does not differentiate for climate and facility size data that are specific to the CSP service territory. On the other hand, the Data Book is very useful for parsing out climate independent electricity and natural gas loads at the segment level. The Energy Consumption Surveys (ECSs) for each sector are more specific to the CSP region. Differences between BEDB and ECSs were attributed to climate with a greater emphasis on heating for the CSP service territory. These two resources effectively generate the Unit Energy Consumption (UEC) for each end use. Commercial sales by end use are directly derived from the energy intensity estimates from BEDB and CBECS and sales data from CSP.

Secondary resources for manufacturing market shares are much less regionally specific. The Manufacturing Energy Consumption Survey (MECS) publishes census region data at a highly aggregated level and manufacturing segment data on a national level. However, the consumption data are broken out into useful end-use bins. By combining the MECS breakouts with the industrial segment sales data for CSP we were able to produce good resolution of consumption by end-use for the entire CSP industrial sector.

The table below shows the share of electricity consumed by the commercial sector broken out by 20 segments. In some cases, there are similarities among segments. For example, much of the government segments and most of the Financial/Insurance/Real Estate consumption can be accurately characterized as office space.

Table 2-3. Commercial Sector Breakout – Electricity

End use	CSP Sales Share	CSP Sales (MWh)
Financial/Insurance/Real Estate	21.0%	1,737,315
Education	16.3%	1,349,797
Retail Trade	10.0%	828,114
Unknown	8.3%	684,506
Health	7.3%	608,798
Miscellaneous Services	7.3%	607,902
Restaurants	6.1%	509,041
Grocery Stores	4.2%	346,230
Car Sales & Service	3.4%	279,969
State Government	3.2%	263,110
Wholesale Trade-NonDurable	3.0%	244,516
Local Government	2.7%	220,974
Hotels/Motels	2.6%	218,280
Entertainment	1.9%	153,860
Federal Government	1.2%	95,792
Wholesale Trade-Durable	0.8%	67,772
Museum/Zoo	0.4%	34,029
Sales for Resale	0.4%	31,286
Private Households	0.04%	3,358
Services NEC	0.03%	2,442
Total	**100%**	**8,287,100**

Figure 2-4. Commercial Sector Breakout - Electricity

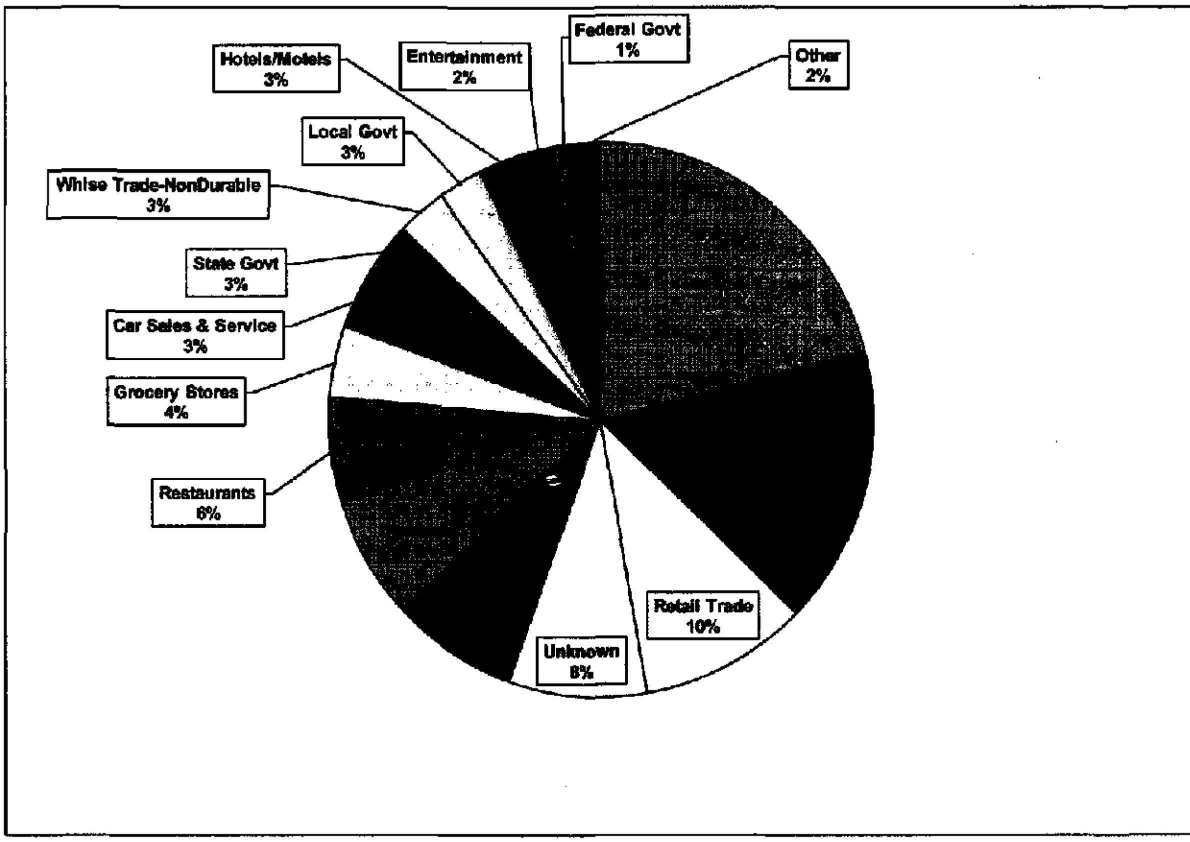
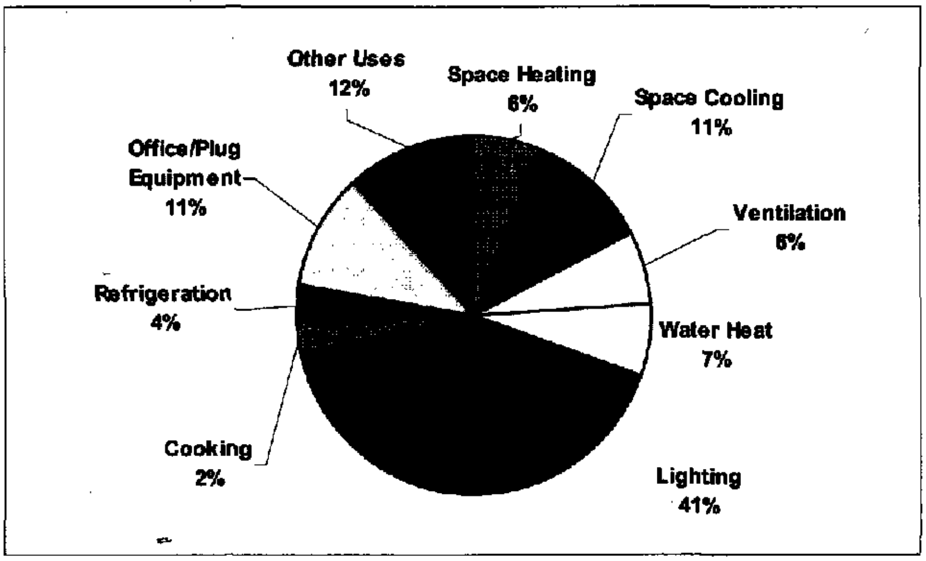


Table 2-4. Commercial Market Profile – Electricity

End use	Share (% of sq.ft.)	UECs (kWh/sq.ft.)	Intensity (kWh/sq.ft.)	CSP Sales (GWh)
Space Heating	13%	9.9	1.3	515.1
Space Cooling	57%	4.1	2.3	943.1
Ventilation	100%	1.3	1.3	510.2
Water Heat	35%	3.9	1.4	562.5
Lighting	100%	8.5	8.5	3,417.4
Cooking	25%	1.7	0.4	178.4
Refrigeration	33%	2.4	0.8	313.7
Office/Plug Equipment	84%	2.6	2.2	887.3
Other Uses	100%	2.4	2.4	959.4
Total			**20.5**	**8,287**

Figure 2-5. Commercial Market Profile - Electricity

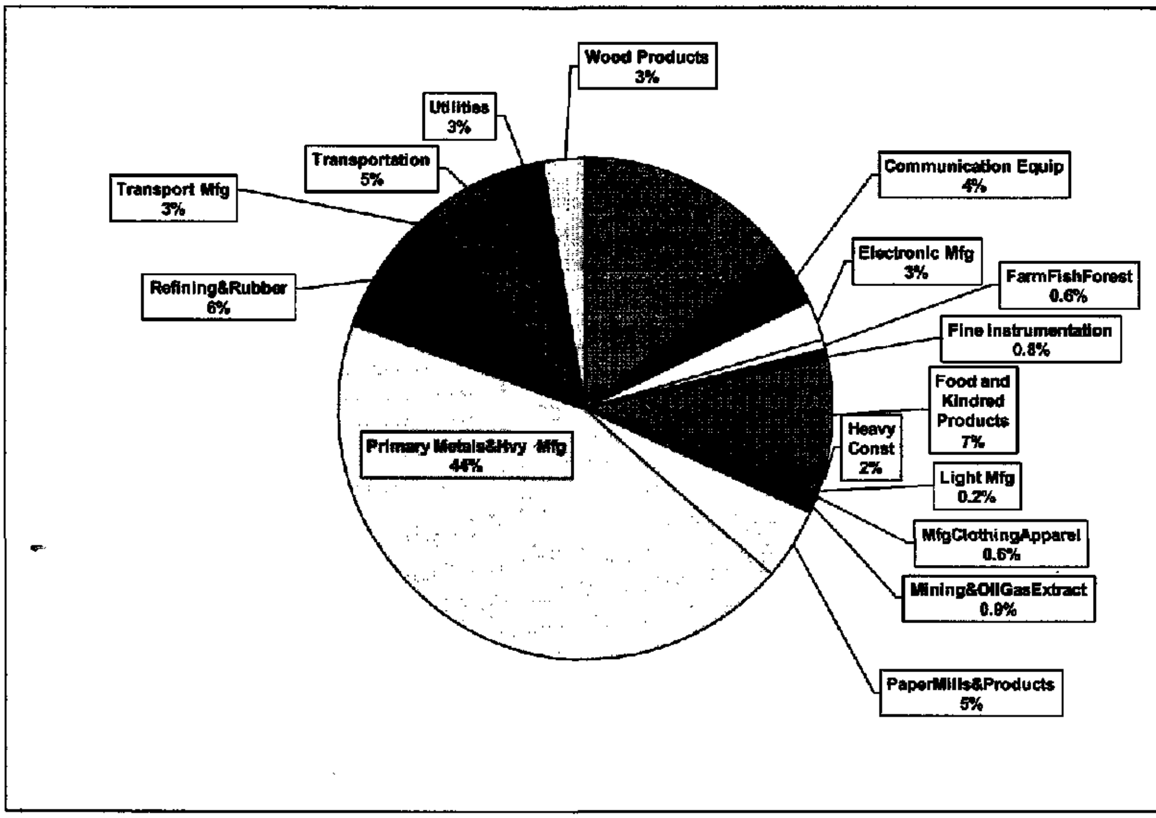


Data Provided by CSP break out industrial sales into 17 segments shown below. The sector is dominated by Primary Metals with almost 44% of total industrial sales.

Table 2-5. Industrial Sector Breakout – Electricity

End use	CSP Sales Share	CSP Sales (MWh)
Primary Metals & Heavy Manufacturing	44.0%	2,391,829
Chemical & Allied Products	14.3%	777,395
Food and Kindred Products	6.7%	363,718
Refining & Rubber	6.5%	353,095
Transportation	5.1%	277,204
Paper Mills & Products	4.7%	254,430
Communication Equipment	3.7%	201,464
Wood Products	2.8%	152,434
Utilities	2.6%	140,544
Transport Manufacturing	2.6%	139,719
Electronic Manufacturing	2.6%	139,531
Heavy Construction	1.5%	81,655
Mining & Oil Gas Extraction	0.9%	48,566
Fine Instrumentation	0.8%	41,426
Farm Fish Forest	0.6%	33,979
Manufacturing Clothing Apparel	0.6%	31,032
Light Manufacturing	0.2%	9,817
Total	**100.0%**	**5,437,839**

Figure 2-6. Industrial Sector Breakout – Electricity

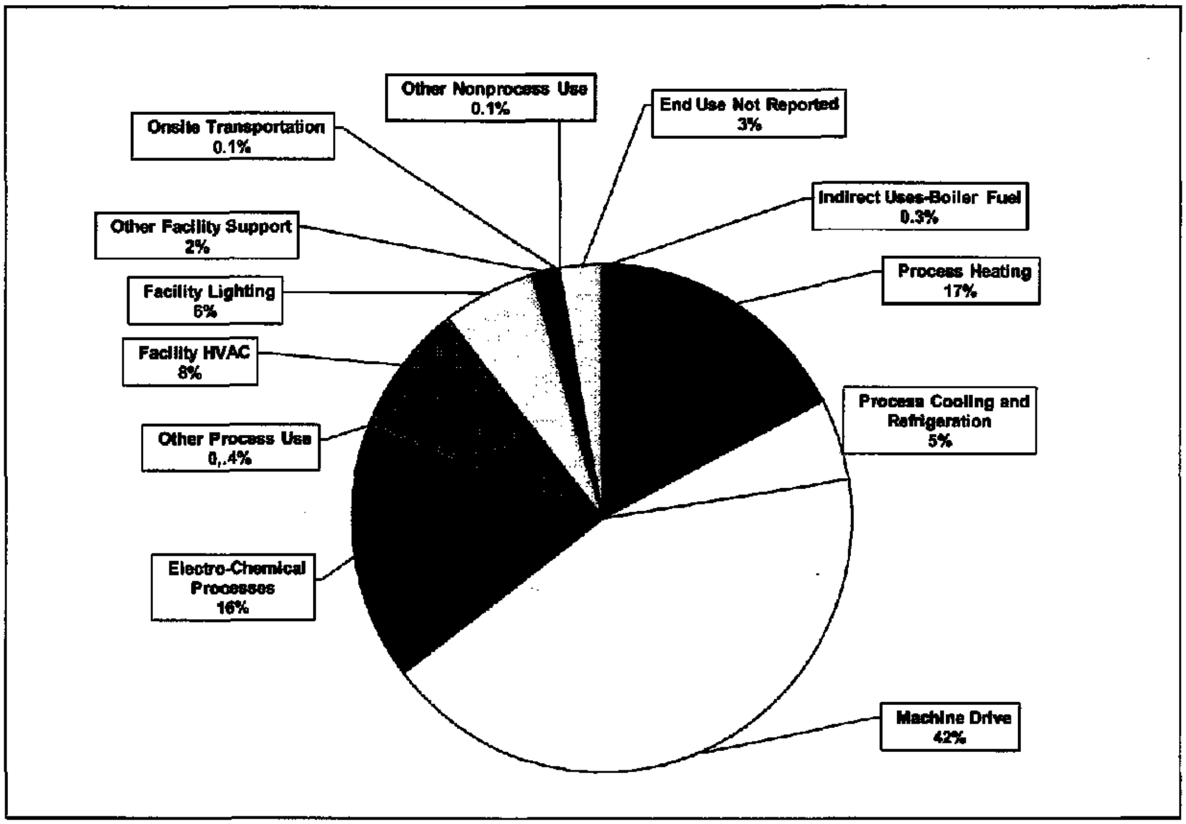


On an end-use basis, machine drives dominate the profile with substantial contributions from process heating and electrochemical processes.

Table 2-6. Industrial Market Profile – Electricity

End use	Midwest Electricity Shares	CSP Sales (GWh)
Indirect Uses-Boiler Fuel	0.3%	14
Process Heating	17.1%	928
Process Cooling and Refrigeration	5.2%	284
Machine Drive	42.0%	2,285
Electro-Chemical Processes	16.3%	888
Other Process Use	0.4%	24
Facility HVAC	8.1%	442
Facility Lighting	6.0%	326
Other Facility Support	1.5%	82
Onsite Transportation	0.1%	7
Other Non-process Use	0.1%	6
End Use Not Reported	2.8%	153
Total	**100.0%**	**5,438**

Figure 2-7. Industrial Market Profile – Electricity



2.2 Baseline Technology Profiles

To estimate the potential for energy savings, it is desirable to have a snapshot of the appliance and equipment inventory in the area of study, including type of equipment and efficiency level. For the residential sector, Summit Blue used the 2006 CSP Residential Appliance Saturation Survey data for the type of equipment. In the absence of primary market research, one must rely on secondary sources, none of which provides adequate information by itself. For example, the EIA surveys, RECS and CBECS have some information about technologies used in residential and non-residential buildings and the age of appliances and equipment which we can use to infer efficiency levels. Other sources, including publicly-available utility studies, statewide studies, and research papers also have some limited information about efficiency levels. We used a variety of sources, together with our experience and judgment, to develop technology profiles for the key end uses presented below. These sources include:

- 2006 Residential Appliance Saturation Survey Data for CSP.
- 2005 Residential Energy Consumption Survey (RECS), Energy Information Administration. http://www.eia.doe.gov/emeu/recs/recs2005/hc2005_tables/detailed_tables2005.html East North Central census division.
- 2003 Commercial Buildings Energy Consumption Survey (CBECS), by census division produced by the Energy Information Agency (EIA), US Department of Energy (US-DoE), http://www.eia.doe.gov/emeu/cbecs/ East North Central census division.
- 2007 Buildings Energy Data Book, Department of Energy, Energy Efficiency and Renewable Energy, September 2007. http://buildingsdatabook.eere.energy.gov/.
- *Midwest Residential Market Assessment and DSM Potential Study*, Midwest Energy Efficiency Alliance, March 2006. http://www.mwalliance.org/image/docs/resources/MEEA-Resource-5.pdf.
- 2006 Characteristics of New Housing, U.S. Census Bureau. http://www.census.gov/const/www/charindex.html.
- Kansas Energy Council DSM Potential Study and Plan, 2008. http://kec.kansas.gov/reports/KEC_DSM_Final_081108.pdf

The estimate of the fraction of inefficient equipment for the residential sector is based on the 2006 MEEA Midwest Residential Market Assessment for Ohio. The non-residential estimates of the inefficient fraction for heating, cooling and water heat end uses are based on the Kansas Energy Council report. These fractions are consistent with Summit Blue observations of commercial equipment in operation coupled with average equipment age data detailed in the Buildings Energy Data Book.

Table 2-7. Residential Technology Shares

End use	Technology	Electric Customer Technology Share	Fraction not efficient
Cooling	Heat Pump	13%	97%
	Central AC	72%	96%
	Room AC	13%	63%
	None	3%	0%
Space heat	Heat Pump	11%	97%
	Electric Furnace	12%	0%
	Natural Gas Furnace/Boiler	72%	73%
	Other Fuel	5%	NA
Lighting*	Incandescent	66%	100%
	Compact Fluorescent Light (CFL)	1%	0%
	Halogen	3%	100%
	Fluorescent	29%	90%
Water Heater	Electric	34%	71%
	Gas/Propane/LPG	66%	90%
Appliances	Dishwasher	76%	63%
	Clothes Washer	94%	NA
	Primary Freezer	38%	82%
	Second Freezer	3%	82%
	Electric Dryer	87%	94%
	1st Refrigerator	99%	69%
	2nd Refrigerator	25%	69%

** Lighting was not included in 2006 CSP RASS data. Lighting is based on 2005 RECS.*

Data for saturation of Non-residential technology and fuel share were based on the Commercial Building Energy Consumption Survey (CBECS) census division data for the commercial sector and the Kansas Energy Council report[14] for the fraction of inefficient equipment.

Table 2-8. Non-Residential Technology Shares

End use	Technology	Electric Customer Technology Share	Fraction not efficient
Space heat	Heat Pump	7%	88%
	Other Electric	10%	0%
	Gas Furnace	55%	88%
	Gas Boiler	28%	90%
Cooling	Heat Pump	7%	88%
	Packaged Direct Expansion (DX)	62%	88%
	Chiller	29%	88%
	Other	2%	88%
Water heating	Electric	40%	90%
	Gas	60%	88%
Lighting	Incandescent	8%	100%
	Fluorescent	74%	62%
	Compact Fluorescent Light (CFL)	3%	0%
	High Intensity Discharge (HID)	14%	7%

The technology share applies only to those customers who have a particular end use. Thus, of the portion of commercial floor space that has cooling, 62% employ packaged direct expansion (DX) equipment. Inefficient HID lighting only includes mercury vapor systems.

[14] Kansas Energy Council DSM Potential Study and Plan Final Report, submitted to: The Kansas Energy Council, August 1, 2008, Summit Blue Consulting, LLC.

3 BASELINE CONSUMPTION PROFILES - OPC

In this section, we describe the development of baseline market profiles and baseline technology profiles.

3.1 Baseline Market Profiles

Summit Blue developed profiles for each sector — residential, commercial and industrial — for the Ohio Power Company (OPC) service territory. Key data sources included:

- Electricity sales data provided by OPC.
- 2006 Residential Appliance Saturation Survey data for OPC.
- Utility-level electricity sales data by sector from Form EIA-862, Annual Electric Power Industry Report, file 2. http://www.eia.doe.gov/cneaf/electricity/page/eia862.html.
- *Midwest Residential Market Assessment and DSM Potential Study*, Midwest Energy Efficiency Alliance, March 2006. http://www.mwalliance.org/image/docs/resources/MEEA-Resource-5.pdf.
- 2007 Buildings Energy Data Book, U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy. http://buildingsdatabook.eere.energy.gov/.
- 2005 Residential Energy Consumption Survey (RECS), Energy Information Administration. http://www.eia.doe.gov/emeu/recs/recs2005/hc2005_tables/detailed_tables2005.html East North Central[15] census division.
- 2003 Commercial Buildings Energy Consumption Survey (CBECS), by census division produced by the Energy Information Agency (EIA), US Department of Energy (US-DoE), http://www.eia.doe.gov/emeu/cbecs/ East North Central[1] census division.
- 2002 Manufacturing Energy Consumption Survey (MECS), by census region produced by the Energy Information Agency (EIA), US Department of Energy (US-DoE), http://www.eia.doe.gov/emeu/mecs/ Midwest Census Region.[16]
- 2008 Building America Benchmark (BABM). http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/42662.pdf.

The methodology used started with sales and customer count data from OPC. The sales data were cross verified and adjusted with 2007 EIA reported data. The tables below are based on OPC sales data for 2007.

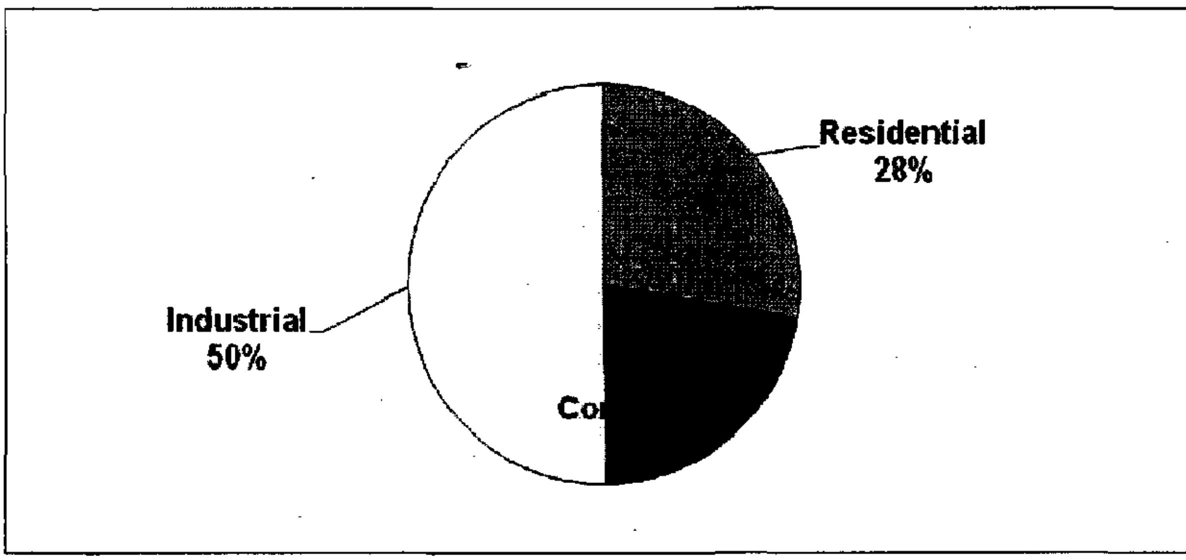
[15] Includes the states of WI, IL, IN, OH and MI

[16] Includes the states of WI, IL, IN, OH, MI, ND, SD, NE, KS, MO, IA and MN.

Table 3-1. Market Profile – Electricity (2007)

Market Sector	Sales MWh	Customers	kWh per Customer
Residential	7,674,433	619,274	12,393
Commercial	6,101,774	93,336	65,374
Industrial	13,951,535	7,402	1,884,833
Total Billed	**27,727,742**	**720,012**	

Figure 3-1. Market Profile – Electricity



3.1.1 Residential Sector Market Profile

The residential sector market profile is built up out of four major sources. OPC total consumption and customer number data for 2007 were used for baseline annual electricity consumption. OPC monthly residential load data for 2007 was used to generate the monthly electricity consumption profile. The 2006 OPC Residential Appliance Saturation Survey data was used for technology saturation data. The 2007 Building America Benchmark (BABM) and a California lighting survey were used for generating annual end use estimates and seasonal electricity consumption profiles.

Residential Electricity Market Profile

The derivation of the residential electricity market profile relied on monthly consumption data and benchmark monthly profiles of end uses to derive annual electricity consumption for seasonal and non-seasonal uses. The starting point in this exercise was the OPC system-level residential electricity consumption by month for 2007. The household total electricity consumption by month was calculated from this data. There are four seasonal end uses that were tabulated (heating, cooling, hot water, and lighting) in addition to the non-seasonal end uses (includes appliances, plug loads, and other).

Hot Water. Seasonal hot water end use was calculated using the hot water end use profiles from the 2008 Building America Benchmark (BABM) multiplied by the saturations of the various hot water end uses. Monthly electricity consumption for homes with electric domestic hot water was then calculated using seasonally-adjusted mains water temperatures. This monthly domestic hot water electricity profile was then multiplied by the electric domestic hot water saturation to derive the average household monthly domestic hot water electricity profile.

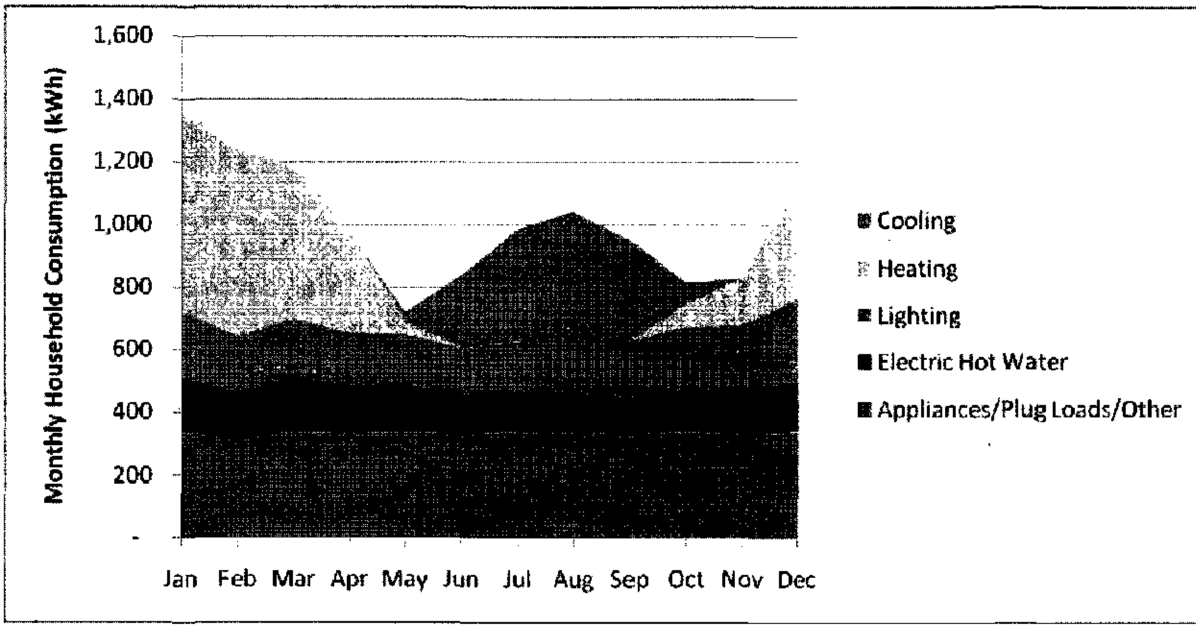
Lighting. Annual lighting consumption per household was estimated using the BABM. Lighting use increases during the winter months when there is less daylight. The seasonal lighting variation profile was derived from a recent California CFL monitoring study, with an addition to December for holiday lighting. The average household monthly lighting electricity consumption was calculated by multiplying the profile by the annual lighting consumption estimate.

Non-Seasonal End uses (Appliances, Plug Loads, Other). After subtracting the hot water and lighting end uses from the annual household electricity consumption profile, the remaining profile has two local minima, one in the spring and one in the fall. It was assumed that during the minimum consumption month (April), heating and cooling each make up 5% of the total electricity consumed for that month. The base, non-seasonal monthly electricity consumption was then calculated as the total consumption for April minus the seasonal end uses for April. This includes all appliances, plug loads, and other non-seasonal end uses.

Heating and Cooling. Summit Blue's experience has shown that heating and cooling energy make up 10% of total electricity consumption in typical homes in the minimum consumption month. After assuming that the minimum consumption month included 5% heating and 5% cooling, the monthly heating and cooling electricity was calculated by subtracting the hot water, lighting, and base end uses from the total for each month. For May to September, all of the heating and cooling electricity is assumed to be cooling. For November to March, all of the heating and cooling electricity is assumed to be heating. For the last month, October, it is assumed that half the heating and cooling electricity is used for cooling and half is used for heating. The annual heating and cooling end uses were then calculated by summing the monthly heating and cooling end uses.

The resulting annual end use profiles are shown in the figure below.

Figure 3-2. Residential Monthly Electricity End use Breakdown

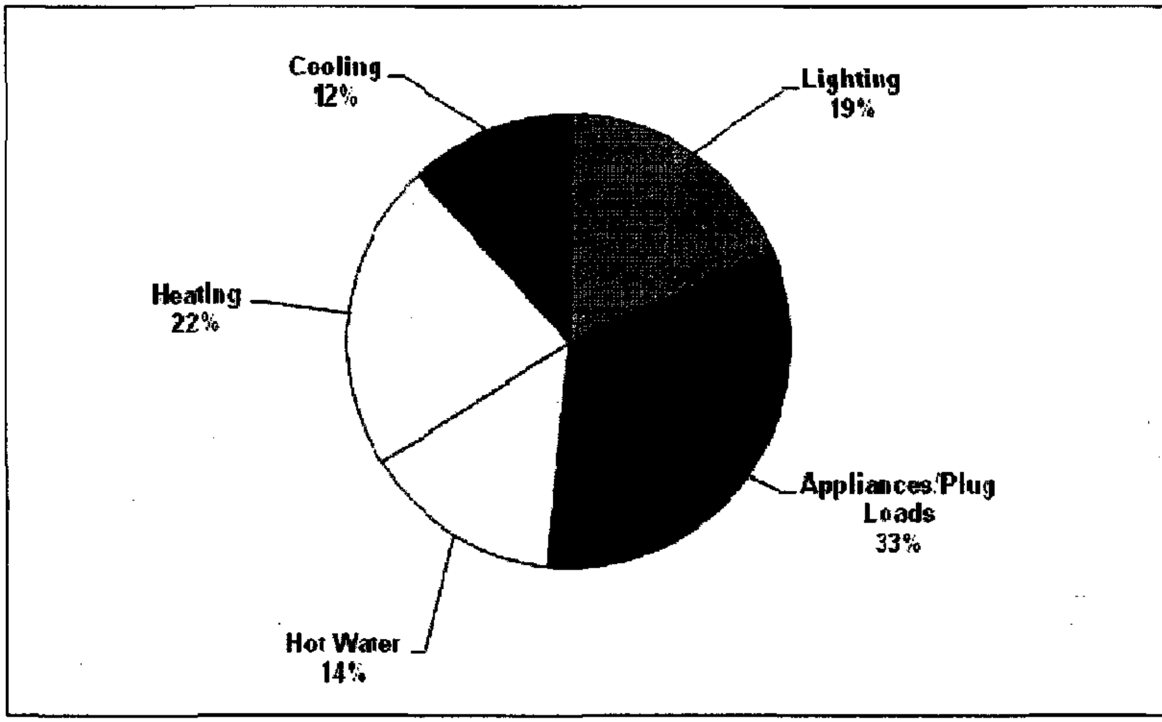


The saturation rates of electric end uses among electricity customers are indicated in the table below. These reflect the saturation rate of an end use among only OPC residential electricity customer households (HH below). The intensity of each electric end use was calculated by multiplying the Unit Energy Consumption (UEC) for each end use by the saturation rates among OPC *residential electricity* customers. Ultimately, this gives the amount of electricity sold by OPC that is used for a given end use.

Table 3-2. Residential Market Profile – Electricity

End use	Saturation (% of electric customer HH)	UECs (kWh/SQFT)	Intensity (kWh/SQFT)	OPC Sales (GWh)
Lighting	100.0%	1.25	1.25	1,390
Appliances/Plug Loads	100.0%	2.23	2.23	2,483
Hot Water	42.6%	2.27	0.97	1,076
Heating	20.4%	7.33	1.49	1,665
Cooling	93.0%	0.86	0.80	887
Total			**6.73**	**7,502**

Figure 3-3. Residential Market Profile – Electricity



3.1.2 Commercial and Industrial Sector Market Profiles

Commercial and Industrial sector profiles were built starting with segment-level sales data provided by OPC. The data were generated by OPC to illuminate the demand response potential in the commercial and industrial sectors. As a result the detailed data represent all industrial customers and the largest commercial customers. The data represent 31% of all commercial customers, but more than 80% of all commercial sales when compared to 2006 EIA data. Summit Blue assumed the rest of the commercial sector was represented proportionally with the data provided for demand response. The detail of these data provides good insight into the size and consumption of these sectors.

For the commercial sector the OPC and EIA sales data were used in conjunction with the 2007 Buildings Energy Data Book (BEDB). This resource is national in scope and does not differentiate for climate and facility size data that are specific to the OPC service territory. On the other hand, the Data Book is very useful for parsing out climate independent electricity and natural gas loads at the segment level. The Energy Consumption Surveys (ECSs) for each sector are more specific to the OPC region. Differences between BEDB and ECSs were attributed to climate with a greater emphasis on heating for the OPC service territory. These two resources effectively generate the Unit Energy Consumption (UEC) for each end use. Commercial sales by end use are directly derived from the energy intensity estimates from BEDB and CBECS and sales data from OPC.

Secondary resources for manufacturing market shares are much less regionally specific. The Manufacturing Energy Consumption Survey (MECS) publishes census region data at a highly aggregated level and manufacturing segment data on a national level. However the consumption data are broken out into useful end-use bins. By combining the MECS breakouts with the industrial segment sales data for

OPC, we were able to produce good resolution of consumption by end-use for the entire OPC industrial sector.

The table below shows the share of electricity consumed by the commercial sector broken out by 20 segments. In some cases, there are similarities among segments. For example, much of the government segments and most of the Financial/Insurance/Real Estate consumption can be accurately characterized as office space

Table 3-3. Commercial Sector Breakout – Electricity

End use	OPC Sales Share	OPC Sales (MWh)
Retail Trade	16.1%	921,275
Education	15.3%	878,233
Health	13.7%	783,815
Restaurants	9.9%	565,566
Financial/Insurance/Real Estate	8.7%	497,522
Grocery Stores	8.4%	482,241
Miscellaneous Services	6.5%	372,580
Car Sales & Service	5.3%	306,666
Local Government	4.5%	257,972
Unknown	3.6%	204,695
State Government	2.1%	121,787
Entertainment	1.7%	99,628
Hotels/Motels	1.3%	74,879
Wholesale Trade-Durable	1.2%	70,018
Wholesale Trade-Non Durable	1.1%	65,356
Museum/Zoo	0.2%	13,329
Sales for Resale	0.1%	8,546
Federal Government	0.1%	5,226
Services NEC	0.1%	3,736
Private Households	0.0%	148
Total	**100%**	**5,733,200**

Figure 3-4. Commercial Sector Breakout - Electricity

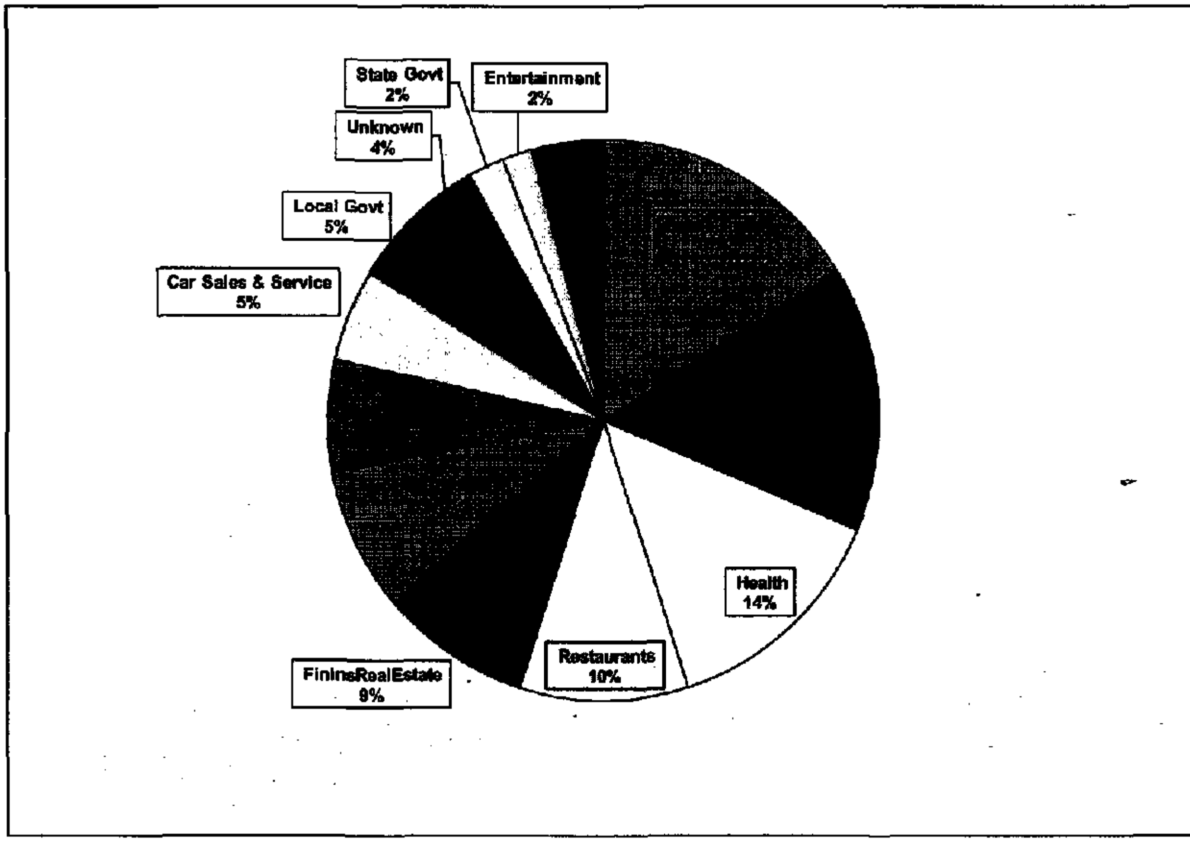
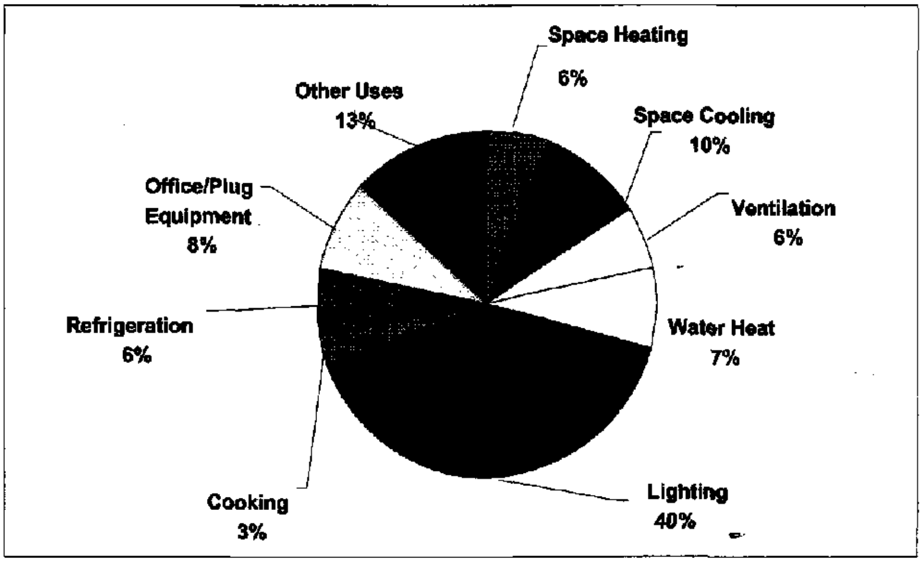


Table 3-4. Commercial Market Profile – Electricity

End use	Share (% of sq.ft.)	UECs (kWh/sq.ft.)	Intensity (kWh/sq.ft.)	OPC Sales (GWh)
Space Heating	13%	9.2	1.2	334.9
Space Cooling	57%	3.7	2.1	596.1
Ventilation	100%	1.2	1.2	325.2
Water Heat	35%	4.2	1.5	422.5
Lighting	100%	8.1	8.1	2,281.1
Cooking	25%	2.4	0.6	168.1
Refrigeration	33%	3.8	1.3	353.7
Office/Plug Equipment	84%	2.1	1.7	486.2
Other Uses	100%	2.7	2.7	765.6
Total			**20.3**	**5,733.2**

Figure 3-5. Commercial Market Profile - Electricity

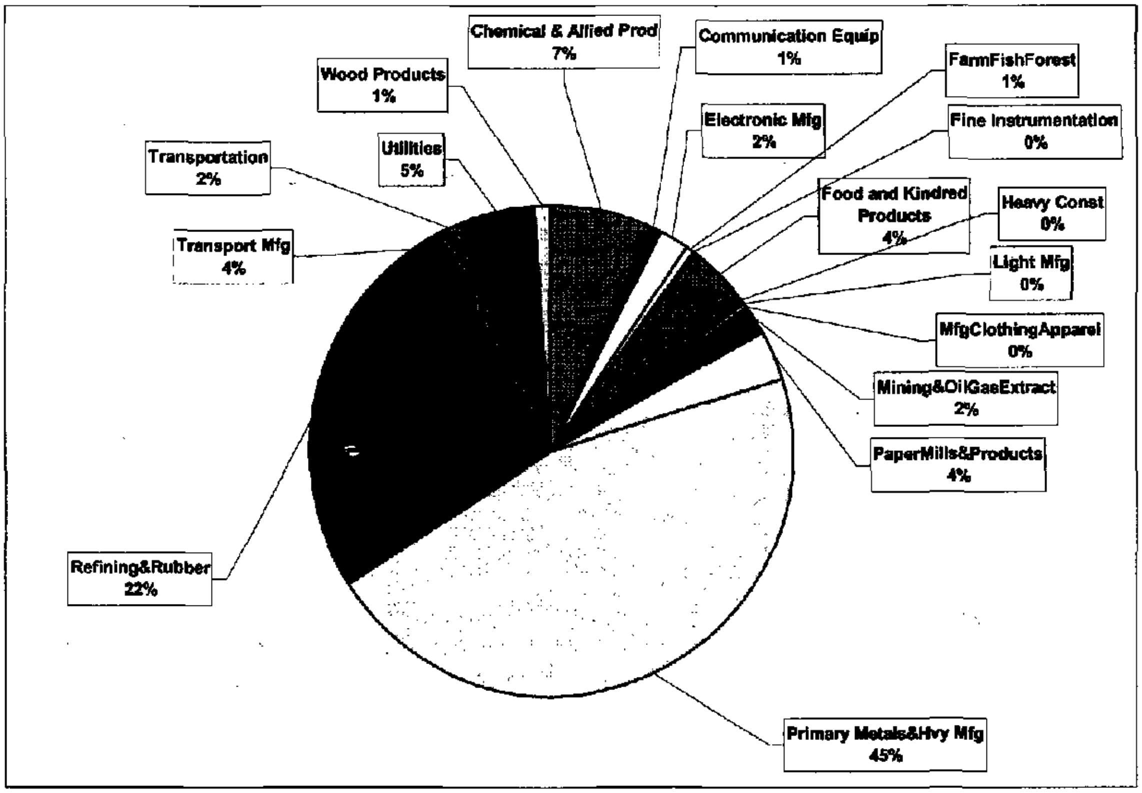


Data Provided by OPC break out industrial sales into 21 segments shown below. The sector is dominated by Primary Metals with more than 45% and Refining and Rubber with over 22% of total industrial sales, with these two segments providing over two-thirds of industrial sales.

Table 3-5. Industrial Sector Breakout – Electricity

End use	OPC Sales Share	OPC Sales (MWh)
Primary Metals & Heavy Manufacturing	45.4%	6,386,246
Refining & Rubber	22.5%	3,164,287
Chemical & Allied Products	6.7%	940,376
Utilities	4.8%	678,495
Transport Manufacturing	4.1%	577,891
Food and Kindred Products	3.9%	550,830
Paper Mills & Products	3.5%	495,803
Electronic Manufacturing	2.1%	294,277
Transportation	1.9%	264,362
Mining & Oil Gas Extraction	1.8%	250,803
Wood Products	1.0%	139,829
Communication Equipment	0.7%	104,234
Farm Fish Forest	0.5%	72,133
Fine Instrumentation	0.4%	55,334
Heavy Construction	0.3%	44,477
Light Manufacturing	0.2%	35,091
Manufacturing Clothing Apparel	0.2%	24,924
Other Facility Support	1.7%	186
Onsite Transportation	0.2%	21
Other Non-process Use	0.2%	20
End use Not Reported	2.9%	320
Total	**100.0%**	**14,079,391**

Figure 3-6. Industrial Sector Breakout – Electricity

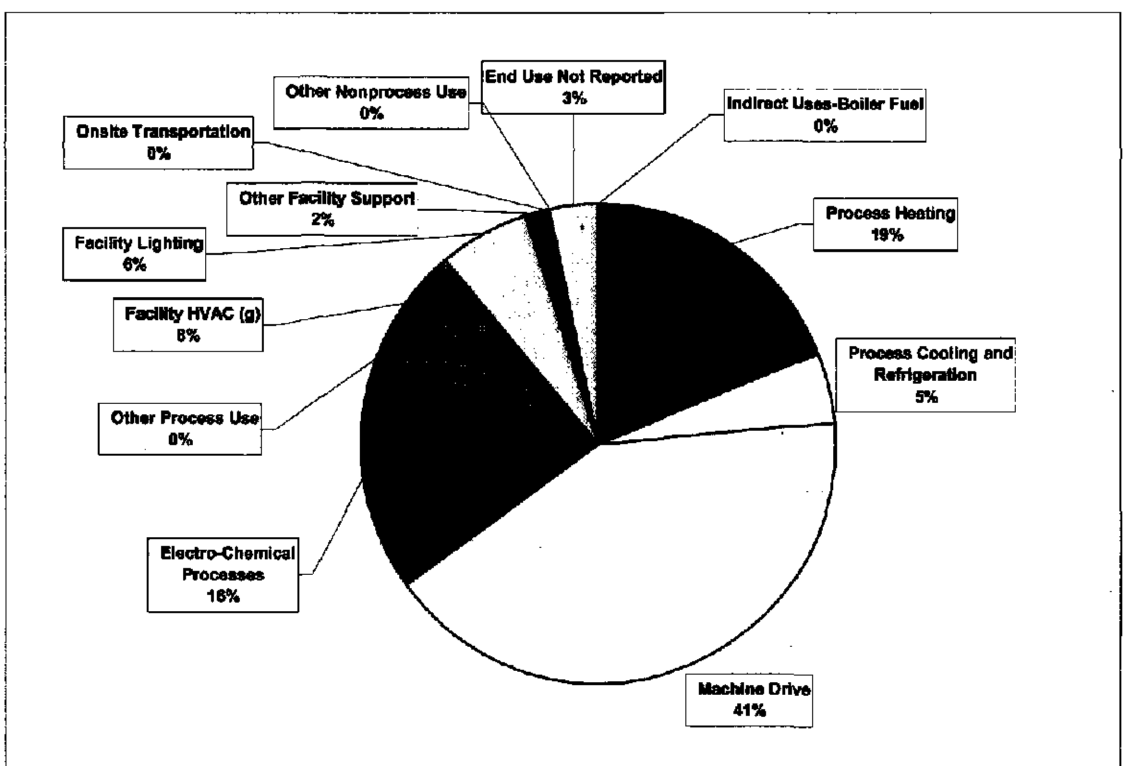


On an end-use basis, machine drives dominate the profile with substantial contributions from process heating and electrochemical processes.

Table 3-6. Industrial Market Profile – Electricity

End use	Midwest Electricity Shares	OPC Sales (GWh)
Indirect Uses-Boiler Fuel	0.2%	27
Process Heating	18.7%	2,629
Process Cooling and Refrigeration	4.7%	664
Machine Drive	41.5%	5,850
Electro-Chemical Processes	15.7%	2,207
Other Process Use	0.4%	61
Facility HVAC	7.7%	1,091
Facility Lighting	6.0%	846
Other Facility Support	1.5%	215
Onsite Transportation	0.1%	19
Other Nonprocess Use	0.1%	11
End Use Not Reported	3.3%	458
Total	**100.0%**	**14,079**

Figure 3-7. Industrial Market Profile – Electricity



3.2 Baseline Technology Profiles

To estimate the potential for energy savings, it is desirable to have a snapshot of the appliance and equipment inventory in the area of study, including type of equipment and efficiency level. For the residential sector, Summit Blue used the 2006 OPC Residential Appliance Saturation Survey for the type of equipment. In the absence of primary market research, one must rely on secondary sources, none of which provides adequate information by itself. For example, the EIA surveys, RECS and CBECS have some information about technologies used in residential and non-residential buildings and the age of appliances and equipment which we can use to infer efficiency levels. Other sources, including publicly-available utility studies, statewide studies, and research papers, also have some limited information about efficiency levels. We used a variety of sources, together with our experience and judgment, to develop technology profiles for the key end uses presented below. These sources include:

- 2006 Residential Appliance Saturation Survey data for OPC.
- 2005 Residential Energy Consumption Survey (RECS), Energy Information Administration. http://www.eia.doe.gov/emeu/recs/recs2005/hc2005_tables/detailed_tables2005.html East North Central census division.
- 2003 Commercial Buildings Energy Consumption Survey (CBECS), by census division produced by the Energy Information Agency (EIA), US Department of Energy (US-DoE), http://www.eia.doe.gov/emeu/cbecs/ East North Central census division.
- 2007 Buildings Energy Data Book, Department of Energy, Energy Efficiency and Renewable Energy, September 2007. http://buildingsdatabook.eere.energy.gov/.
- *Midwest Residential Market Assessment and DSM Potential Study*, Midwest Energy Efficiency Alliance, March 2006. http://www.mwalliance.org/image/docs/resources/MEEA-Resource-5.pdf.
- 2006 Characteristics of New Housing, U.S. Census Bureau. http://www.census.gov/const/www/charindex.html.
- Kansas Energy Council DSM Potential Study and Plan, 2008. http://kec.kansas.gov/reports/KEC_DSM_Final_081108.pdf

The estimate of the fraction of inefficient equipment for the residential sector is based on the 2006 MEEA Midwest Residential Market Assessment for Ohio. The non-residential estimates of the inefficient fraction for heating, cooling and water heat end uses are based on the Kansas Energy Council report. These fractions are consistent with Summit Blue observations of commercial equipment in operation coupled with average equipment age data detailed in the Buildings Energy Data Book.

Table 3-7. Residential Technology Shares

End use	Technology	Electric Customer Technology Share	Fraction not efficient
Cooling	Heat pump	7%	97%
	Central AC	66%	96%
	Room AC	20%	63%
	None	7%	0%
Space heat	Heat Pump	8%	97%
	Electric Furnace	13%	0%
	Natural Gas furnace/Boiler	63%	73%
	Other Fuel	16%	NA
Lighting*	Incandescent	66%	100%
	Compact Fluorescent Light (CFL)	1%	0%
	Halogen	3%	100%
	Fluorescent	29%	90%
Water Heater	Electric	43%	71%
	Gas/Propane/LPG	57%	90%
Appliances	Dishwasher	61%	63%
	Clothes Washer	94%	NA
	Primary Freezer	61%	82%
	Second Freezer	7%	82%
	Electric Dryer	90%	94%
	1st Refrigerator	99%	69%
	2nd Refrigerator	31%	69%

** Lighting was not included in 2006 CSP RASS data. Lighting is based on 2005 RECS.*

Data for saturation of Non-residential technology and fuel share were based on the Commercial Building Energy Consumption Survey (CBECS) census division data for the commercial sector and the Kansas Energy Council report[17] for the fraction of inefficient equipment.

Table 3-8. Non-Residential Technology Shares

End use	Technology	Electric Customer Technology Share	Fraction not efficient
Space heat	Heat Pump	7%	88%
	Other Electric	10%	0%
	Gas Furnace	55%	88%
	Gas Boiler	28%	90%
Cooling	Heat Pump	7%	88%
	Packaged Direct Expansion (DX)	62%	88%
	Chiller	29%	88%
	Other	2%	88%
Water heating	Electric	40%	90%
	Gas	60%	88%
Lighting	Incandescent	8%	100%
	Fluorescent	74%	62%
	Compact Fluorescent Light (CFL)	3%	0%
	High Intensity Discharge (HID)	14%	7%

The technology share applies only to those customers who have a particular end use. Thus, of the portion of commercial floor space that has cooling, 62% employ packaged direct expansion (DX) equipment. Inefficient HID lighting only includes mercury vapor systems.

[17] Kansas Energy Council DSM Potential Study and Plan Final Report, submitted to: The Kansas Energy Council, August 1, 2008, Summit Blue Consulting, LLC.

4 EE/PDR MEASURE CHARACTERIZATIONS

After estimating baseline consumption, characterization of EE/PDR measures requires: 1) determining the list of measures to evaluate, 2) estimating the incremental savings from each measure – improving from the baseline to the new technology, and 3) determining the incremental costs and lifetimes for each of the new technologies.

4.1 EE/PDR Measure List

The first step in the EE/PDR measure characterization process is to develop appropriate sets of measures for inclusion in this study. The measures selected for analysis are based on the experience of Summit Blue professionals to balance the need for thoroughness in examining the "measure universe" and the need for timely completion of our analysis within the project budget. The analyzed measures frequently pass various B/C tests in other areas; they are widespread in their potential application, thus garnering a large portion of the conservation potential. We then developed estimates of energy and demand savings, costs, and lifetimes in the residential and non-residential sectors.

The measures and descriptions of the technologies are provided in Appendix C. Three different program design options are included.

- **Replace on Burnout** (ROB) means that an EE/PDR measure is not implemented until the existing technology it is replacing fails. An example would be an energy efficient clothes washer being purchased after the failure of the existing clothes washer.
- **Retrofit** means that the EE/PDR measure could be implemented immediately. For instance, installing a low flow showerhead is usually implemented before an existing showerhead fails. Replacing incandescent lamps may be replaced on burnout, but they can be treated as a retrofit because of the relatively short lifetime for incandescent bulbs.
- **New Construction** means measures that are installed at the time of new construction. Baseline technologies may be different in the new construction market.

Analytically, these design options affect the savings estimates and measure costs.

The energy savings of Replace on Burnout measures is the incremental difference in energy use between the efficient measure and standard or code-compliant alternatives.[18] The incremental measure cost is the difference between a standard code-compliant unit and the Energy Star Measure. On the other hand, there is no incremental labor cost for the delivery and installation of the replace on burnout unit since the customer would have borne those costs, regardless, when replacing the failed unit.

New construction measures share many of the same characteristics of Replace on Burnout, since the baseline is again code-compliant. If R-30 ceiling insulation is code-compliant, then the R-38 measure savings is only the difference between a home with R-30 versus a home with R-38 insulation. The

[18] For example, replacing an old refrigerator (1500 kWh/year) on burn-out will save a lot of energy, because the efficiency of this appliance has improved greatly over the past 20 years. New code-compliant refrigerators (500 kWh) might save 67% of the energy consumed by the machine being replaced, but the savings from the Energy Star refrigerator (425 kWh) measure is only the difference between the Energy Star and code compliant unit (75 kWh) or about 15%.

incremental cost is mostly material cost for thicker blankets and the incremental labor cost can be $0, since the labor to roll out two R-19 blankets is roughly the same as rolling out R-11 on top of R-19.

In retrofit situations, the characterization can claim full savings between the baseline existing inefficient equipment and the measure, since arguably the customer could have left the baseline equipment as-is indefinitely. A typical example of this is adding insulation to existing homes. The incremental measure cost, though, is the full measure material cost (it does not cost any capital to do nothing with existing insulation), plus the full labor cost of installation.

4.2 Energy Savings Estimates

We used measure appropriate methods for estimating savings for climate-dependent measures and for climate-independent measures, such as water heating, appliances, and motors. Lighting use is typically climate independent; however, we used climate dependent methods (primarily hourly computer simulations) for lighting installed in conditioned areas, because lighting energy contributes to cooling loads and supplements heating equipment.

4.2.1 Climate-Dependent Measures

For climate-*dependent* measures, Summit Blue used a combination of building simulation modeling using the eQuest model and engineering estimates to estimate EE/PDR measure per unit savings. We first developed building prototypes based on the AEP Ohio customer information analyzed for the Market and Technology Profiles discussed in the previous section.

For the residential sector, Summit Blue used four prototypes: single family new and existing construction, manufactured housing, and multi-family residences. For each of these prototypes, we modeled measures with respect to electric resistance heating, heat pump heating, and gas heat.

Summit Blue chose to use three prototype buildings to represent the commercial sector: office, retail, and restaurant. These three segments include a significant portion of the commercial floor area and consumption (see Market Profile) and diverse energy end-uses. For each of these prototypes, we modeled measures with respect to electric heat pump heating and gas heat.

Summit Blue did not model industrial measures with the eQuest simulation tool, since we assume less climate dependence within this sector; thus, engineering calculations are sufficient.

With all prototypes, we calibrated the eQuest simulation for electric use to the market profiles developed with AEP Ohio's data, Ohio weather data, and then we estimated the EE/PDR measure savings impacts using the building simulation software.

4.2.2 Climate-Independent Measures

For the climate-*independent* EE/PDR measures, Summit Blue used many resources, including the U.S. Department of Energy ENERGY STAR Program,[19] the California Database of Energy Efficiency Resources (DEER),[20] deemed savings estimates from other jurisdictions (MN & MI), various utility online audit services, and manufacturer and national retailer data. We adjusted the energy and demand impacts for the AEP Ohio customer operating parameters as necessary. Other measures were analyzed using engineering principles, such as steady-state heat loss, rated power, and hours of operation. As appropriate, we considered interaction with heating and cooling systems, using factors developed with the eQuest model.

4.2.3 Direct Load Control Measures

The previous two sections describe methods used for conservation and efficiency measures. This study also looks at load control measures for demand response. AEP Ohio is a summer peaking utility. The summer peak is associated with air conditioning loads on hot summer days. Summit Blue characterized direct load control (DLC) measures for devices – primarily residential and small commercial air conditioning in the summer. Our estimates for costs and savings are based on *ex post* results from other utilities using a 50% cycling regimen.

4.3 EE/PDR Measure Costs and Lifetimes

For EE/PDR measure costs, Summit Blue used a variety of sources, primarily the DEER database, adjusted by geographic multiplier factors contained in industry sources, such as the RS Means *Mechanical Cost Data*. For EE/PDR measure lifetimes, a combination of resources was used, including manufacturer data, typical economic depreciation assumptions, the DEER database, and various studies reviewed for this project.

A select sample of results of the EE/PDR characterization are presented in Appendix C with the measure descriptions.

[19] http://www.energystar.gov/.

[20] http://www.energy.ca.gov/deer/.

5 Benchmarking and Best Practice Results

To ensure that the EE/PDR potential estimates that we develop are reasonable and appropriate, and to identify the best practices regarding DSM programs, we conducted a benchmarking assessment on other utilities' and agencies' DSM programs. We also collected information on selected national DSM programs that previous studies have identified as top performers. To identify common best practices of top performers, the analysis compares detailed program results by customer sector of those utilities identified as achieving high levels of DSM savings for below median costs.

The results suggest the performance benchmarks that a new EE/PDR program can reasonably be expected to achieve after an initial ramp up period of three to four years.

The next section discusses the organizations included in the analysis.

5.1 Organizations Reviewed

We collected data and information for DSM program results for 14 investor-owned utilities (IOUs) and agencies in nine states across three regions in the U.S. (see Table 5-1 below). The IOUs and agencies were selected as having established and/or aggressive DSM programs. Some of these data were collected for previous projects with additional locations included specifically for this report.

Table 5-1. Benchmarked Utilities and Agencies

Agencies and Investor-Owned Utilities			
Midwest		**Northeast**	
Interstate Power & Light	IA	Efficiency Maine	ME
Interstate Power & Light	MN	Efficiency Vermont	VT
MidAmerican Energy	IA	National Grid	MA
Minnesota Power	MN	NSTAR	MA
Otter Tail Power	MN	**West**	
Xcel Energy	MN	Arizona Public Service	AZ
Wisconsin Focus on Energy	WI	SWEPCO	TX
		Xcel Energy	CO

In North America, DSM is generally delivered by central agencies or utilities—investor- or government-owned. In the Midwest, DSM is generally provided through vertically integrated IOUs. The organizations examined in the Northeast region all provide DSM through a central agency, except the IOUs in Massachusetts. The results do not cover all DR provided by the Independent System Operators/Regional

Transmission Operators (ISO/RTOs) serving this region—PJM, NYISO and NE-ISO. In the West, as in the Midwest, most DSM is delivered through investor owned utilities.

5.2 Methodology

This section describes the methodology used to collect data and information, analyze and compare impacts and costs overall and by customer sector and by program where appropriate.

The benchmarking data for each organization were prepared as follows:

Collected reported incremental DSM program results for 2007:

- Expenditures[21]
- Energy savings
- Peak demand savings
- Program descriptions

The sources for almost all of the DSM program data were the utilities' and agencies' annual reports on their 2007 DSM programs.

Collected baseline data for 2007:

- Revenues
- Energy sales
- Peak demand

The main source for the baseline data was FERC Form 861 from the Energy Information Administration's web site (www.eia.doe.gov).

Categorized reported DSM program results and baseline data by major customer sector:

- Residential
- Commercial and industrial (C&I)

Normalized incremental results and expenditures overall and for the two major customer sectors:

- Expenditures as a percentage of revenue
- Energy savings as a percentage of energy sales
- Peak demand savings as a percentage of peak demand

Calculated costs of savings on a first year basis:

- Divided DSM expenditures by DSM program energy savings, $/kWh, first year
- Divided DSM expenditures by DSM peak demand savings, $/kW

Identified median of normalized spending, savings, and costs of saving.

[21] Expenditures for load management programs exclude rate discount incentives.

Identified best practice organizations--those with above median savings at below median costs of savings.

Analyzed DSM portfolios of best practice organizations at the program level.

It should be noted that the cost of energy savings is calculated on a first year basis. It is not levelized cost of lifetime savings, thus not comparable to supply side $/kWh (no organization includes the statistics needed to calculate levelized cost of lifetime savings in their annual regulatory DSM report). The cost of first year energy savings is used in this benchmarking analysis simply to identify 1) typical costs on a first year basis and 2) organizations that achieved savings at costs below the typical.

Although every effort is made to collect comparable data, given the inherent variation in organizations' evaluation and reporting practices and in their program offerings, the results cannot be considered a strictly "apples-and-apples" comparison. For example, not every utility offers low income programs or load management programs. Also, utilities may report estimated savings at meter, busbar, or generator; some utilities' methods for estimating savings may be more accurate than other utilities'; only some annual DSM reports included savings that were verified; and few distinguish net savings from gross savings. However, despite these variations in programming, reporting, and evaluation, the results provide calibration targets for DSM potential estimates and identify key programs and results for top-performing portfolios[22].

Also, given the selection of organizations, the typical performance of this group is likely not typical of all DSM programs; this group's performance is likely better than the national average. Thus, for an organization with new DSM efforts, the results of this study are suitable goals after an initial ramp up period.

5.3 Regulatory and Market Context for DSM Achievements

This section compares the regulatory and market context of the benchmarked locations and discusses the impact on achievement of DSM.

The achievement of significant DSM savings is influenced by several factors, including the regulatory environment under which utilities and agencies operate, whether DSM funds are provided through system benefit charges (SBC), how the issue of lost revenues is addressed, the provision of financial incentives for DSM performance, etc. Table 5-2 provides key characteristics by state such as the electricity market structure, cost-effectiveness tests used, DSM targets, and the year DSM programs began.

Iowa, Massachusetts, Minnesota, and Vermont all achieved about 1% or more reductions in annual energy sales due to DSM program activity in 2007. The electricity market structure is not a determining variable in DSM performance; most of the high achievers operated under a traditional market structure. The year that programs began does not appear to have a strong influence on savings achieved. All states achieving high DSM savings set significant mandated goals for utilities' DSM programs. Other success factors include financial incentives for cost-effective DSM (Minnesota, Vermont), adjustments for lost revenues caused by DSM programs, and use of the TRC test or societal test for cost-effectiveness rather than the RIM test (Iowa, Minnesota, and Vermont).

[22] See Appendix A for complete information on DSM program results and expenditures.

Table 5-2. DSM Environment by State

State/ Province	Year Began	Energy Savings as % of Sales	DSM Environment
Arizona	–	–	No DSM requirements.
Iowa	1990	0.8%	Iowa operates under a traditional electricity market structure. Electric utilities are expected to secure maximum achievable DSM potential, and the Societal Cost test is the primary test and is the benchmark for cost-effectiveness. From 1990-1996, the regulator offered utilities financial incentives to deliver efficiency, as authorized by law, with cost recovery approved via "mini" rate cases that occurred once every few years. In 1996 the law was changed and incentives were abandoned in exchange for concurrent cost recovery. The shift from incentive-based regulation to annual cost recovery is seen as a success by the utilities. Under the original rules, utilities waited for up to six years before recovering their investments in efficiency. This "cost of money" diminished the value of the efficiency incentives.[23]
Maine	2002	0.8%	Maine has a traditional electricity market structure. $1.5 million/year is allocated for SBC funded energy efficiency; the 2006 budget was $9.6 million. Programs are administered by the Maine PUC and delivered through a statewide effort called Efficiency Maine with goals established by statute. It has been noted that "the current rate mechanisms used for Maine investor-owned utilities do not coexist easily with revenue neutral efficiency schemes."[24]
Massachusetts	1990s	1.0%	State legislation restructured the electricity market in 1998 and created a SBC of $0.0033/kWh which was changed to $0.0025/kWh in 2002. The Division of Energy Resources oversees ratepayer-funded DSM programs, run by DUs or municipal aggregators, while the Department of Department of Telecommunications and Energy reviews cost effectiveness with the TRC and approves performance incentives.
Minnesota	1980	0.3 to 1.6%	Minnesota operates under a traditional electricity market structure. Minimum spending is mandated by law for the utilities: Xcel Energy, which is nuclear based, must spend 2% of electric revenues on DSM; non-nuclear electric utilities must spend 1.5% of revenues. Spending levels are also determined by IRP process. However, in May 2007 the state passed the New Generation Energy Act which changes goals from spending as percentage of revenues to savings as a percentage of sales, specifically 1.5% of retail sales and a minimum of 1% starting in 2010, effectively doubling savings goals. The regulator considers the societal test to be the most important test of the five California tests but also considers the participant test to be important as well as the utility test. The utilities used to operate under a lost revenue mechanism but experienced long times between rate cases. This became a problem, and in 1999 the regulator developed a new DSM incentive mechanism. The Company earns an incentive for achievement greater than 91% of its

[23] Ibid.

[24] Inquiry into New Conservation Programs and Developing a Plan for Using Increases in the Conservation Fund: Docket 2006-446, Maine Public Utilities Commission, March 9, 2007.

State/ Province	Year Began	Energy Savings as % of Sales	DSM Environment
			minimum spending equivalent energy savings goal, which is equal to the number of kWh expected to save when the utility meets its minimum spending requirement. DSM incentives can equal up to 30% of program costs.[25]
Texas	2000	0.1%	Texas has a deregulated electricity market. In 1999 Texas required utilities to meet 10% of load growth through efficiency or approved load management. In 2007, legislature increased the standard to 15% of load growth by 2009, 20% of load growth by 2010.
Vermont	1990	1.0%	Vermont has a traditional electricity market structure. DSM was historically funded by a wires charged capped at 3% of revenues; the cap was removed in 2005. Administered centrally as Efficiency Vermont by third party—Vermont Energy Investment Corp. (VEIC). VEIC receives incentives and performance bonuses to achieve savings higher than goals. Efficiency is seen as an option that offers a high level of net benefits to the state, both environmental and economic, without the controversy and public outcry that other solutions have historically faced. As Vermont's future energy needs are discussed, efficiency is increasingly seen as the most politically viable solution and has been actively promoted by the PSB, the Legislature, and the Governor.[26]
Wisconsin	Mid 1980's	0.3%	Wisconsin has a traditional electricity market structure and pays for DSM through a public benefits fund of up to 3% of annual electric revenues. The Wisconsin Public Service Commission is the overall administrator for the state's public benefits programs, subcontracting with third party "implementation contractors" to implement various parts of the Focus on Energy program portfolio. No financial incentives are available to utilities to provide DSM programs. One notable setback for the Focus on Energy programs in the past was that the Wisconsin legislature diverted 47% of the funds collected from utility ratepayers for the Focus on Energy programs and diverted them to help balance the Wisconsin state budget.[27]

25 Ibid.

[26] Ibid.

[27] Ibid.

5.4 Performance Results for 2007

This section compares 2007 electricity DSM program results for residential and C&I customer sectors combined across the various locations. The analysis, overall customer sectors, identifies typical results and organizations that achieve above typical savings at below typical costs (i.e., organizations with best practice portfolios). See Appendices for complete data and statistics.

5.4.1 Electricity DSM Results Over All Sectors

This section reviews DSM program spending, savings, and costs over all customer sectors.

Table 5-3 shows the median result for electricity DSM spending, savings, costs, and energy costs over all customer sectors for the reviewed organizations. Given that some of the datasets are skewed or contain outliers, the median is used here as it is a better indication of central tendency than the average.

Table 5-3. Medians for Overall Results

Spending as % of Revenue	Energy Savings as % of Sales	Peak Demand Savings as % of Peak Demand	Cost of Energy $/kWh	Cost of First Year Savings	
				$/kWh	$/kW
1.8%	0.9%	0.6%	$0.08	$0.15	$754

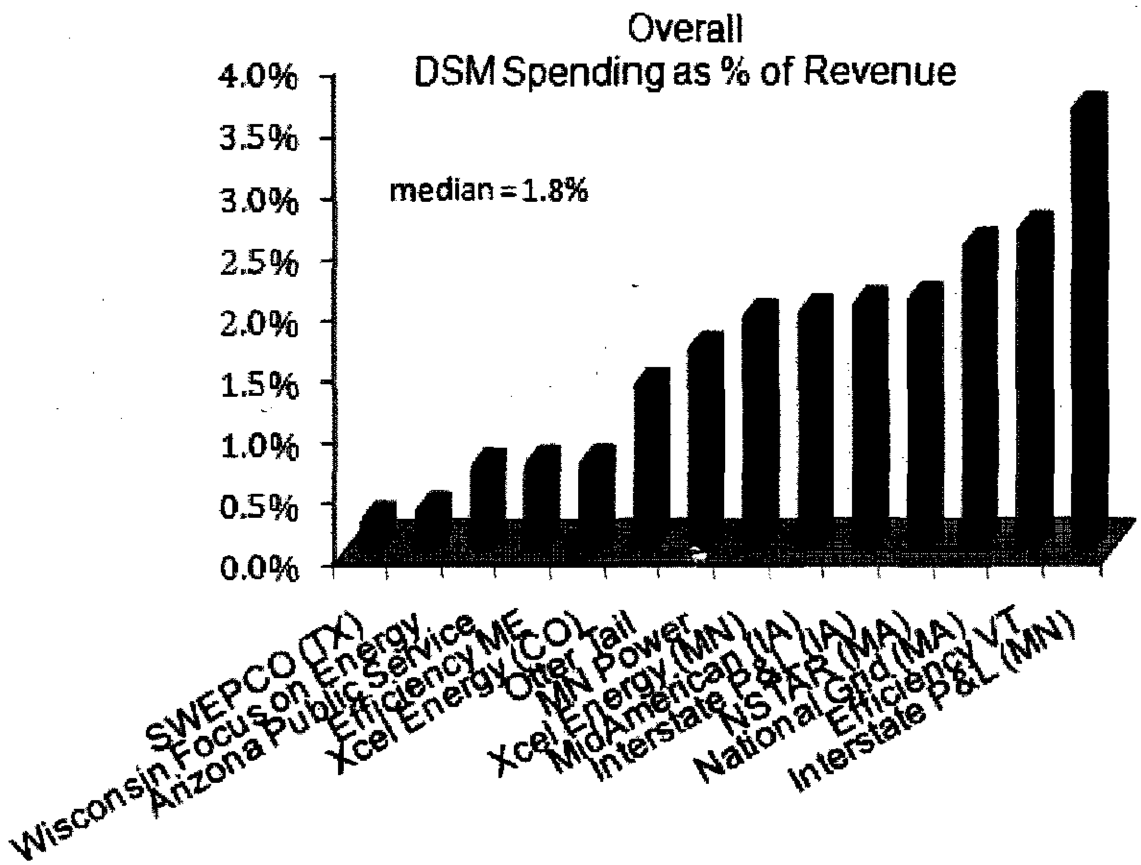
Notes: Cost of first year savings should not be confused with a levelized cost of conserved energy. Assuming an average program life of ten years and a 9% discount rate, dividing the cost of first year energy savings by 6.0 approximates the levelized cost of conserved energy.

5.4.2 Electricity DSM Spending

This section reviews DSM spending as a percentage of all retail revenue over all customer sectors.

For the IOUs and agencies reviewed, the spending on electricity DSM as a percentage of revenue ranges from 0.3% to 3.6% with the median at 1.8%. Figure **5-1** below shows the distribution of spending on electricity DSM as a percentage of annual revenues. Organizations with spending rates in the top quartile are MidAmerican (IA) National Grid (MA), Efficiency VT, and Interstate P&L (MN), which has the highest spending rate, double the median.

Figure 5-1. IOU & Agency Electricity DSM Spending as % of Revenue

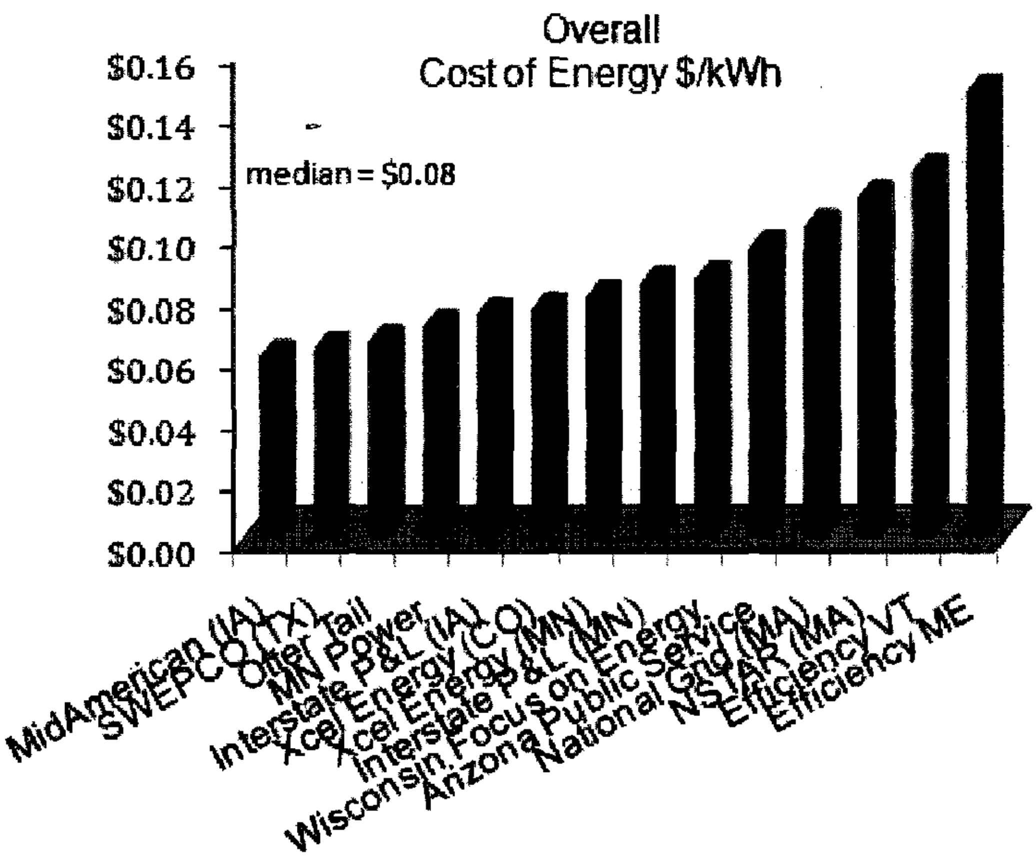

Overall
DSM Spending as % of Revenue
4.0%
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
median = 1.8%
SWEPCO (TX)
Wisconsin Focus on Energy
Arizona Public Service
Efficiency ME
Xcel Energy (CO)
Otter Tail
MN Power
Xcel Energy (MN)
MidAmerican (IA)
Interstate P&L (IA)
NSTAR (MA)
National Grid (MA)
Efficiency VT
Interstate P&L (MN)

5.4.3 Cost of Electricity

The average retail cost of electricity was calculated by dividing total annual retail revenue by total annual retail sales for each organization and state.

For the IOUs and agencies reviewed, the average retail cost of energy ranges from $0.06/kWh to $0.15/kWh with the median at $0.08/kWh (Figure 5-2). Organizations with energy costs in the bottom quartile are MN Power, Otter Tail, SWEPCO (TX), and MidAmerican (IA)

Figure 5-2. IOU & Agency Cost of Electricity

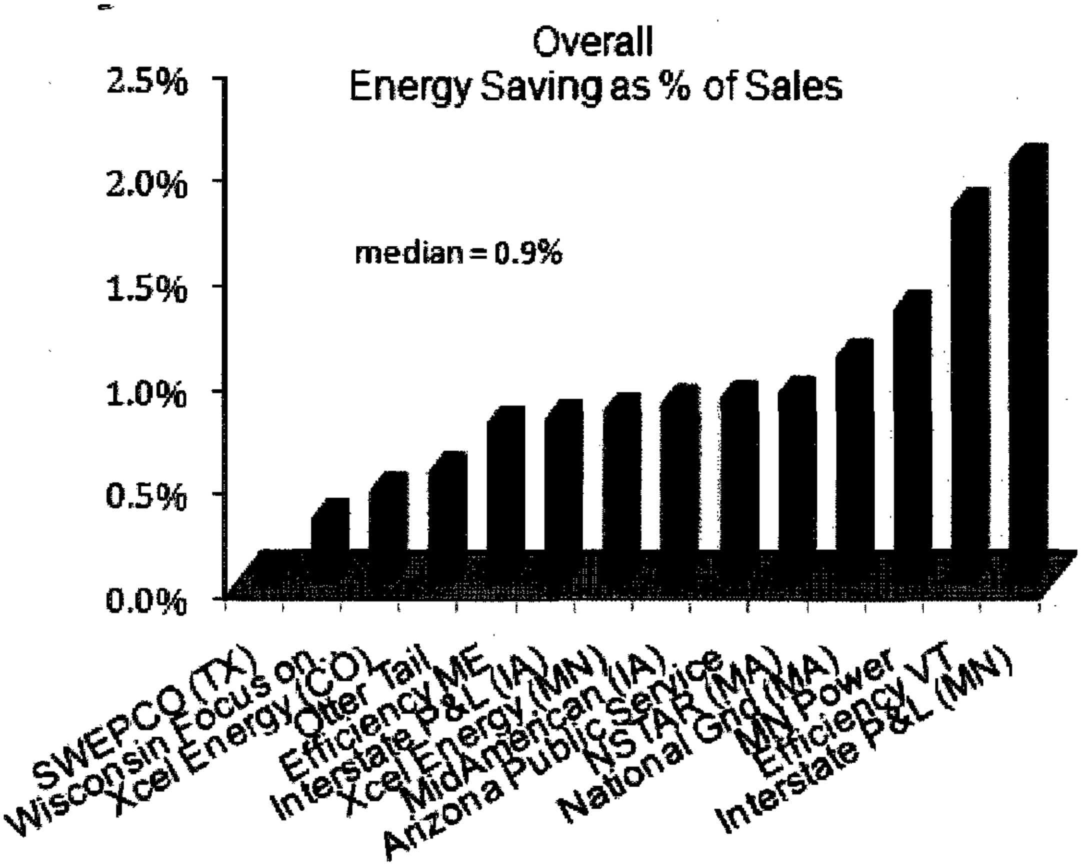


5.4.4 Electric Energy and Peak Demand Savings

This section details the energy saved (as a percentage of sales) by the DSM programs over all customer sectors.

For the IOUs and agencies reviewed, *five* out of the seven organizations with above median electricity DSM spending rates also achieved median or above median energy savings as a percentage of sales: Interstate P&L (MN) has the highest energy savings as a percentage of sales at 2.0%, more than twice the median of 0.9%, while MN Power and Efficiency VT achieved savings rates of about 1.6% of sales; MidAmerican (IA), Arizona Public Service, NSTAR (MA) and National Grid (MA) achieved savings rates of about 1.0%, (Figure 5-3).

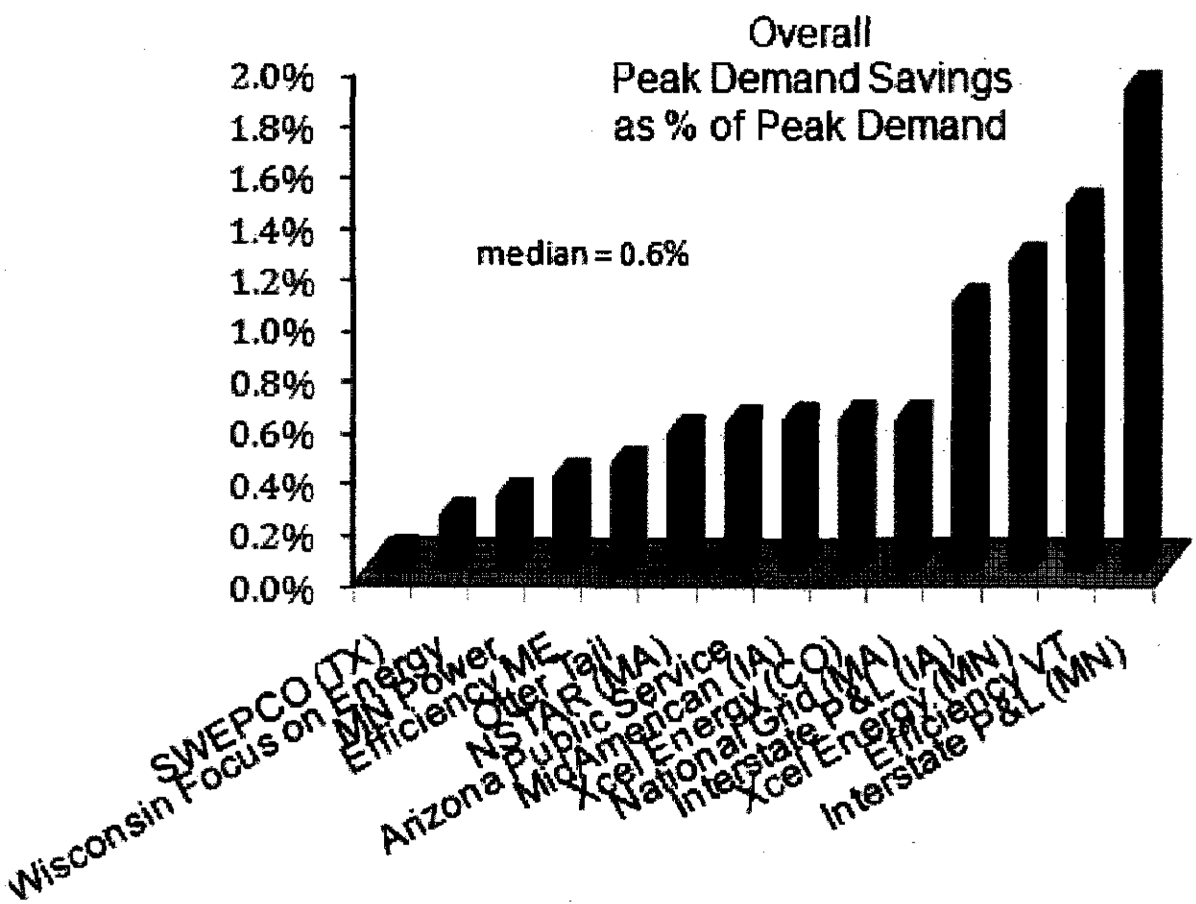
Figure 5-3. IOU & Agency Electricity DSM Energy Savings as % of Sales--First Year[28]



[28] Savings reported for Wisconsin Focus on Energy do not include non-tracked energy impacts.

For the IOUs and agencies reviewed, Figure 5-4 shows electricity DSM incremental peak demand savings as a percentage of annual peak demand. Interstate P&L (MN) has the highest percentage of peak demand conserved at 1.9%, about three times the median of 0.6%. Interstate P&L (MN) and most of the utilities with above median peak demand savings rates have rates of electricity DSM spending at or above the median: Efficiency VT, Xcel Energy (MN), and Interstate P&L (IA) conserved about 1.3% of peak demand, while National Grid (MA), Xcel Energy (CO), and MidAmerican (IA) conserved about 0.6% of peak demand.

Figure 5-4. IOU & Agency Peak Demand Savings as % of Peak Demand

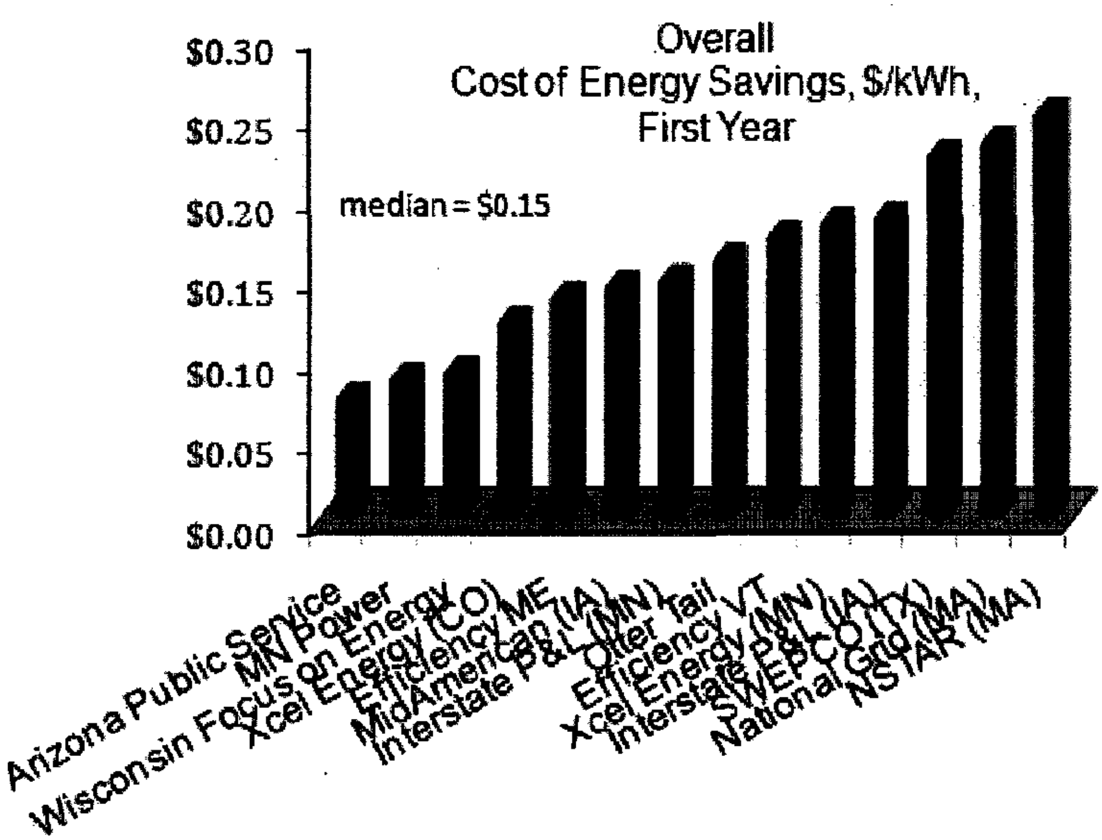


5.4.5 Cost of Savings

This section discusses the cost of first year energy savings and peak demand savings for the DSM program year.

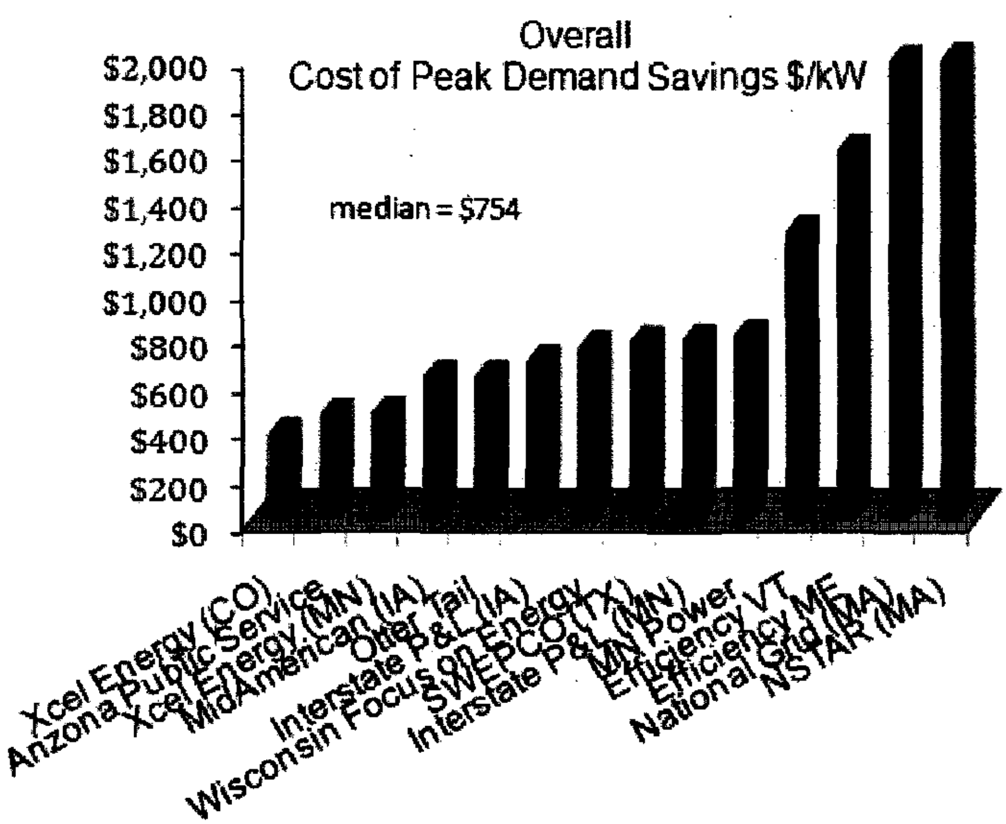
For the IOUs and agencies reviewed, the cost of first year energy savings ranges from \$0.07/kWh to \$0.25/kWh, with the median at \$0.15/kWh (Figure 5-5). Arizona Public Service achieved the lowest cost of energy savings. MidAmerican (IA) and Interstate P&L (MN) also achieved their energy savings at costs below the median, but these two utilities achieved these low cost energy savings with electricity DSM spending rates (as a percentage of revenue) at or above the median and energy savings rates (as a percentage of sales) at or above the median.

Figure 5-5. IOU & Agency Cost of Electric Energy Savings (\$/kWh) First Year



For the IOUs and agencies reviewed, Figure 5-6 shows that Xcel Energy (CO), at $367/kW, achieved the lowest costs of conserved peak demand, well below the median of $754/kW. Xcel Energy (CO) and Xcel Energy (MN)'s achieved their low-cost peak demand savings with their demand response programs, Residential Saver's Switch. Arizona Public Service's achieved savings at low costs with its lighting program, Consumer Products.

Figure 5-6. IOU & Agency Cost of Peak Demand Savings ($/kW)



5.4.6 Identifying Best Practice DSM Organizations

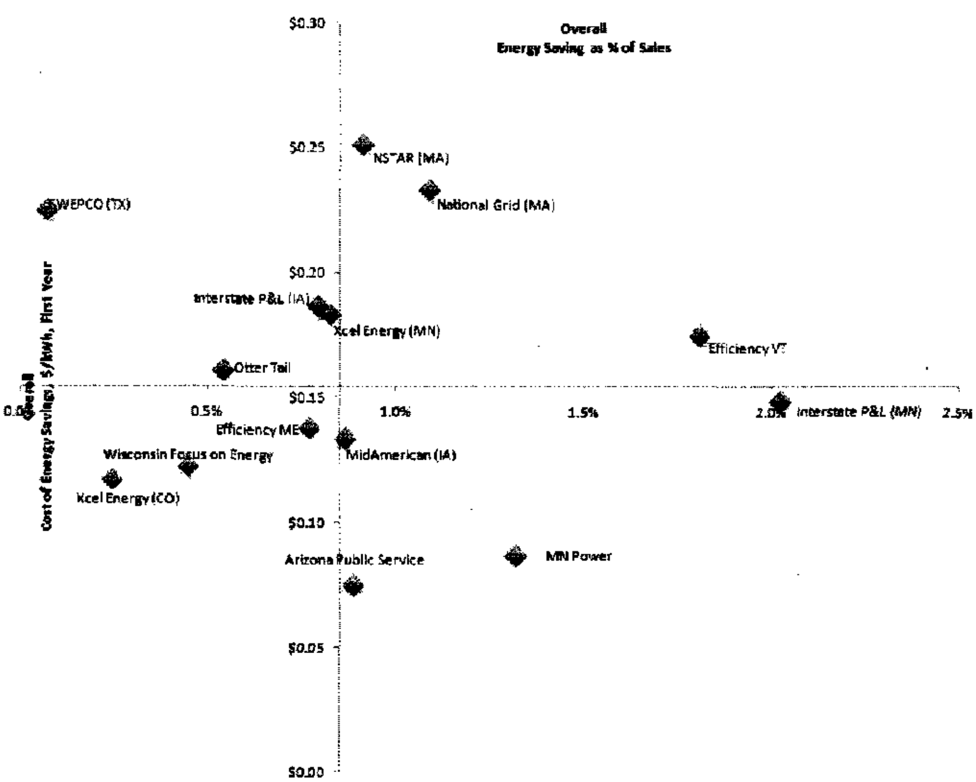
This section identifies the organizations that achieved above median saving at or below median costs.

For the IOUs and agencies reviewed, the scatter plot in Figure 5-7 below illustrates where each organization falls relative to median energy savings and median costs. The utilities listed below achieved near median or higher energy savings as a percentage of sales near or lower than the median cost:

1. Interstate P&L (MN): 2.0%, $0.15/kWh
2. MN Power: 1.3%, $0.09/kWh
3. Arizona Public Service: 0.9%, $0.07/kWh
4. MidAmerican (IA): 0.9%, $0.13 /kWh

Most of the low-cost energy savings of Arizona Public Service and MidAmerican (IA) were achieved by their lighting programs. MN Power and Interstate P&L (MN)'s low-cost savings were achieved by their custom incentives programs.

Figure 5-7. IOU & Agency Scatter Plot of Electric Energy Savings and First Year Costs ($/kWh)

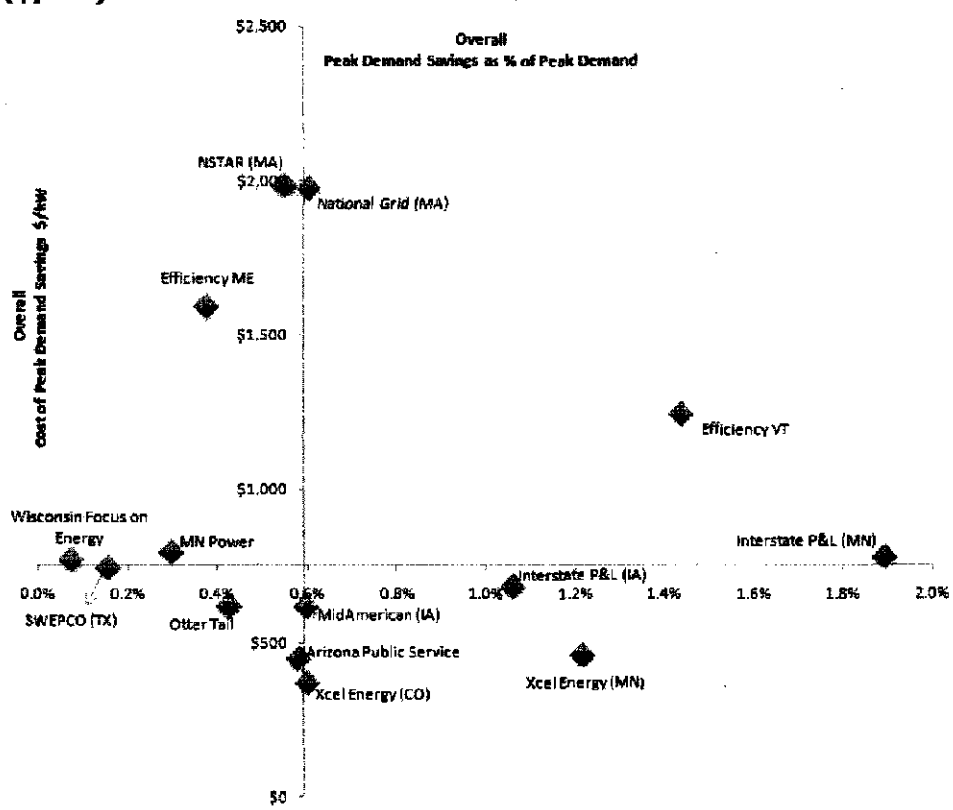


For the IOUs and agencies reviewed, the scatter plot shown in Figure 5-8 below illustrates organizations' results relative to median peak demand savings and median costs. The utilities listed below achieved near median or higher peak demand savings as a percentage of peak demand near or lower than the median cost[29]:

1. Interstate P&L (MN): 1.9%, $774/kW
2. Xcel Energy (MN): 1.2%, $457/kW
3. Interstate P&L (IA): 1.1%, $683/kW
4. Xcel Energy (CO): 0.6%, $367/kW
5. Arizona Public Service: 0.6%, $447/kW
6. MidAmerican (IA): 0.6%, $616/kW

Interstate P&L (MN), Interstate P&L (IA), MidAmerican (IA), and Arizona Public Service achieved most of their peak demand savings from their lighting programs which had very low costs of conserved peak demand. Interstate P&L (IA) also achieved a large amount of its peak demand savings from its custom incentives program. Xcel Energy (MN) and Xcel Energy (CO) achieved most of their peak demand savings from their demand response programs, which tend to have low costs of conserved peak demand.

Figure 5-8. IOU & Agency Scatter Plot of Peak Demand Savings and First Year Costs ($/kW)



[29] All of these IOUs were summer peaking in 2007.

5.5 Sector Analysis

This section compares 2007 electricity DSM program results for the commercial and industrial (C&I) and residential sectors and reviews program-level detail for those organizations that achieved high savings at low costs.

5.5.1 C&I Sector

This section reviews DSM program spending, savings, and costs for the C&I customer sector.

Table 5-4 shows the median results for spending, savings, and costs for the C&I sector for all reviewed organizations (where data are available).

Table 5-4. Medians for C&I Results

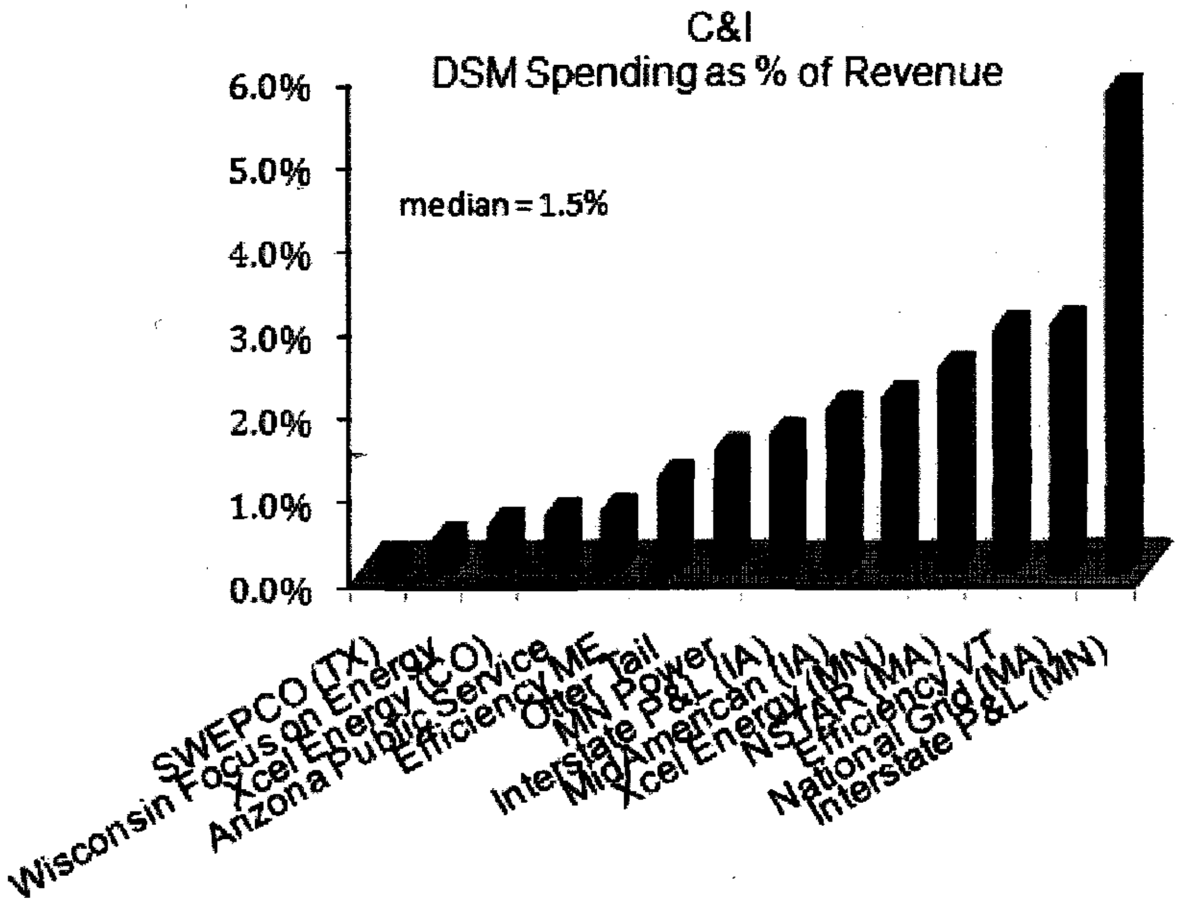
C&I Electricity DSM Spending

Spending as % of Revenue	Electric Energy Savings as % of Sales	Peak Demand Savings as % of Peak Demand	Cost of Savings	
			$/kWh	$/kW
1.5%	0.7%	0.6%	$0.13	$676

This section reviews DSM spending for the C&I customer sector as a percentage of C&I revenue.

For the IOUs and agencies reviewed, electricity DSM spending in the C&I sector, as a percentage of annual revenue of retail energy sales, ranges from 0.2% to 5.7% with the median at 1.5% (Figure 1-16). Organizations with spending rates in the top quartile are NSTAR (MA), Efficiency VT, National Grid (MA), and Interstate P&L (MN) which has the highest spending rate, more than three times the median. Every organization, except National Grid (MA), with above median spending rate also achieved above median energy savings as a percentage of sales (Table 5-9).

Figure 5-9. IOU & Agency C&I Electricity DSM Spending as % of Revenue

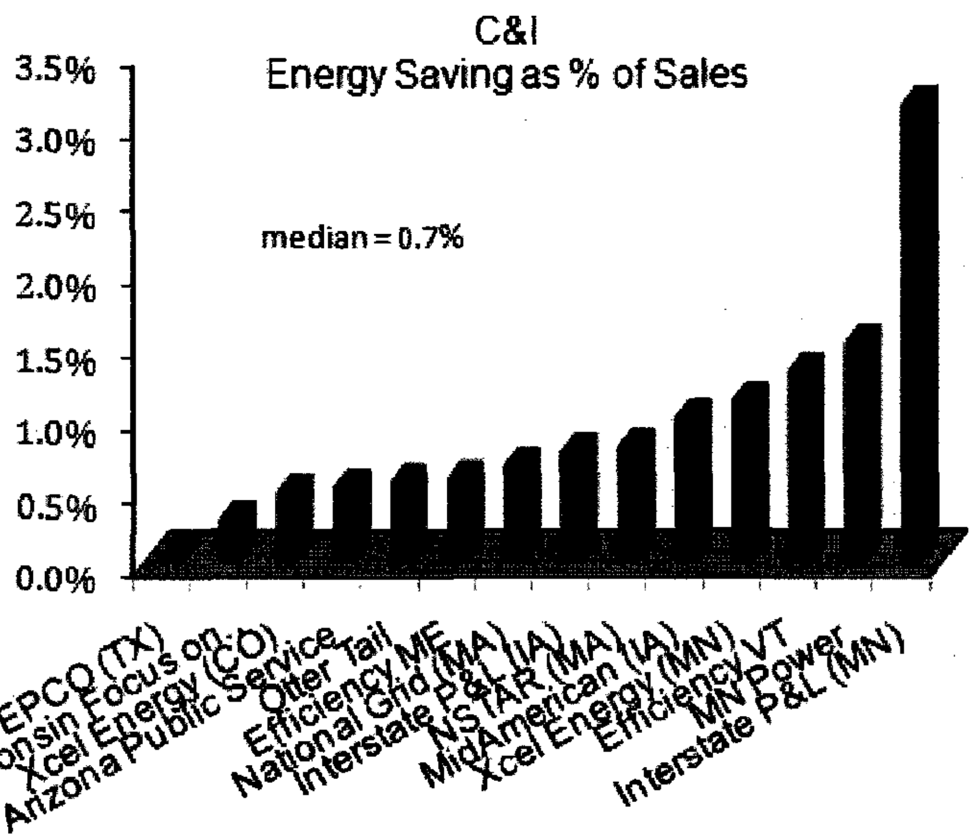


C&I Electric Energy Savings

This section reviews the energy saved (as a percentage of sales) and the costs of first year energy savings achieved by DSM programs in the C&I customer sector.

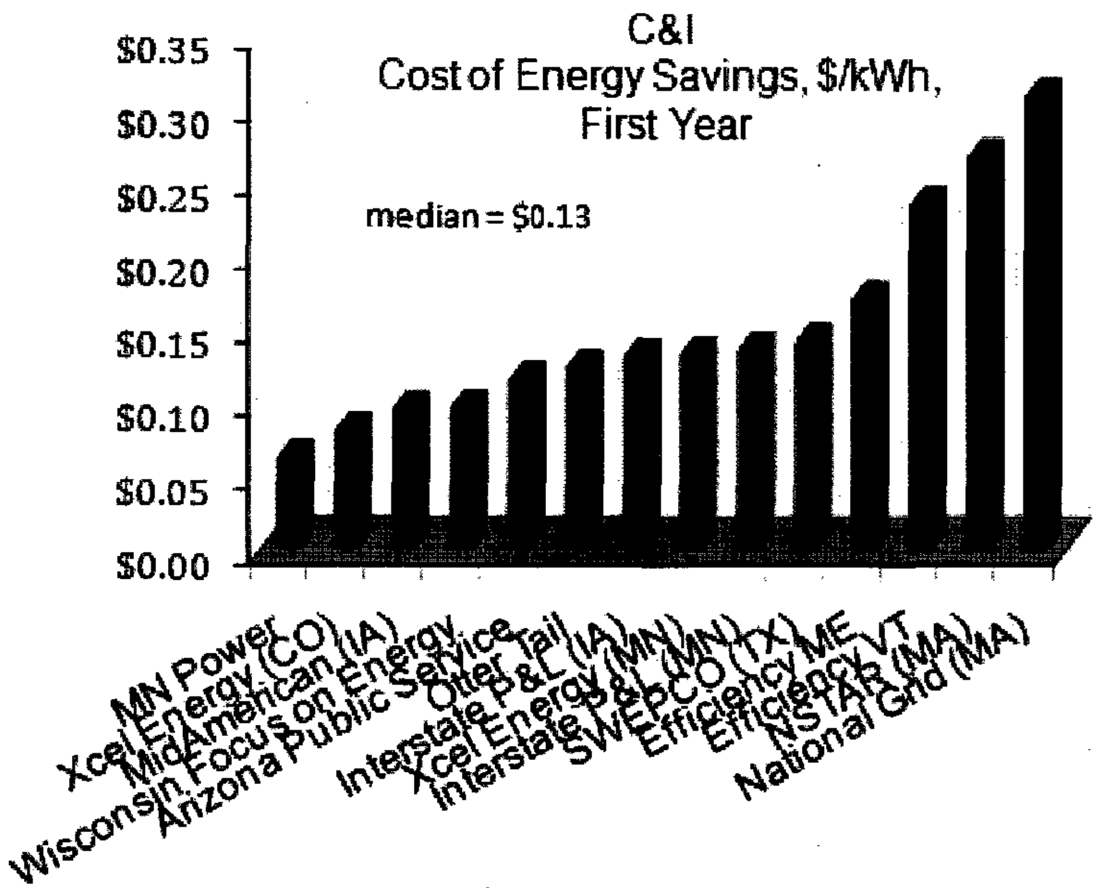
For the IOUs and agencies reviewed, Figure 5-10 shows the energy savings as a percentage of sales in the C&I sector. Energy savings as a percentage of sales ranges from 0.1% to 3.1% with the median at 0.7%. Interstate P&L (MN) has the highest savings rate, more than four times the median as well as the highest DSM spending rate. Interstate P&L (MN)'s high savings rate was achieved by its custom incentives program. Interstate P&L (IA), NSTAR (MA), MidAmerican (IA), Xcel Energy (MN), Efficiency VT, and MN Power also achieved above median energy savings ranging from 0.8% - 1.5% of sales.

Figure 5-10. IOU & Agency C&I Electric Energy Savings as % of Sales First Year



For the IOUs and agencies reviewed, costs of first year C&I energy savings ranges from $0.06/kWh to $0.31/kWh, with the median at $0.13/kWh (Figure 5-11). MN Power achieved their energy savings at the lowest cost, principally with its custom incentives program. Xcel Energy (MN), MidAmerican (IA), and Interstate P&L (IA), with DSM spending rates above median and high energy savings rates, achieved their savings near or below median costs. Xcel Energy (CO) and MidAmerican (IA) achieved their low-cost energy savings with their lighting programs; Xcel Energy (CO) also achieved low-cost savings with its motors program.

Figure 5-11. IOU & Agency C&I Cost of Electric Energy Savings ($/kWh) First Year



C&I DSM Programs with High Energy Savings and Low Costs

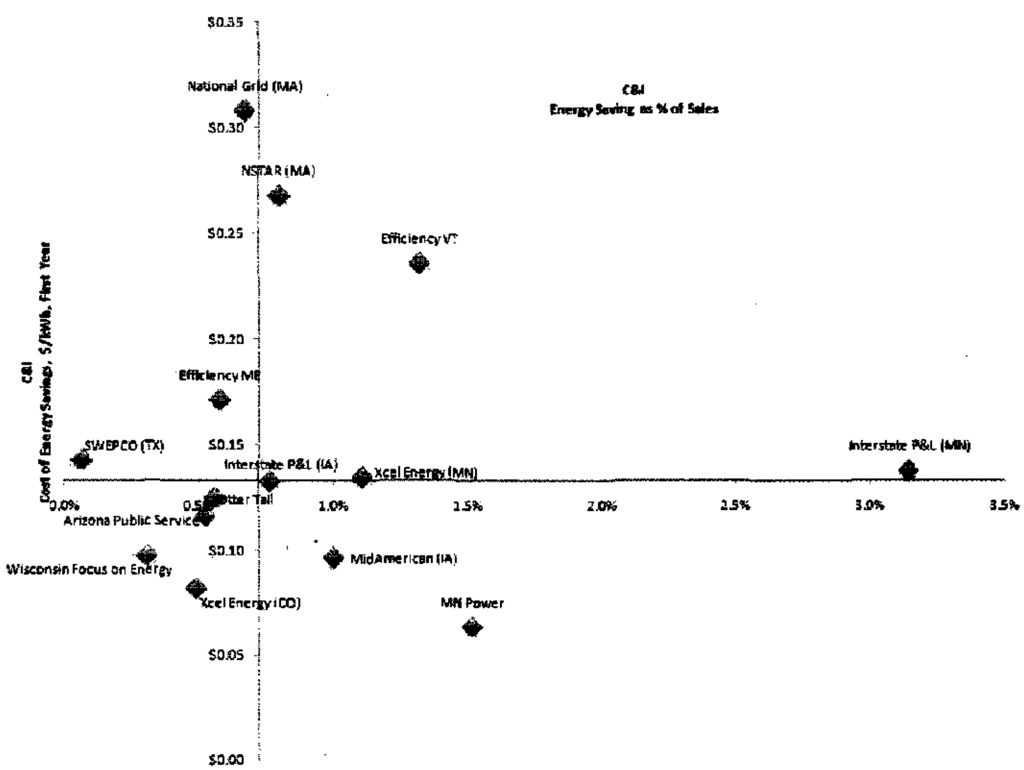
This section identifies the organizations with DSM programs that achieved above median energy savings (as a percentage of sales) at or below median costs for the C&I customer sector.

For the IOUs and agencies reviewed, the scatter plot shown in Figure 5-12 below illustrates where each organization falls relative to median energy savings and median costs. Interstate P&L (MN) achieved the greatest rate of C&I energy savings as a percentage of sales near median costs $0.14/kWh. MN Power, Xcel Energy (MN), MidAmerican (IA), and Interstate P&L (IA) also achieved above median energy savings rates near or below median costs:

1. Interstate P&L (MN): 3.1%, $0.14/kWh
2. MN Power: 1.5%, $0.06/kWhXcel Energy (MN): 1.1%, $0.13/kWh
3. MidAmerican (IA): 1.0%, $0.10/kWh
4. Interstate P&L (IA): 0.8%, $0.13/kWh

Interstate P&L (MN), MN Power, and Interstate P&L (IA) achieved most of their high savings at low costs through their custom incentives programs. Xcel Energy (MN) and MidAmerican (IA)'s high savings at low costs were mostly due to their lighting programs.

Figure 5-12. IOU & Agency Scatter Plot of C&I Electric Energy Savings and First Year Costs ($/kWh)



For the IOUs and agencies reviewed, Table 5-5 and Table 5-6 below show program-level savings and first year costs for the organizations that achieved above median energy savings rates at below median costs in the C&I sector.

Interstate P&L (IA), Interstate P&L (MN), and MN Power achieved most of their energy savings with custom type incentive programs: Interstate P&L (IA)'s Custom Rebates and Performance Contracting, Interstate P&L (MN)'s C/I Shared Savings Project, and MN Power's PowerGrant. Xcel Energy (MN), achieved significant savings with programs for custom incentives, motors, and cooling/heating/roofing but earned most of its savings from its three lighting programs, CEE One-Stop Shop, Energy Mgt. Systems, and Lighting Efficiency, and from its new construction program, Energy Design Assistance. Like Xcel Energy (MN), MidAmerican (IA) achieved most of its savings from its lighting program, Nonresidential Equipment Program and its new construction program, Commercial New Construction.

Table 5-5. IOU & Agency Electric Energy Savings for C&I Programs as % of Sales[30]

C&I	Interstate P&L (IA)	Interstate P&L (MN)	MidAmerican (IA)	MN Power	Xcel Energy (MN)
Program/Measures					
Lighting	0.07%	0.07%	0.14%		0.41%
Cooling/Heating/Roofing	0.01%	0.01%			0.10%
Refrigeration					
Motors	0.02%		0.38%		0.19%
Compressed Air					
Combination			0.04%		
Custom Rebates	0.56%	2.76%	0.10%	1.52%	0.11%
Energy Audit			0.09%		
New Construction	0.06%		0.25%		0.29%
Agriculture	0.05%	0.31%			
C&I Interruptible Rates			0.01%		0.0001
C&I Direct Load Control					<0.01%
Total C&I Savings (GWh)	86.1	16.2	133.6	34.7	245.4
Annual C&I Sales (GWh)	11,215.3	515.7	13,342.6	2,288.3	22,109.8
C&I Savings as % of C&I Sales	0.77%	3.15%	1.00%	1.52%	1.11%

[30] Although all organizations here reported both impacts and costs per program, some organizations reported program details of impacts per end-use.

As seen in Table 5-6 below, costs of energy savings per program varies widely, but costs for all custom type incentive programs are at or below the median cost. MidAmerican (IA)'s costs per kWh for its high achieving prescriptive incentives program, Nonresidential Equipment, is just $0.03/kWh, well below the median. Xcel Energy (MN)'s costs per kWh per program are at or below the median for most programs.

Table 5-6. IOU & Agency Costs of C&I Electric Energy Savings by Type of Program First Year[31]

C&I	Interstate P&L (IA)	Interstate P&L (MN)	MidAmerican (IA)	MN Power	Xcel Energy (MN)
Program/Measures					
Lighting	*		*		$0.16
Cooling/Heating/Roofing	*	$0.21			$0.12
Refrigeration	*	*			
Motors	*		*		$0.06
Compressed Air					
Combination	0.08*	0.28*	0.03*		
Custom Rebates	$0.10	$0.13	$0.11	$0.05	$0.13
Energy Audit			$0.20		
New Construction	$0.27		$0.14		$0.09
Agriculture	$0.10	$0.14			
Indirect Impact					
C&I Interruptible Rates			$0.90		$0.44
C&I Direct Load Control					$27.27
Total C&I Savings (GWh)	86.1	16.2	133.6	34.7	245.4
Total Costs ($M)	11.4	2.2	12.8	2.2	32.9
Costs of C&I Savings ($kWh)	$0.13	$0.14	$0.10	$0.06	$0.13

[31] Total costs include costs of indirect impact programs, i.e., programs for which energy and peak demand savings are not acountable.

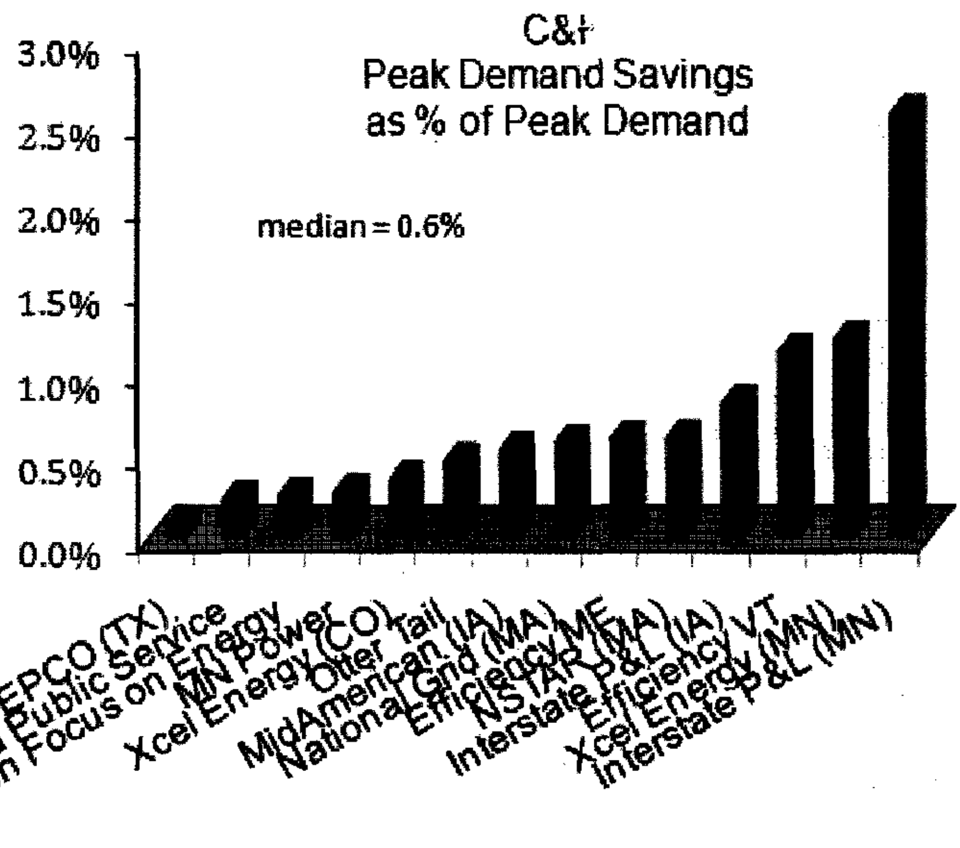
*Interstate P&L (IA) and Interstate P&L (MN) reported only impacts per end-use and reported costs at the program level.

C&I Peak Demand Savings

This section reviews the peak demand saved (as a percentage of peak demand) and the costs of peak demand savings achieved by DSM programs in the C&I customer sector.

For the IOUs and agencies reviewed, Figure 5-13 below shows DSM incremental peak demand savings as a percentage of annual peak demand for the C&I customer sector.[32] C&I peak demand savings as a percentage of C&I peak demand range from 0.1% to 2.6% with the median at 0.6%. Interstate P&L (MN) achieved the highest percentage of conserved peak demand with its custom incentives program. Xcel Energy (MN), Efficiency VT, Interstate P&L (IA), NSTAR (MA), Efficiency ME and National Grid (MA) also achieved above median peak demand savings rates.

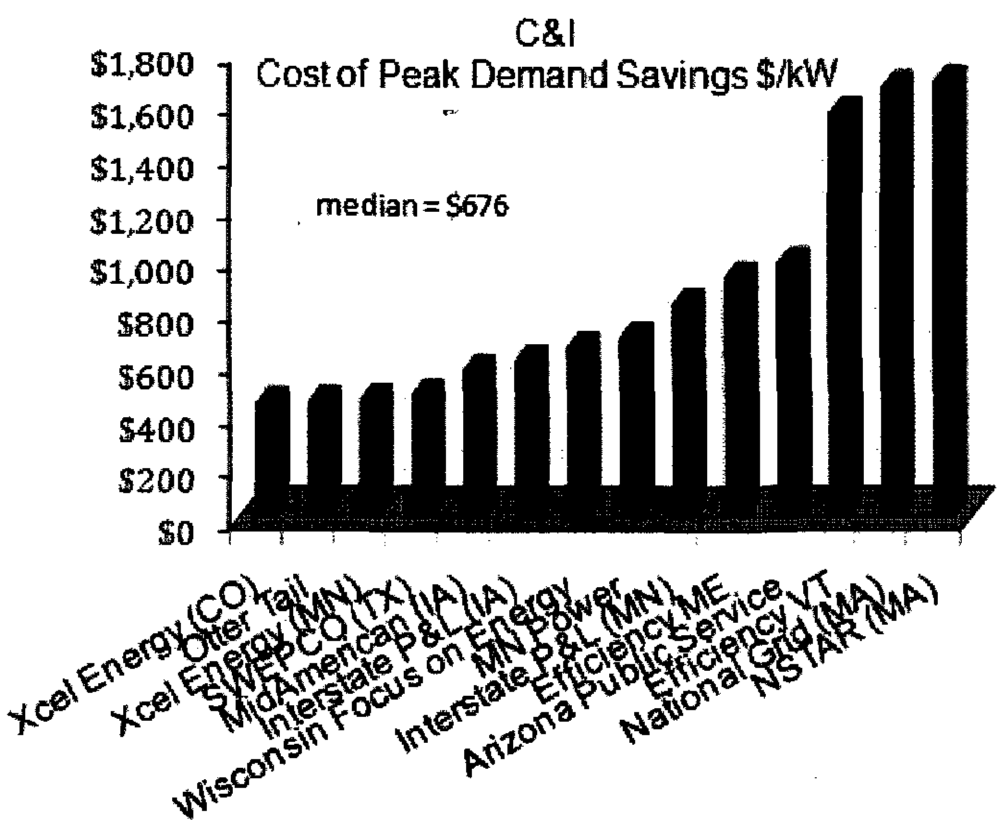
Figure 5-13. IOU & Agency C&I Peak Demand Savings as % of Peak Demand



[32] Sector-level peak demand data were available for few organizations; for all other organizations, estimates were made factoring overall system peak demand by the ratio of sector-level energy sales to overall energy sales.

For the IOUs and agencies reviewed, costs of C&I peak demand savings range from $443/kW to $1,683/kW, with the median at $676/kW (Figure 5-14). Xcel Energy (CO) achieved the lowest cost of peak demand savings at $443/kW mostly with its Lighting and Motor Efficiency programs. Otter Tail, Xcel Energy (MN), Wisconsin Focus on Energy, SWEPCO (TX), MidAmerican (IA), and Interstate P&L (IA) also achieved peak demand savings below median costs. Otter Tail achieved its low-cost savings with its Geothermal Heat Pump program while Xcel Energy (MN) achieved its low-costs savings with its demand response programs.

Figure 5-14. IOU & Agency C&I Cost of Peak Demand Savings ($/kW)



C&I DSM Programs with High Peak Demand Savings and Low Costs

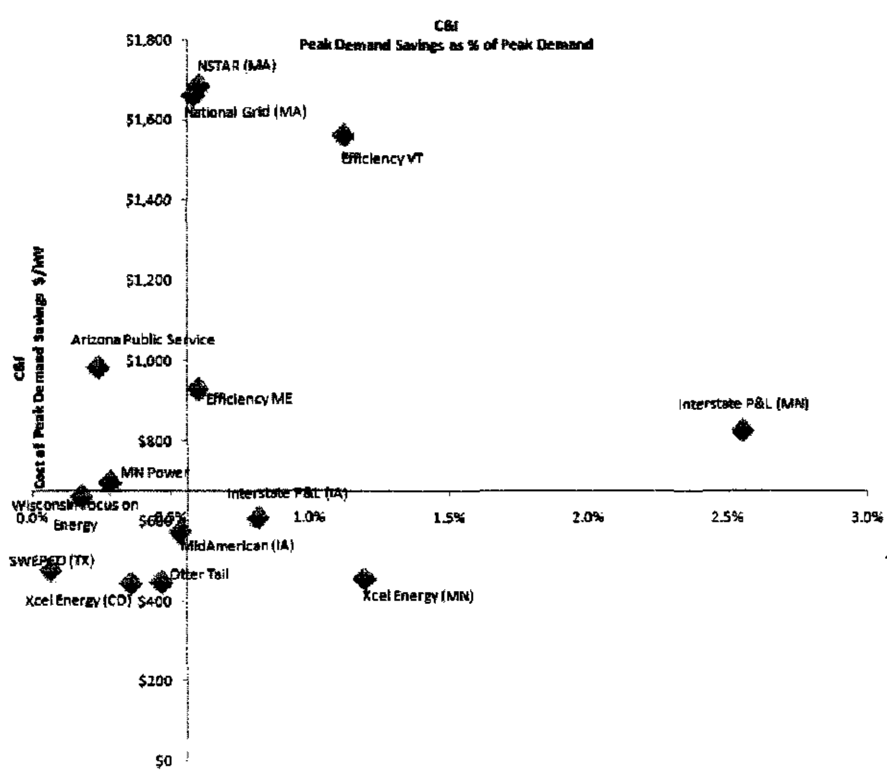
This section identifies the organizations with DSM programs that achieved above median peak demand savings (as a percentage of peak demand) at or below median costs for the C&I customer sector.

For the IOUs and agencies reviewed, the scatter plot shown in Figure 5-15 below illustrates where each organization falls relative to median peak demand savings and median costs in the C&I sector. Interstate P&L (MN) achieved the greatest peak demand savings rate, but achieved those savings at costs above the median. Xcel Energy (MN) and Interstate P&L (IA) achieved above median peak demand savings rates at below median costs[33]:

1. Xcel Energy (MN): 1.2%, $454/kW
2. Interstate P&L (IA): 0.8%, $605/kW

Xcel Energy (MN) achieved most of its peak demand savings from its demand response programs, which tend to have low costs of conserved peak demand while Interstate P&L (IA) achieved most of its peak demand savings from its custom incentives program.

Figure 5-15. Scatter Plot of C&I Peak Demand Savings and First Year Costs ($/kW)



[33] These two IOUs were summer peaking in 2007.

For the IOUs and agencies reviewed, Table 5-7 and Table 5-8 below show program-level incremental peak demand savings and costs for the organizations that achieved above median peak demand savings at or below median costs in the C&I sector: Interstate P&L (IA) and Xcel Energy (MN).

Interstate P&L (IA) achieved most of their C&I peak demand savings from its custom type incentive programs, Custom Rebates and Performance Contracting, and its interruptible rate program. While Xcel Energy (MN) earned its peak demand savings from several programs, including lighting, new construction, and motors, it achieved most of its peak demand savings from its demand response programs: Electric Rate Savings, an interruptible rate program, and Saver's Switch, a direct load control program.

Table 5-7. C&I Percentage of Peak Demand Savings by Type of Program[34]

C&I	Interstate P&L (IA)	Xcel Energy (MN)
Program/Measures		
Lighting	0.09%	0.29%
Cooling/Heating/Roofing	0.02%	0.09%
Refrigeration	<0.01%	
Motors	0.02%	0.10%
Compressed Air		
Combination	0.42%	0.04%
Custom Rebates		
Energy Audit	0.07%	0.28%
New Construction	0.04%	
Agriculture	0.14%	0.29%
C&I Interruptible Rates		0.11%
C&I Direct Load Control		
Total C&I Savings (GWh)	18.8	72.5
Peak Demand (MW)	2,293.5	6,020.3
C&I Savings as % of Peak Demand	0.82%	1.20%

[34] Although all organizations here reported both impacts and costs per program, some organizations reported program details of impacts per end-use.

Table 5-8 below shows the costs of C&I peak demand savings by program for these IOUs and agencies with high peak demand savings at low costs.

Interstate P&L (IA)'s custom incentives program achieved high savings at costs slightly above the median. Although Xcel Energy (MN) spent above the median on its high saving lighting program, it achieved overall below median costs per kW with its very low cost-high savings interruptible rates and direct load control programs.

Table 5-8. Costs of C&I Peak Demand Savings by Type of Program[35]

C&I	Interstate P&L (IA)	Xcel Energy (MN)
Program/Measures		
Lighting	*	$815
Cooling/Heating/Roofing	*	$466
Refrigeration	*	
Motors	*	$432
Compressed Air		
Combination	$455*	
Custom Rebates	$657	$1,387
Energy Audit		
New Construction	$1,134	$361
Agriculture	$527	
C&I Interruptible Rates	$33	$34
C&I Direct Load Control		$239
Total C&I Savings (GWh)	18.8	72.5
Total Costs ($M)	11.4	32.9
Costs of C&I Savings ($kW)	$605	$454

[35] Total costs include costs of indirect impact programs, i.e., programs for which energy and peak demand savings are not accountable.

*Interstate P&L (IA) reported only impacts per end-use and reported costs at the program level.

5.5.2 Residential Sector

This section reviews DSM program spending, savings, and costs for the residential customer sector.

Table 5-9 shows the median result for spending, savings, and costs for the residential sector for the all reviewed organizations.

Table 5-9. Medians for Residential Results

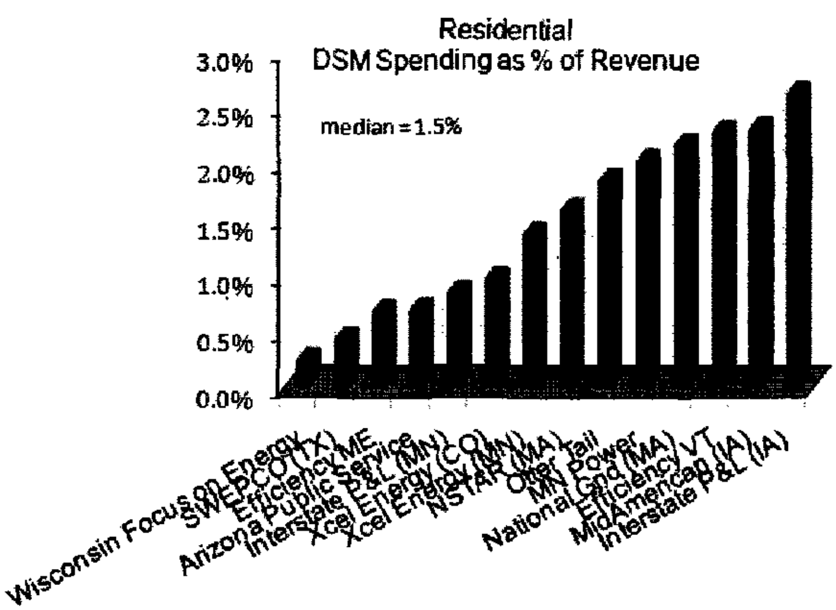
Spending as % of Revenue	Electric Energy Savings as % of Sales	Peak Demand Savings as % of Peak Demand	Cost of Savings	
			$/kWh	$/kW
1.5%	0.7%	0.8%	$0.23	$933

Residential Electricity DSM Spending

This section reviews DSM spending for the residential customer sector as a percentage of residential revenue.

For the IOUs and agencies reviewed, electricity DSM spending in the residential sector, as a percentage of annual revenue of retail energy sales, ranges from 0.3% to 2.6%, with the median at 1.5% (Figure 5-16. Organizations with spending rates in the top quartile are National Grid (MA), Efficiency VT, MidAmerican (IA), and Interstate P&L (IA); these organizations also have above median spending rates in the C&I sector. Most of the organizations with above median spending in the residential sector achieved median or above median energy savings rates: Interstate P&L (IA), Efficiency VT, National Grid (MA), MN Power, and NSTAR (MA).

Figure 5-16. IOU & Agency Residential Electricity DSM Spending as % of Revenue

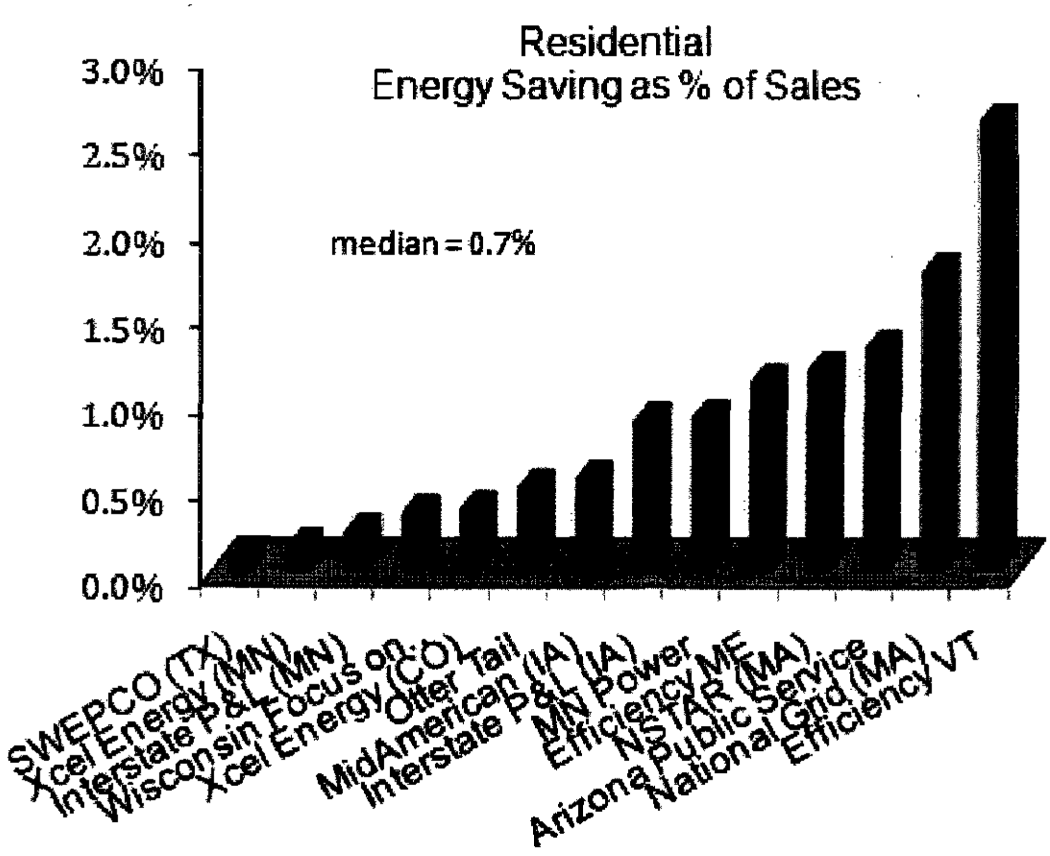


Residential Electric Energy Savings

This section reviews the energy saved (as a percentage of sales) and the costs of first year energy savings achieved by DSM programs in the residential customer sector.

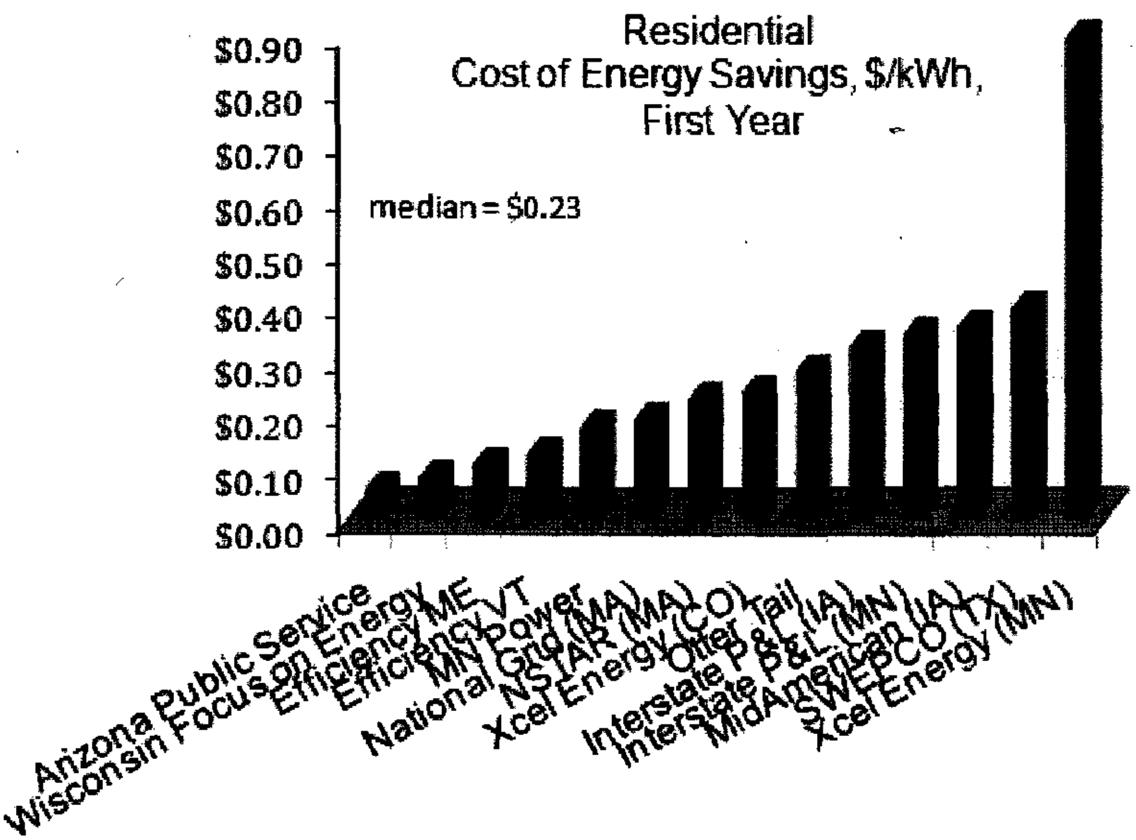
For the IOUs and agencies reviewed, Figure 5-17 shows the energy savings as a percentage of sales in the residential sector. Energy savings as a percentage of sales ranges from 0.1% to 2.6% with the median at 0.7%. Efficiency VT has the highest savings rate, more than triple the median; National Grid (MA) has an energy savings rate more than twice the median. Efficiency ME, Arizona Public Service, and NSTAR (MA) achieved above median energy savings as a percentage of sales, around 1.2%. MN Power, Interstate P&L (IA), achieved median energy savings, about 0.9% of sales.

Figure 5-17. IOU & Agency Residential Electric Energy Savings as % of Annual Sales First Year



For the IOUs and agencies reviewed, cost of first year residential energy savings ranges widely from \$0.06/kWh to \$0.89/kWh, with the median at \$0.23/kWh (Figure 5-18). As in the C&I sector, Arizona Public Service, MN Power, Wisconsin Focus on Energy, and Xcel Energy (CO) achieved residential energy savings at costs near or below the median. Arizona Public Service, Efficiency ME, and Efficiency VT also achieved residential energy savings at very low cost/kWh, principally with their lighting programs. Most of the organizations that spent above median (as a percentage of revenue) also achieved above median energy savings at below median costs: Efficiency VT, National Grid (MA), MN Power, and NSTAR (MA).

Figure 5-18. IOU & Agency Residential Costs of Electric Energy Savings (\$/kWh) First Year



Residential DSM Programs with High Energy Savings and Low Costs

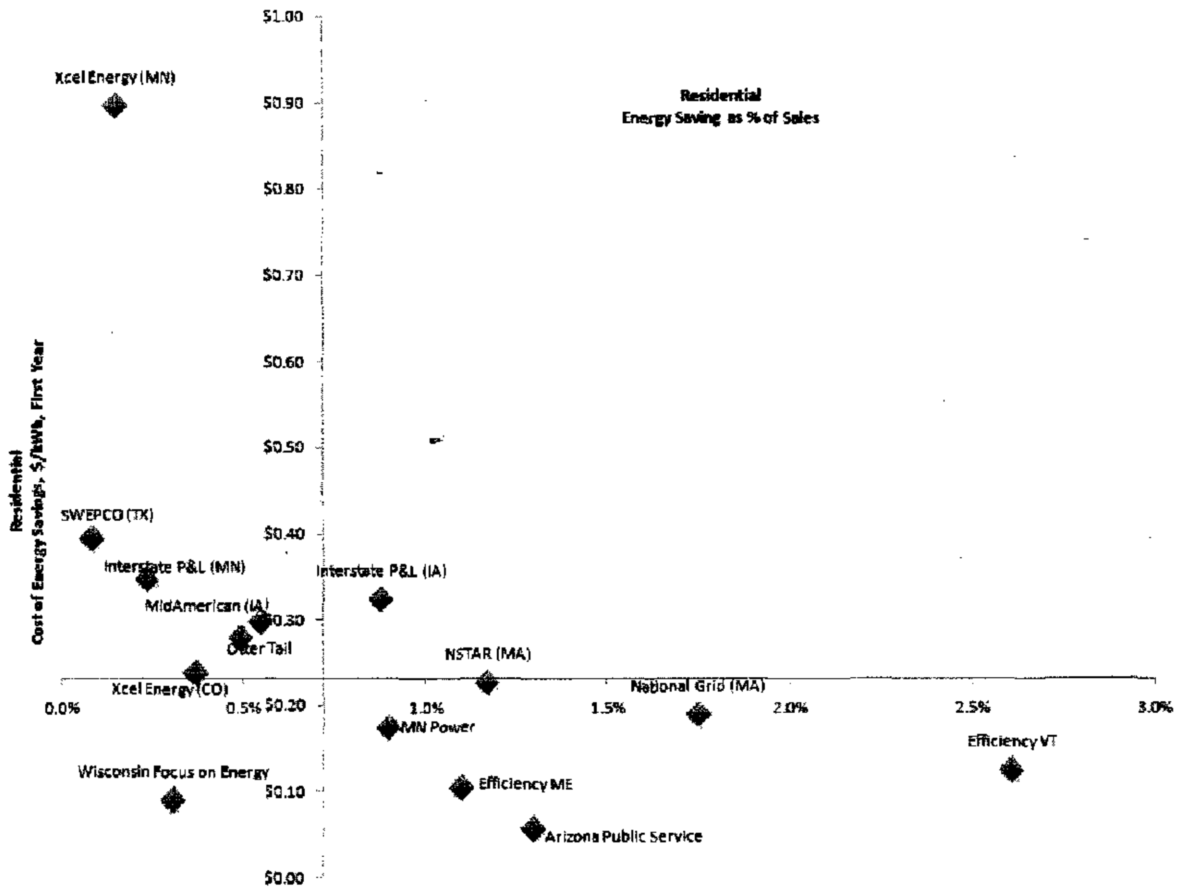
This section identifies the organizations with DSM programs that achieved above median energy savings (as a percentage of sales) at or below median costs for the residential customer sector.

For the IOUs and agencies reviewed, the scatter plot shown in Figure 5-19 below illustrates where each organization falls relative to median energy savings and median costs. Efficiency VT achieved the greatest residential energy savings as a percentage of sales, well above the median and at below median costs. Below are Efficiency VT and the other organizations that achieved energy savings rates above median and at costs/kWh below median:

1. Efficiency VT: 2.6%, $0.12/kWh
2. National Grid (MA): 1.8%, $0.19/kWh
3. Arizona Public Service: 1.3%, $0.06/kWh
4. NSTAR (MA): 1.2%, $0.22/kWh
5. Efficiency ME: 1.1%, $0.10/kWh
6. MN Power: 0.9%, $0.17/kWh

All these utilities achieved above median energy savings as a percentage of sales at below median costs because of their lighting programs.

Figure 5-19. IOU & Agency Scatter Plot of Residential Electric Energy Savings and First Year Costs ($/kWh)



For the IOUs and agencies reviewed, Table 5-10 and Table 5-11 below show program-level energy savings and costs for the organizations that achieved above median energy savings rates at or below median costs in the residential sector.

Lighting programs provided the greatest savings at the lowest costs for every best practice organization. Efficiency VT and MN Power offered programs of incentives for multiple consumer products; however, most of the savings of those programs were achieved by lighting. MN Power's Triple E Plus program included product incentives for lighting, cooling/heating/roofing, and Energy Star appliances. Efficiency VT's Existing Homes and Efficiency Products programs included incentives for lighting, cooling/heating/roofing, ES appliances, and water heating. Arizona Public Service's lighting program, Consumer Products, and National Grid (MA)'s and NSTAR (MA)'s lighting program, Residential Lighting, accounted for most of their residential portfolio's total savings at costs well below the median. National Grid, MN Power, and Efficiency ME achieved significant savings with low income program but at above median costs. Efficiency VT's New Construction program earned significant energy savings but at above median costs.

Table 5-10. IOU & Agency Electric Energy Savings for Residential Programs as % of Energy Sales[36] [37]

Residential	Arizona Public Service	Efficiency ME	Efficiency VT	MN Power	National Grid (MA)	NSTAR (MA)
Program/Measures						
Lighting	1.16%	1.01%	2.37%	0.40%	1.51%	1.02%
Cooling/Heating/Roofing	0.09%		0.01%	0.07%	0.01%	0.01%
Building Envelope						
Refrigerator/Freezer Removal						
ES Appliances			0.07%	0.04%	<0.01%	0.01%
Water Heating			0.01%			
Energy Audit					0.13%	0.09%
Combination				0.0025		
Low Income	0.01%	0.09%		0.14%	0.09%	0.04%
New Construction	0.05%		0.16%		0.02%	0.01%
Residential Direct Load Control						
Total Residential Savings (GWh)	179.2	48.7	54.3	9.5	151.7	77.6
Annual Residential Sales (GWh)	13,771.5	4,413.0	2,079.4	1,051.5	8,657.5	6,607.4
Residential Savings as % of Residents	1.30%	1.10%	2.61%	0.90%	1.75%	1.17%

[36] All data in this study for Efficiency VT exclude impacts and costs for fuel switching measures (administrative costs for fuel switching were estimated and excluded).

[37] Although all organizations here reported both impacts and costs per program, some organizations reported program details of impacts per end-use.

Table 5-11. IOU & Agency Costs of Residential Electric Energy Savings by Type of Program[38] [39]

Residential	Arizona Public Service	Efficiency ME	Efficiency VT	MN Power	National Grid (MA)	NSTAR (MA)
Program/Measures						
Lighting	$0.03	$0.06	*	*	$0.03	$0.04
Cooling/Heating/Roofing	$0.16		*	*	$1.48	$2.47
Building Envelope						
Refrigerator/Freezer Removal						
ES Appliances			*	*	$4.08	$3.27
Water Heating			*			
Energy Audit					$0.85	$0.86
Combination			$0.07*	$0.11*		
Low Income	$1.68	$0.54		$0.24	$1.13	$1.39
New Construction	$0.26		$0.81		$0.85	$1.42
Indirect Impact						
Residential Direct Load Control						
Total Residential Savings (GWh)	179.2	48.7	54.3	9.5	151.7	77.6
Total Costs ($M)	$10.0	$5.0	$6.7	$1.6	$28.5	$17.4
Costs of Residential Savings ($/kWh)	$0.06	$0.10	$0.12	$0.17	$0.19	$0.22

Residential Peak Demand Savings

This section reviews the peak demand saved (as a percentage of peak demand) and the costs of peak demand savings achieved by DSM programs in the residential customer sector.

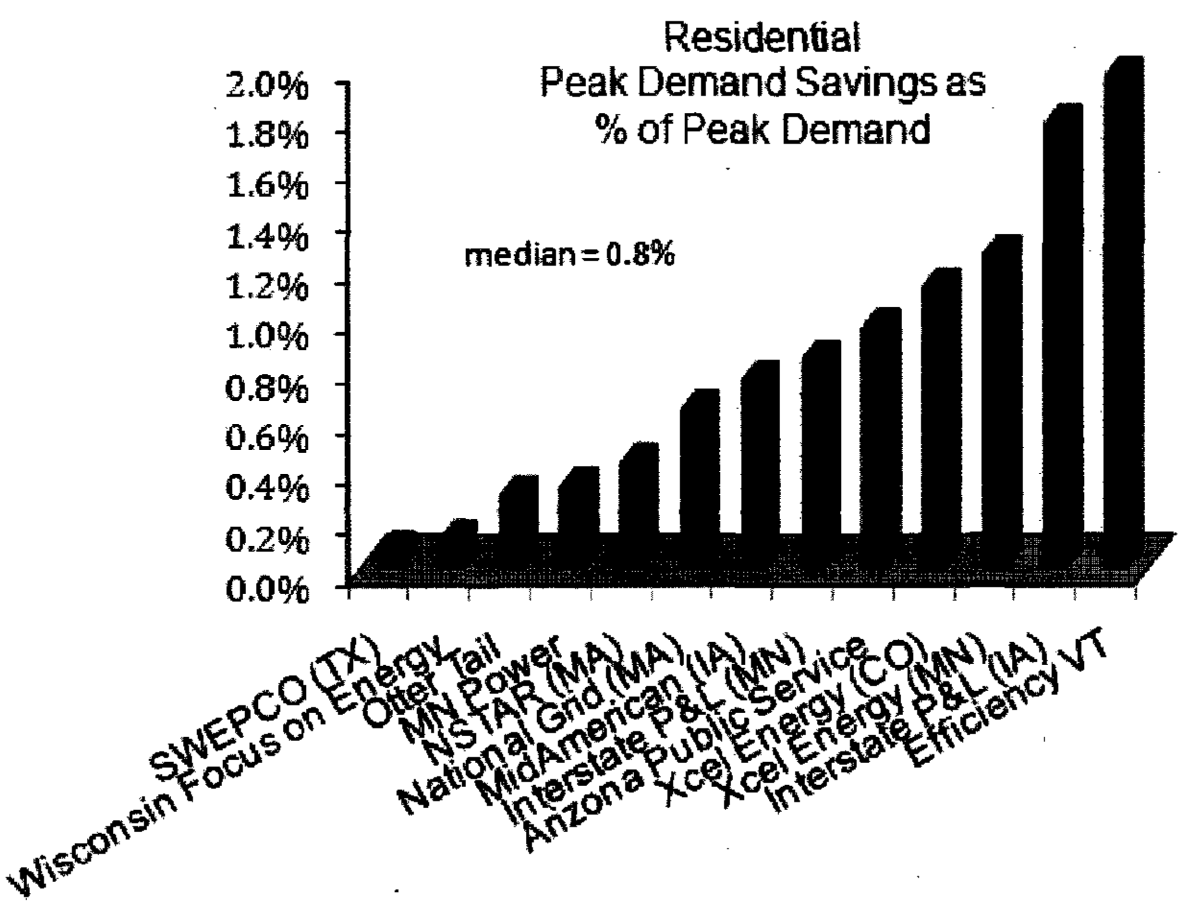
[38] For the MA utilities, indirect impact costs include evaluation, shareholder's incentives, and, for only NSTAR, incentive tax liability costs.

[39] Total costs include costs of indirect impact programs, i.e., programs for which energy and peak demand savings are not accountable.

For the IOUs and agencies reviewed,

Figure 5-20 below shows DSM incremental peak demand savings as a percentage of annual peak demand for the residential customer sector.[40] Peak demand savings as a percentage of peak demand ranges from 0.1% to 2.0% with the median at 0.8%. Efficiency VT and Interstate P&L (IA) achieved the highest percentage of peak demand conserved with very high residential DSM spending (as a percentage of revenue). Xcel Energy (MN), Xcel Energy (CO), Arizona Public Service, and Interstate P&L (MN) also achieved above median rates of peak demand conserved. Efficiency VT achieved most of its conserved peak demand with prescriptive incentives for lighting measures.

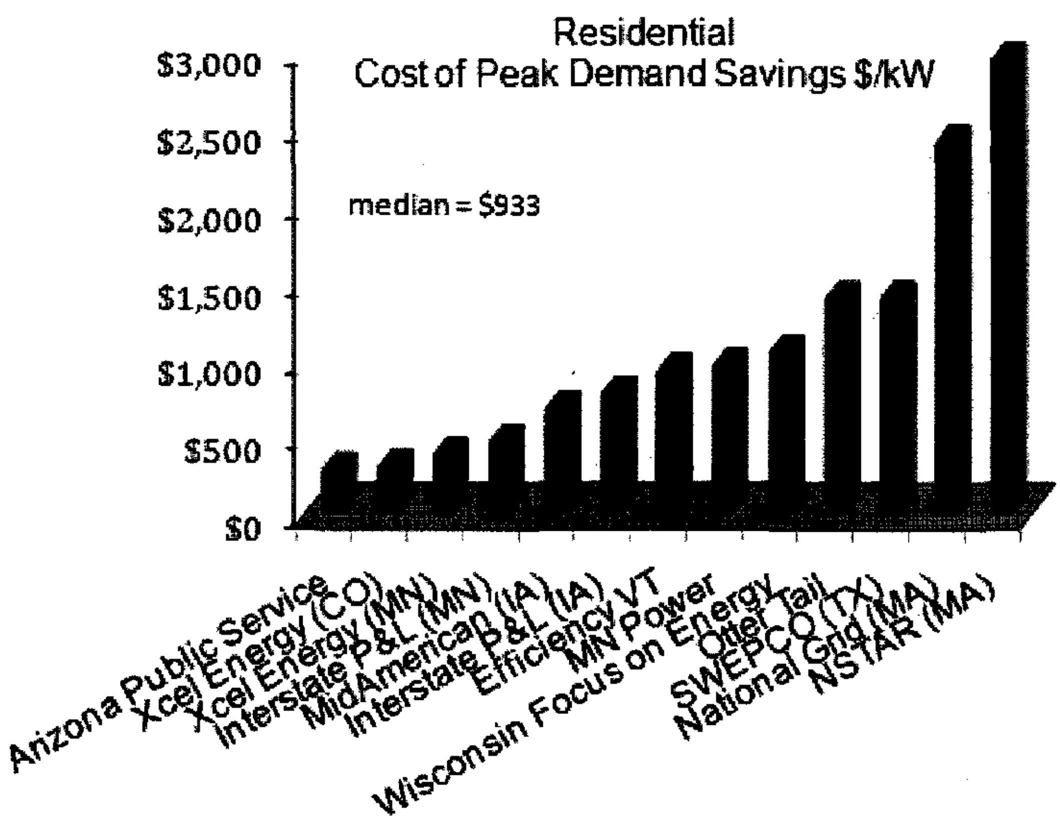
Figure 5-20. IOU & Agency Residential Peak Demand Savings as % of Peak Demand



[40] Sector-level peak demand data were available for few organizations; for all other organizations, estimates were made factoring overall system peak demand by the ratio of sector-level energy sales to overall energy sales.

For the IOUs and agencies reviewed, shown below in Figure 5-21, costs of peak demand savings ranges widely from $296/kW to $2,945/kW, with the median at $933/kW. Arizona Public Service, Xcel Energy (CO), Xcel Energy (MN), Interstate P&L (MN), and Interstate P&L (IA) achieved their above median peak demand savings at below median costs. However, Interstate P&L (IA) is the only organization that achieved above median peak demand savings with above median spending rates at below median costs. Xcel Energy (CO), Xcel Energy (MN), and Interstate P&L (IA) achieved their low-cost peak demand savings with their demand response programs; Interstate P&L (IA) also achieved significant low-cost savings with its lighting program as did Arizona Public Service and Interstate P&L (MN).

Figure 5-21. IOU & Agency Residential Cost of Peak Demand Savings ($/kW)



Residential DSM Programs with High Peak Demand Savings and Low Costs

This section identifies the organizations with DSM programs that achieved above median peak demand savings (as a percentage of peak demand) at or below median costs for the residential customer sector.

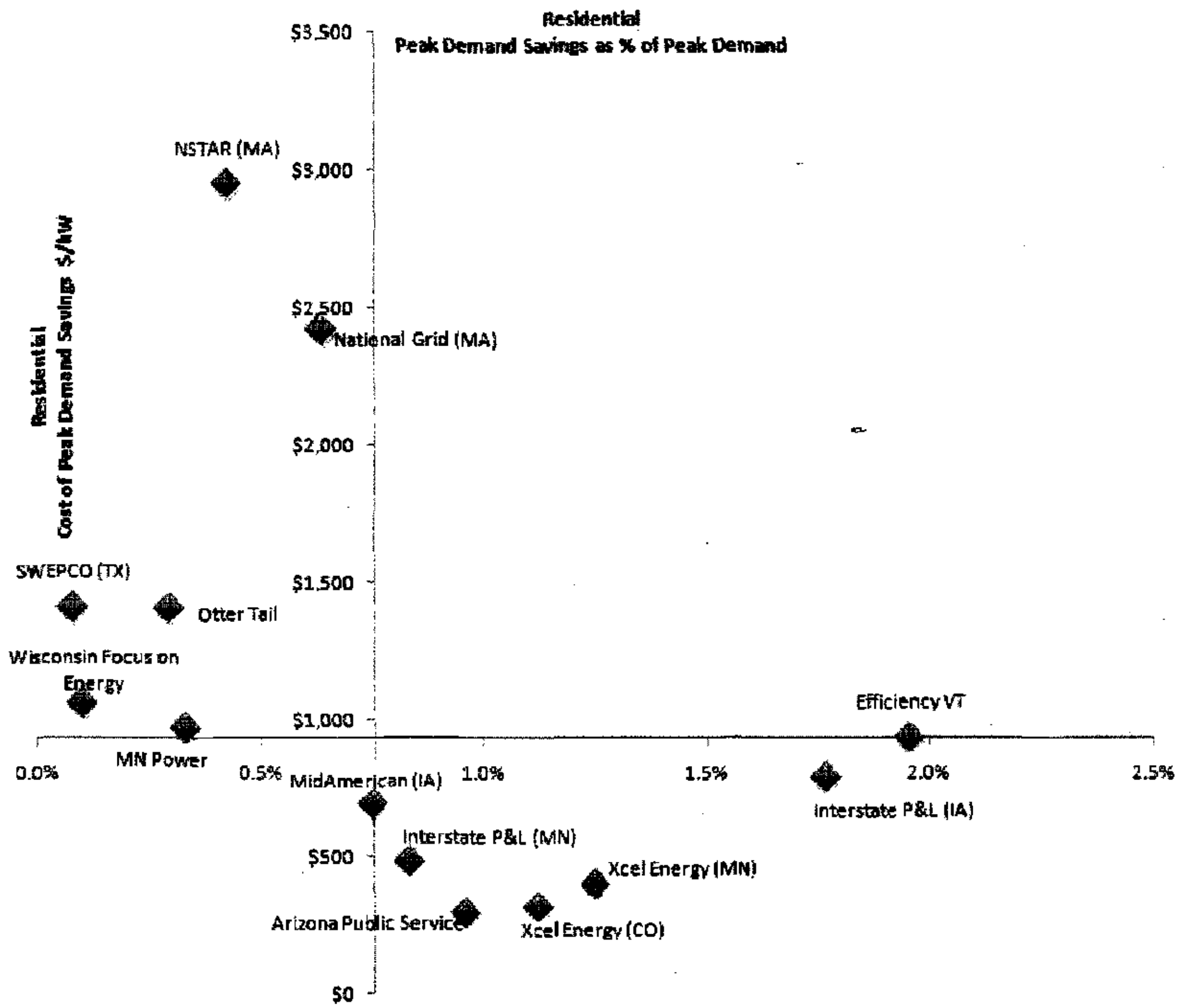
For the IOUs and agencies reviewed, the scatter plot shown in Figure 5-22 below illustrates where each organization falls relative to median peak demand savings and median costs in the residential sector. As in the C&I sector, Xcel Energy (MN), and Interstate P&L (IA) achieved a high percentage of peak demand savings at low costs in the residential sector. These two and the other organizations that achieved above median percentage of peak demand savings very below the median cost are listed below[41]:

- Efficiency VT: 2.0%, $933/kW
- Interstate P&L (IA): 1.8%, $787/kW
- Xcel Energy (MN): 1.3%, $398/kW
- Xcel Energy (CO): 1.1%, $314/kW
- Arizona Public Service: 1.0%, $296/kW
- Interstate P&L (MN): 0.8%, $481/kW
- MidAmerican (IA): 0.8%, $691/kW

Xcel Energy (MN) and Xcel Energy (CO) achieved significant amounts of their electricity DSM peak demand savings from direct load control programs, which tend to have low costs of conserved peak demand. Efficiency VT, Interstate P&L (IA), Arizona Public Service and Interstate P&L (MN) achieved significant peak demand savings with their lighting programs while MidAmerican (IA) achieved its peak demand savings at below median costs with its new construction program.

[41] All of these IOUs were summer peaking in 2007.

Figure 5-22. IOU & Agency Scatter Plot of Residential Peak Demand Savings and First Year Costs ($/kW)



For the IOUs and agencies reviewed, Xcel Energy (CO) and Xcel Energy (MN) achieved most of their residential peak demand savings with direct load control programs, Saver's Switch. They also achieved significant savings below costs with their cooling/heating/roofing programs: Xcel Energy (CO)'s Evaporative Cooling and Central AC Tune Up and Xcel Energy (MN)'s Central AC Quality Installation. Interstate P&L (MN) and Arizona Public Service achieved most of their peak demand savings at below median costs from their lighting and cooling/heating/roofing programs: Interstate P&L (MN)'s Residential Equipment Incentives and Arizona Public Service's Consumer Products and Existing Homes HVAC. Interstate P&L (IA) achieved significant savings at below median costs from its refrigerator/freezer removal, new construction, and direct load control programs, but the majority of its low-cost peak demand savings was achieved by cooling/heating/roofing and building envelope measures of its Prescriptive Rebate program. Lighting measures achieved the majority of peak demand savings also for Efficiency VT through its prescriptive incentives program, Efficiency Products, and its energy audit/retrofit program, Existing Homes. Most of MidAmerican (IA)'s residential peak demand savings was achieved by its new construction program.

Table 5-12 and Table 5-13 below show program-level incremental peak demand savings and costs for the organizations that achieved above median peak demand savings at or below median costs in the residential sector: Arizona Public Service, Interstate P&L (IA), Interstate P&L (MN), Xcel Energy (CO), and Xcel Energy (MN).

Xcel Energy (CO) and Xcel Energy (MN) achieved most of their residential peak demand savings with direct load control programs, Saver's Switch. They also achieved significant savings below costs with their cooling/heating/roofing programs: Xcel Energy (CO)'s Evaporative Cooling and Central AC Tune Up and Xcel Energy (MN)'s Central AC Quality Installation. Interstate P&L (MN) and Arizona Public Service achieved most of their peak demand savings at below median costs from their lighting and cooling/heating/roofing programs: Interstate P&L (MN)'s Residential Equipment Incentives and Arizona Public Service's Consumer Products and Existing Homes HVAC. Interstate P&L (IA) achieved significant savings at below median costs from its refrigerator/freezer removal, new construction, and direct load control programs, but the majority of its low-cost peak demand savings was achieved by cooling/heating/roofing and building envelope measures of its Prescriptive Rebate program. Lighting measures achieved the majority of peak demand savings also for Efficiency VT through its prescriptive incentives program, Efficiency Products, and its energy audit/retrofit program, Existing Homes. Most of MidAmerican (IA)'s residential peak demand savings was achieved by its new construction program.

Table 5-12. IOU & Agency Residential Peak Demand Savings by Type of Program[42]

Residential	Arizona Public Service	Efficiency VT	Interstate P&L (IA)	Interstate P&L (MN)	MidAmerican (IA)	Xcel Energy (CO)	Xcel Energy (MN)
Program/Measures							
Lighting	0.74%	1.71%	0.17%	0.39%	0.10%	0.15%	0.04%
Cooling/Heating/Roofing	0.14%	0.05%	0.50%	0.23%		0.24%	0.24%
Building Envelope			0.31%	0.16%			
Refrigerator/Freezer Removal			0.23%				
E$ Appliances		0.05%	0.01%	0.01%			
Water Heating		<0.01%	<0.01%				
Energy Audit			0.10%	0.03%	0.18%		<0.01%
Combination							
Low Income	<0.01%		0.09%	0.01%	0.02%		0.01%
New Construction	0.08%	0.14%	0.23%		0.32%		<0.01%
Fuel Switch							
Residential Direct Load Control			0.12%		0.13%	0.74%	0.97%
Total Residential Savings (MW)	33.9	7.2	14.0	0.6	12.9	25.0	31.2
Peak Demand (MW)	3519	367.9	791.5	66.1	1714.6	2223.9	2484.7
Residential Savings as % of Peak Demand	0.96%	1.96%	1.77%	0.84%	0.75%	1.12%	1.25%

[42] Although all organizations here reported both impacts and costs per program, some organizations reported program details of impacts per end-use.

Table 5-13. IOU & Agency Costs of Residential Peak Demand Savings by Type of Program[43]

Residential	Arizona Public Service	Efficiency VT	Interstate P&L (IA)	Interstate P&L (MN)	MidAmerican (IA)	Xcel Energy (CO)	Xcel Energy (MN)
Program/Measures							
Lighting	$156	*	*	*	$1,369	$171	$282
Cooling/Heating/Roofing	$394	*	*	*		$187	$472
Building Envelope			*	*			
Refrigerator/Freezer Removal			$378				
ES Appliances		*	*	*			
Water Heating		*	*				
Energy Audit			$931	$1,204	$453		$615
Combination		$551*	$773*	$386*			
Low Income	$11,516		$940	$4,080	$1,611		$3,950
New Construction	$603	$5,114	$693		$434		$4,321
Fuel Switch							
Residential Direct Load Control			$477		$645	$378	$298
Total Residential Savings (MW)	33.9	7.2	14.0	0.6	12.9	25.0	31.2
Peak Demand (MW)	$10.0	$6.7	$11.0	$0.3	$8.9	$7.9	$12.4
Residential Savings as % of Peak Demand	$296	$933	$787	$481	$691	$314	$398

5.6 Summary and Conclusion

For the electricity DSM programs of the IOUs and agencies reviewed, the overall median energy savings as a percentage of annual sales for 2007 is 0.9% and the median first year costs for energy savings is $0.15/kWh, but the best practice organizations, i.e., those with the largest relative energy savings and below median costs, achieved their energy savings at about 1.3% of annual sales. The analysis for peak demand savings as a percentage of peak demand finds the median savings is 0.6% of peak demand and the median cost is $754/kW, but the organizations with the largest relative peak demand savings and below median costs saved about 1.1% of peak demand.

Five Midwestern IOUs achieved above median relative energy savings at costs near or below the median in the C&I sector: Interstate P&L (IA), Interstate P&L (MN), MN Power, Xcel Energy (MN), and MidAmerican (IA). These achieved most of their energy savings with custom incentives, lighting, and new construction. These programs also provided most of the C&I peak demand savings; however, Xcel Energy (MN) achieved significant peak demand savings with very low cost load management programs.

In the residential sector, several organizations achieved high energy savings as a percentage of sales at low costs: Efficiency VT, National Grid (MA), Arizona Public Service, NSTAR, Efficiency ME, and MN

[43] Total costs include costs of indirect impact programs, i.e., programs for which energy and peak demand savings are not accountable.

*Interstate P&L (MN) reported only impacts per end-use and reported costs at the program level

Power. While these savings were achieved principally by programs that combined a range of product incentives and services, the majority of activity and impacts of these programs is lighting measures.

High rates of peak demand savings at low costs were achieved in the residential sector by Arizona Public Service, Efficiency VT, Interstate P&L (IA), Interstate P&L (MN), MidAmerican (IA), Xcel Energy (CO), and Xcel Energy (MN). Xcel Energy (MN) and Xcel Energy (CO) achieved most of their peak demand savings by direct load control programs at about $350/kW, well below the median costs; Efficiency VT, Interstate P&L (IA), and Interstate P&L (MN) achieved most of their peak demand savings with low cost prescriptive incentive programs; Arizona Public Service achieved most of its peak demand savings with low cost lighting and cooling/heating/roofing programs; and MidAmerican (IA) achieved most of its peak demand savings with low cost new construction and energy audit programs.

Most of the benchmarked IOUs and agencies have been conducting electricity DSM programs for an extended period. Since these organizations have been conducting electricity DSM programs, they have realized savings from a lot of the "low hanging fruit" among DSM measures, such as T12 lighting system conversions to T8 systems.

A new DSM program can reasonably be expected to achieve these results after an initial ramp up period of three to four years. Thus, the averaged results of the best practice organizations are used to calibrate the DSM potential model such that energy savings ramps up to best practice results in four years.

Further analysis examines incentive and administrative cost components of key programs of the best practice organizations. See Appendices B and C for a full discussion of best practice programs and their cost components. Average incentive costs and administrative costs per conserved kWh of best practice organizations are used to check reasonableness of the costs estimated by the potential model.

For a new DSM program, administrative costs per kWh are expected to be greater than best practice costs in the first few years, but should approach the best practice costs in four years.

6 EE/PDR Measure Cost-Effectiveness Analysis

The cost-effectiveness analysis of the energy conservation and demand response measures involved developing a list of possible measures, quantifying the necessary data inputs, and then applying tests to determine the cost-effectiveness of each measure given the input parameters. This section of the report summarizes this procedure and presents the results of the cost-effectiveness analysis.

The discussion begins with a brief overview of the inputs into the model.

6.1 Model Inputs

Model inputs include general inputs, measure inputs, and program inputs.

6.1.1 General Inputs

Key general inputs are:

- **Avoided energy costs.** These reflect costs for new energy avoided or deferred by EE/PDR measures. Annual averaged avoided energy costs, per AEP Ohio, start at $0.036/kWh on-peak and $0.030/kWh off-peak in 2009 and are escalated over the forecast period. Tables 6-1 and 6-2 summarize the cost picture for the residential and C&I sectors.

- **Avoided capacity cost.** These reflect the capital costs of new capacity avoided or deferred by EE/PDR measures and were provided by AEP Ohio.

- **Electricity prices.** These reflect the average retail price paid by AEP Ohio customers. We used a value of $0.0699/kWh for residential and $0.0694/kWh for non-residential, escalated at 3.1% per AEP Ohio's projections.[44]

[44] The analysis conducted for this report was completed before the March 18, 2009 PUCO Order on AEP Ohio's Electric Security Plan.

In line with standard industry practice, Summit Blue used the TRC test to determine which EE/PDR programs to include in AEP Ohio's portfolio of EE/PDR programs. The RIM test is a more restrictive test that is only used as the main EE/PDR benefit-cost test in very few states.[45] Most of the measures passed the TRC test. The portfolio of EE/PDR programs that Summit Blue developed is cost effective by industry standards.[46]

Table 6-1. Summary of Program Benefit-Cost Test Results – 2009 to 2011

Consumer Sector	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Rate Impact Measure Test (RIM)
Products	2.2	3.2	6.3	0.5
Recycling	1.4	0.8	NA	0.3
Retrofit	1.3	2.0	3.9	0.5
Low Income	1.5	2.1	N/A	0.5
New Construction	1.3	2.0	2.6	0.7
Consumer Sector Total	**1.7**	**2.4**	**5.2**	**0.5**
Business Sector	**Total Resource Cost Test (TRC)**	**Utility Cost Test (UCT)**	**Participant Cost Test (PCT)**	**Rate Impact Measure Test (RIM)**
Prescriptive	2.1	3.3	3.4	0.7
Custom	1.1	2.2	2.5	0.5
New Construction	1.5	2.4	3.4	0.5
LED Traffic Signals	1.8	2.6	4.8	0.6
Demand Response	10.9	3.0	N/A	2.6
Business Sector Total	**2.1**	**2.9**	**3.2**	**0.8**
PORTFOLIO TOTAL	**2.0**	**2.7**	**3.7**	**0.7**

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

[46] The analysis conducted for this report was completed before the March 18, 2009 PUCO Order on AEP Ohio's Electric Security Plan.

6.1.2 Measure-Specific Inputs

The key inputs into the cost-effectiveness analysis that are measure-specific are the measure's energy and demand savings, lifetime, and incremental cost. These inputs are described in the EE/PDR measure characterization chapter.

6.1.3 Program Cost Inputs

The final input into the cost-effectiveness analysis is the program cost. On the basis of the program benchmarking results, for most measures, Summit Blue assumes an incentive cost/unit of 50% of the technology cost/unit, and sector-specific administrative costs/unit for residential of $0.04 per kWh conserved for the Efficient Products program and $0.21 for the Retrofit and Low Income programs; and for C&I of $0.04/kWh for the C&I Prescriptive program and $0.08/kWh for the C&I Custom program. For both residential and C&I new contruction, the administrative cost was set equal to the incentive cost. The technology costs per unit are based on values from the California DEER database, adjusted by geographic multiplier factors contained in industry sources, such as the RS Means Mechanical Cost Data.

Using all of the above information, Summit Blue generated the cost-effectiveness numbers for each measure.

6.2 Cost-Effectiveness Results

This section summarizes the results of the cost-effectiveness analysis at the measure level. Following are four cost-effectiveness test results:[47]

1. **Participant test**: a measure is cost-effective from this perspective if the resulting reduction in electric costs to the participating customer exceeds the participant's after-rebate cost of the measure.

2. **Utility (or Program administrator) cost ("UCT") test**: a measure is cost-effective from this perspective if the costs avoided by the resulting energy and demand savings are greater than the utility EE/PDR program costs to promote the measure, including customer rebates.

3. **Ratepayer impact measure ("RIM") test:** a measure is cost effective from this perspective if the avoided costs are greater than the sum of the measure's EE/PDR program costs and the measure's resulting "lost revenues."

4. **Total resource cost ("TRC") test:** a measure is cost effective from this perspective if the avoided costs are greater than the sum of the measure costs and the EE/PDR program administrative costs.

In line with standard industry practice, Summit Blue primarily uses the TRC test to determine which EE/PDR programs to include in a portfolio of EE/PDR programs. Table 5.3 shows the cost and benefit components considered for each test.

[47] California Public Utilities Commission. *California Standard Practice Manual Economic Analysis of Demand-Side Programs and Projects*, October 2001.

Table 6-2. Cost-Effectiveness Tests

	Benefits				Costs			
Test	Externality	Energy	Demand	Non Energy	Net lost revenues	Program Admin	Program Rebates	Customer Costs
1. Total Resource (TRC)		X	X			X		X
2. Societal Cost Test (SCT)	X	X	X	X		X		X
3. Utility Cost Test (UCT)		X	X			X	X	
4. Rate Impact		X	X		X	X	X	
5. Participant		X	X	X				X

6.2.1 Residential Measures

The cost-effectiveness for each of the measures was analyzed for each of the residential segments. An incentive cost of 50 percent of the incremental measure cost was used for residential measures, except for retirement of second refrigerators and freezers.

Tables 6-3 to Table 6-7 show the results for individual residential measures for single-family existing homes for Columbus Southern Power. Where theTRC ratio is less than 1.0, the measure did not pass an initial TRC screen and is excluded from the potentials analysis. Results were also developed for three other housing types: new construction, multi-family and mobile homes, as well as all building types for Ohio Power Company.

Table 6-3. Residential Cost-Effectiveness Ratios – 2009 to 2011, Single-Family Existing with Electric Heat, CSP

	Lighting	TRC	UCT	PCT	RIM
Heating Type	Measure	Total Resource Cost Test	Utility Cost Test	Participant Cost Test	Rate Impact Measure Test
Electric	9-16W Screw-in CFL	1.32	2.184	3.393	0.457
Electric	9-16W Screw-in CFL	2.02	3.056	5.640	0.486
Electric	17-24W Screw-in CFL	2.18	3.232	6.250	0.491
Electric	25-34W Screw-in CFL	1.80	2.795	4.849	0.479
Electric	Over 34W Screw-in CFL	1.31	2.162	3.348	0.456
Electric	9-16W Pin Based CFL	0.08	0.127	0.720	0.104
Electric	9-16W Pin Based CFL	0.15	0.221	0.883	0.160
Electric	Pin based CFL table Lamp	0.16	0.239	0.914	0.169
Electric	Pin based CFL table Lamp	0.18	0.269	0.965	0.184
Electric	Pin based CFL table Lamp	0.17	0.248	0.929	0.174
Electric	Pin based CFL table Lamp	0.27	0.407	1.203	0.239
Electric	Over 54W Pin Based CFL	0.22	0.331	1.072	0.210
Electric	9-16W Screw-in CFL - Outdoor	1.77	2.792	5.441	0.417
Electric	9-16W Screw-in CFL - Outdoor	2.59	3.717	9.203	0.433
Electric	17-24W Screw-in CFL - Outdoor	2.80	3.927	10.420	0.436
Electric	25-34W Screw-in CFL - Outdoor	2.43	3.544	8.326	0.431
Electric	Over 34W Screw-in CFL - Outdoor	2.17	3.264	7.097	0.427
Electric	9-16W Pin Based CFL - Outdoor	0.22	0.331	1.174	0.198
Electric	9-16W Pin Based CFL - Outdoor	0.38	0.576	1.674	0.265
Electric	17-24W Pin Based CFL - Outdoor	0.42	0.626	1.777	0.275
Electric	25-34W Pin Based CFL - Outdoor	0.48	0.716	1.959	0.291
Electric	35-44W Pin Based CFL - Outdoor	0.45	0.677	1.880	0.284
Electric	45-54W Pin Based CFL - Outdoor	0.75	1.121	2.784	0.341
Electric	Over 54W Pin Based CFL - Outdoor	0.84	1.265	3.078	0.354
Electric	Indoor Torchieres	0.31	0.463	1.211	0.270
Electric	Indoor Torchieres	0.55	0.828	1.772	0.365
Electric	LED night light	0.85	1.269	3.085	0.354
Electric	LED holiday lights	0.45	0.680	1.886	0.285

Table 6-4. Residential Cost-Effectiveness Ratios – 2009 to 2011, Single-Family Existing with Gas Heat, CSP (continued)

	Lighting	TRC	UCT	PCT	RIM
Heating Type	Measure	Total Resource Cost Test	Utility Cost Test	Participant Cost Test	Rate Impact Measure Test
Gas	9-16W Screw-in CFL	2.32	3.490	5.786	0.549
Gas	9-16W Screw-in CFL	3.28	4.483	9.894	0.569
Gas	17-24W Screw-in CFL	3.48	4.665	11.010	0.571
Gas	25-34W Screw-in CFL	2.99	4.203	8.448	0.564
Gas	Over 34W Screw-in CFL	2.29	3.462	5.706	0.548
Gas	9-16W Pin Based CFL	0.17	0.262	0.902	0.187
Gas	9-16W Pin Based CFL	0.30	0.455	1.199	0.268
Gas	Pin based CFL table Lamp	0.33	0.492	1.256	0.280
Gas	Pin based CFL table Lamp	0.37	0.554	1.350	0.299
Gas	Pin based CFL table Lamp	0.34	0.510	1.284	0.286
Gas	Pin based CFL table Lamp	0.56	0.837	1.785	0.366
Gas	Over 54W Pin Based CFL	0.45	0.681	1.545	0.333
Gas	*9-16W Screw-in CFL - Outdoor*	1.77	2.792	5.441	0.417
Gas	9-16W Screw-in CFL - Outdoor	2.59	3.717	9.203	0.433
Gas	17-24W Screw-in CFL - Outdoor	2.80	3.927	10.420	0.436
Gas	25-34W Screw-in CFL - Outdoor	2.43	3.544	8.326	0.431
Gas	Over 34W Screw-in CFL - Outdoor	2.17	3.264	7.097	0.427
Gas	9-16W Pin Based CFL - Outdoor	0.22	0.331	1.174	0.198
Gas	9-16W Pin Based CFL - Outdoor	0.38	0.576	1.674	0.265
Gas	17-24W Pin Based CFL - Outdoor	0.42	0.626	1.777	0.275
Gas	25-34W Pin Based CFL - Outdoor	0.48	0.716	1.959	0.291
Gas	35-44W Pin Based CFL - Outdoor	0.45	0.677	1.880	0.284
Gas	45-54W Pin Based CFL - Outdoor	0.75	1.121	2.784	0.341
Gas	Over 54W Pin Based CFL - Outdoor	0.84	1.265	3.078	0.354
Gas	Indoor Torchieres	0.56	0.846	1.799	0.368
Gas	Indoor Torchieres	1.01	1.513	2.624	0.455
Gas	LED night light	1.55	2.316	5.225	0.405
Gas	LED holiday lights	0.45	0.680	1.866	0.285

Table 6-5. Residential Cost-Effectiveness Ratios – 2009 to 2011, Single-Family Existing, CSP

	Appliances & Pool Pumps	TRC	UCT	PCT	RIM
Heating Type	Measure	Total Resource Cost Test	Utility Cost Test	Participant Cost Test	Rate Impact Measure Test
Electric	Refrigerator, replace with Energy Star	0.16	0.323	0.774	0.211
Electric	Freezer Energy Star	0.39	0.741	1.158	0.335
Electric	Refrigerator, retire old	1.06	0.679	0.000	0.360
Electric	Freezer retire old	0.84	0.702	0.000	0.327
Electric	Variable Speed Drive Pool Pumps	1.09	1.892	3.115	0.390
Electric	occ sensor power bars	0.17	0.333	0.785	0.215
Gas	Refrigerator, replace with Energy Star	0.30	0.575	1.001	0.296
Gas	Freezer Energy Star	0.68	1.272	1.702	0.413
Gas	Refrigerator, retire old	1.06	0.679	0.000	0.360
Gas	Freezer retire old	0.84	0.702	0.000	0.327
Gas	Variable Speed Drive Pool Pumps	1.09	1.892	3.115	0.390
Gas	occ sensor power bars	0.31	0.587	1.021	0.299

Table 6-6. Residential Cost-Effectiveness Ratios – 2009 to 2011, Single-Family Existing, CSP

	Hot Water	TRC	UTC	PCT	RIM
Heating Type	Measure	Total Resource Cost Test	Utility Cost Test	Participant Cost Test	Rate Impact Measure Test
Electric	High Efficiency Water Heating Tank	1.98	3.318	4.572	0.508
Electric	Low flow showerhead	0.88	1.315	2.691	0.412
Electric	Faucent Aerators	1.97	3.213	4.722	0.506
Electric	Dishwasher - Energy Star	0.07	0.137	0.642	0.107
Electric	Drain Water Heat Recovery	0.28	0.417	1.195	0.246
Electric	Clothes Washer - Tier 3	0.39	0.756	1.152	0.343
Electric	tank insulation	0.97	1.451	2.917	0.425
Electric	pipe insulation	8.51	12.765	21.769	0.573
Gas	High Efficiency Water Heating Tank	1.98	3.318	4.572	0.508
Gas	Low flow showerhead	0.88	1.315	2.691	0.412
Gas	Faucent Aerators	1.97	3.213	4.722	0.506
Gas	Dishwasher - Energy Star	0.10	0.196	0.705	0.140
Gas	Drain Water Heat Recovery	0.28	0.417	1.195	0.246
Gas	Clothes Washer - Tier 3	0.41	0.779	1.173	0.348
Gas	tank insulation	0.97	1.451	2.917	0.425
Gas	pipe insulation	8.51	12.765	21.769	0.573

Table 6-7. Residential Cost-Effectiveness Ratios – 2009 to 2011, Single-Family Existing, CSP

	HVAC & Shell	TRC	UCT	PCT	RIM
Heating Type	Measure	Total Resource Cost Test	Utility Cost Test	Participant Cost Test	Rate Impact Measure Test
Electric	Room A/C - Energy Star	1.32	2.500	1.328	1.009
Electric	Central A/C - SEER 14 w/TXV	0.42	0.822	0.723	0.572
Electric	Window Upgrade	0.11	0.172	0.768	0.134
Electric	Improved Ceiling Insulation	0.16	0.245	0.880	0.178
Electric	Improved Wall Insulation	1.00	1.506	3.133	0.415
Electric	Reduce Infiltration	1.11	1.667	3.009	0.475
Electric	HVAC testing and Maintanence	2.69	4.035	7.646	0.495
Electric	Duct Repair	1.19	1.790	3.507	0.447
Electric	Energy Star Air Source Heat Pump	2.86	4.553	6.973	0.527
Gas	Room A/C - Energy Star	1.32	2.500	1.328	1.009
Gas	Central A/C - SEER 14 w/TXV	0.42	0.822	0.723	0.572
Gas	Window Upgrade	0.03	0.050	0.538	0.046
Gas	Improved Ceiling Insulation	0.05	0.072	0.525	0.070
Gas	Improved Wall Insulation	0.24	0.363	0.803	0.276
Gas	Reduce Infiltration	0.39	0.588	0.809	0.449
Gas	HVAC testing and Maintanence	0.61	0.912	1.282	0.512
Gas	Duct Repair	0.56	0.836	0.829	0.629
Both	Solar Photovoltaics	0.07	0.100	0.623	0.089

Of the residential measures screened, most passed the TRC and Participant screening. No measures that passed the TRC test failed the Participant test.

The results for all residential segments combined show that most of these measures are cost-effective from the perspective of every test but the RIM test. Few measures passed the RIM test.[48]

Most measures for water heating and low-use lighting failed the TRC test in the initial screening or in the analysis over all segments, mostly due to relatively high incremental cost and low energy and peak demand savings. About a third of the HVAC and shell measures failed the TRC test due mostly to the high cost, labor-intensive retrofitting of cooling and heating measures in existing construction.

AEP Ohio's relatively low estimated avoided costs also play a significant role in the benefit-cost test results. The low avoided costs tend to lower the portion of measures passing.

6.2.2 Non-Residential Measures

The cost-effectiveness for each measure was analyzed for each of the four C&I segments/building types:

- Office
- Retail
- Restaurant
- Industrial

[48] Results ratios less than one for the RIM test are typical for energy efficiency measures.

Overall, C&I results are shown in

Table 6-8 to Table 6-11 for restaurants for Columbus Southern Power.[49] Where the TRC ratio is less than 1.0, the measure did not pass an initial TRC screen and is excluded from the potentials analysis. Results were also developed for four other building types: new construction, retail, office and industrial, as well as all building types for Ohio Power Company. An incentive cost of 50 percent of the incremental measure cost was used for C&I measures, except for screw-in CFLs and the custom measure.

Table 6-8. Commercial Cost-Effectiveness Ratios – 2009 to 2011, Restaurant, CSP

	Lighting	TRC	UCT	PCT	RIM
Heating Type	Measure	Total Resource Cost Test	Utility Cost Test	Participant Cost Test	Rate Impact Measure Test
Electric	CFL - Screw-in weighted Watts	3.28	3.658	22.471	0.608
Electric	CFL - Hard-wired weighted Watts	4.69	6.213	13.660	0.652
Electric	T8 Electronic Ballast - Dimming	0.50	0.957	1.233	0.414
Electric	LED Exit	0.93	1.727	2.071	0.466
Electric	T8/T5 w/Electronic Ballast	1.27	2.324	2.422	0.555
Electric	Delamping w/Reflectors (2 lamp)	2.21	3.797	4.109	0.611
Electric	Occupancy Sensor Motion Detector	1.35	2.368	2.345	0.619
Electric	50W MH HID	1.57	2.810	2.926	0.579
Electric	75W MH HID	0.52	1.010	1.259	0.420
Electric	100W MH HID	1.32	2.403	2.519	0.556
Electric	175W PS MH HID	6.68	9.151	19.545	0.675
Electric	250W PS MH HID	4.65	7.141	10.928	0.657
Electric	50W MH HID	0.86	1.632	2.061	0.444
Electric	75W MH HID	0.29	0.570	0.999	0.293
Electric	100W MH HID	0.74	1.395	1.815	0.422
Electric	175W PS MH HID	4.51	6.471	12.745	0.557
Electric	250W PS MH HID	3.02	4.764	7.288	0.537
Electric	Outdoor Lighting Controls	0.49	0.904	1.634	0.309
Electric	T5 Interior High Bay Fluorescent Fixture - four lamp	2.18	3.736	4.247	0.588
Electric	T8 Interior High Bay Fluorescent Fixture - six lamp	1.87	3.259	3.709	0.564
Gas	CFL - Screw-in weighted Watts	3.16	3.452	28.102	0.562
Gas	CFL - Hard-wired weighted Watts	4.81	6.131	17.033	0.605
Gas	T8 Electronic Ballast - Dimming	0.58	1.079	1.420	0.414
Gas	LED Exit	1.06	1.973	2.474	0.461
Gas	T8-T5 w/Electronic Ballast	1.44	2.579	2.914	0.533
Gas	Delamping w/Reflectors (2 lamp)	2.45	4.104	5.034	0.577
Gas	Occupancy Sensor Motion Detector	1.48	2.561	2.817	0.584
Gas	50W MH HID	1.76	3.091	3.560	0.552
Gas	75W MH HID	0.60	1.150	1.453	0.421
Gas	100W MH HID	1.49	2.666	3.036	0.534
Gas	175W PS MH HID	7.06	9.043	24.426	0.625
Gas	250W PS MH HID	5.15	7.293	13.601	0.612
Gas	50W MH HID	0.86	1.632	2.061	0.444
Gas	75W MH HID	0.29	0.570	0.999	0.293
Gas	100W MH HID	0.74	1.395	1.815	0.422
Gas	175W PS MH HID	4.51	6.471	12.745	0.557
Gas	250W PS MH HID	3.02	4.764	7.288	0.537
Gas	Outdoor Lighting Controls	0.49	0.904	1.634	0.309
Gas	T5 Interior High Bay Fluorescent Fixture - four lamp	2.44	4.057	5.207	0.556
Gas	T8 Interior High Bay Fluorescent Fixture - six lamp	2.11	3.580	4.531	0.540

[49] Measures not listed here, but considered for the study, are not listed because the measure failed an initial TRC screening value of 1.0 in all segments and, thus, is excluded from the portfolio.

Table 6-9. Commercial Cost-Effectiveness Results – 2009 to 2011, CSP

	Motors & Other	TRC	UCT	PCT	RIM
Heating Type	Measure	Total Resource Cost Test	Utility Cost Test	Participant Cost Test	Rate Impact Measure Test
Electric	Prem Motor < =10 HP	0.91	1.703	1.849	0.507
Electric	Prem Motor > 10HP	1.44	2.609	2.737	0.566
Electric	Adjustable Speed Drives for Fans & Pumps	1.17	2.060	3.486	0.373
Electric	Compressed Air Controls	0.07	0.141	0.654	0.109
Electric	Convection Oven	0.14	0.269	0.706	0.193
Electric	Spray Nozzles for Food Service	1.58	1.914	8.687	0.430
Electric	Hot Water Circulation Pump Time Clock	0.95	1.567	3.069	0.364
Electric	Retrocommissioning	0.36	0.660	1.269	0.290
Gas	Prem Motor < =10 HP	0.91	1.703	1.849	0.507
Gas	Prem Motor > 10HP	1.44	2.609	2.737	0.566
Gas	Adjustable Speed Drives for Fans & Pumps	1.22	2.142	3.486	0.386
Gas	Compressed Air Controls	0.07	0.141	0.654	0.109
Gas	Convection Oven	0.14	0.269	0.706	0.193
Gas	Spray Nozzles for Food Service	1.58	1.914	8.687	0.430
Gas	Hot Water Circulation Pump Time Clock	0.95	1.567	3.069	0.364
Gas	Retrocommissioning	0.32	0.597	1.171	0.280

Table 6-10. Commercial Cost-Effectiveness Results – 2009 to 2011, CSP

	HVAC & Shell	TRC	UCT	PCT	RIM
Heating Type	Measure	Total Resource Cost Test	Utility Cost Test	Participant Cost Test	Rate Impact Measure Test
Electric	Packaged Rooftop A/C 12 EER	0.87	1.680	1.239	0.709
Electric	EMS System - Lighting & HVAC	0.75	1.293	2.393	0.349
Electric	Programmable Thermostat	2.05	3.158	7.181	0.384
Electric	Economizer	0.47	0.873	1.540	0.309
Electric	Reflective Window Film	0.59	1.184	0.535	1.107
Electric	Cool Roof	3.16	5.443	4.075	0.880
Electric	Tune-up/Advanced Diagnostics	0.29	0.577	0.734	0.398
Gas	Packaged Rooftop A/C 12 EER	0.87	1.677	1.240	0.707
Gas	EMS System - Lighting & HVAC	0.64	1.121	2.058	0.336
Gas	Programmable Thermostat	0.73	1.291	2.756	0.287
Gas	Economizer	0.45	0.839	1.494	0.305
Gas	Reflective Window Film	0.88	1.653	1.496	0.600
Gas	Cool Roof	3.13	5.494	3.557	0.978

Table 6-11. Commercial Cost-Effectiveness Results – 2009 to 2011, CSP

	Refrigeration	TRC	UCT	PCT	RIM
Heating Type	Measure	Total Resource Cost Test	Utility Cost Test	Participant Cost Test	Rate Impact Measure Test
Electric	Motor Upgrade for Fans & Compressors - ECM & PSC motors	2.50	3.631	6.213	0.590
Electric	Single Line to Multiplex Compressor	0.09	0.173	0.665	0.131
Electric	Multiplex system with oversized condenser	0.06	0.127	0.603	0.106
Electric	High efficiency, low temperature compressor with EER of 5.2	0.54	0.975	1.433	0.387
Electric	Evap Fan Controller for Med. Temp Walk-in	3.70	4.699	13.598	0.581
Electric	Strip Curtains	1.59	1.846	10.261	0.453
Electric	Night Covers	0.60	1.171	0.634	0.934
Electric	Anti-sweat Heater Controls	0.07	0.128	0.601	0.107
Electric	Floating Head Pressure Controls	2.97	3.416	24.037	0.426
Electric	Glass Doors on Low and Med. Temperature Displays	0.07	0.137	0.621	0.111
Gas	Motor Upgrade for Fans & Compressors - ECM & PSC motors	2.50	3.631	6.213	0.590
Gas	Single Line to Multiplex Compressor	0.09	0.173	0.665	0.131
Gas	Multiplex system with oversized condenser	0.06	0.127	0.603	0.106
Gas	High efficiency, low temperature compressor with EER of 5.2	0.54	0.975	1.433	0.387
Gas	Evap Fan Controller for Med. Temp Walk-in	3.70	4.699	13.598	0.581
Gas	Strip Curtains	1.59	1.846	10.261	0.453
Gas	Night Covers	0.60	1.171	0.634	0.934
Gas	Anti-sweat Heater Controls	0.07	0.128	0.601	0.107
Gas	Floating Head Pressure Controls	2.97	3.416	24.037	0.426
Gas	Glass Doors on Low and Med. Temperature Displays	0.07	0.137	0.621	0.111

Of C&I measures screened, a majority passed the TRC test. These results indicate that most common commercial EE/PDR measures are cost effective in AEP Ohio's service area.

7 EE/PDR POTENTIAL METHODOLOGY AND RESULTS

This section presents a summary of the methodology and results for the EE/PDR potential aspect of the project. All results reported in this chapter are based on a summer peak analysis.

7.1 Methodology – DSM RAM

This section describes the EE/PDR potential analysis approach and method.

The Summit Blue DSM Resource Assessment Model ("DSM-RAM") is a model based on the integration of EE/PDR measure impacts and costs, utility customer characteristics, utility load forecasts, and utility avoided costs and rate schedules. The model utilizes a "bottom-up" approach in that the starting points are the study area building stocks and equipment saturation estimates, forecasts of building stock decay and new construction, EE/PDR technology data, past EE/PDR program accomplishments, and decision maker variables that help drive the market potential scenarios.

The baseline estimates of building stocks and equipment saturations came from data provided by AEP Ohio. DSM-RAM also used the electricity forecast, avoided cost forecast, and electricity prices as described in Chapter 6, above.

DSM-RAM estimates technical, economic, and achievable EE/PDR resource potential as defined below:

- **Technical EE/PDR potential** describes the amount of EE/PDR savings that could be achieved, not considering economic and market barriers, by customers installing EE/PDR measures. Technical potential is calculated as the product of the EE/PDR measures' savings per unit, the quantity of applicable equipment in each facility, the number of facilities in a utility's service area, and 100% – the measure's current market saturation. Technical potential estimates include EE/PDR measures that may not be cost effective, and technical potential does not consider market barriers, such as customer's lack of awareness of EE/PDR measures. Therefore, technical EE/PDR potential estimates do not provide a realistic basis for setting EE/PDR program goals.

- **Economic EE/PDR potential** describes the amount of technical EE/PDR potential that is "cost-effective," as defined by the results of the TRC test. The program benefits for the TRC test include the avoided costs of generation, transmission, and distribution investments and avoided fuel costs due to the energy conserved by the EE/PDR programs. The costs for the TRC test are the EE/PDR measure costs, plus the EE/PDR program administration costs. The TRC test does not consider economic or market barriers to customers installing EE/PDR measures.

- **Achievable EE/PDR market potential** estimates the amount of EE/PDR potential that could be captured by realistic EE/PDR programs that include cost effective EE/PDR measures over the forecast period covered by this EE/PDR potential analysis. Achievable EE/PDR potential can vary with EE/PDR program parameters, such as the magnitude of rebates or incentives offered to customers for installing EE/PDR measures and, thus, many different scenarios can be modeled.

Within the achievable EE/PDR potential assessment, the individual measures are modeled by expected type of EE/PDR program design. Three different program design options are included in DSM-RAM.

- **Replace on Burnout ("ROB")** means that a EE/PDR measure is not implemented until the existing technology it is replacing fails. An example would be an energy efficient clothes washer being purchased after the failure of the existing clothes washer.
- **Retrofit ("RET")** means that the EE/PDR measure could be implemented immediately. For instance, installing a low flow showerhead is usually implemented before an existing shower head fails. Replacing incandescent lamps may be a ROB, but can be treated as a RET, because of the relatively short lifetime for incandescent bulbs.
- **New Construction ("New")** means measures that are installed at the time of new construction. Baseline technologies may be different in the new construction market, and implementation costs are often different due to the different technologies, either the energy efficient or base technology.

Cost Effectiveness Tests

DSM-RAM employs several financial tests, including the cost effectiveness tests described in Chapter 5: the TRC, UCT, PCT and RIM tests.

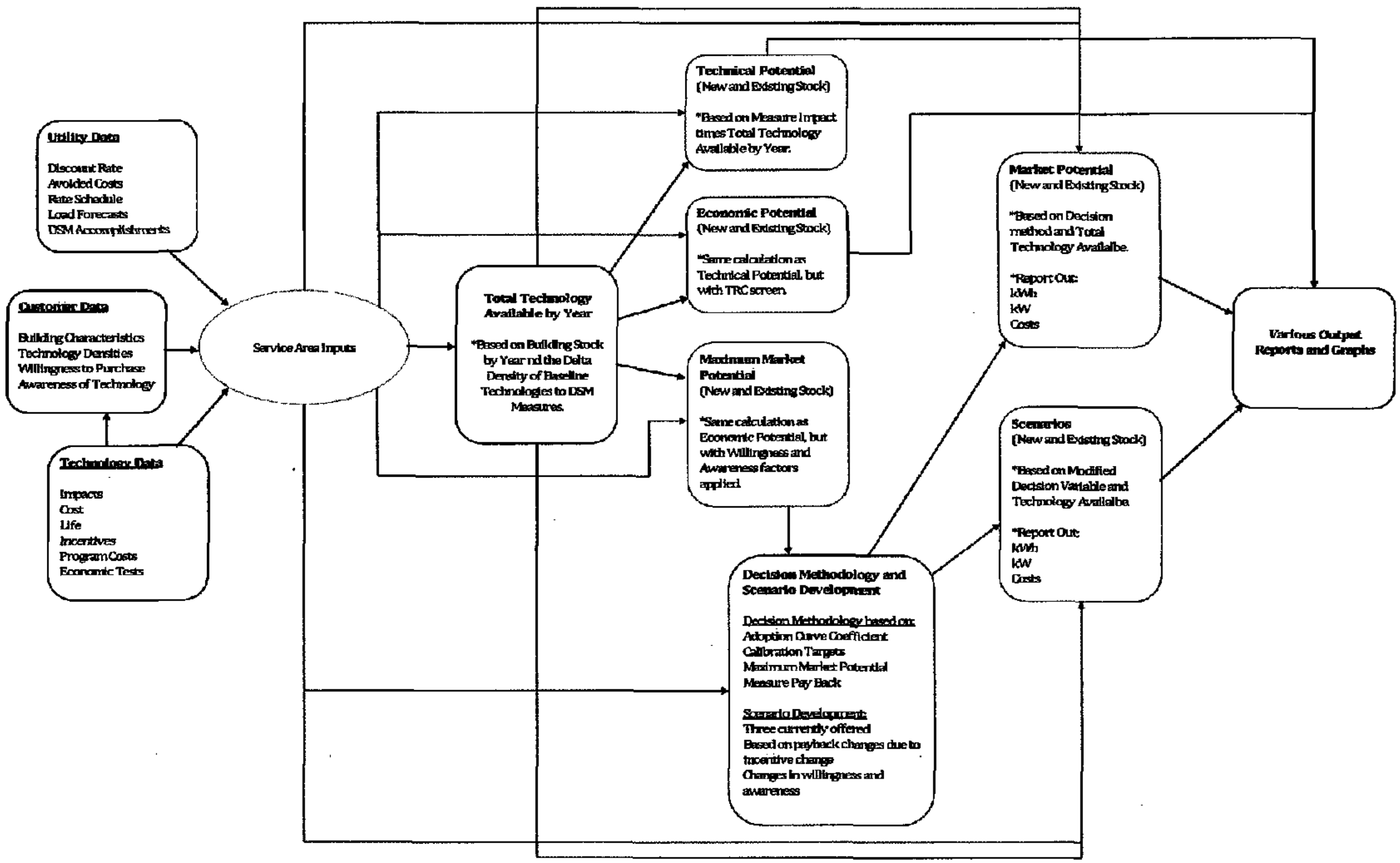
Simple Customer Payback

The decision model of DSM-RAM includes simple customer payback as part of its analysis. The calculation takes measure cost less the incentive received and divides it by first year energy bill savings.

EE/PDR Measure Levelized Cost/kWh

EE/PDR supply curves are based on the EE/PDR measure cost per kWh, levelized over the lifetime of the measure. It is calculated by multiplying EE/PDR measure costs by the Capital Recovery Factor ("CRF"), then dividing by the first year kWh savings. Figure 7-1 illustrates the flow of information in and out of DSM-RAM.

Figure 7-1. DSM-RAM Process Flow Overview



7.2 Overall EE/PDR Potential Results

Based on AEP Ohio's summer peak, the cumulative annual net EE/PDR potential savings at meter (Base Case Scenario Market Potential) in 2028 is estimated to be 7,893 GWh, about 14% of forecast sales, and 1,438 MW, about 12% of peak demand, as shown in Table 7-1. In 2028, the cumulative annual energy and demand savings are greater for the commercial and industrial sector than for the residential sector.

These results assume a net-to-gross impact ratio of 1.0, whereby free ridership is assumed for this analysis to be offset by spillover impacts, except for the recycling of second refrigerators and freezers. The impacts analyzed are not expected to reach full scale (i.e., ~1%/year) until the fifth year (2013), reflecting program startup and market development dynamics. The results reflect likely consumer behavior such as many types of equipment not being replaced until burnout, similarly to historical behavior.

Table 7-1. Projected Cumulative Annual Net Savings at Meter and Costs – 2028

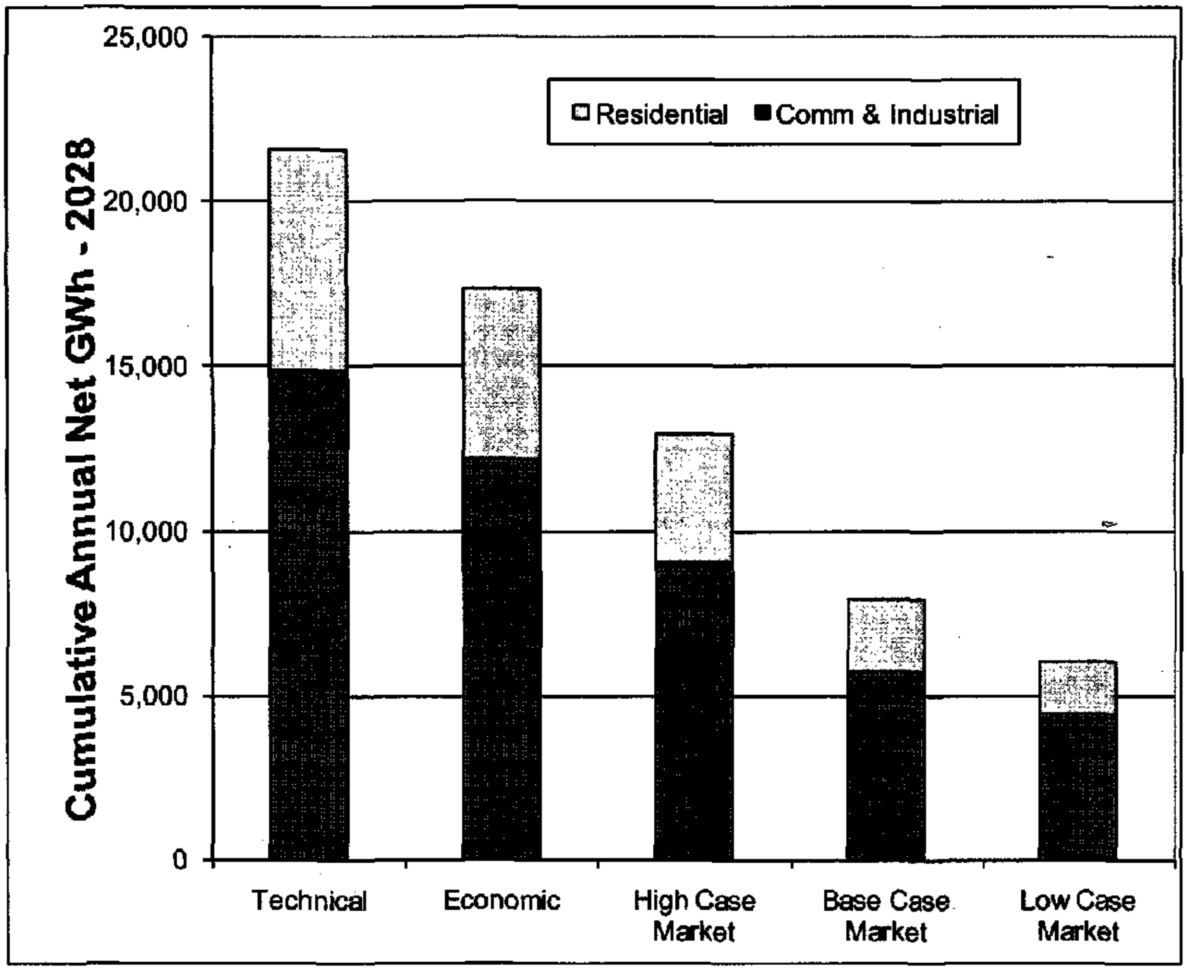
Potential Scenario	Cumulative Annual Net Energy Savings (1) at Meter (2028)		Cumulative Annual Net Summer Peak Demand Savings (1) at Meter (2028)		Total Cost (Energy Efficiency Only) (2)
Residential	GWh	% of 2028 Forecast Sales	MW	% of 2028 Forecast Sales	20 Year Cost (2009 to 2028) - 2009$ million
Technical	6,678	38%	1,222	30%	-
Economic	5,218	30%	719	18%	-
High Case	3,888	22%	699	17%	$1,050
Base Case	2,200	13%	328	8%	$414
Low Case	1,573	9%	221	5%	$255
Comm & Industrial					
Technical	14,892	36%	2,404	30%	-
Economic	12,163	29%	1,920	24%	-
High Case	9,024	22%	1,536	19%	$1,577
Base Case	5,692	14%	1,110	14%	$801
Low Case	4,425	11%	883	11%	$502
Total					
Technical	21,570	37%	3,626	30%	-
Economic	17,381	29%	2,639	22%	-
High Case	12,912	22%	2,235	18%	$2,627
Base Case	7,893	14%	1,438	12%	$1,214
Low Case	5,998	10%	1,104	9%	$757

Figure 7-2 and

(1) Savings are not included for: Demand Response, Low Income Energy Conservation Kits, Behavior Modification, Self Direct Program, and Renewable Energy Technology Program. AEP Ohio will also conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables and portfolio cost-benefit analysis.

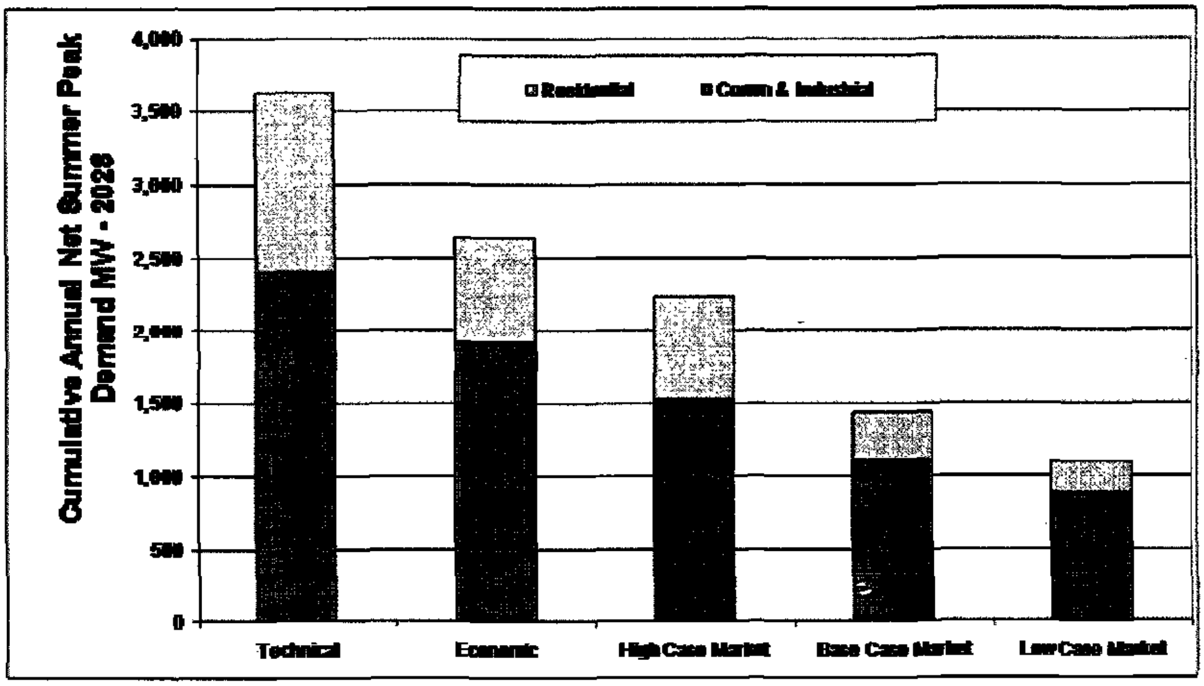
Figure 7-3 show the cumulative annual net energy and summer peak demand savings in 2028 for each of the five potential analysis scenarios. These results assume a net-to-gross impact ratio of 1.0 in most instances whereby free ridership is assumed for this analysis to be offset by spillover impacts, except for the recycling of second refrigerators and freezers. The Base Case market potential meets the SB 221 savings targets in 2009 to 2011. The high case market potential meets the SB 221 cumulative savings targets. The Base Case market potential includes incentives at 50% of incremental measure costs in most instances. The High Case market potential includes incentives at 75% of incremental measure costs, while the Low Case includes incentives at 25% of incremental measure costs.

Figure 7-2. Cumulative Annual Net GWh Energy Savings in 2028



(1) Savings are not included for: Demand Response, Low Income Energy Conservation Kits, Behavior Modification, Self Direct Program, and Renewable Energy Technology Program. AEP Ohio will also conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables and portfolio cost-benefit analysis.

Figure 7-3. Cumulative Annual Net Summer Peak MW Demand Savings in 2028

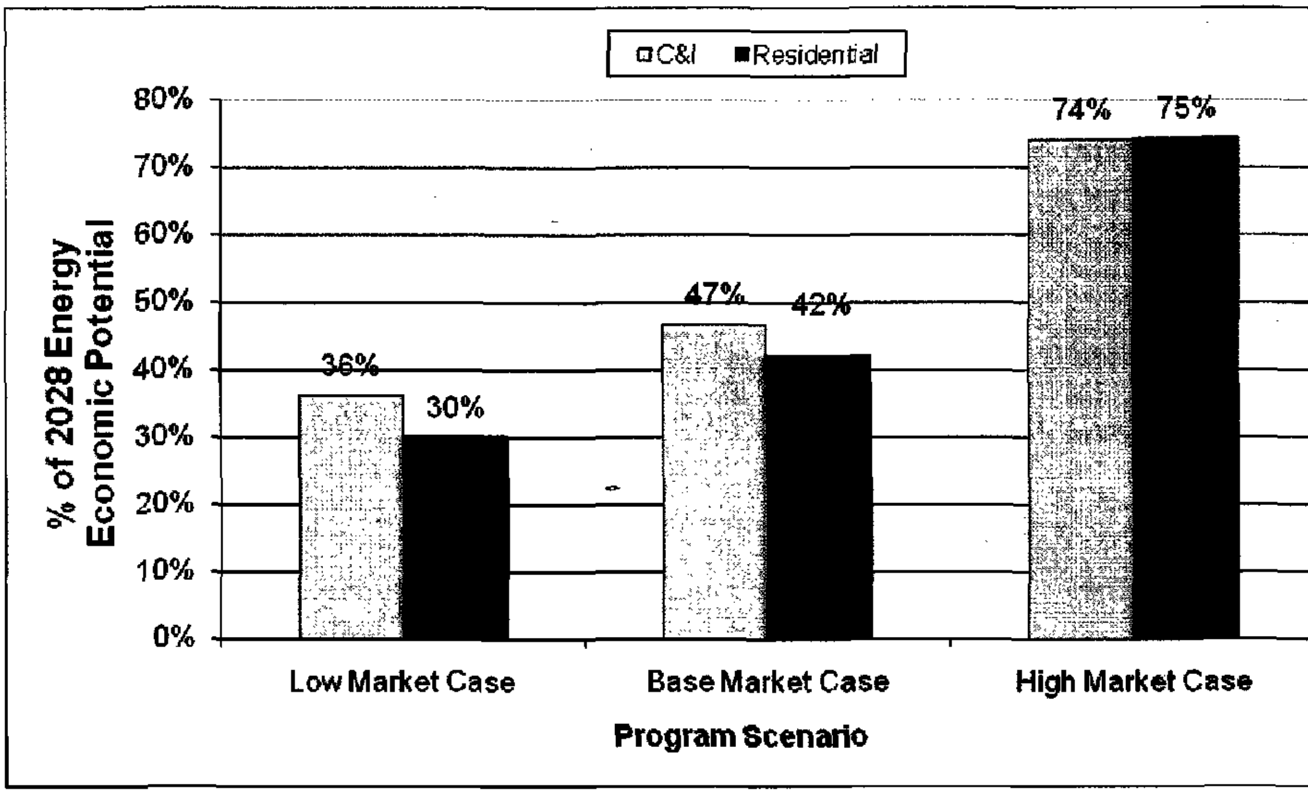


(1) Savings are not included for: Demand Response, Low Income Energy Conservation Kits, Behavior Modification, Self Direct Program, and Renewable Energy Technology Program. AEP Ohio will also conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables and portfolio cost-benefit analysis.

Figure 7-4 and Figure 7-5 show the cumulative Market Potential[50] as a percent of the Economic Potential for energy efficiency.

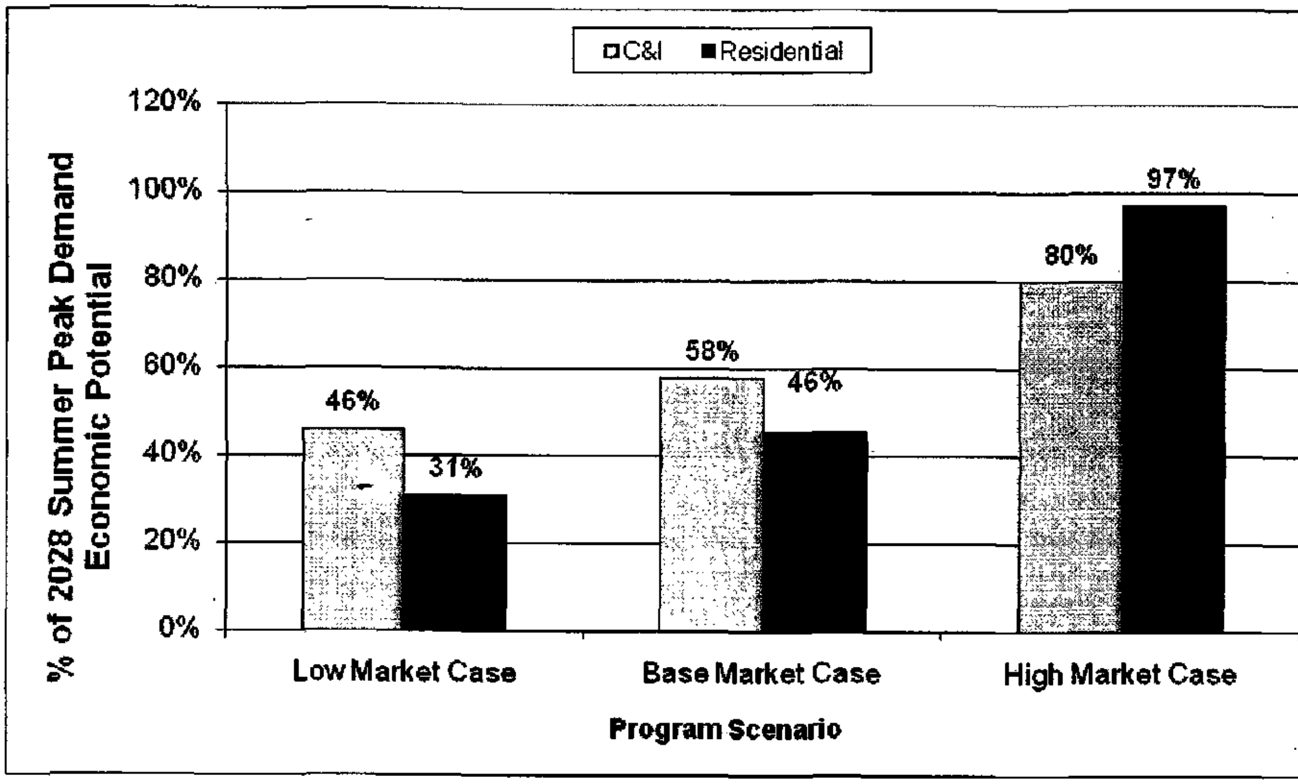
[50] Defined here as the potential achievable in real-world market risk situations.

Figure 7-4. Market Potential Net Annual Energy Savings at Meter as Percent of Economic Potential in 2028



(1) Savings are not included for: Demand Response, Low Income Energy Conservation Kits, Behavior Modification, Self Direct Program, and Renewable Energy Technology Program. AEP Ohio will also conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables and portfolio cost-benefit analysis.

Figure 7-5. Market Potential Net Annual Peak Demand Savings at Meter as Percent of Economic Potential in 2028



(1) Savings are not included for: Demand Response, Low Income Energy Conservation Kits, Behavior Modification, Self Direct Program, and Renewable Energy Technology Program. AEP Ohio will also conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables and portfolio cost-benefit analysis.

7.3 Residential EE/PDR Potential Results

This section provides the EE/PDR potential results for the residential sector. The total and annual incremental residential achievable EE/PDR potential results for twenty years (2009-2028) are shown in Table 7-2 to 7-6. The energy values shown below are for the EE/PDR measures' first-year at meter energy savings, the incremental demand savings are the summer peak coincident demand savings, and the program costs are the total estimated EE/PDR program budgets for a given year, including rebate or other customer incentive costs, as well as administrative and implementation costs.

The total twenty-year estimated residential base case market potential in 2028 is about 1,120 GWh in cumulative annual net savings at meter is about 165 MW of cumulative annual net summer peak demand. The annual incremental net energy savings at meter starts at 0.3% and peak out in 2014 at about 1.0% of AEP Ohio's forecast annual residential energy sales (annual impacts begin to decline slowly thereafter as markets are saturated). Savings are predominantly from HVAC and lighting, followed by appliances and pool pumps, and hot water measures. These results assume a net-to-gross impact ratio of 1.0, whereby free ridership is assumed for this analysis to be offset by spillover impacts, except for the recycling of second refrigerators and freezers.

The base case market potential projects savings for 2009 to 2011 consistent with meeting the requriements of SB 221. However, to meet the full SB 221 requirements through 2025 of 22.2% cumulative energy savings, AEP Ohio would need to meet the projected savings in the high case market potential scenario.

Table 7-2. Base Case Scenario: 2009 – 2028 Residential Cumulative Annual Net Savings at Meter and Costs

Market Potential - Residential Sector Programs

Cumulative Energy Potential (MWh)

Cumulative Annual MWh Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	43,757	119,298	209,905	268,786	329,189	388,843	447,039	499,833	547,741	591,251	630,779	666,706	699,330	728,982	755,925	780,417	802,652	822,864	841,231	857,930
Total Appliances & Pool Pumps	4,884	13,900	29,633	48,457	72,693	100,219	125,789	148,560	168,862	186,985	203,184	217,679	230,658	242,297	252,741	262,125	270,559	278,151	284,988	291,154
Total Hot Water	2,739	6,838	12,797	20,098	28,980	37,784	46,461	54,626	62,318	69,577	76,434	82,920	89,054	94,862	100,366	105,585	110,534	115,232	119,694	123,936
Total HVAC & Shell	11,466	32,754	56,362	99,404	144,152	205,900	258,826	311,076	363,201	418,915	474,396	530,520	581,122	634,296	685,119	736,474	782,835	831,864	879,448	927,458
TOTAL	**62,846**	**172,791**	**308,697**	**436,746**	**575,013**	**732,747**	**878,116**	**1,014,096**	**1,142,121**	**1,266,728**	**1,384,794**	**1,497,825**	**1,600,164**	**1,700,436**	**1,794,150**	**1,884,601**	**1,966,580**	**2,048,110**	**2,125,362**	**2,200,477**
Total as % of Sector Sales	0.41%	1.11%	1.97%	2.74%	3.60%	4.53%	5.41%	6.22%	6.97%	7.68%	8.33%	8.94%	9.49%	10.02%	10.50%	10.96%	11.38%	11.78%	12.16%	12.51%

Cumulative Demand Potential (kW)

Cumulative Annual Peak kW Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	5,082	14,030	24,952	31,828	38,854	45,792	52,553	58,686	64,251	69,306	73,899	78,073	81,864	85,310	88,441	91,288	93,872	96,222	98,358	100,300
Total Appliances & Pool Pumps	563	1,567	3,281	5,085	6,754	8,298	9,725	11,042	12,259	13,383	14,422	15,382	16,269	17,089	17,847	18,547	19,193	19,790	20,342	20,852
Total Hot Water	301	752	1,408	2,211	3,188	4,156	5,110	6,008	6,854	7,653	8,407	9,121	9,795	10,434	11,039	11,614	12,158	12,675	13,165	13,632
Total HVAC & Shell	1,368	6,060	10,389	21,156	28,989	43,856	53,439	62,986	72,766	84,633	96,660	109,278	119,391	131,054	141,791	153,044	162,036	172,606	182,685	193,205
TOTAL	**7,314**	**22,409**	**40,029**	**60,280**	**77,785**	**102,102**	**120,827**	**138,723**	**156,131**	**174,975**	**193,388**	**211,854**	**227,319**	**243,887**	**259,118**	**274,492**	**287,259**	**301,293**	**314,550**	**327,990**
Total as % of Sector Sales	0.21%	0.64%	1.14%	1.70%	2.18%	2.83%	3.32%	3.78%	4.22%	4.69%	5.13%	5.57%	5.92%	6.30%	6.63%	6.96%	7.23%	7.51%	7.78%	8.04%

Incremental Energy Potential (MWh)

Incremental Annual MWh Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	43,757	75,541	90,606	58,881	60,403	59,654	58,196	52,795	47,907	43,511	39,528	35,926	32,624	29,652	26,943	24,492	22,236	20,211	18,367	16,699
Total Appliances & Pool Pumps	4,884	9,016	15,733	18,824	24,235	27,527	25,570	22,771	20,301	18,124	16,198	14,495	12,980	11,638	10,445	9,384	8,434	7,591	6,838	6,165
Total Hot Water	2,739	4,099	5,959	7,301	8,882	8,804	8,677	8,165	7,692	7,259	6,858	6,486	6,133	5,809	5,504	5,220	4,948	4,696	4,462	4,242
Total HVAC & Shell	11,466	21,288	23,608	43,042	44,748	61,749	52,926	52,250	52,125	55,714	55,482	56,124	50,602	53,174	50,823	51,355	46,361	49,029	47,585	48,009
TOTAL	**62,846**	**109,944**	**135,906**	**128,049**	**138,268**	**157,733**	**145,369**	**135,980**	**128,025**	**124,607**	**118,066**	**113,031**	**102,338**	**100,273**	**93,714**	**90,451**	**81,979**	**81,530**	**77,252**	**75,116**
Total as % of Sector Sales	0.41%	0.70%	0.87%	0.80%	0.87%	0.98%	0.90%	0.83%	0.78%	0.76%	0.71%	0.67%	0.61%	0.59%	0.55%	0.53%	0.47%	0.47%	0.44%	0.43%

Incremental Demand Potential (kW)

Incremental Annual Peak kW Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	5,082	8,948	10,922	6,876	7,026	6,938	6,761	6,133	5,565	5,055	4,592	4,174	3,791	3,446	3,131	2,847	2,585	2,350	2,136	1,942
Total Appliances & Pool Pumps	563	1,004	1,714	1,804	1,669	1,545	1,427	1,317	1,217	1,124	1,039	960	887	820	757	700	646	597	552	510
Total Hot Water	301	451	655	803	977	968	954	898	846	798	754	713	675	639	605	574	544	517	491	467
Total HVAC & Shell	1,368	4,692	4,328	10,768	7,833	14,867	9,583	9,547	9,780	11,867	12,027	12,618	10,113	11,663	10,737	11,253	8,992	10,570	10,079	10,521
TOTAL	**7,314**	**15,095**	**17,620**	**20,252**	**17,506**	**24,317**	**18,725**	**17,896**	**17,408**	**18,844**	**18,412**	**18,466**	**15,465**	**16,568**	**15,231**	**15,374**	**12,767**	**14,034**	**13,257**	**13,439**
Total as % of Sector Sales	0.21%	0.43%	0.50%	0.57%	0.49%	0.67%	0.52%	0.49%	0.47%	0.50%	0.49%	0.49%	0.40%	0.43%	0.39%	0.39%	0.32%	0.35%	0.33%	0.33%

Incremental Incentive Cost ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$1,694,401	$2,818,352	$3,284,995	$3,230,099	$3,454,405	$3,412,038	$3,331,098	$3,020,020	$2,738,832	$2,488,279	$2,257,751	$2,051,304	$1,861,987	$1,691,880	$1,538,829	$1,398,769	$1,267,707	$1,152,158	$1,046,899	$951,817
Total Appliances & Pool Pumps	$592,857	$1,091,817	$1,901,690	$2,254,853	$2,849,025	$3,207,020	$2,978,426	$2,656,294	$2,371,673	$2,120,472	$1,898,059	$1,701,046	$1,525,464	$1,369,875	$1,231,194	$1,107,820	$997,154	$898,798	$810,747	$732,083
Total Hot Water	$147,529	$206,523	$270,490	$377,362	$524,708	$525,288	$521,370	$484,258	$450,374	$419,831	$391,835	$366,241	$342,093	$320,222	$299,825	$281,112	$263,277	$247,159	$232,108	$218,253
Total HVAC & Shell	$1,261,251	$2,834,238	$2,859,236	$5,845,872	$5,482,223	$8,662,832	$6,652,561	$6,593,299	$6,644,430	$7,451,426	$7,474,925	$7,674,922	$6,614,108	$7,206,042	$6,790,055	$6,961,821	$6,003,330	$6,609,256	$6,373,063	$6,517,338
TOTAL	$3,696,039	$6,950,730	$8,316,412	$11,708,186	$12,310,380	$15,807,179	$13,483,455	$12,753,871	$12,205,399	$12,478,009	$12,022,569	$11,793,513	$10,343,632	$10,587,999	$9,857,902	$9,747,522	$8,531,467	$8,907,370	$8,462,816	$8,419,491

Incremental Administrative Cost ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$842,065	$1,359,053	$1,531,395	$1,601,345	$1,680,240	$1,659,451	$1,622,473	$1,471,021	$1,334,067	$1,210,949	$1,099,507	$998,786	$906,483	$823,480	$747,852	$679,497	$616,580	$560,184	$508,820	$462,401
Total Appliances & Pool Pumps	$577,108	$1,041,846	$1,792,256	$1,976,315	$2,099,306	$2,145,942	$1,987,914	$1,802,270	$1,635,464	$1,485,965	$1,351,349	$1,230,136	$1,119,997	$1,020,914	$931,024	$849,783	$775,502	$708,568	$647,666	$592,432
Total Hot Water	$79,892	$114,378	$155,533	$206,594	$272,630	$272,204	$269,760	$251,806	$235,338	$220,402	$206,649	$194,011	$182,067	$171,178	$160,990	$151,592	$142,630	$134,467	$126,818	$119,736
Total HVAC & Shell	$2,000,826	$4,074,554	$4,922,954	$8,172,422	$8,049,368	$11,261,881	$9,081,085	$8,802,408	$8,655,858	$9,285,420	$9,148,666	$9,203,969	$8,010,934	$8,483,716	$7,959,143	$8,032,490	$6,983,419	$7,507,624	$7,196,725	$7,273,063
TOTAL	$3,499,891	$6,589,831	$8,402,138	$11,956,676	$12,101,543	$15,339,479	$12,961,231	$12,327,504	$11,860,727	$12,202,736	$11,806,171	$11,626,902	$10,219,481	$10,499,288	$9,799,010	$9,713,362	$8,518,131	$8,910,843	$8,480,019	$8,447,632

Total Incremental Costs ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$2,536,466	$4,177,404	$4,816,390	$4,831,444	$5,134,645	$5,071,489	$4,953,570	$4,491,040	$4,072,899	$3,697,228	$3,357,258	$3,050,089	$2,768,460	$2,515,340	$2,284,681	$2,076,265	$1,884,287	$1,712,342	$1,555,719	$1,414,218
Total Appliances & Pool Pumps	$1,169,966	$2,133,463	$3,693,947	$4,231,168	$4,948,331	$5,352,962	$4,966,340	$4,458,564	$4,007,138	$3,606,438	$3,249,408	$2,931,182	$2,645,461	$2,390,789	$2,162,218	$1,957,604	$1,772,656	$1,607,366	$1,458,402	$1,324,515
Total Hot Water	$227,421	$320,901	$426,023	$583,956	$797,337	$797,492	$791,130	$736,064	$685,712	$640,233	$598,483	$560,252	$524,159	$491,400	$460,815	$432,704	$405,906	$381,626	$358,925	$337,989
Total HVAC & Shell	$3,262,077	$6,908,792	$7,782,190	$14,018,294	$13,531,590	$19,924,714	$15,733,646	$15,395,707	$15,300,288	$16,736,846	$16,623,591	$16,878,892	$14,625,042	$15,689,758	$14,749,198	$14,994,311	$12,966,749	$14,116,879	$13,569,789	$13,790,401
TOTAL	$7,195,930	$13,540,560	$16,718,550	$23,664,862	$24,411,903	$31,146,657	$26,444,687	$25,081,375	$24,066,036	$24,680,745	$23,828,740	$23,420,415	$20,563,113	$21,087,287	$19,656,912	$19,460,884	$17,849,598	$17,818,213	$16,942,836	$16,867,123

Table 7-3. Residential Technical Potential Scenario: 2009 – 2028 Net Savings at Meter

Technical Potential

Cumulative Energy Potential (MWh)

Residential Sector	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Lighting	1,703,483	1,703,536	1,702,828	1,215,074	1,214,402	1,214,657	1,214,056	1,213,465	1,212,923	1,212,681	1,212,476	1,212,365	1,211,925	1,211,711	1,211,383	1,211,138	1,210,596	1,210,282	1,209,913	1,209,615
Appliances & Pool Pumps	735,239	735,326	735,056	735,442	735,058	735,276	734,938	734,608	734,308	734,204	734,123	734,103	733,869	733,782	733,621	733,514	733,214	733,063	732,875	732,734
Hot Water	734,746	735,080	734,951	735,675	735,397	735,902	735,684	735,474	735,305	735,389	735,504	735,698	735,614	735,720	735,730	735,809	735,638	735,659	735,633	735,667
HVAC & Shell	3,589,653	3,620,721	3,636,747	3,680,410	3,691,562	3,728,069	3,741,112	3,754,435	3,769,032	3,791,824	3,815,579	3,841,900	3,859,179	3,882,603	3,902,884	3,925,411	3,939,781	3,960,369	3,979,410	4,000,390
Total All	**6,763,121**	**6,794,662**	**6,809,582**	**6,366,602**	**6,376,419**	**6,413,904**	**6,425,789**	**6,437,983**	**6,451,568**	**6,474,098**	**6,497,681**	**6,524,066**	**6,540,588**	**6,563,817**	**6,583,618**	**6,605,872**	**6,619,229**	**6,639,372**	**6,657,830**	**6,678,407**
Total as % of Sector Sales	43.80%	43.54%	43.40%	40.00%	39.92%	39.68%	39.58%	39.49%	39.38%	39.23%	39.08%	38.92%	38.81%	38.66%	38.54%	38.40%	38.31%	38.19%	38.08%	37.96%

Cumulative Demand Potential (kW)

Residential Sector	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Lighting	188,922	188,928	188,849	132,325	132,251	132,278	132,212	132,147	132,088	132,061	132,038	132,025	131,976	131,952	131,916	131,889	131,829	131,794	131,754	131,721
Appliances & Pool Pumps	72,613	72,640	72,623	72,686	72,656	72,698	72,673	72,649	72,629	72,633	72,639	72,652	72,640	72,645	72,642	72,645	72,624	72,622	72,615	72,614
Hot Water	80,444	80,486	80,475	80,562	80,534	80,595	80,574	80,553	80,538	80,551	80,568	80,593	80,587	80,603	80,608	80,621	80,605	80,611	80,611	80,619
HVAC & Shell	706,740	723,649	732,912	756,221	763,004	782,673	790,415	798,298	806,827	819,521	832,703	847,188	857,077	870,088	881,499	894,052	902,457	914,022	924,799	936,561
Total All	**1,048,720**	**1,065,703**	**1,074,860**	**1,041,794**	**1,048,444**	**1,068,244**	**1,075,874**	**1,083,648**	**1,092,082**	**1,104,765**	**1,117,947**	**1,132,459**	**1,142,281**	**1,155,288**	**1,166,665**	**1,179,206**	**1,187,515**	**1,199,048**	**1,209,779**	**1,221,514**
Total as % of Sector Sales	30.20%	30.53%	30.66%	29.45%	29.36%	29.62%	29.59%	29.56%	29.52%	29.60%	29.66%	29.76%	29.76%	29.83%	29.86%	29.92%	29.87%	29.90%	29.91%	29.95%

Table 7-4. Residential Economic Potential Scenario: 2009 – 2028 Net Savings at Meter

Economic Potential

Cumulative Energy Potential (MWh)

Residential Sector	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Lighting	1,387,377	1,387,530	1,387,015	972,821	972,314	972,602	972,156	971,719	971,323	971,185	971,078	971,052	970,744	970,629	970,416	970,275	969,879	969,678	969,430	969,244
Appliances & Pool Pumps	553,947	553,966	553,737	553,964	553,655	553,766	553,489	553,218	552,968	552,853	552,756	552,701	552,497	552,395	552,242	552,127	551,877	551,730	551,558	551,419
Hot Water	221,428	221,400	221,288	221,330	221,191	221,193	221,065	220,939	220,820	220,747	220,680	220,627	220,524	220,455	220,369	220,296	220,177	220,093	220,001	219,920
HVAC & Shell	3,169,797	3,193,225	3,205,110	3,238,205	3,246,350	3,273,953	3,283,550	3,293,363	3,304,153	3,321,233	3,339,052	3,358,841	3,371,692	3,389,258	3,404,413	3,421,292	3,431,912	3,447,303	3,461,508	3,477,202
Total All	**5,332,550**	**5,356,121**	**5,367,149**	**4,986,320**	**4,993,509**	**5,021,514**	**5,030,260**	**5,039,238**	**5,049,263**	**5,066,018**	**5,083,566**	**5,103,221**	**5,115,456**	**5,132,738**	**5,147,440**	**5,163,989**	**5,173,844**	**5,188,805**	**5,202,498**	**5,217,785**
Total as % of Sector Sales	34.53%	34.33%	34.21%	31.33%	31.26%	31.07%	30.99%	30.91%	30.82%	30.70%	30.58%	30.44%	30.35%	30.23%	30.13%	30.02%	29.95%	29.85%	29.75%	29.65%

Cumulative Demand Potential (kW)

Residential Sector	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Lighting	161,507	161,532	161,477	113,186	113,129	113,169	113,119	113,071	113,028	113,016	113,008	113,010	112,977	112,968	112,947	112,934	112,891	112,872	112,846	112,828
Appliances & Pool Pumps	50,753	50,772	50,760	50,803	50,782	50,811	50,794	50,777	50,763	50,765	50,769	50,779	50,770	50,774	50,771	50,773	50,759	50,757	50,752	50,751
Hot Water	24,355	24,352	24,340	24,345	24,329	24,330	24,315	24,302	24,288	24,280	24,273	24,267	24,256	24,248	24,239	24,231	24,218	24,209	24,198	24,189
HVAC & Shell	359,284	371,885	378,860	396,169	401,320	415,951	421,806	427,766	434,200	443,699	453,556	464,372	471,806	481,537	490,091	499,485	505,827	514,493	522,580	531,391
Total All	**595,900**	**608,541**	**615,437**	**584,503**	**589,560**	**604,260**	**610,035**	**615,916**	**622,280**	**631,760**	**641,607**	**652,428**	**659,809**	**669,527**	**678,048**	**687,423**	**693,694**	**702,330**	**710,376**	**719,160**
Total as % of Sector Sales	17.16%	17.44%	17.55%	16.52%	16.51%	16.76%	16.78%	16.80%	16.82%	16.93%	17.02%	17.15%	17.19%	17.29%	17.36%	17.44%	17.45%	17.52%	17.56%	17.63%

Table 7-5. High Case Scenario: 2009 – 2028 Residential Cumulative Annual Net Savings at Meter and Costs

High Scenario - Residential Sector Programs

Cumulative Energy Potential (MWh)

Cumulative Annual MWh Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	43,757	258,581	468,210	584,276	681,938	760,092	822,236	870,957	909,542	940,467	965,498	985,966	1,002,771	1,016,739	1,028,411	1,038,256	1,046,540	1,053,612	1,059,663	1,064,893
Total Appliances & Pool Pumps	4,884	15,731	35,204	62,674	106,601	152,154	184,254	207,005	223,977	237,285	248,186	257,436	265,492	272,645	279,079	284,923	290,278	295,223	299,792	304,015
Total Hot Water	2,739	12,340	24,275	39,112	56,660	71,545	84,194	94,754	103,705	111,409	118,117	124,022	129,247	133,925	138,137	141,962	145,441	148,639	151,593	154,337
Total HVAC & Shell	11,466	89,392	171,287	314,006	452,513	635,296	779,028	917,097	1,051,589	1,194,267	1,333,666	1,472,732	1,592,721	1,718,748	1,835,842	1,953,041	2,053,484	2,160,885	2,262,712	2,364,824
TOTAL	62,846	376,043	698,976	1,000,067	1,297,712	1,619,087	1,869,712	2,089,814	2,288,813	2,483,429	2,665,467	2,840,156	2,990,231	3,142,057	3,281,470	3,418,182	3,535,743	3,658,359	3,773,760	3,888,070
Total as % of Sector Sales	0.41%	2.41%	4.46%	6.28%	8.12%	10.02%	11.52%	12.82%	13.97%	15.05%	16.03%	16.94%	17.74%	18.51%	19.21%	19.87%	20.46%	21.04%	21.58%	22.10%

Cumulative Demand Potential (kW)

Cumulative Annual Peak kW Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	5,082	28,517	51,937	64,740	75,614	84,434	91,547	97,228	101,815	105,566	108,666	111,253	113,421	115,260	116,826	118,171	119,325	120,326	121,196	121,959
Total Appliances & Pool Pumps	563	1,567	3,283	5,090	6,765	8,315	9,743	11,061	12,276	13,399	14,436	15,395	16,280	17,099	17,855	18,554	19,199	19,796	20,347	20,856
Total Hot Water	301	1,357	2,670	4,302	6,232	7,869	9,261	10,422	11,407	12,254	12,992	13,641	14,216	14,731	15,194	15,615	15,997	16,349	16,674	16,976
Total HVAC & Shell	1,368	18,643	33,791	70,102	94,792	140,364	167,413	193,886	220,673	253,530	286,573	321,167	347,815	379,028	407,210	438,818	459,327	486,571	512,196	539,085
TOTAL	7,314	50,085	91,681	144,234	183,403	240,982	277,964	312,597	346,171	384,750	422,667	461,456	491,733	526,117	557,085	589,157	613,849	643,042	670,413	698,876
Total as % of Sector Sales	0.21%	1.44%	2.61%	4.08%	5.14%	6.68%	7.65%	8.53%	9.36%	10.31%	11.21%	12.13%	12.81%	13.59%	14.26%	14.95%	15.44%	16.04%	16.58%	17.13%

Incremental Energy Potential (MWh)

Incremental Annual MWh Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	43,757	214,824	209,628	116,066	97,663	78,154	62,144	48,721	38,585	30,925	25,030	20,468	16,805	13,968	11,672	9,845	8,284	7,071	6,052	5,230
Total Appliances & Pool Pumps	4,884	10,847	19,473	27,470	43,927	45,553	32,100	22,751	16,972	13,308	10,900	9,250	8,056	7,153	6,434	5,844	5,354	4,945	4,569	4,223
Total Hot Water	2,739	9,601	11,935	14,837	17,548	14,885	12,650	10,560	8,951	7,704	6,708	5,905	5,225	4,678	4,212	3,825	3,479	3,199	2,953	2,745
Total HVAC & Shell	11,466	77,925	81,896	142,718	138,507	182,783	143,732	138,069	134,492	142,678	139,399	139,068	119,989	126,026	117,095	117,199	100,443	107,401	101,827	102,112
TOTAL	62,846	313,197	322,932	301,091	297,645	321,375	250,626	220,101	198,999	194,615	182,038	174,690	150,075	151,826	139,413	136,713	117,561	122,616	115,401	114,310
Total as % of Sector Sales	0.41%	2.01%	2.06%	1.89%	1.86%	1.99%	1.54%	1.35%	1.21%	1.18%	1.09%	1.04%	0.89%	0.89%	0.82%	0.79%	0.68%	0.71%	0.66%	0.65%

Incremental Demand Potential (kW)

Incremental Annual Peak kW Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	5,082	23,435	23,420	12,803	10,874	8,819	7,113	5,680	4,587	3,752	3,099	2,587	2,168	1,838	1,566	1,345	1,154	1,001	870	762
Total Appliances & Pool Pumps	563	1,005	1,716	1,807	1,675	1,550	1,429	1,317	1,216	1,123	1,037	959	885	818	756	699	645	596	551	509
Total Hot Water	301	1,056	1,313	1,632	1,930	1,637	1,391	1,162	985	847	738	649	575	515	463	421	383	352	325	302
Total HVAC & Shell	1,368	17,275	15,148	36,311	24,690	45,572	27,049	26,473	26,767	32,857	33,043	34,594	26,648	31,213	28,182	29,608	22,510	27,244	25,625	26,889
TOTAL	7,314	42,771	41,596	52,553	39,169	57,579	36,982	34,633	33,575	38,578	37,917	38,789	30,277	34,384	30,967	32,073	24,691	29,193	27,371	28,462
Total as % of Sector Sales	0.21%	1.23%	1.19%	1.49%	1.10%	1.60%	1.02%	0.94%	0.91%	1.03%	1.01%	1.02%	0.79%	0.89%	0.79%	0.81%	0.62%	0.73%	0.68%	0.70%

High Scenario - Residential Sector Programs (Costs)

Incremental Incentive Cost ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total Lighting	$1,894,401	$13,296,351	$12,611,355	$10,427,429	$9,150,995	$7,173,410	$5,563,502	$4,215,281	$3,222,327	$2,492,273
Total Appliances & Pool Pumps	$592,857	$1,944,711	$3,480,239	$4,833,377	$7,578,656	$7,836,150	$5,563,550	$3,981,127	$2,998,781	$2,372,426
Total Hot Water	$147,529	$1,005,393	$1,162,935	$1,523,899	$1,900,689	$1,563,554	$1,283,593	$1,024,576	$828,460	$679,437
Total HVAC & Shell	$1,261,251	$15,599,686	$14,944,958	$29,377,016	$25,764,396	$39,234,207	$27,761,276	$26,885,972	$26,584,067	$29,826,746
TOTAL	$3,896,039	$31,846,141	$32,198,486	$46,161,722	$44,394,736	$55,807,321	$40,171,921	$36,106,966	$33,633,635	$35,370,882

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$1,945,708	$1,535,211	$1,213,792	$974,167	$785,779	$641,513	$520,283	$431,365	$358,855	$302,859
Total Appliances & Pool Pumps	$1,957,874	$1,671,271	$1,461,800	$1,302,087	$1,173,626	$1,067,611	$978,810	$904,094	$835,374	$772,100
Total Hot Water	$562,610	$470,362	$393,489	$333,296	$283,168	$242,756	$207,027	$179,619	$156,287	$137,395
Total HVAC & Shell	$29,500,958	$30,032,232	$24,781,233	$27,193,328	$24,983,006	$25,512,972	$20,850,308	$23,431,711	$22,146,197	$22,635,457
TOTAL	$33,967,150	$33,709,077	$27,850,313	$29,802,878	$27,225,580	$27,464,853	$22,556,409	$24,946,789	$23,496,512	$23,847,811

Incremental Administrative Cost ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total Lighting	$842,065	$4,865,687	$4,470,442	$3,742,142	$3,106,501	$2,387,561	$1,813,149	$1,331,530	$980,953	$728,938
Total Appliances & Pool Pumps	$577,108	$1,115,078	$1,941,851	$2,322,141	$2,886,984	$2,867,010	$2,249,082	$1,801,480	$1,502,307	$1,293,335
Total Hot Water	$79,892	$334,432	$394,573	$508,039	$619,273	$515,445	$428,658	$347,610	$285,704	$238,205
Total HVAC & Shell	$2,000,826	$12,072,080	$12,556,330	$22,716,572	$21,063,870	$29,790,212	$21,348,590	$20,172,330	$19,563,333	$21,434,774
TOTAL	$3,499,891	$18,387,278	$19,363,196	$29,288,894	$27,676,627	$35,560,229	$25,839,489	$23,652,949	$22,332,298	$23,693,252

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$540,342	$403,379	$299,024	$223,742	$166,648	$124,825	$90,937	$67,774	$49,815	$37,349
Total Appliances & Pool Pumps	$1,139,431	$1,020,342	$923,049	$841,524	$770,595	$708,192	$652,309	$602,729	$556,916	$514,733
Total Hot Water	$200,662	$170,763	$145,748	$125,933	$109,336	$95,810	$83,851	$74,487	$66,456	$59,842
Total HVAC & Shell	$21,000,979	$21,187,552	$17,550,132	$19,046,849	$17,477,952	$17,750,100	$14,569,771	$16,229,653	$15,317,608	$15,594,758
TOTAL	$22,881,414	$22,782,036	$18,917,953	$20,237,847	$18,524,331	$18,678,928	$15,396,867	$16,974,644	$15,990,795	$16,206,682

Total Incremental Costs ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total Lighting	$2,536,466	$18,162,038	$17,081,797	$14,169,572	$12,257,496	$9,560,971	$7,376,651	$5,546,821	$4,203,280	$3,219,212
Total Appliances & Pool Pumps	$1,169,966	$3,059,789	$5,422,091	$7,155,518	$10,465,640	$10,703,160	$7,812,641	$5,782,606	$4,501,088	$3,665,760
Total Hot Water	$227,421	$1,339,825	$1,557,508	$2,031,938	$2,519,961	$2,078,999	$1,712,252	$1,372,186	$1,114,164	$917,642
Total HVAC & Shell	$3,262,077	$27,671,766	$27,501,286	$52,093,588	$46,828,266	$69,024,420	$49,109,866	$47,058,302	$46,147,400	$51,261,621
TOTAL	$7,195,930	$50,233,418	$51,562,682	$75,458,616	$72,071,363	$91,367,550	$66,011,410	$59,759,916	$55,965,932	$59,064,134

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$2,486,050	$1,938,590	$1,512,815	$1,197,909	$952,428	$766,339	$611,200	$499,140	$408,470	$340,208
Total Appliances & Pool Pumps	$3,097,305	$2,691,613	$2,384,649	$2,143,611	$1,944,221	$1,775,804	$1,631,119	$1,506,823	$1,392,290	$1,286,833
Total Hot Water	$763,272	$641,125	$539,237	$459,230	$392,504	$338,567	$290,878	$254,106	$222,743	$197,237
Total HVAC & Shell	$50,501,937	$51,219,784	$42,331,365	$46,239,976	$42,460,958	$43,263,072	$35,420,079	$39,661,365	$37,463,805	$38,230,215
TOTAL	$56,848,564	$56,491,112	$46,768,266	$50,040,726	$45,750,111	$46,143,781	$37,953,276	$41,921,433	$39,487,308	$40,054,492

Table 7-6. Low Case Scenario: 2009 – 2028 Residential Cumulative Annual Net Savings at Meter and Costs

Low Scenario - Residential Sector Programs

Cumulative Energy Potential (MWh)

Cumulative Annual MWh Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	43,757	83,332	133,178	167,403	204,430	243,110	283,181	321,097	356,978	390,953	423,127	453,603	482,453	509,777	535,650	560,157	583,350	605,316	626,117	645,818
Total Appliances & Pool Pumps	4,884	13,570	28,596	45,672	65,387	87,007	107,744	126,869	144,507	160,779	175,789	189,638	202,410	214,190	225,054	235,074	244,309	252,825	260,675	267,911
Total Hot Water	2,739	5,484	9,913	15,468	22,047	28,693	35,389	41,830	48,028	53,996	59,744	65,282	70,614	75,752	80,702	85,472	90,067	94,495	98,764	102,879
Total HVAC & Shell	11,466	22,593	35,214	58,680	83,702	118,902	149,914	180,724	211,640	244,770	277,929	311,610	342,290	374,579	405,664	437,183	465,981	496,419	526,149	556,231
TOTAL	**62,846**	**124,979**	**206,903**	**287,222**	**375,565**	**477,712**	**576,228**	**670,521**	**761,154**	**850,498**	**936,590**	**1,020,133**	**1,097,767**	**1,174,298**	**1,247,071**	**1,317,886**	**1,383,708**	**1,449,058**	**1,511,704**	**1,572,839**
Total as % of Sector Sales	0.41%	0.80%	1.32%	1.80%	2.35%	2.96%	3.55%	4.11%	4.65%	5.15%	5.63%	6.09%	6.51%	6.92%	7.30%	7.66%	8.01%	8.33%	8.65%	8.94%

Cumulative Demand Potential (kW)

Cumulative Annual Peak kW Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	5,082	9,770	15,783	19,788	24,105	28,615	33,287	37,706	41,889	45,849	49,599	53,151	56,513	59,697	62,712	65,568	68,271	70,830	73,254	75,549
Total Appliances & Pool Pumps	563	1,567	3,281	5,085	6,752	8,294	9,719	11,036	12,251	13,375	14,414	15,374	16,261	17,080	17,838	18,538	19,185	19,782	20,334	20,845
Total Hot Water	301	603	1,090	1,701	2,425	3,156	3,893	4,601	5,283	5,939	6,571	7,180	7,767	8,332	8,877	9,401	9,907	10,394	10,863	11,316
Total HVAC & Shell	1,368	3,814	6,120	11,962	16,322	24,728	30,298	35,874	41,606	48,549	55,605	63,019	69,023	75,930	82,326	89,032	94,465	100,812	106,894	113,241
TOTAL	**7,314**	**15,753**	**26,274**	**38,536**	**49,604**	**64,793**	**77,197**	**89,217**	**101,029**	**113,712**	**126,189**	**138,724**	**149,563**	**161,039**	**171,752**	**182,539**	**191,827**	**201,818**	**211,345**	**220,951**
Total as % of Sector Sales	0.21%	0.45%	0.75%	1.09%	1.39%	1.80%	2.12%	2.43%	2.73%	3.05%	3.35%	3.65%	3.90%	4.16%	4.40%	4.63%	4.83%	5.03%	5.23%	5.42%

Incremental Energy Potential (MWh)

Incremental Annual MWh Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	43,757	39,575	49,846	34,225	37,027	38,679	40,071	37,916	35,881	33,975	32,174	30,476	28,849	27,324	25,874	24,506	23,194	21,966	20,800	19,701
Total Appliances & Pool Pumps	4,884	8,687	15,026	17,075	19,715	21,621	20,737	19,125	17,638	16,271	15,011	13,849	12,771	11,780	10,864	10,020	9,235	8,515	7,850	7,237
Total Hot Water	2,739	2,744	4,430	5,555	6,579	6,646	6,696	6,441	6,198	5,968	5,748	5,538	5,332	5,138	4,950	4,770	4,595	4,429	4,268	4,115
Total HVAC & Shell	11,466	11,127	12,622	23,465	25,022	35,200	31,012	30,811	30,916	33,130	33,159	33,680	30,681	32,289	31,085	31,519	28,798	30,438	29,730	30,082
TOTAL	**62,846**	**62,133**	**81,924**	**80,320**	**88,343**	**102,146**	**98,516**	**94,293**	**90,633**	**89,344**	**86,092**	**83,543**	**77,633**	**76,531**	**72,773**	**70,816**	**65,621**	**65,348**	**62,648**	**61,135**
Total as % of Sector Sales	0.41%	0.40%	0.52%	0.50%	0.55%	0.63%	0.61%	0.58%	0.55%	0.54%	0.52%	0.50%	0.46%	0.45%	0.43%	0.41%	0.38%	0.38%	0.36%	0.35%

Incremental Demand Potential (kW)

Incremental Annual Peak kW Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	5,082	4,688	6,013	4,006	4,317	4,510	4,672	4,420	4,182	3,960	3,750	3,552	3,362	3,184	3,015	2,856	2,703	2,560	2,424	2,296
Total Appliances & Pool Pumps	563	1,004	1,714	1,804	1,667	1,543	1,425	1,316	1,216	1,124	1,038	960	887	820	758	700	647	598	552	510
Total Hot Water	301	302	487	611	724	731	737	709	682	656	632	609	587	565	544	525	505	487	469	453
Total HVAC & Shell	1,368	2,445	2,307	5,842	4,360	8,405	5,571	5,575	5,732	6,944	7,056	7,413	6,004	6,906	6,396	6,706	5,433	6,348	6,082	6,347
TOTAL	**7,314**	**8,439**	**10,521**	**12,262**	**11,068**	**15,189**	**12,404**	**12,020**	**11,812**	**12,684**	**12,477**	**12,535**	**10,840**	**11,476**	**10,713**	**10,787**	**9,288**	**9,992**	**9,527**	**9,605**
Total as % of Sector Sales	0.21%	0.24%	0.30%	0.35%	0.31%	0.42%	0.34%	0.33%	0.32%	0.34%	0.33%	0.33%	0.28%	0.30%	0.27%	0.27%	0.23%	0.25%	0.24%	0.24%

Low Scenario - Residential Sector Programs (Costs)

Incremental Incentive Cost ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$1,694,401	$1,107,288	$1,353,415	$1,401,757	$1,577,647	$1,648,467	$1,707,471	$1,615,315	$1,528,344	$1,446,992	$1,370,167	$1,297,782	$1,228,365	$1,163,364	$1,101,544	$1,043,303	$987,343	$935,065	$885,436	$838,681
Total Appliances & Pool Pumps	$592,657	$791,048	$1,366,924	$1,544,373	$1,757,428	$1,909,633	$1,828,201	$1,686,228	$1,555,281	$1,434,912	$1,323,884	$1,221,567	$1,126,614	$1,039,337	$958,604	$884,221	$815,094	$751,650	$693,002	$638,981
Total Hot Water	$147,529	$88,049	$123,505	$174,798	$244,244	$254,324	$263,077	$252,050	$241,590	$231,853	$222,599	$213,845	$205,250	$197,219	$189,489	$182,131	$174,903	$168,170	$161,693	$155,554
Total HVAC & Shell	$1,261,251	$1,109,725	$1,144,857	$2,383,678	$2,292,859	$3,687,139	$2,910,380	$2,900,063	$2,936,300	$3,295,095	$3,318,347	$3,416,523	$2,975,135	$3,239,867	$3,073,199	$3,157,369	$2,757,872	$3,026,807	$2,935,304	$3,006,088
TOTAL	$3,696,039	$3,096,110	$3,988,701	$5,504,606	$5,872,178	$7,499,563	$6,709,129	$6,453,655	$6,261,516	$6,408,852	$6,234,996	$6,148,717	$5,535,364	$5,639,787	$5,322,817	$5,267,024	$4,735,212	$4,881,692	$4,675,436	$4,639,304

Incremental Administrative Cost ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$842,065	$711,889	$840,211	$923,886	$1,021,603	$1,067,198	$1,105,512	$1,045,962	$989,741	$937,094	$887,358	$840,471	$795,547	$753,437	$713,397	$675,654	$639,427	$605,542	$573,376	$543,056
Total Appliances & Pool Pumps	$577,108	$1,028,860	$1,783,970	$1,906,359	$1,918,496	$1,909,703	$1,794,579	$1,656,421	$1,528,947	$1,411,875	$1,303,847	$1,204,293	$1,111,683	$1,026,601	$947,806	$875,215	$807,545	$745,533	$688,142	$635,291
Total Hot Water	$79,892	$69,132	$102,664	$138,017	$179,908	$185,321	$189,974	$182,339	$175,073	$168,265	$161,775	$155,612	$149,575	$143,900	$138,420	$133,212	$128,096	$123,298	$118,678	$114,282
Total HVAC & Shell	$2,000,826	$2,630,782	$3,474,662	$5,326,260	$5,292,193	$7,144,382	$5,997,099	$5,830,630	$5,737,638	$6,085,996	$5,996,629	$6,016,267	$5,323,689	$5,580,859	$5,269,492	$5,299,301	$4,689,352	$4,976,902	$4,788,844	$4,822,136
TOTAL	$3,499,891	$4,440,463	$6,181,507	$8,294,521	$8,412,201	$10,306,604	$9,087,164	$8,715,352	$8,431,399	$8,603,230	$8,349,609	$8,216,643	$7,380,475	$7,584,797	$7,069,115	$6,983,381	$6,264,421	$6,451,275	$6,169,040	$6,114,764

Total Incremental Costs ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$2,536,466	$1,819,177	$2,193,626	$2,325,642	$2,599,249	$2,715,665	$2,812,984	$2,661,277	$2,518,085	$2,384,085	$2,257,525	$2,138,253	$2,023,912	$1,916,801	$1,814,942	$1,718,957	$1,626,770	$1,540,607	$1,458,813	$1,381,736
Total Appliances & Pool Pumps	$1,169,966	$1,819,708	$3,130,894	$3,450,732	$3,675,924	$3,819,336	$3,622,780	$3,342,649	$3,084,229	$2,846,787	$2,627,731	$2,425,861	$2,238,278	$2,065,938	$1,906,409	$1,759,436	$1,622,639	$1,497,183	$1,381,144	$1,274,272
Total Hot Water	$227,421	$157,181	$226,169	$312,815	$424,152	$439,645	$453,051	$434,389	$416,663	$400,118	$384,374	$369,457	$354,825	$341,120	$327,890	$315,343	$303,000	$291,468	$280,371	$269,836
Total HVAC & Shell	$3,262,077	$3,740,507	$4,619,520	$7,709,939	$7,586,052	$10,831,521	$8,907,479	$8,730,693	$8,673,938	$9,381,092	$9,314,976	$9,432,790	$8,298,824	$8,820,726	$8,342,691	$8,456,670	$7,447,224	$8,003,708	$7,724,148	$7,828,224
TOTAL	$7,195,930	$7,536,573	$10,170,208	$13,799,127	$14,284,378	$17,806,167	$15,796,294	$15,169,007	$14,692,915	$15,012,082	$14,584,605	$14,366,368	$12,915,840	$13,144,584	$12,391,932	$12,250,406	$10,999,633	$11,332,966	$10,844,476	$10,754,068

7.3.1 Residential Energy Efficiency Results by End Use

Figures 7-6 to 7-9 show residential sector Base Case Market Potential energy and peak demand savings for the first year (2009) and in year twenty (2028). Residential lighting measures, primarily CFLs in high-use and medium-use fixtures, account for most of the total estimated residential energy efficiency potential initially, shifting over time to HVAC and building envelope emphasis. Residential lighting measures, primarily CFLs in high-use and medium-use fixtures, account for most of the total estimated residential peak demand potential initially, shifting over time to HVAC and building envelope emphasis.

Figure 7-6. Residential Base Case Market Potential Incremental Annual Net Energy Savings at Meter – 2009 by End Use

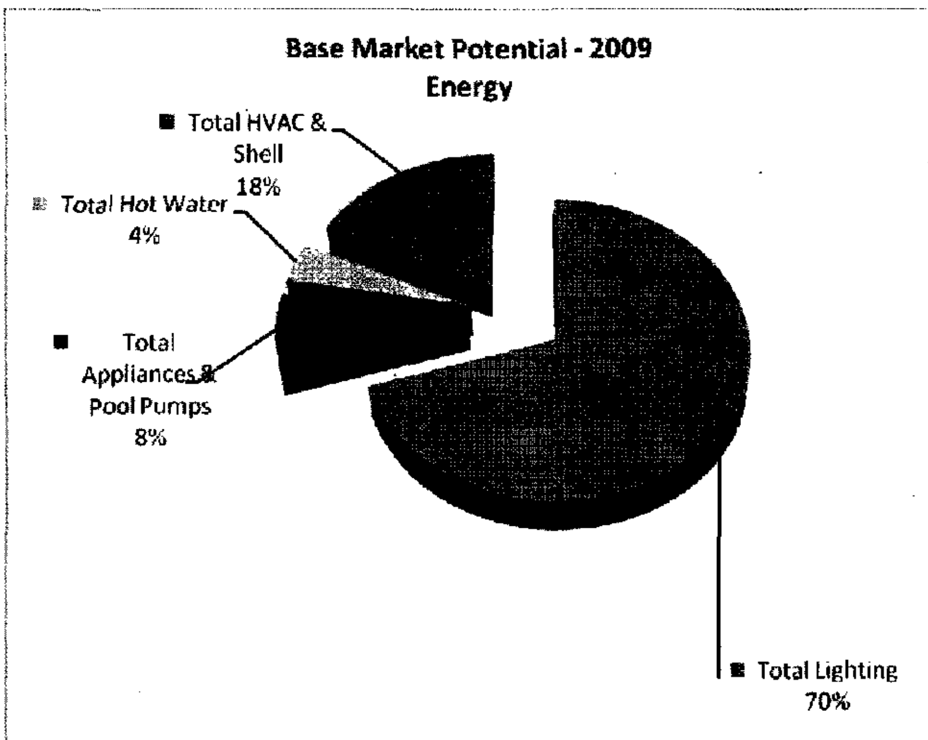


Figure 7-7. Residential Base Case Market Potential Incremental Annual Net Summer Peak Demand Savings at Meter – 2009 by End Use

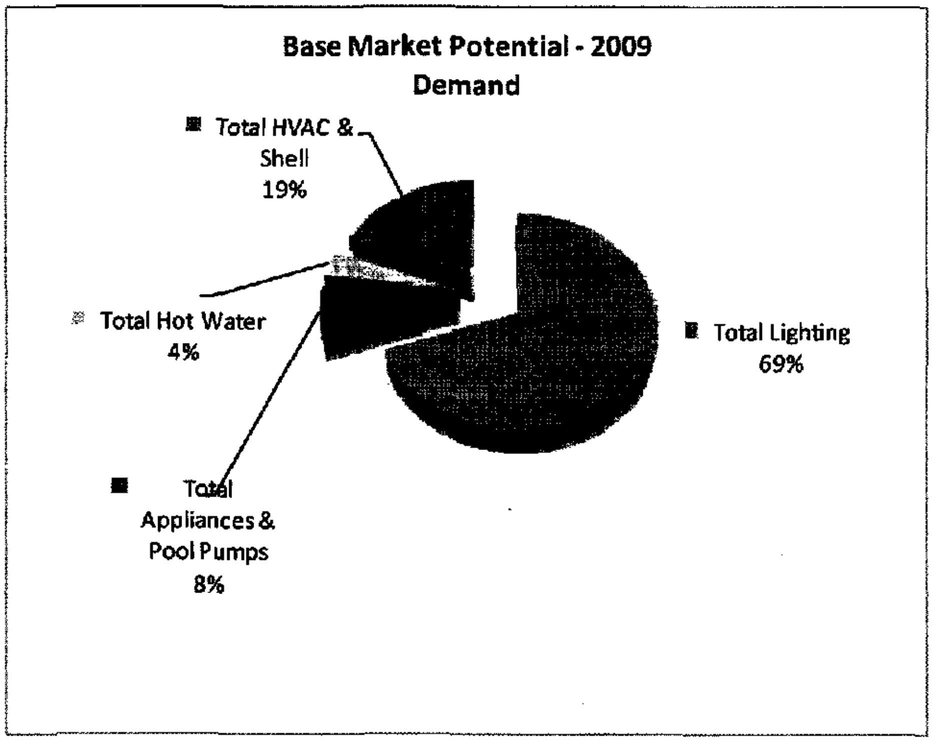


Figure 7-8. Residential Base Case Market Potential Incremental Annual Net Energy Savings at Meter – 2028 by End Use

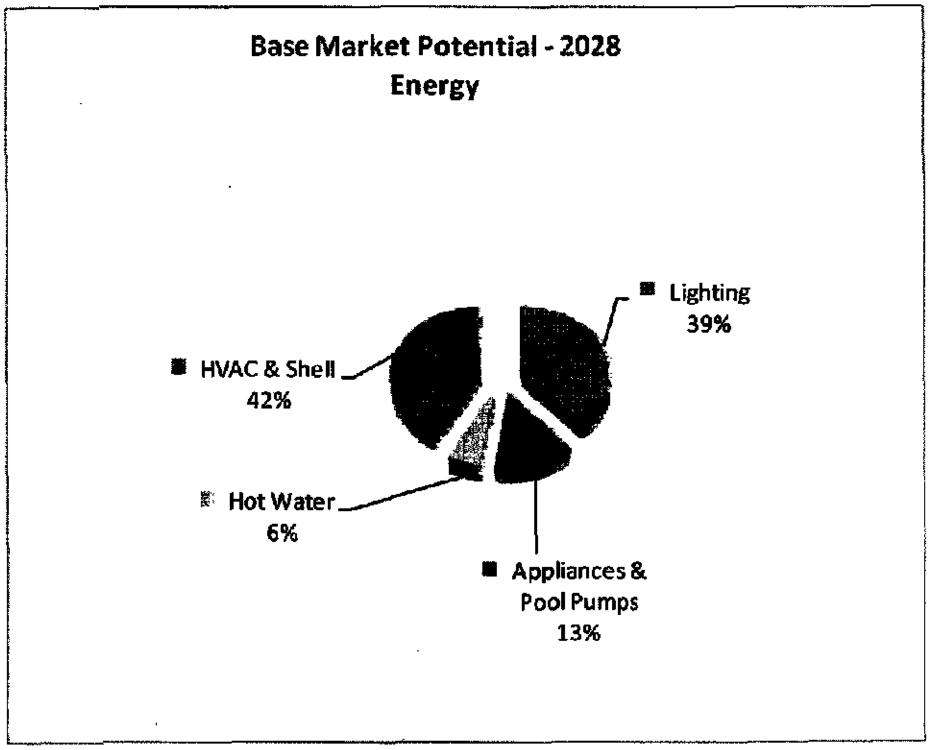
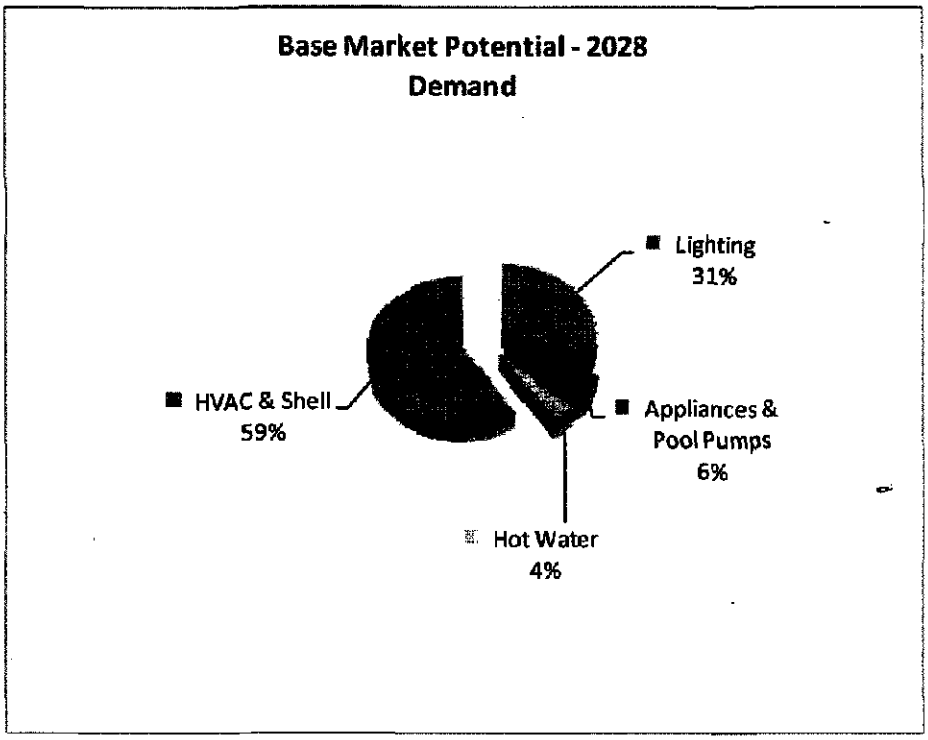


Figure 7-9. Residential Base Case Market Potential Incremental Annual Net Summer Peak Demand Savings at Meter – 2028 by End Use



Figures 7-10 to Figure 7-15 present residential sector results for the Base Case Market , Economic and Technical Potentials for the twenty year period (2009 to 2028) and in year twenty (2028). In 2028, while HVAC measures account for most of the economic potential, HVAC and lighting energy savings are projected to provide a similar amount of market potential. Projected demand savings follow a similar pattern, except that HVAC measures account for a larger amount of market potential.

Total technical and economic potential energy and demand savings through 2028 are projected primarily from HVAC measures with the other end uses providing less savings. The end use contribution to economic potential energy and demand savings in 2028 follows a similar pattern.

Figure 7-10. Residential Base Case Market and Economic Potential Net Energy Savings at Meter – 2028 by End Use

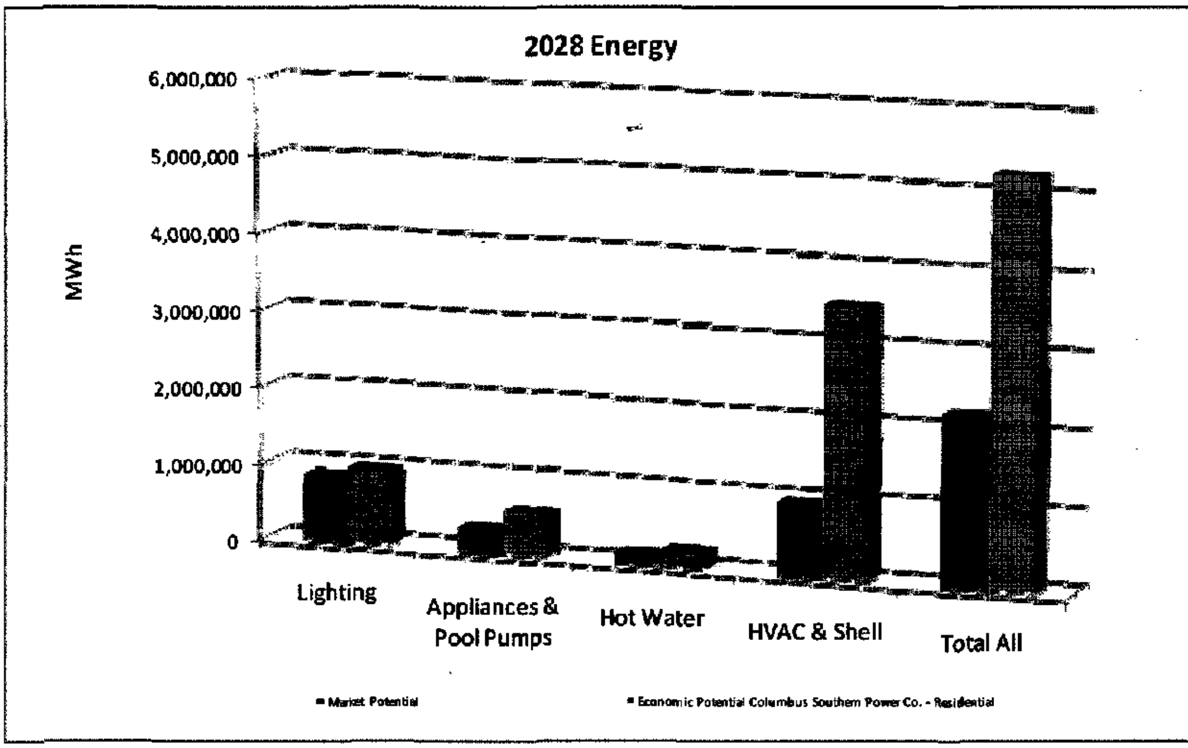


Figure 7-11. Residential Base Case Market and Economic Potential Net Summer Peak Demand Savings at Meter – 2028 by End Use

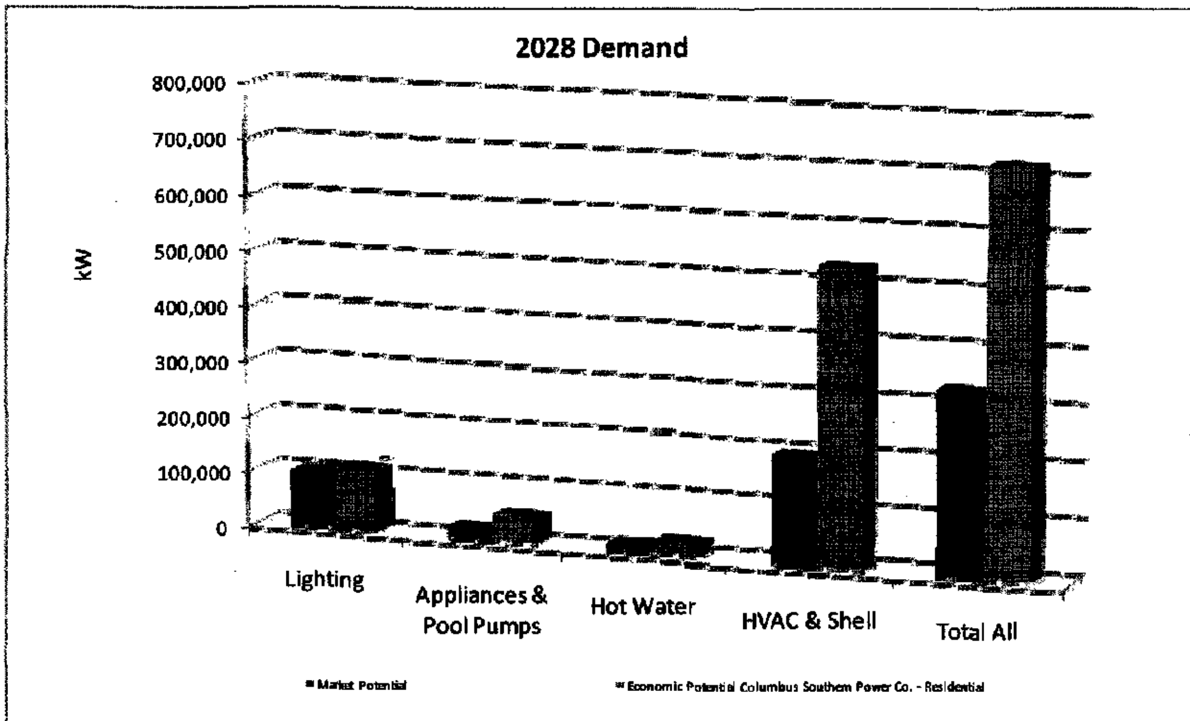


Figure 7-12. Residential Technical and Economic Potential Net Energy Savings at Meter – 2028 by End Use

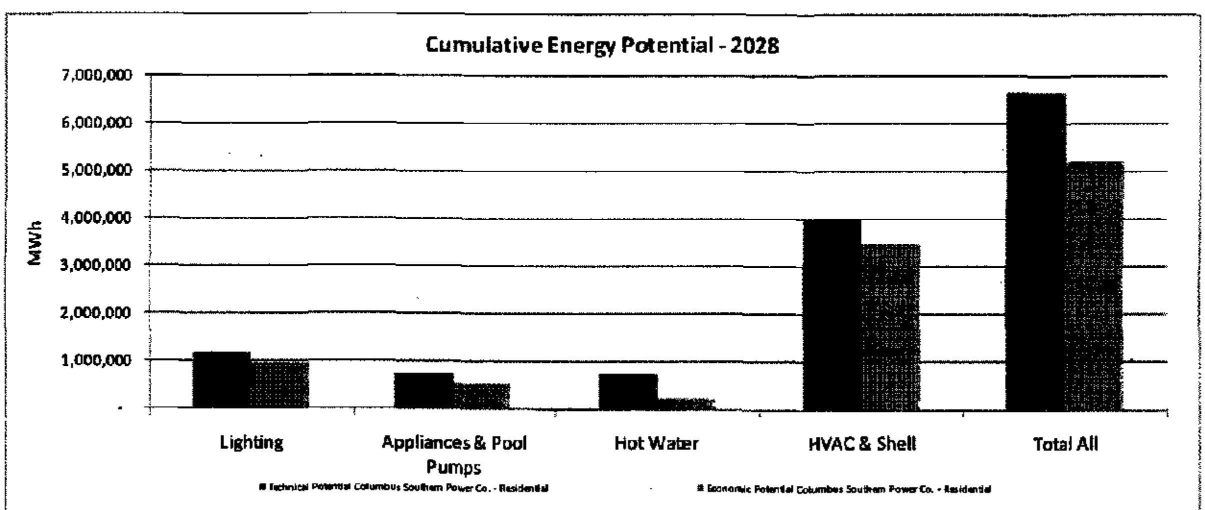


Figure 7-13. Residential Technical and Economic Potential Net Summer Peak Demand Savings at Meter – 2028 by End Use

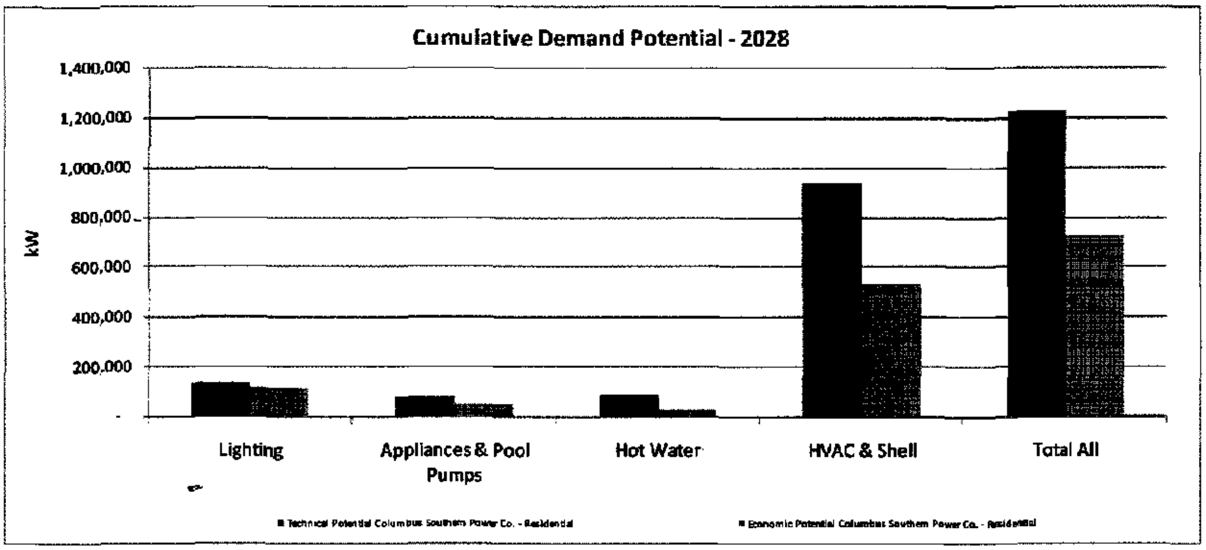


Figure 7-14. Residential Economic Potential Net Energy Savings at Meter – 2028 by End Use

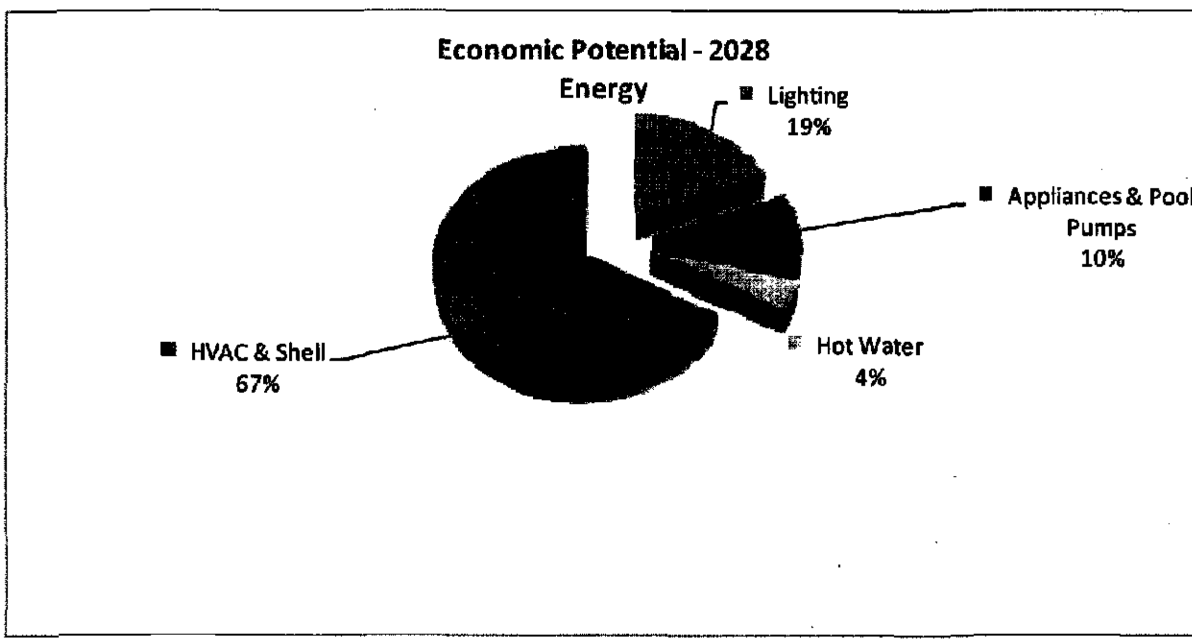
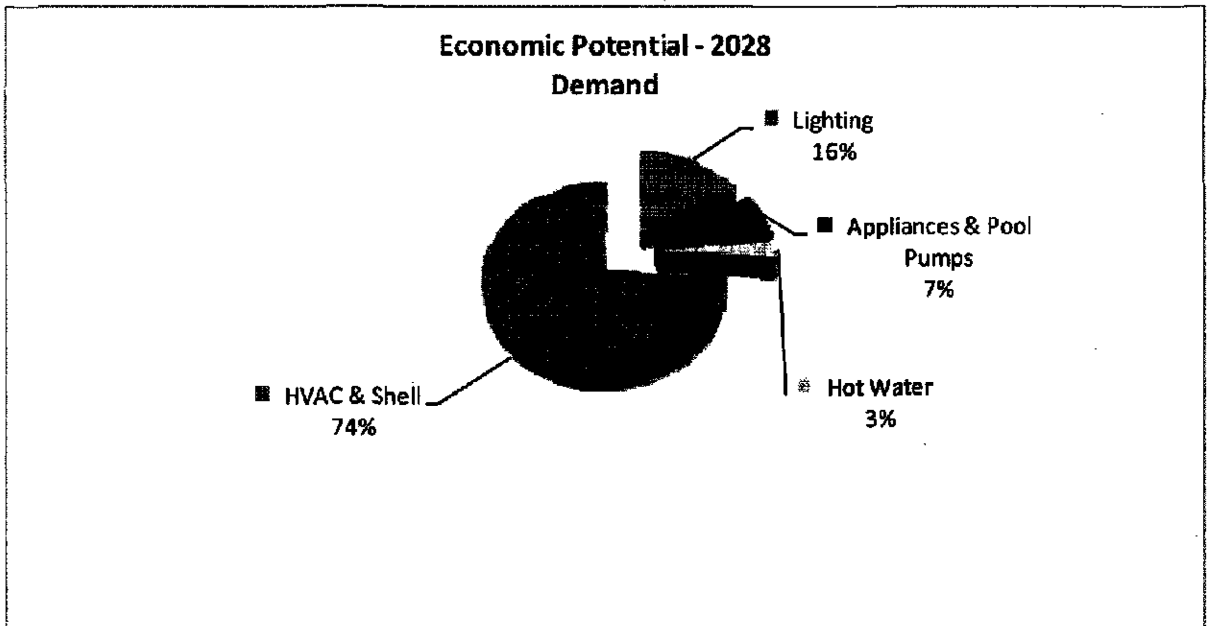


Figure 7-15. Residential Economic Potential Net Summer Peak Demand Savings at Meter – 2028 by End Use



7.4 Commercial and Industrial EE/PDR Potential Results

This section provides the EE/PDR potential results for the non-residential sector. The total and annual incremental non-residential achievable EE/PDR potential results for the twenty years (2009 to 2028) are shown in Table 7-6 through 7-11. The energy values shown are for the EE/PDR measures' first-year at meter energy savings, the incremental demand savings are the summer peak demand savings, and the program costs are the total estimated EE/PDR program budgets for a given year, including rebate or other customer incentive costs, as well as administrative and implementation costs.

The total twenty-year estimated non-residential base case market potential in 2028 is about 5,700 GWh in cumulative annual net savings at meter is about 1,100 MW of cumulative annual net summer peak demand. The annual incremental net energy savings at meter starts at 0.3% and peak out in 2014 at about 1.1% of AEP Ohio's forecast annual non-residential energy sales (annual impacts begin to decline slowly thereafter as markets are saturated). Savings are predominantly from lighting, and motors and others, followed by HVAC and shell, and refrigeration measures. These results assume a net-to-gross impact ratio of 1.0, whereby free ridership is assumed for this analysis to be offset by spillover impacts.

The base case market potential projects savings for 2009 to 2011 consistent with meeting the requriements of SB 221. However, to meet the full SB 221 requirements through 2025 of 22.2% cumulative energy savings, AEP Ohio would need to meet the projected savings in the high case market potential scenario.

Table 7-6. Base Case Scenario: 2009 – 2028 Commercial and Industrial Cumulative Annual Net Savings at Meter and Costs

Market Potential : Commercial & Industrial Program

Cumulative Energy Potential (MWh)

Commercial & Industrial	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	58,235	163,258	314,916	482,335	697,185	911,707	1,112,257	1,297,752	1,468,320	1,617,989	1,748,454	1,862,192	1,961,260	2,048,201	2,124,530	2,191,844	2,251,111	2,303,762	2,350,498	2,392,145
Total Motors & Other	29,109	67,240	119,985	197,304	331,823	476,784	624,219	774,485	927,753	1,076,831	1,221,977	1,363,374	1,501,154	1,635,470	1,766,423	1,894,125	2,018,660	2,140,140	2,258,642	2,374,255
Total HVAC & Shell	18,774	50,150	92,346	147,405	206,926	265,100	319,711	372,028	422,034	468,542	512,092	552,853	590,473	626,235	659,908	691,941	721,921	750,750	778,133	804,299
Total Refrigeration	1,060	2,995	6,330	11,762	17,653	23,824	30,285	37,040	44,100	51,160	58,220	65,279	72,339	79,399	86,458	93,518	100,578	107,637	114,697	121,757
TOTAL	**107,178**	**283,642**	**533,577**	**838,807**	**1,253,587**	**1,677,416**	**2,086,471**	**2,481,305**	**2,862,207**	**3,214,521**	**3,540,743**	**3,843,698**	**4,125,226**	**4,389,304**	**4,637,319**	**4,871,428**	**5,092,270**	**5,302,289**	**5,501,969**	**5,692,456**
Total as % of Sector Sales	0.30%	0.80%	1.50%	2.34%	3.47%	4.59%	5.66%	6.66%	7.62%	8.48%	9.25%	9.95%	10.59%	11.17%	11.70%	12.18%	12.63%	13.04%	13.41%	13.76%

Cumulative Demand Potential (kW)

Commercial & Industrial	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	18,026	50,221	96,816	149,506	216,519	283,411	345,951	403,824	457,018	503,663	544,295	579,686	610,465	637,462	661,142	682,013	700,364	716,667	731,127	744,010
Total Motors & Other	2,713.	6,229	11,038	18,088	30,531	44,132	58,063	72,332	86,932	101,164	115,039	128,568	141,758	154,620	167,167	179,407	191,346	202,997	214,364	225,458
Total HVAC & Shell	3,707	10,850	20,324	29,608	38,445	46,669	54,318	61,425	67,994	73,976	79,472	84,563	89,308	93,757	97,949	101,913	105,676	109,256	112,671	115,935
Total Refrigeration	209	568	1,188	2,264	3,436	4,665	5,955	7,306	8,722	10,137	11,553	12,968	14,384	15,800	17,215	18,631	20,046	21,462	22,878	24,293
TOTAL	**24,655**	**67,868**	**129,366**	**199,465**	**288,931**	**378,877**	**464,287**	**544,887**	**620,666**	**688,941**	**750,359**	**805,784**	**855,913**	**901,639**	**943,473**	**981,965**	**1,017,432**	**1,050,381**	**1,081,041**	**1,109,697**
Total as % of Sector Sales	0.36%	0.99%	1.87%	2.86%	4.11%	5.34%	6.49%	7.56%	8.53%	9.39%	10.13%	10.78%	11.35%	11.85%	12.30%	12.69%	13.04%	13.35%	13.62%	13.87%

Cumulative Energy Potential (MWh)

Commercial & Industrial	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	58,235	105,023	151,658	167,420	214,650	214,522	200,550	185,495	170,569	149,669	130,465	113,738	99,069	86,941	76,329	67,314	59,268	52,651	46,735	41,648
Total Motors & Other	29,109	38,131	52,745	77,319	134,519	144,961	147,435	150,266	153,268	149,078	145,147	141,397	137,780	134,315	130,953	127,702	124,535	121,480	118,502	115,613
Total HVAC & Shell	18,774	31,376	42,196	55,059	59,520	58,174	54,611	52,317	50,006	46,506	43,560	40,780	37,620	35,762	33,673	32,033	29,980	28,828	27,383	26,166
Total Refrigeration	1,060	1,934	3,335	5,432	5,891	6,171	6,481	6,756	7,060	7,060	7,060	7,060	7,060	7,060	7,060	7,060	7,060	7,060	7,060	7,060
TOTAL	**107,178**	**176,464**	**249,935**	**305,230**	**414,780**	**423,828**	**409,056**	**394,834**	**380,902**	**352,314**	**326,221**	**302,955**	**281,528**	**264,078**	**248,015**	**234,109**	**220,843**	**210,018**	**199,680**	**190,486**
Total as % of Sector Sales	0.30%	0.50%	0.70%	0.85%	1.15%	1.16%	1.11%	1.06%	1.01%	0.93%	0.85%	0.78%	0.72%	0.67%	0.63%	0.59%	0.55%	0.52%	0.49%	0.46%

Cumulative Demand Potential (kW)

Commercial & Industrial	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	18,026	32,195	46,595	52,690	67,013	66,892	62,540	57,873	53,194	46,645	40,631	35,391	30,779	26,997	23,680	20,872	18,351	16,302	14,461	12,883
Total Motors & Other	2,713	3,516	4,810	7,048	12,445	13,601	13,931	14,269	14,601	14,232	13,875	13,529	13,188	12,864	12,547	12,240	11,939	11,651	11,368	11,094
Total HVAC & Shell	3,707	7,143	9,474	9,284	8,837	8,224	7,649	7,107	6,569	5,982	5,496	5,090	4,745	4,449	4,191	3,964	3,762	3,580	3,415	3,264
Total Refrigeration	209	360	620	1,077	1,172	1,229	1,289	1,351	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
TOTAL	**24,655**	**43,213**	**61,498**	**70,099**	**89,466**	**89,946**	**85,410**	**80,600**	**75,779**	**68,274**	**61,418**	**55,425**	**50,128**	**45,727**	**41,834**	**38,492**	**35,468**	**32,949**	**30,659**	**28,656**
Total as % of Sector Sales	0.36%	0.63%	0.89%	1.01%	1.27%	1.27%	1.19%	1.12%	1.04%	0.93%	0.83%	0.74%	0.66%	0.60%	0.55%	0.50%	0.45%	0.42%	0.39%	0.36%

Market Potential - C & I Sector Programs (Costs)

Incremental Incentive Cost ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$5,540,873	$7,469,050	$10,171,315	$15,768,165	$24,326,197	$25,300,391	$23,778,291	$21,998,555	$20,215,088	$17,621,538	$15,238,773	$13,174,638	$11,379,493	$9,898,958	$8,614,579	$7,529,678	$6,571,129	$5,786,405	$5,089,932	$4,496,048
Total Motors & Other	$2,873,255	$3,571,826	$4,680,536	$7,139,727	$12,916,637	$13,934,585	$14,165,642	$14,448,969	$14,757,676	$14,377,639	$14,023,544	$13,685,716	$13,357,838	$13,044,567	$12,738,405	$12,441,517	$12,149,894	$11,868,734	$11,592,835	$11,324,192
Total HVAC & Shell	$1,226,920	$1,752,567	$2,357,923	$3,733,400	$4,375,307	$4,355,117	$4,081,265	$3,940,775	$3,799,985	$3,547,160	$3,332,858	$3,120,987	$2,858,429	$2,725,769	$2,560,000	$2,436,673	$2,263,168	$2,183,377	$2,068,032	$1,974,392
Total Refrigeration	$51,377	$88,887	$154,384	$286,547	$313,159	$328,370	$344,253	$380,744	$377,887	$377,887	$377,887	$377,887	$377,887	$377,887	$377,887	$377,887	$377,887	$377,887	$377,887	$377,887
TOTAL	$9,692,426	$12,882,330	$17,364,158	$26,927,839	$41,931,391	$43,918,473	$42,370,451	$40,749,042	$39,150,637	$35,924,224	$32,973,062	$30,359,228	$27,973,647	$26,047,182	$24,290,871	$22,785,756	$21,362,079	$20,215,403	$19,128,687	$18,172,519

Incremental Administrative Cost ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$1,844,584	$3,432,350	$4,861,415	$5,464,695	$6,518,821	$6,518,925	$6,023,572	$5,508,833	$5,065,327	$4,467,329	$3,917,896	$3,438,101	$3,017,768	$2,664,659	$2,355,495	$2,090,186	$1,854,234	$1,655,899	$1,479,031	$1,325,348
Total Motors & Other	$45,880	$99,359	$185,841	$253,886	$311,012	$250,157	$198,298	$166,337	$144,610	$126,077	$113,562	$103,337	$92,222	$86,589	$79,925	$75,006	$68,226	$65,082	$60,609	$57,001
Total HVAC & Shell	$1,081,971	$1,747,454	$2,352,415	$3,443,652	$3,867,564	$3,851,323	$3,588,471	$3,459,390	$3,328,949	$3,120,565	$2,944,940	$2,767,048	$2,534,591	$2,428,798	$2,287,185	$2,185,847	$2,031,941	$1,970,203	$1,871,375	$1,792,880
Total Refrigeration	$2,334,812	$3,749,037	$5,157,515	$7,575,783	$8,517,434	$8,446,507	$7,892,114	$7,625,597	$7,367,303	$6,932,003	$6,568,238	$6,202,228	$5,726,199	$5,508,979	$5,219,050	$5,011,094	$4,696,904	$4,570,282	$4,368,153	$4,207,577
TOTAL	$5,307,246	$9,028,200	$12,557,186	$16,758,017	$19,214,830	$19,066,912	$17,702,455	$16,760,156	$15,906,189	$14,645,974	$13,544,636	$12,510,715	$11,370,780	$10,689,025	$9,941,634	$9,361,933	$8,651,305	$8,261,466	$7,779,167	$7,382,816

Total Incremental Costs ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$7,385,457	$10,901,400	$15,032,731	$21,252,861	$30,845,018	$31,819,316	$29,801,863	$27,507,388	$25,280,415	$22,088,867	$19,156,669	$16,612,739	$14,397,261	$12,563,618	$10,970,073	$9,619,884	$8,425,364	$7,441,305	$6,568,963	$5,821,396
Total Motors & Other	$2,919,135	$3,671,185	$4,866,377	$7,393,613	$13,227,649	$14,184,752	$14,364,940	$14,615,305	$14,902,286	$14,503,716	$14,137,106	$13,789,053	$13,450,060	$13,131,156	$12,818,330	$12,516,523	$12,218,121	$11,933,815	$11,653,443	$11,381,193
Total HVAC & Shell	$2,308,891	$3,500,020	$4,710,338	$7,177,052	$8,242,871	$8,206,440	$7,669,738	$7,400,164	$7,128,934	$6,667,725	$6,277,797	$5,888,035	$5,393,020	$5,154,567	$4,847,164	$4,622,320	$4,295,109	$4,153,579	$3,939,407	$3,767,282
Total Refrigeration	$2,386,190	$3,837,924	$5,311,899	$7,862,330	$8,830,593	$8,774,877	$8,236,368	$7,986,341	$7,745,191	$7,309,891	$6,946,126	$6,580,116	$6,104,087	$5,886,867	$5,596,937	$5,388,982	$5,074,791	$4,948,170	$4,746,041	$4,585,464
TOTAL	$14,999,672	$21,910,530	$29,921,344	$43,685,855	$61,146,131	$62,985,386	$60,072,906	$57,509,199	$55,056,826	$50,570,198	$46,517,698	$42,889,943	$39,344,427	$36,736,207	$34,232,505	$32,147,689	$30,013,384	$28,476,869	$26,907,855	$25,555,335

Table 7-7. Commercial & Industrial Technical Potential Scenario: 2009 – 2028 Net Savings at Meter

Technical Potential

Energy Potential (MWh)

Commercial & Industrial	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	4,262,325	4,269,477	4,274,049	3,908,598	3,913,165	3,920,403	3,925,023	3,929,709	3,934,462	3,939,884	3,945,746	3,951,719	3,956,512	3,961,921	3,967,047	3,972,394	3,976,880	3,981,959	3,986,849	3,991,821
Total Motors & Other	8,138,434	8,138,958	8,139,292	8,140,077	8,140,555	8,141,311	8,141,794	8,142,284	8,142,781	8,143,348	8,143,961	8,144,586	8,145,087	8,145,652	8,146,188	8,146,747	8,147,216	8,147,747	8,148,259	8,148,778
Total HVAC & Shell	2,155,053	2,166,550	2,173,900	2,191,138	2,201,625	2,218,247	2,228,858	2,239,619	2,250,535	2,262,985	2,276,448	2,290,167	2,301,173	2,313,594	2,325,367	2,337,646	2,347,949	2,359,612	2,370,842	2,382,260
Total Refrigeration	369,007	369,007	369,007	369,007	369,007	369,007	369,007	369,007	369,007	369,007	369,007	369,007	369,007	369,007	369,007	369,007	369,007	369,007	369,007	369,007
Total All	14,924,819	14,943,992	14,956,248	14,608,821	14,624,352	14,648,969	14,664,682	14,680,620	14,696,786	14,715,224	14,735,162	14,755,479	14,771,779	14,790,174	14,807,610	14,825,794	14,841,052	14,858,326	14,874,956	14,891,867
Total as % of Sector Sales	42.26%	42.15%	42.03%	40.69%	40.43%	40.09%	39.76%	39.42%	39.11%	38.81%	38.49%	38.19%	37.91%	37.63%	37.35%	37.07%	36.80%	36.53%	36.27%	36.01%

Demand Potential (kW)

Commercial & Industrial	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	1,194,892	1,197,426	1,199,045	1,093,959	1,095,577	1,098,141	1,099,777	1,101,437	1,103,121	1,105,041	1,107,118	1,109,234	1,110,931	1,112,847	1,114,663	1,116,557	1,118,146	1,119,945	1,121,677	1,123,438
Total Motors & Other	792,979	792,984	792,988	792,995	793,000	793,008	793,013	793,018	793,023	793,028	793,035	793,041	793,046	793,052	793,057	793,063	793,067	793,073	793,078	793,083
Total HVAC & Shell	392,942	394,587	395,638	398,104	399,604	401,982	403,500	405,039	406,600	408,381	410,307	412,269	413,844	415,620	417,304	419,061	420,535	422,203	423,809	425,442
Total Refrigeration	62,268	62,268	62,268	62,268	62,268	62,268	62,268	62,268	62,268	62,268	62,268	62,268	62,268	62,268	62,268	62,268	62,268	62,268	62,268	62,268
Total All	2,443,082	2,447,265	2,449,939	2,347,327	2,350,449	2,355,398	2,358,558	2,361,762	2,365,012	2,368,719	2,372,727	2,376,812	2,380,089	2,383,787	2,387,292	2,390,948	2,394,016	2,397,489	2,400,832	2,404,232
Total as % of Sector Sales	35.69%	35.59%	35.47%	33.70%	33.44%	33.20%	32.98%	32.76%	32.51%	32.28%	32.03%	31.79%	31.56%	31.34%	31.12%	30.90%	30.68%	30.47%	30.25%	30.04%

Table 7-8. Commercial & Industrial Economic Potential Scenario: 2009 – 2028 Net Savings at Meter

Economic Potential

Energy Potential (MWh)

Commercial & Industrial	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	3,217,688	3,223,055	3,226,485	2,861,119	2,864,546	2,869,978	2,873,445	2,876,961	2,880,528	2,884,596	2,888,995	2,893,478	2,897,074	2,901,133	2,904,980	2,908,992	2,912,359	2,916,170	2,919,839	2,923,570
Total Motors & Other	7,508,658	7,508,665	7,508,669	7,508,679	7,508,685	7,508,694	7,508,700	7,508,706	7,508,713	7,508,720	7,508,727	7,508,735	7,508,741	7,508,748	7,508,755	7,508,762	7,508,768	7,508,774	7,508,781	7,508,787
Total HVAC & Shell	1,347,378	1,356,417	1,362,195	1,375,749	1,383,994	1,397,063	1,405,404	1,413,865	1,422,448	1,432,235	1,442,821	1,453,607	1,462,260	1,472,026	1,481,282	1,490,936	1,499,036	1,508,206	1,517,035	1,526,012
Total Refrigeration	204,746	204,746	204,746	204,746	204,746	204,746	204,746	204,746	204,746	204,746	204,746	204,746	204,746	204,746	204,746	204,746	204,746	204,746	204,746	204,746
Total All	12,278,471	12,292,883	12,302,096	11,950,293	11,961,971	11,980,481	11,992,296	12,004,279	12,016,434	12,030,298	12,045,290	12,060,566	12,072,822	12,086,654	12,099,763	12,113,436	12,124,909	12,137,897	12,150,402	12,163,116
Total as % of Sector Sales	34.76%	34.68%	34.57%	33.28%	33.07%	32.79%	32.51%	32.23%	31.98%	31.73%	31.47%	31.21%	30.98%	30.75%	30.52%	30.29%	30.07%	29.84%	29.62%	29.41%

Demand Potential (kW)

Commercial & Industrial	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	971,416	973,430	974,717	869,419	870,706	872,744	874,045	875,365	876,704	878,231	879,882	881,564	882,914	884,437	885,881	887,387	888,650	890,081	891,458	892,858
Total Motors & Other	748,600	748,602	748,603	748,606	748,607	748,610	748,611	748,613	748,614	748,616	748,618	748,620	748,621	748,623	748,625	748,627	748,628	748,630	748,631	748,633
Total HVAC & Shell	238,058	238,058	238,058	238,058	238,058	238,058	238,058	238,058	238,058	238,058	238,058	238,058	238,058	238,058	238,058	238,058	238,058	238,058	238,058	238,058
Total Refrigeration	40,500	40,500	40,500	40,500	40,500	40,500	40,500	40,500	40,500	40,500	40,500	40,500	40,500	40,500	40,500	40,500	40,500	40,500	40,500	40,500
Total All	1,998,574	2,000,590	2,001,878	1,896,583	1,897,870	1,899,911	1,901,214	1,902,535	1,903,876	1,905,404	1,907,057	1,908,742	1,910,093	1,911,618	1,913,064	1,914,571	1,915,836	1,917,268	1,918,647	1,920,049
Total as % of Sector Sales	29.19%	29.09%	28.99%	27.23%	27.00%	26.78%	26.59%	26.39%	26.18%	25.97%	25.75%	25.53%	25.33%	25.13%	24.94%	24.74%	24.55%	24.36%	24.18%	23.99%

Table 7-9. High Case Scenario: 2009 – 2028 Commercial & Industrial Cumulative Annual Net Savings at Meter and Costs

High Scenario C & I Sector Programs

Cumulative Energy Potential (MWh)

Cumulative Annual MWh Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	58,235	339,982	734,379	1,186,050	1,721,329	2,144,635	2,398,079	2,515,569	2,581,047	2,626,467	2,661,738	2,691,442	2,717,195	2,741,327	2,763,432	2,784,138	2,802,739	2,820,577	2,837,152	2,852,754
Total Motors & Other	29,109	107,581	211,675	354,854	591,644	840,267	1,087,042	1,331,982	1,574,908	1,807,354	2,029,856	2,242,875	2,446,811	2,642,174	2,829,330	3,008,674	3,180,514	3,345,246	3,503,155	3,654,547
Total HVAC & Shell	18,774	112,576	217,753	345,114	465,761	568,793	653,551	728,046	794,167	853,389	907,393	956,174	998,316	1,037,865	1,073,942	1,107,813	1,138,017	1,167,314	1,194,659	1,220,631
Total Refrigeration	1,060	7,882	19,198	37,727	57,428	77,610	98,276	119,313	140,713	162,114	183,514	204,914	226,315	247,715	269,116	290,516	311,917	333,317	354,717	376,118
TOTAL	107,178	568,081	1,183,005	1,923,745	2,836,162	3,631,305	4,234,949	4,694,910	5,090,835	5,449,324	5,782,499	6,095,405	6,388,637	6,669,081	6,935,819	7,191,140	7,433,186	7,666,455	7,889,683	8,104,049
Total as % of Sector Sales	0.30%	1.60%	3.32%	6.36%	7.84%	9.94%	11.48%	12.61%	13.55%	14.37%	15.11%	15.77%	16.40%	16.97%	17.49%	17.98%	18.43%	18.85%	19.24%	19.59%

Cumulative Demand Potential (kW)

Cumulative Annual Peak kW Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	18,026	106,726	231,010	376,747	543,853	675,460	752,581	788,775	806,614	822,422	833,193	842,325	850,227	857,713	864,599	871,098	876,926	882,574	887,842	892,827
Total Motors & Other	2,713	9,713	19,023	32,088	54,551	78,361	102,002	125,490	148,801	171,124	192,507	212,989	232,597	251,392	269,402	286,668	303,211	319,078	334,291	348,880
Total HVAC & Shell	3,707	19,288	35,050	46,032	54,798	61,419	66,993	72,008	76,671	81,083	85,294	89,334	93,222	96,970	100,588	104,082	107,459	110,722	113,877	116,928
Total Refrigeration	209	1,569	3,826	7,678	11,785	15,994	20,305	24,698	29,171	33,645	38,119	42,593	47,066	51,540	56,014	60,488	64,962	69,435	73,909	78,383
TOTAL	24,655	137,296	288,909	461,545	664,987	831,254	941,881	1,010,970	1,063,258	1,108,274	1,148,113	1,187,241	1,223,113	1,257,615	1,290,603	1,322,336	1,352,558	1,381,811	1,409,920	1,437,918
Total as % of Sector Sales	0.36%	2.00%	4.18%	6.63%	9.46%	11.72%	13.17%	14.02%	14.62%	15.11%	15.51%	15.88%	16.22%	16.53%	16.82%	17.09%	17.33%	17.58%	17.77%	17.96%

Incremental Energy Potential (MWh)

Incremental Annual MWh Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	58,235	281,727	394,417	451,670	535,279	423,307	251,444	118,490	65,478	45,420	35,270	29,706	25,753	24,131	22,105	20,706	18,601	17,839	16,575	15,601
Total Motors & Other	29,109	78,471	104,095	143,179	236,790	248,623	246,775	244,939	242,926	232,447	222,501	213,019	203,936	195,364	187,156	179,344	171,840	164,733	157,906	151,392
Total HVAC & Shell	18,774	93,802	105,177	127,361	120,647	103,032	84,758	74,494	66,121	59,222	54,004	48,781	42,142	39,550	36,076	33,871	30,205	29,297	27,345	25,972
Total Refrigeration	1,060	6,822	11,316	18,530	19,701	20,182	20,667	21,037	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400
TOTAL	107,178	460,822	615,084	740,740	912,416	795,144	603,643	458,961	395,925	358,489	333,175	312,906	293,232	280,445	266,738	255,321	242,048	233,268	223,229	214,366
Total as % of Sector Sales	0.30%	1.30%	1.73%	2.06%	2.52%	2.18%	1.64%	1.24%	1.05%	0.95%	0.87%	0.81%	0.75%	0.71%	0.67%	0.64%	0.60%	0.57%	0.54%	0.52%

Incremental Demand Potential (kW)

Incremental Annual Peak kW Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	18,026	88,700	124,283	144,738	168,106	131,627	77,100	38,194	19,839	13,806	10,771	9,133	7,902	7,485	6,886	6,499	5,829	5,648	5,267	4,985
Total Motors & Other	2,713	7,000	9,311	13,064	22,463	23,810	23,641	23,487	23,312	22,323	21,383	20,482	19,608	18,795	18,010	17,266	16,543	15,867	15,213	14,589
Total HVAC & Shell	3,707	15,581	15,762	10,982	8,766	6,621	5,575	5,015	4,663	4,412	4,211	4,040	3,888	3,748	3,618	3,494	3,377	3,264	3,155	3,050
Total Refrigeration	209	1,360	2,258	3,852	4,107	4,209	4,311	4,393	4,474	4,474	4,474	4,474	4,474	4,474	4,474	4,474	4,474	4,474	4,474	4,474
TOTAL	24,655	112,641	151,614	172,636	203,442	166,267	110,627	69,089	52,287	45,016	40,839	38,128	35,871	34,502	32,988	31,733	30,222	29,263	28,109	27,096
Total as % of Sector Sales	0.36%	1.64%	2.20%	2.48%	2.89%	2.34%	1.55%	0.96%	0.72%	0.61%	0.55%	0.51%	0.48%	0.45%	0.43%	0.41%	0.39%	0.37%	0.35%	0.34%

Incremental Incentive Cost ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total Lighting	$5,540,873	$41,939,434	$54,454,931	$76,702,506	$105,094,779	$87,130,442	$51,220,815	$21,160,241	$8,651,998	$4,666,499
Total Motors & Other	$2,873,255	$11,014,300	$13,813,500	$19,898,525	$34,049,266	$35,957,047	$35,851,047	$35,732,320	$35,564,710	$34,110,489
Total HVAC & Shell	$1,226,920	$10,136,483	$11,285,603	$16,221,049	$16,498,754	$14,185,364	$11,485,741	$10,004,563	$8,787,786	$7,789,537
Total Refrigeration	$51,377	$511,808	$851,994	$1,552,201	$1,661,060	$1,701,755	$1,742,783	$1,778,848	$1,814,733	$1,814,733
TOTAL	$9,692,426	$63,602,025	$80,406,028	$114,374,281	$157,303,859	$138,974,609	$100,300,386	$68,675,972	$54,819,227	$48,381,257

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$2,805,835	$1,949,524	$1,528,989	$1,504,547	$1,390,144	$1,357,122	$1,189,978	$1,225,974	$1,164,883	$1,137,624
Total Motors & Other	$32,721,076	$31,384,628	$30,090,708	$28,871,838	$27,695,387	$26,573,065	$25,486,045	$24,459,069	$23,466,657	$22,517,375
Total HVAC & Shell	$7,046,011	$6,287,006	$5,286,392	$4,936,516	$4,436,795	$4,138,629	$3,597,088	$3,502,390	$3,233,693	$3,056,661
Total Refrigeration	$1,814,733	$1,814,733	$1,814,733	$1,814,733	$1,814,733	$1,814,733	$1,814,733	$1,814,733	$1,814,733	$1,814,733
TOTAL	$44,387,655	$41,435,891	$38,719,821	$37,127,634	$35,337,059	$33,883,549	$32,087,843	$31,002,166	$29,679,966	$28,526,393

Incremental Administrative Cost ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total Lighting	$1,844,584	$7,968,176	$10,959,572	$11,840,820	$13,442,413	$11,159,137	$7,247,215	$4,017,069	$2,513,346	$1,926,081
Total Motors & Other	$45,880	$325,676	$464,170	$486,131	$321,325	$234,775	$193,950	$174,953	$158,458	$147,750
Total HVAC & Shell	$1,081,971	$5,789,525	$6,629,476	$9,055,022	$8,863,258	$7,789,307	$6,330,179	$5,597,201	$4,991,873	$4,518,182
Total Refrigeration	$2,334,812	$12,450,482	$14,628,401	$20,078,566	$19,623,915	$17,427,941	$14,507,651	$13,052,319	$11,854,257	$10,896,166
TOTAL	$5,307,246	$26,533,859	$32,681,619	$41,460,539	$42,250,912	$36,611,160	$28,278,996	$22,841,542	$19,517,934	$17,488,179

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$1,591,297	$1,378,095	$1,219,113	$1,120,294	$1,020,569	$940,115	$850,391	$793,116	$729,580	$675,687
Total Motors & Other	$140,117	$129,553	$110,857	$107,352	$98,824	$94,533	$83,299	$82,918	$77,639	$74,349
Total HVAC & Shell	$4,176,079	$3,794,125	$3,227,006	$3,076,221	$2,809,632	$2,665,015	$2,348,026	$2,320,651	$2,170,483	$2,075,845
Total Refrigeration	$10,204,328	$9,429,858	$8,276,922	$7,971,846	$7,430,141	$7,136,615	$6,491,403	$6,436,272	$6,130,657	$5,938,092
TOTAL	$16,111,822	$14,731,630	$12,833,898	$12,275,713	$11,358,166	$10,836,278	$9,773,119	$9,632,958	$9,108,359	$8,763,973

Total Incremental Costs ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total Lighting	$7,385,457	$49,907,610	$65,414,503	$88,543,326	$118,537,192	$98,289,579	$58,468,031	$25,177,309	$11,165,345	$6,592,580
Total Motors & Other	$2,919,135	$11,339,975	$14,277,670	$20,384,657	$34,370,592	$36,191,822	$36,044,997	$35,907,273	$35,723,169	$34,258,239
Total HVAC & Shell	$2,308,891	$15,926,008	$17,915,079	$25,276,071	$25,362,013	$21,974,672	$17,815,921	$15,601,764	$13,779,659	$12,307,719
Total Refrigeration	$2,386,190	$12,962,290	$15,480,395	$21,630,767	$21,284,975	$19,129,696	$16,250,434	$14,831,167	$13,668,989	$12,710,899
TOTAL	$14,999,672	$90,135,884	$113,087,647	$155,834,820	$199,554,771	$175,585,769	$128,579,383	$91,517,514	$74,337,162	$65,869,436

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$4,397,133	$3,327,620	$2,748,102	$2,624,841	$2,410,714	$2,297,237	$2,040,369	$2,019,090	$1,894,463	$1,813,311
Total Motors & Other	$32,861,192	$31,514,181	$30,201,565	$28,979,189	$27,794,211	$26,667,597	$25,569,343	$24,541,986	$23,544,296	$22,591,724
Total HVAC & Shell	$11,222,091	$10,081,131	$8,512,398	$8,012,737	$7,246,427	$6,803,644	$5,945,113	$5,823,041	$5,404,175	$5,132,506
Total Refrigeration	$12,019,061	$11,244,569	$10,091,655	$9,786,579	$9,244,874	$8,951,348	$8,306,136	$8,251,004	$7,945,390	$7,752,824
TOTAL	$60,499,477	$56,167,521	$51,553,719	$49,403,346	$46,696,225	$44,719,826	$41,860,962	$40,635,122	$38,788,325	$37,290,366

Table 7-10. Low Case Scenario: 2009 – 2028 Commercial & Industrial Cumulative Annual Net Savings at Meter and Costs

Low Scenario - C & I Sector Programs

Cumulative Energy Potential (MWh)

Cumulative Annual MWh Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	58,235	126,533	223,365	324,689	453,611	586,550	717,299	846,723	972,198	1,090,158	1,199,672	1,311,292	1,395,443	1,482,958	1,564,232	1,639,815	1,709,989	1,775,369	1,836,212	1,892,897
Total Motors & Other	29,109	55,350	91,423	145,809	243,194	350,344	461,174	575,816	694,349	810,397	824,093	1,035,541	1,144,820	1,252,019	1,357,198	1,460,416	1,561,718	1,661,161	1,758,782	1,854,626
Total HVAC & Shell	18,774	37,344	63,394	97,919	136,358	175,127	213,234	251,298	289,216	325,372	359,910	392,850	423,939	453,841	482,402	509,859	535,975	561,252	585,526	608,931
Total Refrigeration	1,060	2,066	3,831	6,717	9,875	13,224	16,777	20,547	24,548	28,549	32,549	36,550	40,551	44,552	48,553	52,553	56,554	60,555	64,556	68,556
TOTAL	107,178	221,293	382,012	575,135	843,038	1,125,245	1,408,485	1,693,385	1,980,311	2,254,475	2,516,224	2,766,233	3,004,752	3,233,370	3,452,385	3,662,643	3,864,237	4,058,336	4,245,076	4,425,010
Total as % of Sector Sales	0.30%	0.62%	1.07%	1.60%	2.33%	3.08%	3.82%	4.55%	5.27%	5.95%	6.57%	7.16%	7.71%	8.23%	8.71%	9.16%	9.58%	9.98%	10.35%	10.70%

Cumulative Demand Potential (kW)

Cumulative Annual Peak kW Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	18,026	38,720	68,156	99,717	139,663	180,895	221,520	261,497	300,877	337,604	371,698	403,327	432,614	459,835	485,108	508,608	530,415	550,733	569,637	587,247
Total Motors & Other	2,713	5,162	8,496	13,511	22,568	32,607	43,032	53,855	65,081	76,101	86,920	97,542	107,967	118,205	128,257	138,128	147,820	157,338	166,685	175,865
Total HVAC & Shell	3,707	8,443	14,982	21,959	29,120	35,948	42,588	49,068	55,373	61,306	66,901	72,191	77,202	81,958	86,480	90,787	94,896	98,820	102,572	106,166
Total Refrigeration	209	390	708	1,269	1,886	2,541	3,236	3,974	4,758	5,542	6,326	7,110	7,894	8,677	9,461	10,245	11,029	11,813	12,597	13,380
TOTAL	24,655	52,716	92,343	136,456	193,236	251,990	310,376	368,395	426,090	480,553	531,845	580,169	625,676	668,676	709,307	747,769	784,159	818,703	851,491	882,658
Total as % of Sector Sales	0.36%	0.77%	1.34%	1.96%	2.75%	3.55%	4.34%	5.11%	5.86%	6.55%	7.18%	7.76%	8.30%	8.79%	9.25%	9.66%	10.05%	10.40%	10.73%	11.03%

Incremental Energy Potential (MWh)

Incremental Annual MWh Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	58,235	68,298	96,832	101,325	128,921	132,940	130,749	128,424	126,474	117,960	109,514	101,620	94,151	87,515	81,274	75,582	70,175	65,379	60,844	56,685
Total Motors & Other	29,109	26,241	36,072	54,386	97,385	107,150	110,831	114,642	118,533	116,048	113,696	111,448	109,279	107,200	105,178	103,218	101,302	99,443	97,622	95,843
Total HVAC & Shell	18,774	18,570	26,050	34,525	38,439	38,769	38,107	38,064	37,918	36,155	34,538	32,940	31,089	29,903	28,561	27,457	26,116	25,277	24,274	23,405
Total Refrigeration	1,060	1,005	1,765	2,886	3,158	3,349	3,553	3,770	4,001	4,001	4,001	4,001	4,001	4,001	4,001	4,001	4,001	4,001	4,001	4,001
TOTAL	107,178	114,115	160,720	193,123	267,903	282,207	283,240	284,899	286,926	274,164	261,748	250,009	238,520	228,618	219,014	210,258	201,594	194,099	186,740	179,934
Total as % of Sector Sales	0.30%	0.32%	0.45%	0.54%	0.74%	0.77%	0.77%	0.76%	0.76%	0.72%	0.68%	0.65%	0.61%	0.58%	0.55%	0.53%	0.50%	0.48%	0.46%	0.44%

Incremental Demand Potential (kW)

Incremental Annual Peak kW Savings	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	18,026	20,694	29,436	31,561	39,945	41,232	40,625	39,977	39,380	36,727	34,094	31,629	29,287	27,222	25,273	23,500	21,807	20,318	18,904	17,610
Total Motors & Other	2,713	2,450	3,334	5,015	9,057	10,039	10,425	10,823	11,226	11,020	10,819	10,621	10,426	10,238	10,052	9,871	9,692	9,518	9,347	9,180
Total HVAC & Shell	3,707	4,736	6,539	6,976	7,161	6,828	6,641	6,479	6,305	5,932	5,596	5,290	5,011	4,756	4,522	4,307	4,108	3,924	3,753	3,593
Total Refrigeration	209	181	318	561	617	655	695	738	784	784	784	784	784	784	784	784	784	784	784	784
TOTAL	24,655	28,061	39,627	44,114	56,780	58,754	58,386	58,018	57,695	54,463	51,292	48,324	45,507	42,999	40,631	38,482	36,390	34,544	32,788	31,167
Total as % of Sector Sales	0.36%	0.41%	0.57%	0.63%	0.81%	0.83%	0.82%	0.80%	0.79%	0.74%	0.69%	0.66%	0.60%	0.57%	0.53%	0.50%	0.47%	0.44%	0.41%	0.39%

Low Scenario - C & I Sector Programs (Costs)

Incremental Incentive Cost ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$5,540,873	$2,972,034	$4,090,962	$6,440,342	$10,102,089	$10,922,620	$10,847,269	$10,732,699	$10,666,463	$9,956,241	$9,244,201	$8,578,602	$7,949,612	$7,390,514	$6,865,231	$6,386,240	$5,931,761	$5,528,401	$5,147,297	$4,797,935
Total Motors & Other	$2,873,255	$1,879,048	$2,479,214	$3,843,433	$7,087,938	$7,806,695	$8,068,115	$8,341,416	$8,622,344	$8,441,886	$8,272,654	$8,111,922	$7,957,146	$7,809,977	$7,666,941	$7,528,609	$7,393,006	$7,262,076	$7,133,462	$7,007,881
Total HVAC & Shell	$1,226,920	$676,310	$957,814	$1,565,767	$1,900,951	$1,948,787	$1,912,655	$1,929,222	$1,941,443	$1,858,614	$1,782,326	$1,702,955	$1,596,684	$1,545,171	$1,475,661	$1,422,695	$1,347,830	$1,311,586	$1,259,967	$1,217,386
Total Refrigeration	$51,377	$33,607	$59,553	$112,093	$123,767	$131,337	$139,423	$148,037	$157,187	$157,187	$157,187	$157,187	$157,187	$157,187	$157,187	$157,187	$157,187	$157,187	$157,187	$157,187
TOTAL	$9,692,426	$5,560,998	$7,587,562	$11,961,636	$19,214,746	$20,809,438	$20,967,462	$21,151,374	$21,387,436	$20,413,928	$19,456,368	$18,550,666	$17,662,629	$16,902,849	$16,165,019	$15,494,731	$14,829,785	$14,259,250	$13,697,912	$13,180,389

Incremental Administrative Cost ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$1,844,584	$2,393,558	$3,307,267	$3,674,564	$4,284,061	$4,380,741	$4,193,629	$4,018,098	$3,924,110	$3,656,060	$3,390,851	$3,144,660	$2,913,629	$2,705,728	$2,511,411	$2,333,444	$2,165,961	$2,015,360	$1,874,037	$1,744,110
Total Motors & Other	$45,880	$48,874	$95,422	$139,257	$188,568	$175,431	$157,615	$143,919	$131,709	$115,715	$103,343	$93,177	$83,437	$77,515	$71,655	$67,276	$62,234	$59,497	$56,212	$53,563
Total HVAC & Shell	$1,081,971	$985,067	$1,380,598	$2,036,613	$2,353,308	$2,421,845	$2,366,590	$2,377,628	$2,382,223	$2,284,929	$2,194,910	$2,099,571	$1,969,996	$1,907,191	$1,822,268	$1,758,709	$1,665,338	$1,622,920	$1,559,522	$1,507,750
Total Refrigeration	$2,334,812	$2,099,462	$2,997,872	$4,443,422	$5,147,845	$5,287,052	$5,175,039	$5,200,796	$5,216,235	$5,005,654	$4,813,245	$4,612,400	$4,343,507	$4,211,978	$4,036,271	$3,904,774	$3,712,990	$3,625,416	$3,495,336	$3,389,143
TOTAL	$5,307,246	$5,526,961	$7,781,159	$10,293,856	$11,973,782	$12,265,068	$11,892,873	$11,740,442	$11,654,277	$11,061,359	$10,502,350	$9,949,808	$9,310,568	$8,902,412	$8,441,605	$8,064,203	$7,606,522	$7,323,192	$6,985,107	$6,694,566

Total Incremental Costs ($)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$7,385,457	$5,365,591	$7,398,249	$10,114,905	$14,386,150	$15,303,360	$15,040,898	$14,750,798	$14,590,573	$13,611,301	$12,635,052	$11,723,261	$10,863,241	$10,096,242	$9,376,641	$8,719,684	$8,097,722	$7,543,761	$7,021,334	$6,542,045
Total Motors & Other	$2,919,135	$1,927,922	$2,574,635	$3,982,690	$7,276,506	$7,982,126	$8,225,729	$8,485,335	$8,754,052	$8,557,602	$8,375,997	$8,205,100	$8,040,583	$7,887,492	$7,738,596	$7,595,885	$7,455,240	$7,321,572	$7,189,674	$7,061,443
Total HVAC & Shell	$2,308,891	$1,661,377	$2,338,412	$3,602,381	$4,254,259	$4,370,632	$4,279,245	$4,306,849	$4,323,666	$4,143,543	$3,977,237	$3,802,526	$3,566,679	$3,452,362	$3,297,929	$3,181,405	$3,013,168	$2,934,505	$2,819,489	$2,725,136
Total Refrigeration	$2,386,190	$2,133,070	$3,057,424	$4,555,515	$5,271,612	$5,418,389	$5,314,462	$5,348,833	$5,373,422	$5,162,841	$4,970,432	$4,769,587	$4,500,694	$4,369,165	$4,193,459	$4,061,961	$3,870,177	$3,782,603	$3,652,524	$3,546,331
TOTAL	$14,999,672	$11,087,959	$15,368,720	$22,255,492	$31,188,527	$33,074,506	$32,860,335	$32,891,816	$33,041,714	$31,475,287	$29,958,718	$28,500,474	$26,973,197	$25,885,261	$24,606,624	$23,558,934	$22,436,307	$21,582,442	$20,663,019	$19,874,955

7.4.1 Commercial and Industrial Energy Efficiency Results by End Use

Figures 7-16 to 7-19 show energy and peak demand savings for the first year (2009) and in year twenty (2028) for different potential scenarios. Non-residential lighting measures, primarily high performance fluorescent fixtures, account for most of the total estimated non-residential energy conservation potential initially, shifting over time to more impact from motors and custom measures. Lighting demand impacts predominate throughout the twenty year (2009 to 2028) forecast period.

Figure 7-16. Commercial and Industrial Market Potential Incremental Annual Net Energy Savings by End Use 2009

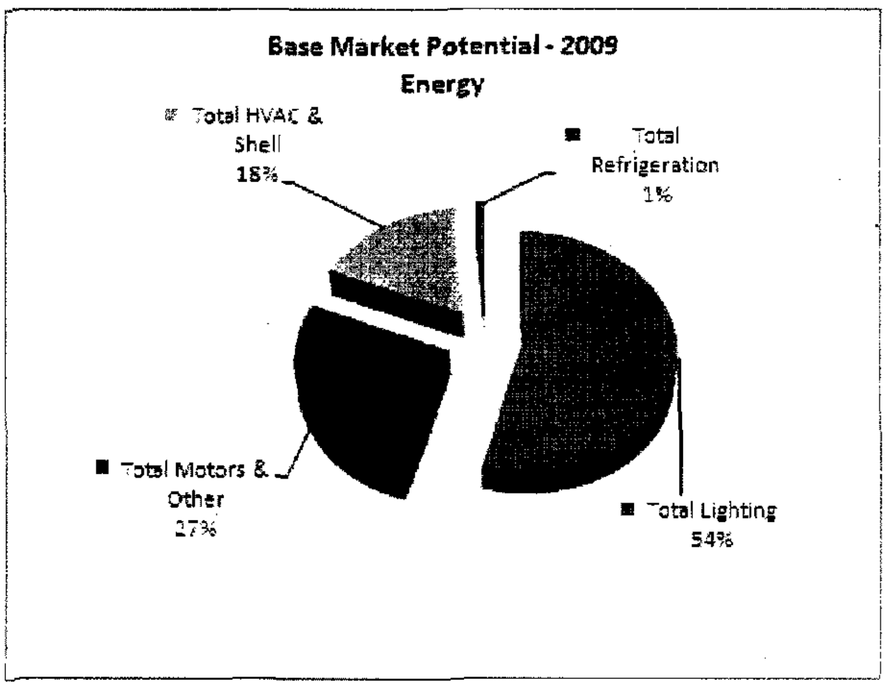


Figure 7-17. Commercial and Industrial Market Potential Incremental Annual Net Summer Peak Demand Savings by End Use 2009

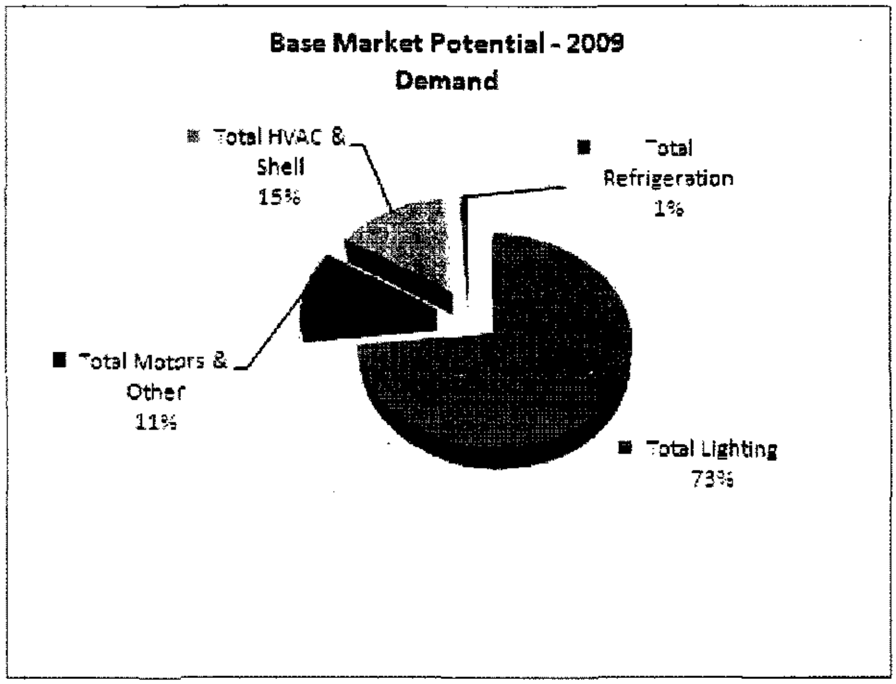


Figure 7-18. Commercial and Industrial Market Potential Incremental Annual Net Energy Savings at Meter by End Use 2028

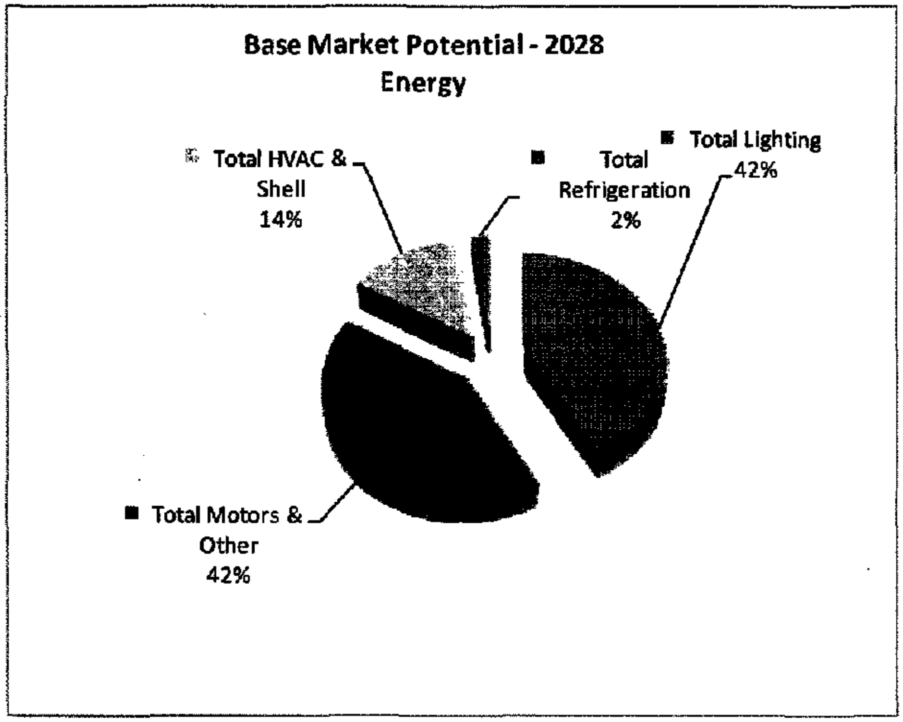
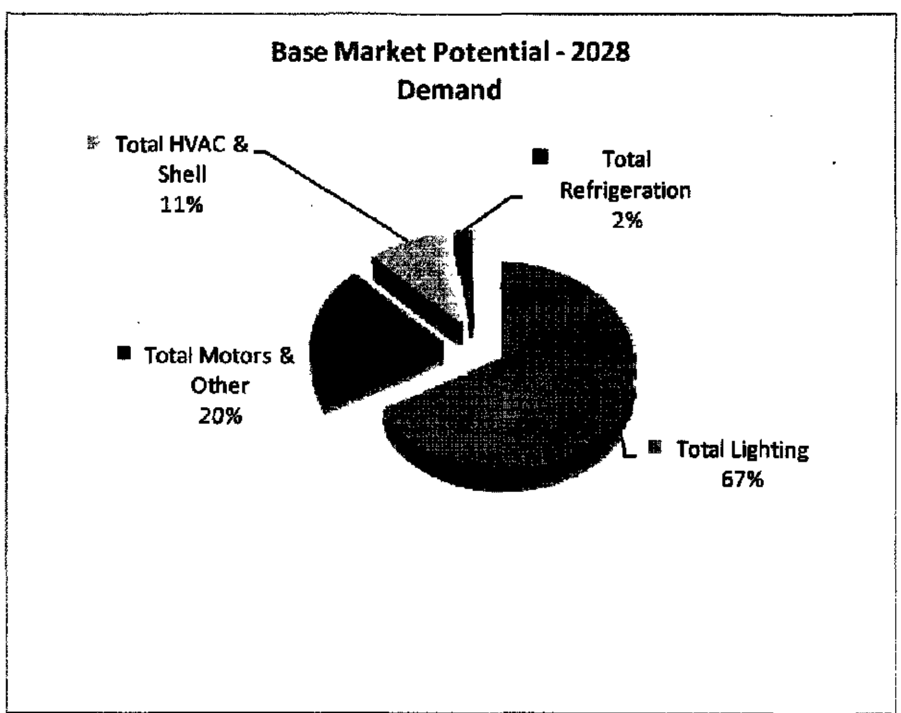


Figure 7-19. Commercial and Industrial Market Potential Incremental Annual Net Summer Peak Demand Savings at Meter by End Use 2028



Figures 7-20 to Figure 7-25 present commercial and industrial sector results for the Base Case Market, Economic and Technical Potentials for the twenty year period (2009 to 2028) and in year twenty (2028). In 2028, while motors and custom measures account for most of the economic potential, motors and custom, and lighting energy savings are projected to provide a similar amount of market potential. In 2028, projected economic potential demand savings are mainly from lighting, and motors and custom measures, while market potential is projected to predominantly be from lighting.

Total technical and economic potential energy savings through 2028 are projected primarily from motors and custom measures with the other end uses providing less savings. Total technical and economic potential peak demand savings through 2028 are projected primarily from lighting, followed by motors and custom measures. The end use contribution to economic potential energy savings in 2028 is projected to be from motors and custom measures, followed by lighting. The end use contribution to economic potential peak demand savings in 2028 is projected to be predominantly from lighting, and motors and custom measures.

Figure 7-20. Commercial and Industrial Base Case Market and Economic Potential Net Energy Savings at Meter – 2028 by End Use

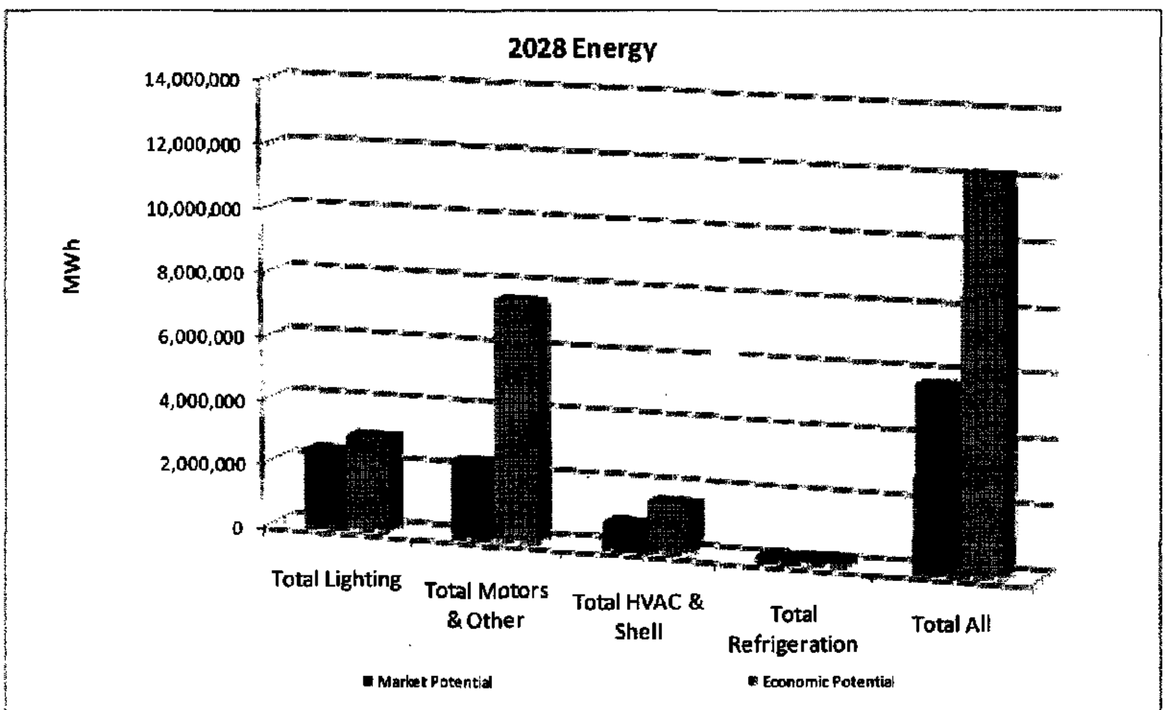


Figure 7-21. Commercial and Industrial Base Case Market and Economic Potential Net Summer Peak Demand Savings at Meter – 2028 by End Use

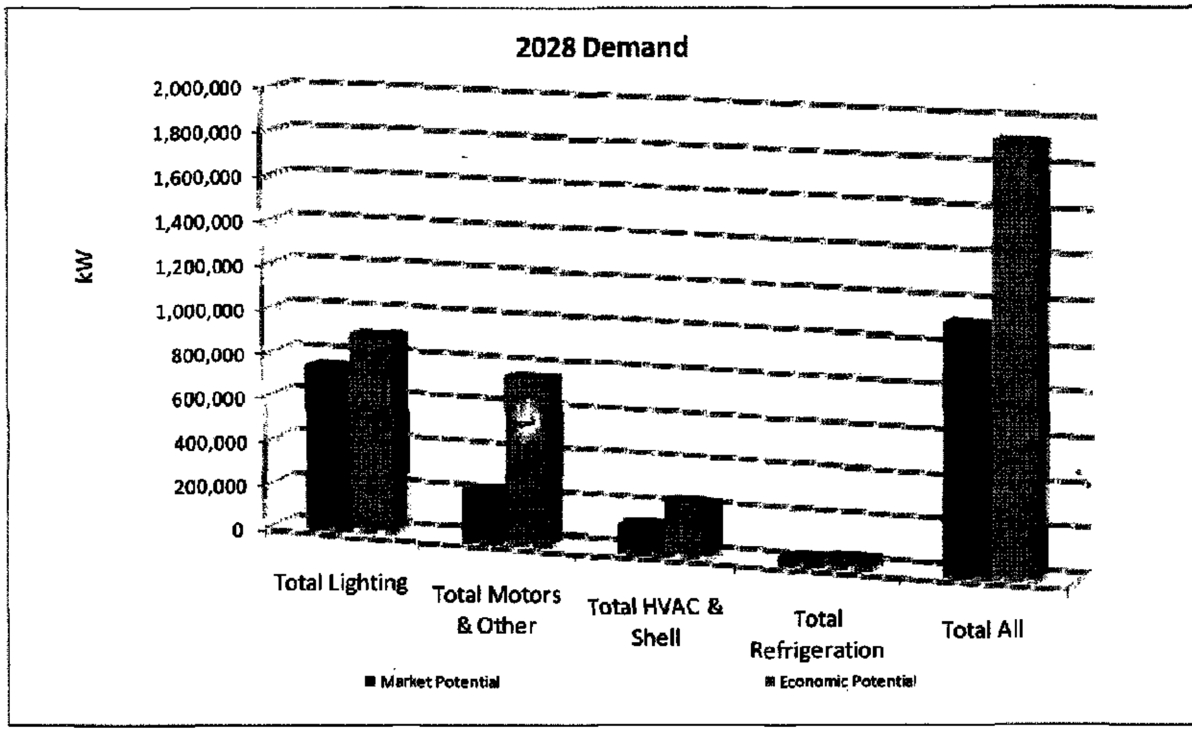


Figure 7-22. Commercial and Industrial Technical and Economic Potential Net Energy Savings at Meter – 2028 by End Use

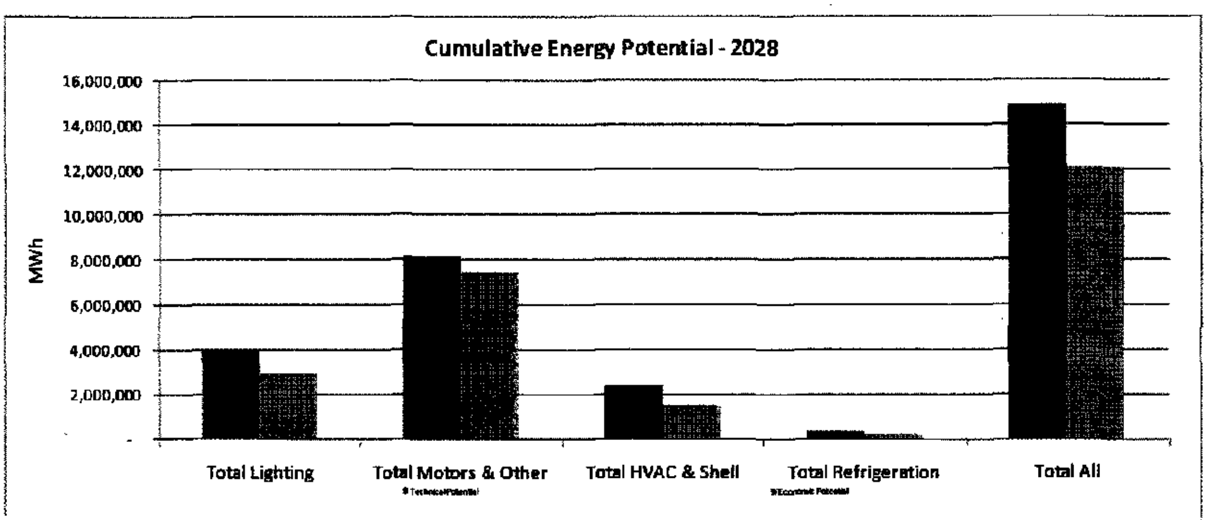


Figure 7-23. Commercial and Industrial Technical and Economic Potential Net Summer Peak Demand Savings at Meter – 2028 by End Use

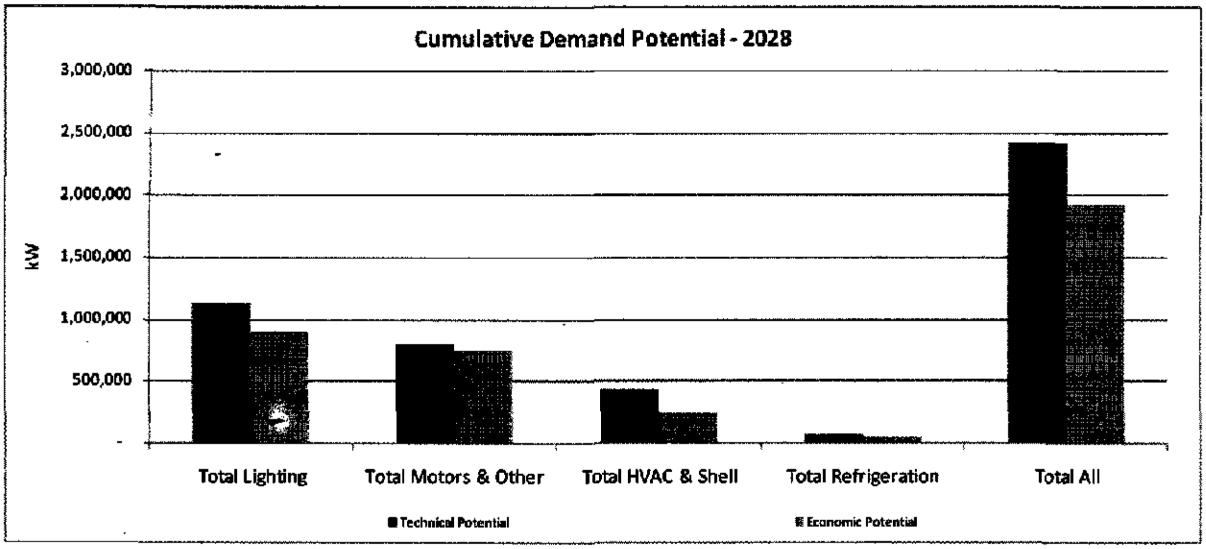


Figure 7-24. Commercial and Industrial Market Potential Incremental Annual Net Energy Savings at Meter by End Use 2028

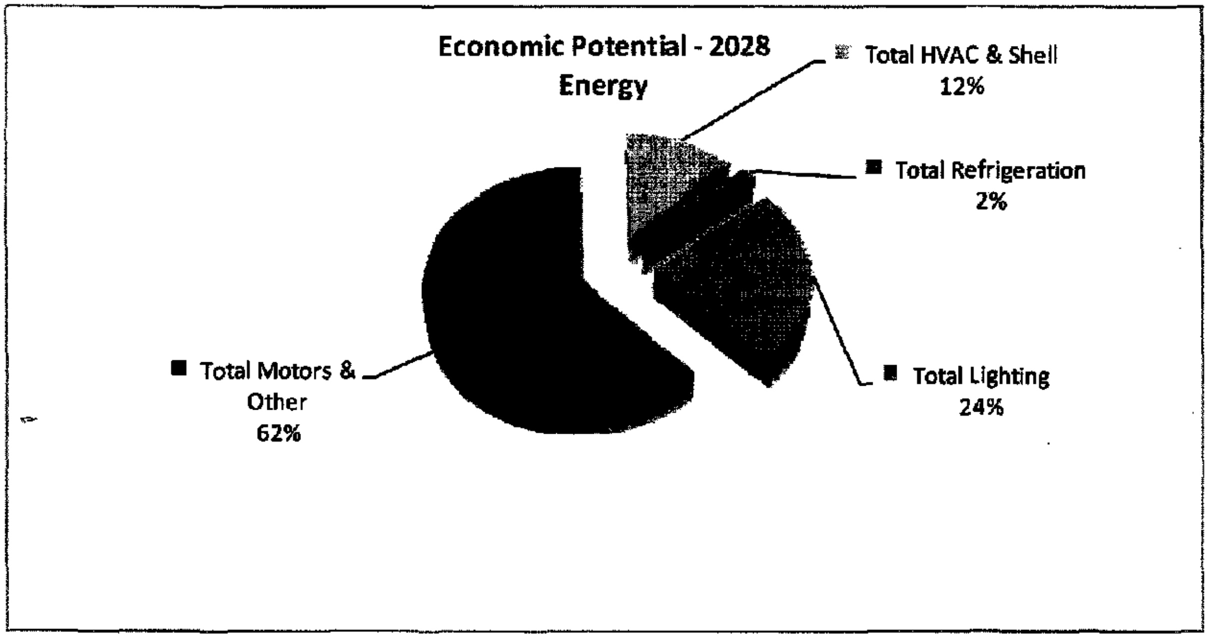
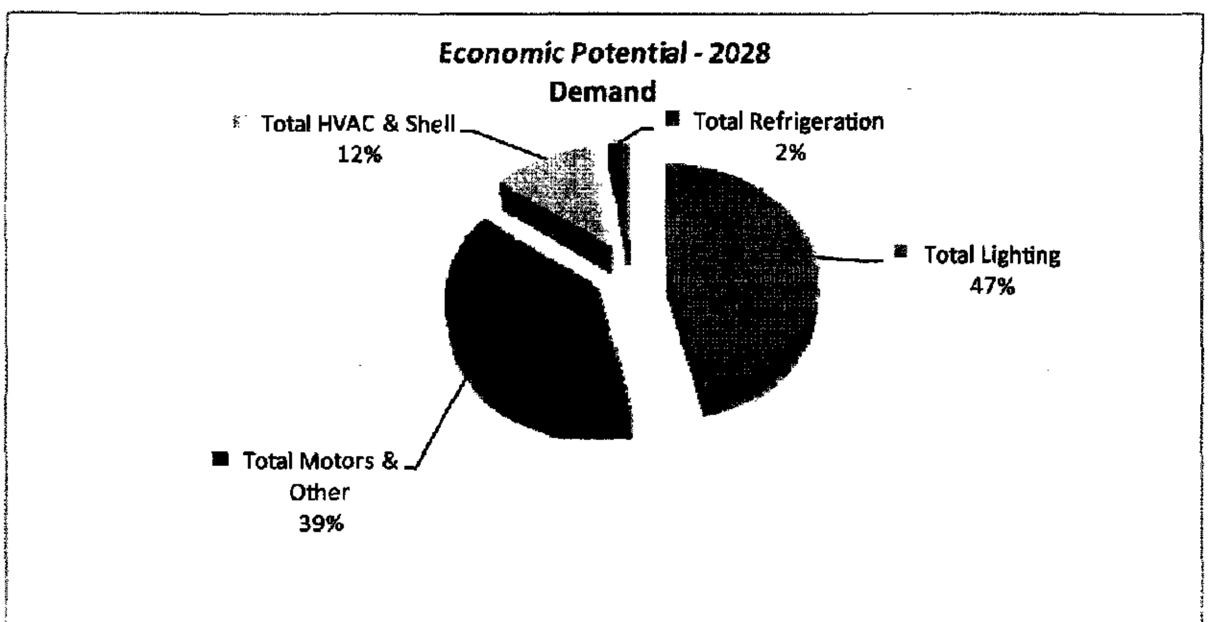


Figure 7-25. Commercial and Industrial Market Potential Incremental Annual Net Summer Peak Demand Savings at Meter by End Use 2028



8 GLOSSARY OF TERMS

Achievable Potential: the amount of energy use that efficiency can realistically be expected to displace assuming the most aggressive program scenario possible (such as providing end-users with payments for the entire incremental cost of more efficient equipment). This is often referred to as maximum achievable potential. Achievable potential takes into account real-world barriers to convincing end-users to adopt efficiency measures, the non-measure costs of delivering programs (for administration, marketing, tracking systems, monitoring and evaluation, etc.), and the capability of programs and administrators to ramp up program activity over time.

Applicability Factor: the fraction of the applicable dwelling units that are technically feasible for conversion to the efficient technology from an **engineering** perspective (e.g., it may not be possible to install CFLs in all light sockets in a home because the CFLs may not fit in every socket in a home).

Base Case Equipment End Use Intensity: the electricity used per customer per year by each base-case technology in each market segment. This is the consumption of the electric energy using equipment that the efficient technology replaces or affects. For example purposes only, if the efficient measure were a high efficiency light bulb (CFL), the base end use intensity would be the annual kWh use per bulb per household associated with an incandescent light bulb that provides equivalent lumens to the CFL.

Base Case Factor: the fraction of the end use electric energy that is applicable for the efficient technology in a given market segment. For example, for residential lighting, this would be the fraction of all residential electric customers that have electric lighting in their household.

Coincidence Factor: the fraction of connected load expected to be "on" and using electricity coincident with the system peak period.

Cost-effectiveness: a measure of the relevant economic effects resulting from the implementation of an energy efficiency measure. If the benefits outweigh the cost, the measure is said to be cost-effective.

Cumulative Annual: refers to the overall savings occurring in a given year from both new participants and savings continuing to result from past participation with measures that are still in place. Cumulative annual does not always equal the sum of all prior year incremental values as some measures have relatively short measure lives and, as a result, their savings drop off over time.

Demand Response: the ability to provide peak load capacity through demand management (load control) programs. This methodology focuses on curtailment of loads during peak demand times thus avoiding the requirement to find new sources of generation capacity.

Early Replacement: refers to an efficiency measure or efficiency program that seeks to encourage the replacement of functional equipment before the end of its operating life with higher-efficiency units

Economic Potential: the subset of the technical potential screen that is economically cost-effective as compared to conventional supply-side energy resources. Both technical and economic potential screens are theoretical numbers that assume immediate implementation of efficiency measures, with no regard for the gradual "ramping up" process of real-life programs. In addition, they ignore market barriers to ensuring actual implementation of efficiency. Finally, they only consider the costs of efficiency measures themselves, ignoring any programmatic costs (such as marketing, analysis, administration) that would be necessary to capture them.

Effective Useful Life (EUL"): the number of years (or hours) that the new energy efficient equipment is expected to function. Useful life is also commonly referred to as "measure life."

End-use: a category of equipment or service that consumes energy (e.g., lighting, refrigeration, heating, process heat).

Energy Efficiency: using less energy to provide the same or an improved level of service to the energy consumer in an economically efficient way. Sometimes "conservation" is used as a synonym, but that term is usually taken to mean using less of a resource even if this results in a lower service level (e.g., setting a thermostat lower or reducing lighting levels). This recognizes that energy efficiency includes using less energy at any time, including at times of peak demand through demand response and peak shaving efforts.

Free Driver: individuals or businesses that adopt an energy efficient product or service because of an energy efficiency program, but are difficult to identify either because they do not receive an incentive or are not aware of exposure to the program.

Free Rider: participants in an energy efficiency program who would have adopted an energy efficiency technology or improvement in the absence of a program of financial incentive.

Incremental: savings or costs in a given year associated only with new installations happening in year.

Impact Evaluation: is the estimation of gross and net effects from the implementation of one or more energy efficiency programs. Most program impact projections contain ex-ante estimates of savings. These estimates are what the program is expected to save as a result of its implementation efforts and are often used for program planning and contracting purposes and for prioritizing program funding choices. In contrast the impact evaluation focuses on identifying and estimating the amount of energy and demand the program actually provides.

Integrated Data Collection (IDC"): an approach in which surveys of key market actors and end-use customers ("EUCs") are conducted in "real time" as close to the key intervention points as possible; usually integrated as part of the standard program implementation or other program paperwork process.

Lost-opportunity: refers to an efficiency measure or efficiency program that seeks to encourage the selection of higher-efficiency equipment or building practices than would typically be chosen at the time of a purchase or design decision.

Market Characterization: refers to evaluations focused on the evaluation of program-induced market effects when the program being evaluated has a goal of making longer-term lasting changes in the way a market operates. These evaluations examine changes within a market that are caused, at least in part, by the energy efficiency programs attempting to change that market.

Market Transformation: an approach in which a program attempts to influence "upstream" service and equipment provider market channels and what they offer end customers, along with educating and informing end customers directly. The emphasis is on influencing market channels and key market actors other than end customers.

Measure: any action taken to increase efficiency, whether through changes in equipment, control strategies, or behavior. Examples are higher-efficiency central air conditioners, occupancy sensor control of lighting, and retro-commissioning. In some cases, bundles of technologies or practices may be modeled as single measures. For example, an ENERGY STAR™ home package may be treated as a single measure.

Megawatt ("MW"): a unit of electrical output, equal to one million watts or one thousand kilowatts. It is typically used to refer to the output of a power plant.

Megawatt-hour ("MWh"): one thousand kilowatt-hours, or one million watt-hours. One MWh is equal to the use of 1,000,000 watts of power in one hour.

Net-to-gross ("NTG") Ratio: a factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts

Portfolio: either a collection of similar programs addressing the same market, technology, or mechanisms; or the set of all programs conducted by one organization.

Process Evaluation: is a systematic assessment of an energy efficiency program for the purposes of documenting program operations at the time of the examination and identifying improvements that can be made to increase the program's efficiency or effectiveness for acquiring energy resources.

Program: a mechanism for encouraging energy efficiency. May be funded by a variety of sources and pursued by a wide range of approaches. Typically includes multiple measures.

Program Potential: the efficiency potential possible given specific program funding levels and designs. Often, program potential studies are referred to as "achievable" in contrast to "maximum achievable."

Remaining Factor: the fraction of applicable units that have not yet been converted to the electric energy efficiency measure; that is, one minus the fraction of units that already have the energy efficiency measure installed.

Replace on Burnout ("ROB"): a EE/PDR measure is not implemented until the existing technology it is replacing fails. An example would be an energy efficient water heater being purchased after the failure of the existing water heater.

Resource Acquisition: an approach in which end customers are the primary target of program offerings (e.g., using rebates to influence customers' purchases of end use equipment).

Retrofit: refers to an efficiency measure or efficiency program that seeks to encourage the replacement of functional equipment before the end of its operating life with higher-efficiency units (also called "early retirement") or the installation of additional controls, equipment, or materials in existing facilities for purposes of reducing energy consumption (e.g., increased insulation, low flow devices, lighting occupancy controls, economizer ventilation systems).

Savings Factor: the percentage reduction in electricity consumption resulting from application of the efficient technology used in the formulas for technical potential screens.

Technical Potential: the theoretical maximum amount of energy use that could be displaced by efficiency, disregarding all non-engineering constraints such as cost-effectiveness and the willingness of end-users to adopt the efficiency measures. It is often estimated as a "snapshot" in time assuming immediate implementation of all technologically feasible energy saving measures, with additional efficiency opportunities assumed as they arise from activities such as new construction.