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April 23, 2010

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HAND DELIVERED

RECEIVED
APR 23 2010
PUBLIC SERVICE
COMMISSION

Jeff R. Derouen
Executive Director
Public Service Commission
211 Sower Boulevard
P.O. Box 615
Frankfort, KY 40602-0615

Dear Mr. Derouen:

Re: P.S.C. Case No. 2010-00095

Enclosed please find and accept for filing an original and five copies of Kentucky Power Company's responses to the Commission Staff's April 9, 2010 data requests.

Very truly yours,

Mark R. Overstreet

RECEIVED

APR 23 2010

PUBLIC SERVICE
COMMISSION

COMMONWEALTH OF KENTUCKY

BEFORE THE

PUBLIC SERVICE COMMISSION OF KENTUCKY

IN THE MATTER OF:

JOINT APPLICATION PURSUANT TO	)
1994 HOUSE BILL NO. 501 FOR THE	)
APPROVAL OF KENTUCKY POWER	)
COMPANY COLLABORATIVE DEMAND-	)
SIDE MANAGEMENT PROGRAMS, AND	)
FOR AUTHORITY TORECOVER COSTS,	)
NET LOST REVENUES AND RECEIVE	)CASE NO. 2010-00095
INCENTIVES ASSOCIATED WITH THE	)
IMPLEMENTATION OF ONE NEW RESIDENTIAL,	)
ONE COMBINED RESIDENTIAL/COMMERICAL,	)
AND ONE COMMERICAL DEMAND-SIDE	)
MANAGEMENT PROGRAM BEGINNING	)
JANUARY 1, 2010	)

Kentucky Power Company Responses to
Commission Staff's First Set of Data Requests

April 23, 2010

VERIFICATION

COMMONWEALTH OF KENTUCKY)
COUNTY OF FRANKLIN) CASE NO. 2010-00095

The undersigned, **Errol Wagner**, being duly sworn, states he is the Director of Regulatory Services for Kentucky Power Company, that he has personal knowledge of the matters set forth in the Data Responses for which he is identified as the witness, and the answers contained therein are true and correct to the best of his information, knowledge and belief.

Errol K. Wagner
ERROL K. WAGNER

Subscribed and sworn to before me, a Notary Public in and before said County and State, this 23rd day of April 2010.

Judy K Rosquist (SEAL)
Notary Public

My Commission Expires:
January 23, 2013

Kentucky Power Company

REQUEST

Refer to Kentucky Power's application of February 26, 2010. In Tab 1, Residential Efficient Products Program paragraph 1, Kentucky Power refers to "special sales events." Provide a description of the events.

RESPONSE

A "special sales event" occurs when the third party implementation contractor schedules a visit at a participating retail store, sets-up a display, and promotes the sale of ENERGY STAR® lighting products.

WITNESS: Errol K Wagner

Kentucky Power Company

REQUEST

Refer to Tab 1, Section 6 of the application, titled "Implementation Plan." It is noted that, rather than having mail-in rebate and claim forms, the qualifying product would be listed at a lower retail price or marked down automatically at the point of sale. At the end of every month, the retailer would provide a point-of-sale report and would be reimbursed for the discount provided on each unit it has sold.

a. How are potential "select retailers" identified?

b. Describe the content of and provide a copy of the monthly report.

c. Describe the procedures that will be in place to ensure the accountability of the program.

d. Will the company track who has purchased the residential efficient products and where they are installed? If yes, explain how.

e. What are the sales tax consequences associated with this program?

f. If there are any sales tax consequences as a result of this program, who will be responsible for addressing such consequences?

RESPONSE

a. The third party implementation contractor will promote the program to large "chain" retailers and small retail establishments within our service area.

b. At this point, there has been no monthly report developed. KPCo and the third party implementation contractor will develop a monthly point-of-sale report. The report will contain the store name, store address, store rebate, store number, bulb model number, bulb mfg, bulb type, bulb wattage, bulbs per package, purchase date, submit date, check date and invoice date.

c. On a monthly basis, the third party implementation contractor will invoice KPCo for the total number discounts provided. Accompanying each invoice will be a detailed report listing the information contained in answer b. This information will be used to verify the monthly invoice.

d. The company will not track customer information for residential efficient products purchased from large "chain" retailers. However, depending on program participation levels, the company may implement a mail-in rebate program which will collect customer information such as name, address, phone number and customer account number. This mail-in rebate program will be targeted to small retail establishments who are unable to afford point-of-sale discounts.

e. A brief explanation of the tax consequences (using fictitious dollar amounts) is as follows: The retailer would charge $3.00 for the purchase of the CFL. KPCo's program provides a $1.00 incentive on the cost of the bulb. The retailer will charge $0.12 sales tax ($2.00 x 6% = $0.12) to the customer on the $2.00 sale. Therefore, the customer pays $2.12 to the retailer. The retailer then invoices KPCo's 3rd party contractor and charges $0.06 sales tax on that retail sale ($1.00 x 6% = $0.06). The 3rd party contractor pays $ 1.06 to the retailer. The 3rd party contractor invoices KPCo for the $1.06, plus a $0.10 service fee.The 3rd party contractor invoice amount of $1.16 ($1.00 incentive + $ $0.06 sales tax + $0.10 service fee) to KPCo would become the cost of the DSM program. The 3rd party contractor's invoice would not include additional sales tax since it is not a retail sale but rather a reimbursement, plus a non-taxable service fee.

f. The retailer will be responsible for addressing the tax consequences described in question e above.

WITNESS: Errol K Wagner

Kentucky Power Company

REQUEST

Refer to Tab 1, Section 9 of the application, titled "Annual Budget." Provide a copy of the cited Market Potential Study performed by Summit Blue Consulting, LLC.

RESPONSE

A copy of the cited Market Potential Study performed by Summit Blue Consulting, L.L.C. is attached to this response.

WITNESS: Errol K Wagner

VOLUME 1:

APPALACHIAN POWER CO – WEST VIRGINIA

2009 TO 2013 DSM ACTION PLAN

November 12, 2009

Rev. March 3, 2010

SUMMIT BLUE
CONSULTING, LLC

Submitted to:

Appalachian Power Company
Suite 1100 Chase Tower
707 Virginia Street East
Charleston, WV 25301

Submitted by:

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APCo West Virginia has a mix of over 400,000 residential, commercial and industrial customers. APCo West Virginia provides low electric rates in West Virginia, ensures high levels of customer satisfaction, and provides reliable utility service to its customers, which include more than 200 communities.

APCo West Virginia commissioned development of this five-year DSM Action Plan ("Plan"). The DSM Action Plan details a diverse portfolio of electric energy efficiency and demand response programs APCo West Virginia may offer. Ultimate program plans would be available for all customer classes, including low-income residential.

This portfolio of electric demand-side management ("DSM") programs was developed with the experienced guidance of an outside consultant, Summit Blue Consulting ("Summit Blue"). Summit Blue drew upon successful programs from other states, particularly the Midwest, and their combined program design and implementation experience with other utilities, in crafting APCo West Virginia's program portfolio.

Summit Blue believes this portfolio provides a menu of proven programs that will directly help participating customers save money on their energy bills. The plan is based on a 5 year horizon, predicated on beginning in 2009, and represents one option APCo could consider for implementation in West Virginia. In any event, the ultimate plan portfolio assumes that appropriate regulatory approvals and cost recovery are granted.

E EXECUTIVE SUMMARY

Demand-side management ("DSM") represents an important resource for APCo West Virginia, one growing increasingly important as fuel and commodity prices become more volatile and greenhouse gas regulation becomes more likely. Estimates of DSM 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 DSM potential in APCo West Virginia's service territory by Summit Blue Consulting ("Summit Blue").

This DSM Action Plan presents strategic information on the approach, energy efficiency and demand response measures and proposed incentive levels. We anticipate that portions of the DSM Plan will need to be revised upon implementation to reflect better information or changing market conditions.

DSM Action Plan Portfolio Summary

If APCo West Virginia elects to implement the recommended plan portfolio, in its entirety, this would equate to an investment of $128 million (2009$) on energy efficiency and demand response programs over a five-year period. Over this same time frame, Summit Blue estimates these programs would result in 506 GWh and 164 MW cumulative annual net savings at the generator. The division of DSM program investment between residential and business customers is commensurate with the relative contribution to the portfolio.

Table E-1 provides the projected savings and associated funding for 2009 to 2013.

Table E-1. Savings Goals and Efficiency Portfolio Investment – 2009 to 2013

Consumer Sector (incremental annual net savings at generator)	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013 Total**
Energy Savings (GWh) (1)	18.7	29.9	40.2	42.6	49.7	181.2
% of Total Sector Loss-Adjusted Sales	0.30%	0.48%	0.64%	0.68%	0.78%	-
Winter Demand Savings (MW) (1)	11.6	13.5	15.2	17.7	23.8	81.7
% of Total Sector Loss-Adjusted Sales	0.67%	0.77%	0.87%	1.01%	1.34%	-
Total Cost (2009$ million) (2)	$4.8	$6.1	$7.7	$9.9	$12.7	$41.3
Business Sector (incremental annual net savings at generator)	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013 Total**
Energy Savings (GWh) (1)	39.1	53.1	68.0	72.9	92.2	325.3
% of Total Sector Loss-Adjusted Sales	0.29%	0.40%	0.51%	0.54%	0.68%	-
Winter Demand Savings (MW) (1)	13.6	15.6	16.8	16.6	20.2	82.8
% of Total Sector Loss-Adjusted Sales	0.95%	1.08%	1.16%	1.14%	1.38%	-
Total Cost (2009$ million)	$7.9	$10.3	$12.9	$16.8	$22.6	$70.5
Total (incremental annual net savings at generator)	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013 Total**
Energy Savings (GWh) (1)	57.8	83.0	108.2	115.5	141.9	506.4
% of Total Sector Loss-Adjusted Sales	0.29%	0.42%	0.55%	0.59%	0.72%	-
Winter Demand Savings (MW) (1)	25.2	29.1	32.0	34.2	44.0	164.5
% of Total Sector Loss-Adjusted Sales	0.79%	0.91%	1.00%	1.06%	1.36%	-
Total Cost (2009$ million)	$12.8	$16.4	$20.6	$26.7	$35.3	$111.9
Other Costs (2009$ million) (2)	$3.0	$3.2	$3.0	$3.2	$3.8	$16.3
Portfolio Total Investment (2009$)	**$15.8**	**$19.6**	**$23.6**	**$29.9**	**$39.1**	**$128.2**

Table E-1 Notes:

(1) Savings are not projected for Low Income Energy Conservation Kits. APCo West Virginia would 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) Other Costs include support and other services, including: APCo West Virginia DSM Department, General Education/Training/Media, Low Income Energy Conservation Kits, and Pilot Program Fund.

Incentive levels and other program elements would be reviewed and adjusted to reflect changes in market conditions or implementation processes in order to maximize cost-effective savings, including considerations for APCo staffing as programs grow over time.

Figure E-1 presents the strategic portfolio structure, including six consumer sector and four commercial and industrial sector programs, as well as two multi-sector programs: education and training and new pilots/emerging technology. APCo West Virginia would 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; these costs are included in the reported program budgets.

Figure E-1. DSM Action Plan Portfolio Structure – 2009 to 2013

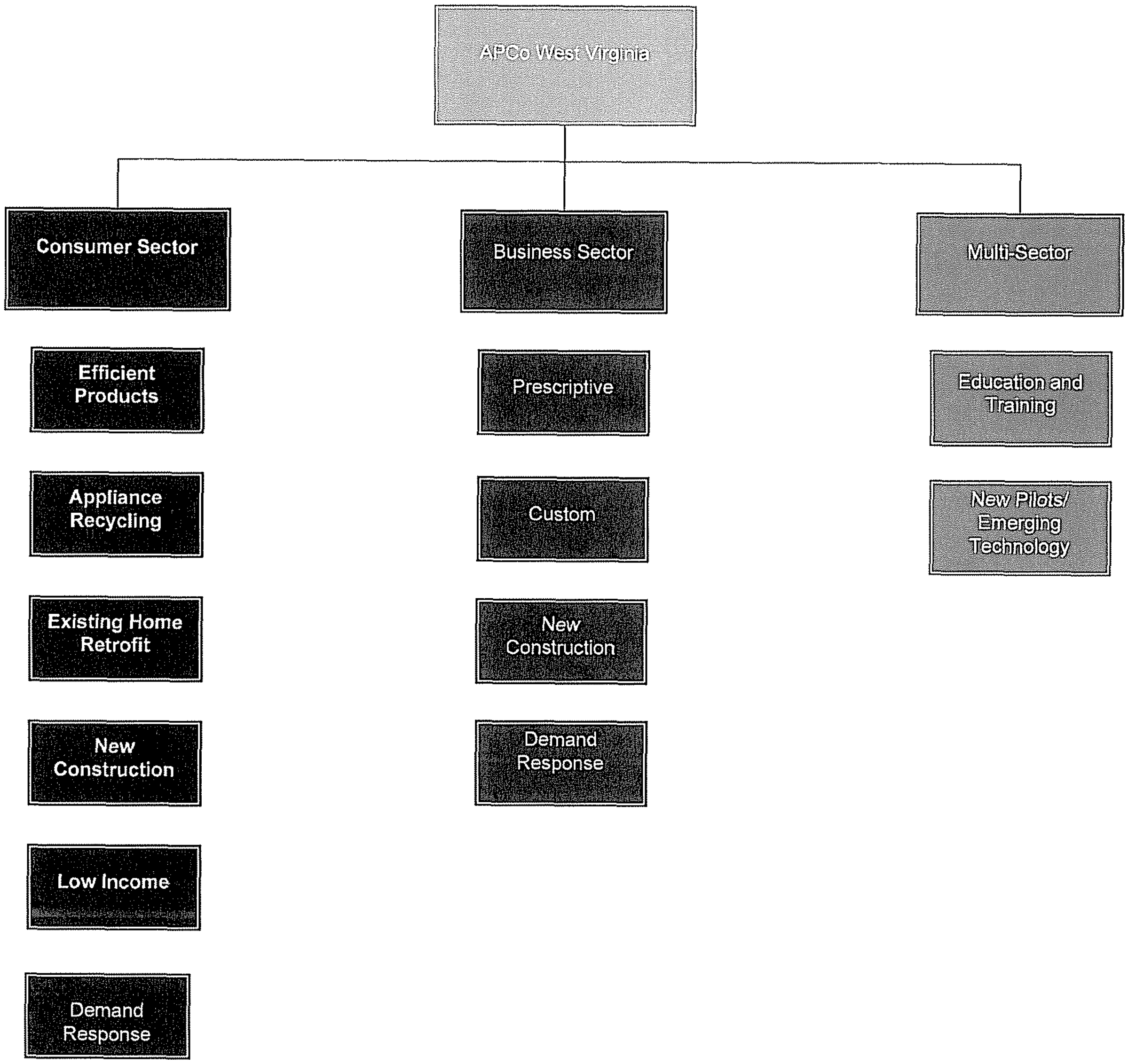


Table E-2 presents the projected MWh energy savings, Total Resource Cost ("TRC") Test results, Net Present Value Benefits in 2009$ million, Lifetime MWh Energy Saved and Lifetime Cost of Saved Energy in 2009$ per kWh over the five-year period from 2009 to 2013.

Table E-2. Annual Incremental Net Energy (MWh) Savings at Generator – 2009 to 2013[1]

Consumer Sector	2009	2010	2011	2012	2013	2009-2013 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$/kWh) With DR	Lifetime Cost of Saved Energy (2009$/kWh) Without DR
Products	8,292	15,985	23,233	19,791	20,587	87,887	17.4%	2.3	$23.97	686	$0.012	$0.012
Recycling	266	964	933	903	875	3,941	0.8%	1	$0.42	20	$0.046	$0.046
Retrofit	5,843	7,324	8,980	12,392	16,452	50,992	10.1%	2.4	$42.33	771	$0.015	$0.015
Low Income	4,057	5,396	6,984	8,576	11,059	36,072	7.1%	2.4	$25.59	496	$0.029	$0.029
New Construction	234	216	86	967	759	2,262	0.4%	2.4	$1.18	35	$0.006	$0.006
Demand Response	0	0	0	0	0	0	0.0%	1.5	$4.81	0		
Consumer Sector Total	18,692	29,885	40,215	42,629	49,732	181,153	35.8%	2.3	$98.30	2,008	$0.021	$0.018
% of Total Sector Loss-Adjusted Sales	0.30%	0.48%	0.64%	0.68%	0.78%	Note: savings from Low income Energy Conservation Kits are not projected.						

Business Sector	2009	2010	2011	2012	2013	2009-2013 Total	Percent of Portfolio Total	Total Resource Cost Test Ratio (TRC)	Net Present Value	Lifetime Energy Saved	Lifetime Cost of Saved Energy (2009$/kWh) With DR	Lifetime Cost of Saved Energy (2009$/kWh) Without DR
Prescriptive	26,220	36,646	45,994	39,489	45,294	193,644	38.2%	2.2	$66.91	1,857	$0.012	$0.012
Custom	12,880	16,434	22,009	32,099	44,234	127,657	25.2%	1.6	$17.69	1,778	$0.012	$0.012
New Construction	22	36	0	1,268	2,643	3,970	0.8%	1.4	$2.81	104	$0.005	$0.005
Demand Response	0	0	0	0	0	0	0.0%	1.6	$17.30	0		
Business Sector Total	39,122	53,117	68,004	72,856	92,171	325,270	64.2%	1.9	$104.71	3,739	$0.019	$0.012
% of Total Sector Loss-Adjusted Sales	0.29%	0.40%	0.51%	0.54%	0.68%							
PORTFOLIO TOTAL	**57,814**	**83,003**	**108,218**	**115,485**	**141,902**	**506,423**	**100.0%**	**2.2**	**$203.01**	**5,747**	**$0.022**	**$0.017**

[1] Revised March 3, 2010 to be consistent with all AEP jurisdictions' presentation of these data.

Table E-3 presents the projected winter peak demand kW savings levels over the five-year period from 2009 to 2013.

Table E-3. Annual Incremental Net Winter Peak Demand (kW) Savings at Generator – 2009 to 2013

Consumer Sector	2009	2010	2011	2012	2013	2009-2013 Total	Percent of Portfolio Total
Products	806	1,585	2,199	1,790	1,867	8,247	5.0%
Recycling	27	98	95	92	89	402	0.2%
Retrofit	4,254	4,925	5,731	7,387	10,770	33,067	20.1%
Low Income	2,429	2,821	3,318	4,200	6,121	18,889	11.5%
New Construction	22	20	8	84	67	201	0.1%
Demand Response	4,029	4,006	3,839	4,126	4,925	20,925	12.7%
Consumer Sector Total	**11,566**	**13,456**	**15,191**	**17,680**	**23,838**	**81,731**	**49.7%**
% of Total Sector Loss-Adjusted Sales	0.67%	0.77%	0.87%	1.01%	1.34%		

Note: savings from Low income Energy Conservation Kits are not projected.

Business Sector	2009	2010	2011	2012	2013	2009-2013 Total	Percent of Portfolio Total
Prescriptive	4,273	5,956	6,977	5,322	6,458	28,986	17.6%
Custom	957	1,276	1,779	2,509	3,208	9,729	5.9%
New Construction	2	2	0	68	141	212	0.1%
Demand Response	8,404	8,373	8,041	8,658	10,347	43,822	26.6%
Business Sector Total	**13,635**	**15,607**	**16,798**	**16,557**	**20,154**	**82,750**	**50.3%**
% of Total Sector Loss-Adjusted Sales	0.95%	1.08%	1.16%	1.14%	1.38%		
PORTFOLIO TOTAL	**25,201**	**29,063**	**31,989**	**34,236**	**43,992**	**164,481**	**100.0%**
% of Total Portfolio Loss-Adjusted Sales	0.79%	0.91%	1.00%	1.06%	1.36%		

DSM Investment

The estimated investment for these programs for 2009 to 2013, in 2009 dollars, would be approximately $16 million in 2009, $20 million in 2010, $24 million in 2011, $30 million in 2012, and $39 million in 2013, for a total $128 million, as shown in Table E-4. The projected investments include one-time startup costs (included in the Administration costs) in the first year of program implementation.

Table E-4. Estimated Annual Total Investments by Program for APCo Virginia (2009$)

Consumer Sector	2009	2010	2011	2012	2013	2009-2013	% of Portfolio Total
Products	$690,676	$1,187,034	$1,797,934	$2,143,230	$2,231,704	$8,050,577	6.3%
Recycling	$66,277	$221,470	$214,374	$207,623	$201,059	$910,803	0.7%
Retrofit	$1,522,492	$1,690,103	$2,021,534	$2,700,284	$3,803,563	$11,737,977	9.2%
Low Income	$1,813,112	$2,073,927	$2,526,252	$3,313,837	$4,589,968	$14,317,095	11.2%
New Construction	$19,223	$16,303	$6,336	$99,377	$79,868	$221,108	0.2%
Demand Response	$717,733	$950,148	$1,155,643	$1,432,144	$1,816,575	$6,072,242	4.7%
Consumer Sector Total	**$4,829,512**	**$6,138,984**	**$7,722,073**	**$9,896,496**	**$12,722,738**	**$41,309,802**	**32.2%**
Business Sector	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013**	**% of Portfolio Total**
Prescriptive	$2,829,483	$3,567,256	$4,268,875	$5,111,194	$6,637,753	$22,414,561	17.5%
Custom	$2,336,478	$2,767,515	$3,579,251	$5,130,878	$7,327,511	$21,141,634	16.5%
New Construction	$2,892	$4,486	$0	$174,308	$361,709	$543,395	0.4%
Demand Response	$2,768,762	$3,967,251	$5,062,370	$6,422,065	$8,223,806	$26,444,255	20.6%
Business Sector Total	**$7,937,615**	**$10,306,509**	**$12,910,496**	**$16,838,446**	**$22,550,779**	**$70,543,845**	**55.0%**
Other Costs	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013**	**% of Portfolio Total**
APCo West Virginia DSM Department	$750,000	$1,250,000	$1,250,000	$1,500,000	$2,000,000	$6,750,000	5.3%
General Education/ Training/Media	$2,000,000	$1,500,000	$1,250,000	$1,250,000	$1,250,000	$7,250,000	5.7%
Energy Conservation Kits	$150,000	$200,000	$200,000	$200,000	$200,000	$950,000	0.7%
Pilot Program Fund	$150,000	$300,000	$300,000	$300,000	$300,000	$1,350,000	1.1%
Other Costs Total	**$3,050,000**	**$3,250,000**	**$3,000,000**	**$3,250,000**	**$3,750,000**	**$16,300,000**	**12.7%**
PORTFOLIO TOTAL	**$15,817,127**	**$19,695,493**	**$23,632,569**	**$29,984,941**	**$39,023,517**	**$128,153,647**	**100.0%**

These cost estimates are high-level for strategic planning and initial organizational development purposes. To firm up cost estimates and make any necessary budget and schedule changes, it is assumed that APCo West Virginia would issue RFP(s) for implementation contractors to bid on the work, and require them to submit more detailed budgets along with estimated savings and implementation schedules. Any adjustments to the cost recovery mechanism, including load management rate discounts, are assumed to be trued up on an annual basis.

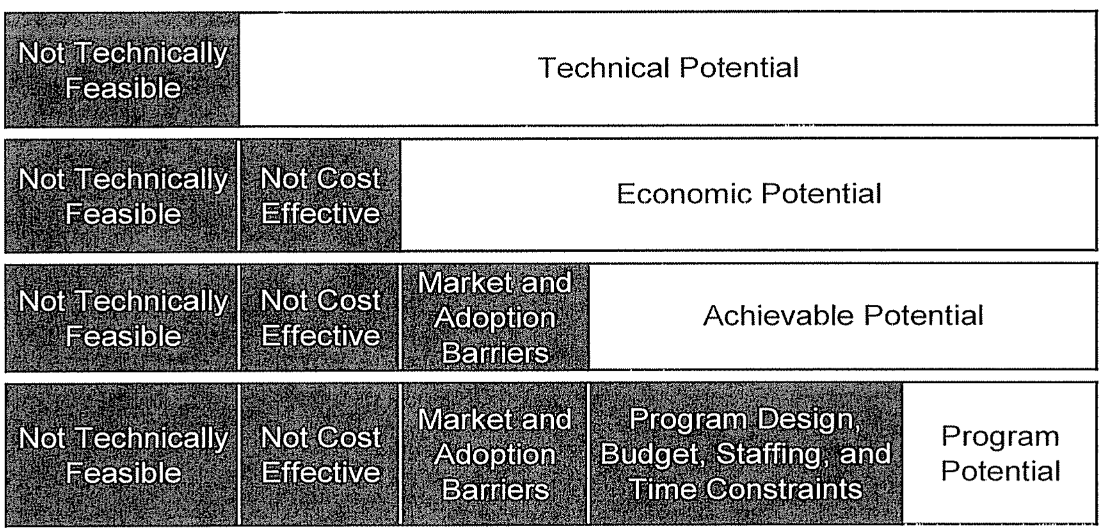
The next section discusses the approach to estimating DSM potential. After that section, there is an overview of DSM Potential results for 2009 to 2028, followed by program plans, and finally, conclusions and recommendations.

E.1 Approach to Estimating DSM Potential

APCo West Virginia's suggested program portfolio was developed by incorporating elements of the most successful energy efficiency programs across North America into program plans designed for the West Virginia market and APCo West Virginia customers in particular. A benchmarking process was to review the selected programs, with a focus on successful Eastern and 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. This DSM Action Plan is focused on capturing cost-effective *program potential* in its service territory. 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 DSM potential study with the following key tasks:

- Develop baseline consumption profiles, and develop initial building simulation model specifications
- Characterize the DSM measures
- Conduct a DSM benchmarking and best practices analysis
- Conduct benefit-cost analysis
- Estimate DSM potentials
- Develop DSM 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 APCo West Virginia service territory 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 APCo West Virginia 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 DSM measures.

E.1.2 Characterize the DSM Measures

Characterization of DSM 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 DSM measures for this study. For the DSM measures having impacts that do not vary with climate, the team used engineering estimates and publicly available and well-respected sources, such as the California Database on Energy-Efficiency Resources ("DEER") database. The team adjusted the DEER energy and demand impacts for APCo West Virginia'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 APCo West Virginia to estimate DSM measure per unit savings.

For DSM 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 DSM measure lifetimes, a combination of resources was used, including manufacturer data, typical economic depreciation assumptions, and the California DEER database.

E.1.3 DSM Benchmarking and Best Practices Assessment

To ensure that the DSM potential estimates that Summit Blue developed for APCo West Virginia are reasonable and appropriate, and to identify the best practices regarding DSM programs, the team conducted a benchmarking assessment on other utilities' and agencies' DSM programs. Summit Blue 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.

For the 14 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 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 DSM programs for an extended period. Since these organizations have been conducting electricity DSM programs, savings have been realized 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.

E.1.4 Benefit-Cost Analysis

The measures were evaluated with respect to each of the four main standard benefit-cost tests.[2]

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 DSM 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 DSM 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 DSM program administrative costs.[3]

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[2] 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.

[3] Administrative costs in this study are all costs for a given program aside from customer incentives: planning, marketing and sales, business process administration such as rebate processing, and evaluation, measurement and verification. General overhead costs such as general DSM department overheads, general education/training, and

In line with standard industry practice, Summit Blue used the TRC test to determine which DSM programs to include in APCo West Virginia's portfolio of DSM programs. The RIM test is a more restrictive test that is only used as the main DSM benefit-cost test in very few states.[4] All of the measures passed the TRC test. The portfolio of DSM programs that Summit Blue developed is quite cost effective by industry standards. Table E-5 presents the overall benefit cost ratios for the consumer sector, the commercial and industrial sector, and the overall portfolio.

Table E-5. Cost-effectiveness Ratios – 2009 to 2013

Consumer Sector	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Rate Impact Measure Test (RIM)
Products	2.3	3.4	6.3	0.5
Recycling	1.0	0.9	na	0.0
Retrofit	2.4	3.6	3.6	0.9
Low Income	2.4	3.6	3.9	0.8
New Construction	2.4	3.7	6.8	0.5
Demand Response	1.5	4.2	1.5	1.1
Consumer Sector Total	**2.3**	**3.6**	**4.0**	**0.7**
Business Sector	**Total Resource Cost Test (TRC)**	**Utility Cost Test (UCT)**	**Participant Cost Test (PCT)**	**Rate Impact Measure Test (RIM)**
Prescriptive	2.2	3.5	3.3	0.8
Custom	1.6	2.3	3.5	0.6
New Construction	1.4	2.2	2.8	0.6
Demand Response	1.6	2.3	0.7	2.0
Business Sector Total	**1.9**	**2.9**	**2.9**	**0.8**
PORTFOLIO TOTAL	**2.2**	**3.3**	**3.9**	**0.7**

pilot program funding are estimated separately from specific programs, but are included in the overall portfolio benefit-cost analysis.

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

E.1.5 Estimate DSM Program Potentials

Summit Blue developed estimates of DSM measure potentials in terms of technical, economic, and "achievable" potential (the program results that would be realistic for APCo West Virginia to achieve through cost-effective DSM 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 DSM potential estimates. These estimates will assume that adequate funding is available to achieve the DSM potentials and that APCo West Virginia would be able to achieve "best practice" DSM program performance within three to four years.

2. A high case estimate based on the experience of the best of the best utilities' DSM program results.

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

E.2 DSM Potential Results

The net annual DSM potential savings (Base Case Scenario Market Potential) in 2028 is estimated to be approximately 2,460 GWh at generator, about 11% of forecast sales, and 488 MW at generator, about 14% of peak winter demand, as shown in Table E-6.

Table E-6 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 uncertain than the market potential results since surveys of APCo West Virginia'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 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 37.5% of incremental measure costs.

Table E-6. Projected Cumulative Annual Net Savings at Generator and Costs – 2012, 15-Year, and 20-Year Plans

Year-End 2012	Energy Efficiency				Demand Response		Costs		
Potential Scenario	Cumulative Annual Net Energy Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Estimated Costs - EE	Estimated Cost - DR	Estimated Total Costs
	GWh	% of Forecasted Sales	MW	% of Forecasted Sales	MW	% of Forecasted Sales	Total Cost Over Term		
Residential									
Technical	1,845	29%	716	41%	315	18%	NA	NA	NA
Economic	1,208	19%	493	28%	315	18%	NA	NA	NA
High Case	373	6%	133	8%	24	1%	$73,451,644	$6,383,501	$79,835,145
Base Case	131	2%	42	2%	16	1%	$19,040,572	$4,255,667	$23,296,240
Low Case	76	1%	25	1%	12	1%	$10,590,802	$3,191,750	$13,782,552
C&I									
Technical	4,123	31%	372	26%	998	69%	NA	NA	NA
Economic	3,096	23%	315	22%	998	69%	NA	NA	NA
High Case	784	6%	103	7%	50	3%	$140,666,753	$27,330,674	$167,997,426
Base Case	233	2%	29	2%	33	2%	$29,772,616	$18,220,449	$47,993,065
Low Case	145	1%	18	1%	25	2%	$16,121,347	$13,665,337	$29,786,684
Total									
Technical	5,968	30%	1,087	34%	1313	41%	NA	NA	NA
Economic	4,304	22%	808	25%	1313	41%	NA	NA	NA
High Case	1,157	6%	235	7%	74	2%	$214,118,397	$33,714,175	$247,832,571
Base Case	365	2%	71	2%	49	2%	$48,813,188	$22,476,116	$71,289,305
Low Case	221	1%	43	1%	37	1%	$26,712,149	$16,857,087	$43,569,236

(1) Numbers in the above table do not include Demand Response programs and Low Income Energy Conservation Kits. APCo West Virginia would 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; these costs are included in this table. Forecasted sales are adjusted for losses.

(2) Costs in this table are not included for: APCo West Virginia DSM Department, General Education/Training/Media, Demand Response programs, Low Income Energy Conservation Kits, and Pilot Program Fund.

Table E-6, continued.

15 Year Plan	Energy Efficiency				Demand Response		Costs		
Potential Scenario	Cumulative Annual Net Energy Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Estimated Costs - EE	Estimated Cost - DR	Estimated Total Costs
	GWh	% of Forecasted Sales	MW	% of Forecasted Sales	MW	% of Forecasted Sales	Total Cost Over Term		
Residential									
Technical	1,872	28%	715	38%	312	16%	NA	NA	NA
Economic	1,221	19%	492	26%	312	16%	NA	NA	NA
High Case	1,121	17%	476	25%	109	6%	$256,473,807	$61,930,823	$318,404,630
Base Case	644	10%	247	13%	73	4%	$109,741,756	$41,287,215	$151,028,971
Low Case	418	6%	152	8%	54	3%	$61,145,972	$30,965,412	$92,111,383
C&I									
Technical	4,197	29%	375	24%	998	64%	NA	NA	NA
Economic	3,154	22%	318	20%	998	64%	NA	NA	NA
High Case	2,663	18%	284	18%	230	15%	$546,729,871	$295,196,650	$841,926,521
Base Case	1,291	9%	140	9%	154	10%	$203,122,160	$196,797,766	$399,919,926
Low Case	783	5%	86	5%	115	7%	$103,398,755	$147,598,325	$250,997,080
Total									
Technical	6,068	29%	1,090	32%	1310	38%	NA	NA	NA
Economic	4,375	21%	810	23%	1310	38%	NA	NA	NA
High Case	3,784	18%	760	22%	339	10%	$803,203,678	$357,127,473	$1,160,331,151
Base Case	1,935	9%	387	11%	226	7%	$312,863,915	$238,084,982	$550,948,897
Low Case	1,202	6%	238	7%	170	5%	$164,544,727	$178,563,736	$343,108,464

Table E-6, continued.

20 Year Plan	Energy Efficiency				Demand Response		Costs		
Potential Scenario	Cumulative Annual Net Energy Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Estimated Costs - EE	Estimated Cost - DR	Estimated Total Costs
	GWh	% of Forecasted Sales	MW	% of Forecasted Sales	MW	% of Forecasted Sales	Total Cost Over Term		
Residential									
Technical	1,893	28%	717	37%	310	16%	NA	NA	NA
Economic	1,232	18%	492	25%	310	16%	NA	NA	NA
High Case	1,216	18%	510	26%	139	7%	$277,088,368	$103,080,138	$380,168,506
Base Case	802	12%	311	16%	93	5%	$138,229,606	$68,720,092	$206,949,698
Low Case	560	8%	201	10%	70	4%	$81,191,360	$51,540,069	$132,731,429
C&I									
Technical	4,241	28%	377	23%	998	62%	NA	NA	NA
Economic	3,189	21%	320	20%	998	62%	NA	NA	NA
High Case	3,102	21%	319	20%	296	18%	$628,201,307	$502,490,077	$1,130,691,385
Base Case	1,658	11%	177	11%	197	12%	$262,508,581	$334,993,385	$597,501,966
Low Case	1,036	7%	111	7%	148	9%	$138,218,766	$251,245,039	$389,463,804
Total									
Technical	6,134	28%	1,094	31%	1308	37%	NA	NA	NA
Economic	4,421	20%	812	23%	1308	37%	NA	NA	NA
High Case	4,318	20%	830	23%	435	12%	$905,289,675	$605,570,215	$1,510,859,891
Base Case	2,460	11%	488	14%	290	8%	$400,738,187	$403,713,477	$804,451,663
Low Case	1,596	7%	313	9%	218	6%	$219,410,126	$302,785,108	$522,195,234

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

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

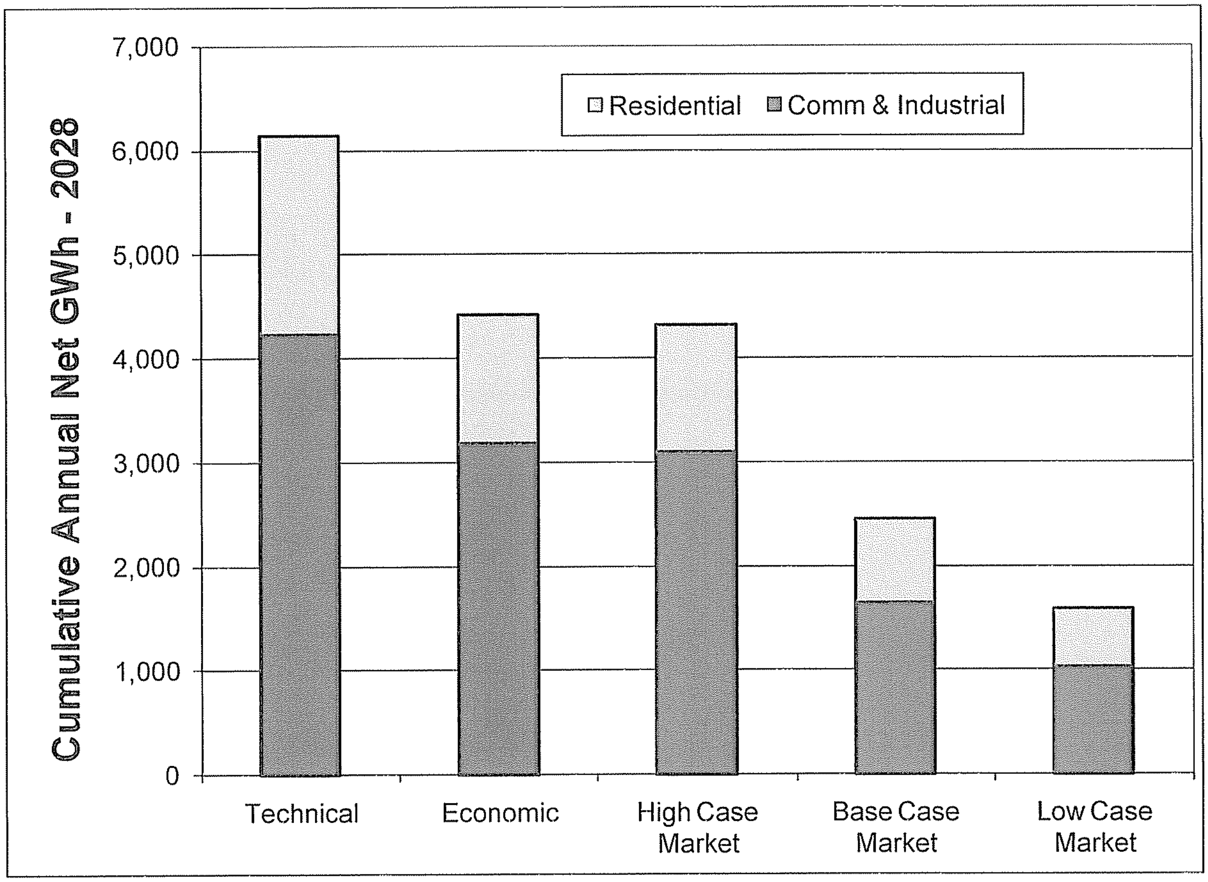


Figure E-4. Cumulative Annual Net Winter Peak MW Demand Savings in 2028 – at Generator

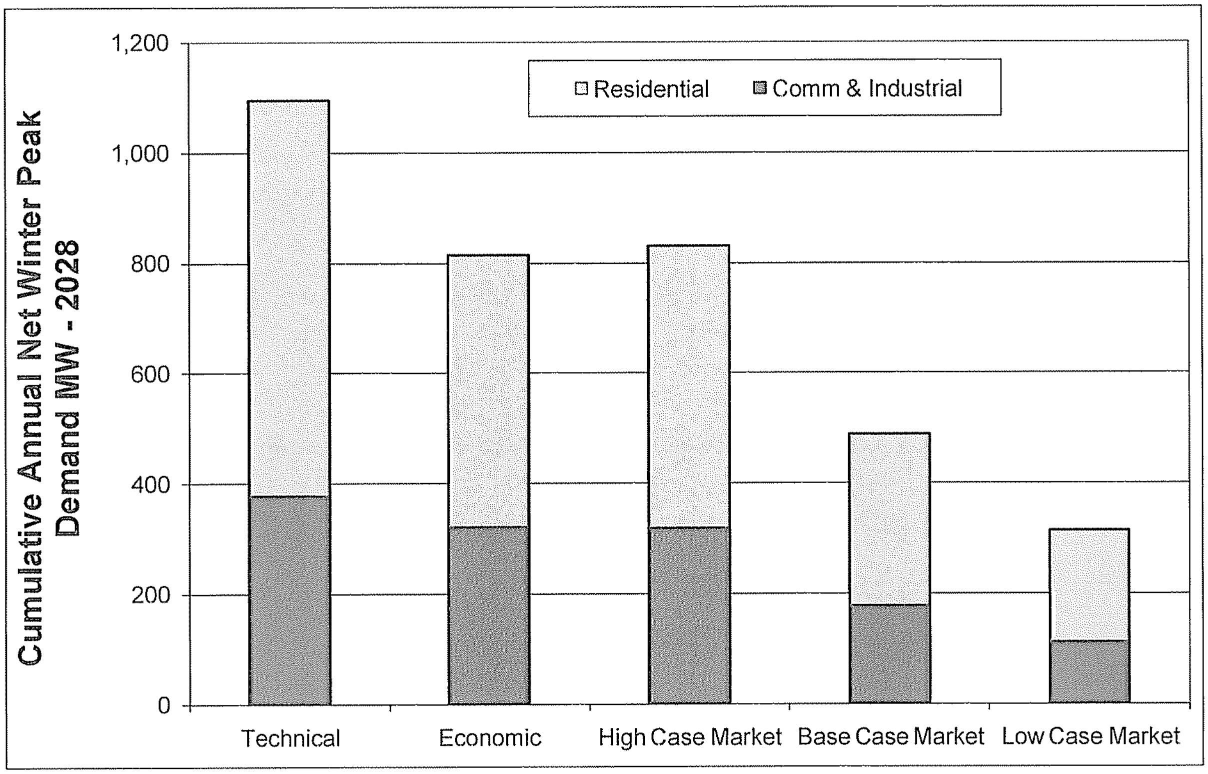
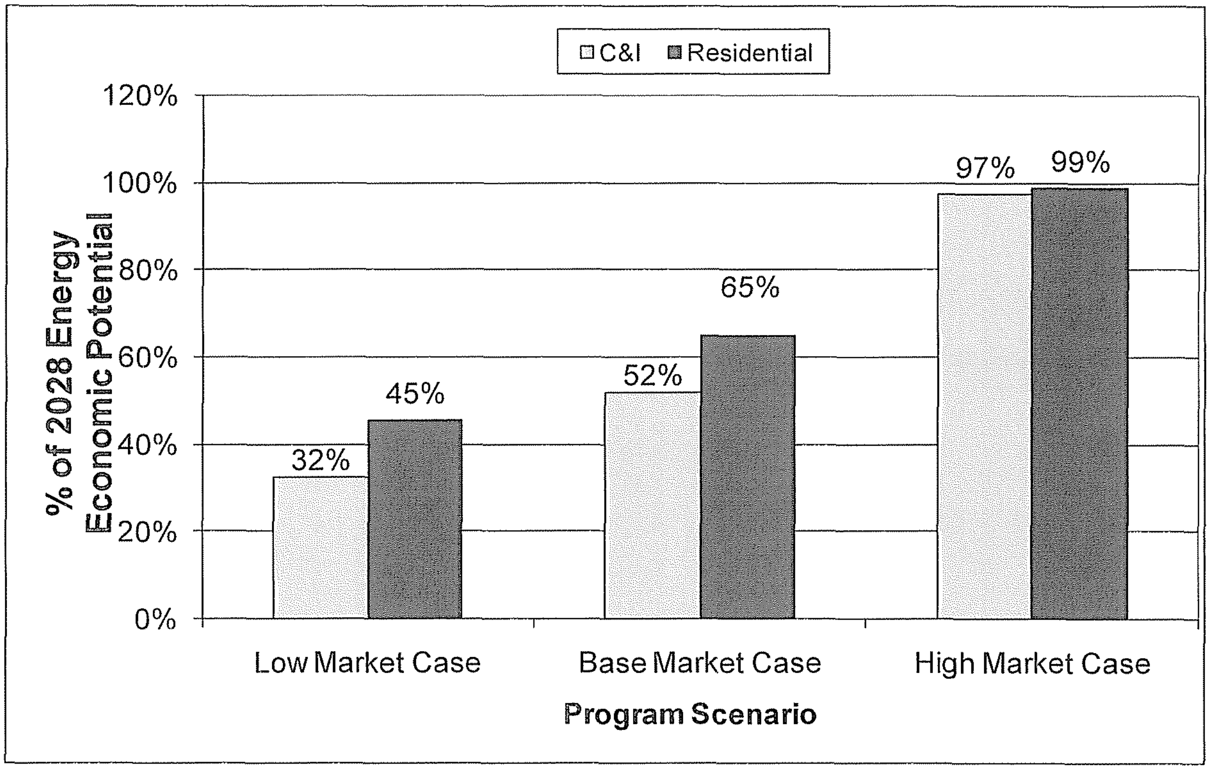


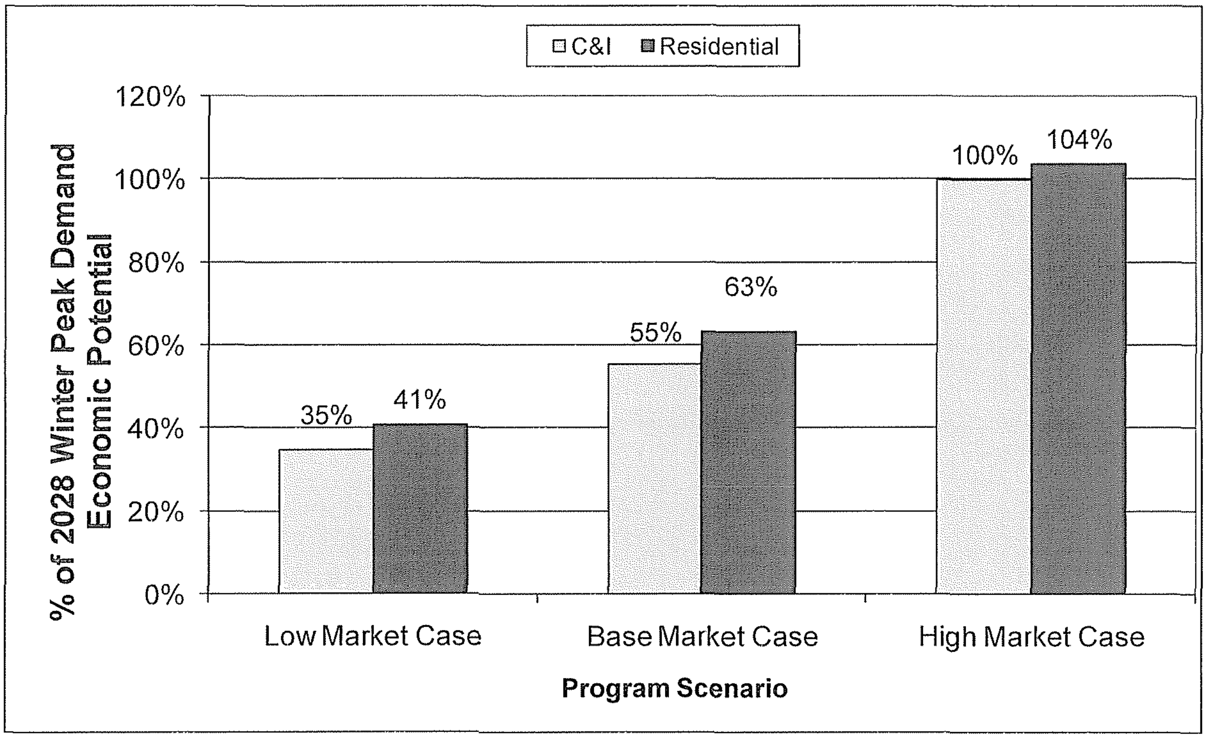
Figure E-5 and Figure E-6 show the cumulative Market Potential[5] as a percent of the Economic Potential for energy efficiency.

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



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

Figure E-6. Market Potential Net Winter Peak Demand Savings at Generator as Percent of Economic Potential in 2028[6]



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. APCo West Virginia's portfolio of programs can be divided into consumer, business and multi-sectors with utility administrative functions providing support across all program areas. APCo West Virginia would maintain as part of its functionality the education, training and emerging technology budgets. These efforts would leverage existing AEP corporate connections and efforts to maximize impact of these outreach and education efforts.

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[6] The high market case shows =/>100% of economic potential because demand response program impacts are included in the High Market Case, but are not included in the Economic Potential.

Consumer Sector

Efficient Products: provides 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 promotes convenient recycling for CFLs at local retailers.

For appliances, the program uses 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 would 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 targets these "second" refrigerators and freezers, providing the dual benefit of cutting energy consumption and keeping the appliances out of the used market. The program provides 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: produces 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 would 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 would be 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: provides 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 coordinates 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: produces 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 identifies and recruits key builders who do not consistently (or seldom) build homes to meet the ENERGY STAR standard. Builders who choose to participate in the program would 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 would be provided.

Residential Demand Response: includes a Direct Load Control (DLC) Program to residential customers with central air conditioners, electric heat pumps and central electric resistance heat or electric water heaters.

Business Sector

Prescriptive Incentive: generates energy savings for all business customers through the promotion of high-efficiency standardized equipment not requiring substantial engineering. Three primary objectives 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 would be offered to customers.

Custom: assists 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 identifies more complex energy savings projects, provide economic analysis and aid in the completion of the incentive application. Incentives would be based on energy savings on a per kWh and per kW basis for installed measures.

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.

C&I Demand Response: includes a Direct Load Control (DLC) Program to non-residential customers with packaged air conditioning, electric resistance heat or electric water heaters, specifically targeting small C&I customers.

Multi-Sector

General Energy Education: This program coordinates APCo West Virginia's efforts to create customer awareness for the programs, enhance demand and educate customers on energy efficiency.

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

New Pilots/Emerging Technology: The program objective would be 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 would focus on proven programs that capture significant energy savings. Later, other innovative technologies, including solid state lighting, plug load and consumer electronics, could be explored.

Portfolio Implementation

This plan assumes that APCo West Virginia implements the proposed portfolio of programs through a combination of in-house utility staff and competitively selected third-party implementation contractors. APCo West Virginia would issue Requests for Proposals ("RFP"s) to qualified firms related to multiple RFPs for the delivery of similar programs targeting specific sectors. By issuing multiple RFPs, it should be possible to obtain more competitive, cost-effective and qualified implementation responses.

Implementation contractors would be eligible to respond to one or all of the RFPs. The process of issuing RFPs, evaluating responses and negotiating contracts along with associated program start-up time could result in 2009 launch dates, at the earliest for some programs. However, it is also recognized that it will take some time for APCO West Virginia to finalize any proposed program portfolio and to obtain necessary regulatory approvals, including appropriate cost recovery. This could, and likely will, push initial program implementation beyond calendar year 2009. The remaining programs would begin at a later time 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 APCo West Virginia portfolio. EM&V would 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 would 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 APCo West Virginia EM&V budget is assumed to be approximately 3-5% of the overall portfolio investment. Summit Blue has included appropriate costs in the proposed budgets for comprehensive EM&V.

All evaluation activities would 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 would 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 would detail all measure savings assumptions, including base efficiency, high efficiency, measure size, measure life, free ridership, and spillover estimates.
- Interfaces with the 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.

Program and Portfolio Risk

Through 2009, the economy will likely remain in a severe economic recession. In this economic environment, APCo West Virginia'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, would be very challenging. APCo West Virginia asked Summit Blue 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, the plan set forth here would capitalize on those segments of the market who may be willing to invest in energy efficiency given the challenging economic landscape. In balance, this would provide APCo West Virginia with its best available plan, under the economic constraints mentioned above, to achieve energy efficiency goals.

The following strategies should help minimize the risks associated with this suggested 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 DSM 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 DSM potential (Base Case Scenario Market Potential) identified in this study represents energy reductions of around 12% for APCo West Virginia residential customers and 11% for commercial and industrial customers below forecasted levels and known enacted energy codes and standards by 2028, or about 0.5% per year. This magnitude of savings has been achieved by best practice program portfolios in the Midwest, Northeast and Western U.S. Winter peak demand and annual energy reductions of the magnitudes found for the Base Market Potentials case are being achieved by a variety of utilities.

The largest sources of uncertainty regarding the estimates that Summit Blue has developed to date for APCo West Virginia stem from using secondary information to profile APCo West Virginia's customers. It is uncertain how well the primarily regional and national estimates used for current DSM measure saturations apply to APCo West Virginia'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 DSM benchmarking analysis results presented in this report should give APCo West Virginia management confidence that a variety of utilities in the region and throughout the country are achieving large-scale results from their DSM 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 DSM program plans that Summit Blue developed are based on the best practice results from the analysis of utility DSM 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 DSM programs often make significant periodic investments to develop and update secondary best-practice and primary market research data to aid their DSM program planning. For example, Xcel Energy in Minnesota conducts large-scale market assessments and DSM potential studies that include significant on-site customer data collection every five to ten years. The Iowa utilities conduct DSM potential studies about every five years to support their periodic DSM program filings with their regulators. These utilities collected significant customer data as part of their 2008 DSM 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 APCo West Virginia brand continuity, as well as strong internal oversight over the life of the portfolio.

1 INTRODUCTION

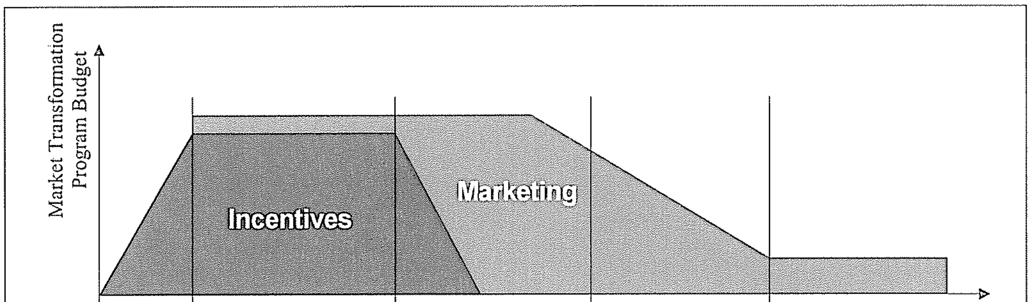
APCo West Virginia is a large provider of electric service with a mix of 400,000 residential, commercial and industrial customers.

The following DSM 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. Summit Blue Consulting anticipates that, prior to actual program implementation, portions of this plan will need to be revised to reflect better information or changing market conditions.

On behalf of APCo West Virginia, Summit Blue Consulting (Summit Blue) has designed a comprehensive portfolio of DSM 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, it is anticipated that, over time, investment in energy efficiency measures would follow a predictable path of market transformation that has been experienced in other jurisdictions. With sustained levels of investment, promotion of efficient measures would in the early years focus on immediate up-front incentives to stimulate the marketplace. Over time, funds could 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 could be transferred to new program areas and new technologies and, if appropriate, the process would repeat. Each series of the market transformation process could result in greater and more efficient opportunities for residential and business customers.

Figure 1-1. Phases of Energy Efficiency Promotion



PHASE	PILOT	FRONTAL ASSAULT	TRANSFORM	POPULARIZE	MAINTAIN
Goal	Experiment	Distribution & sales	Build value message	Mass adoption	Support market
Methods	Give away, direct install	Per-unit incentives, basic marketing	Declining incentives, marketing blitz	Innovative marketing, training & field support	Recommend, refer, inform

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 APCo West Virginia, one growing increasingly important as fuel and commodity prices become more volatile and greenhouse gas regulation becomes more likely. Estimates of DSM 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 DSM potential in APCo West Virginia's service territory by Summit Blue Consulting.

1.1 APCo West Virginia Overview

As described on Appalachian Power Company's website, the Company overall has about one million customers, about 400,000 being in West Virginia, and 8,000 megawatts of generation. Figure 1-2 presents APCo's service territory, which includes a large geographic area in West Virginia. APCo West Virginia provides power to more than 200 communities.

Figure 1-2. Appalachian Power Company Service Territories

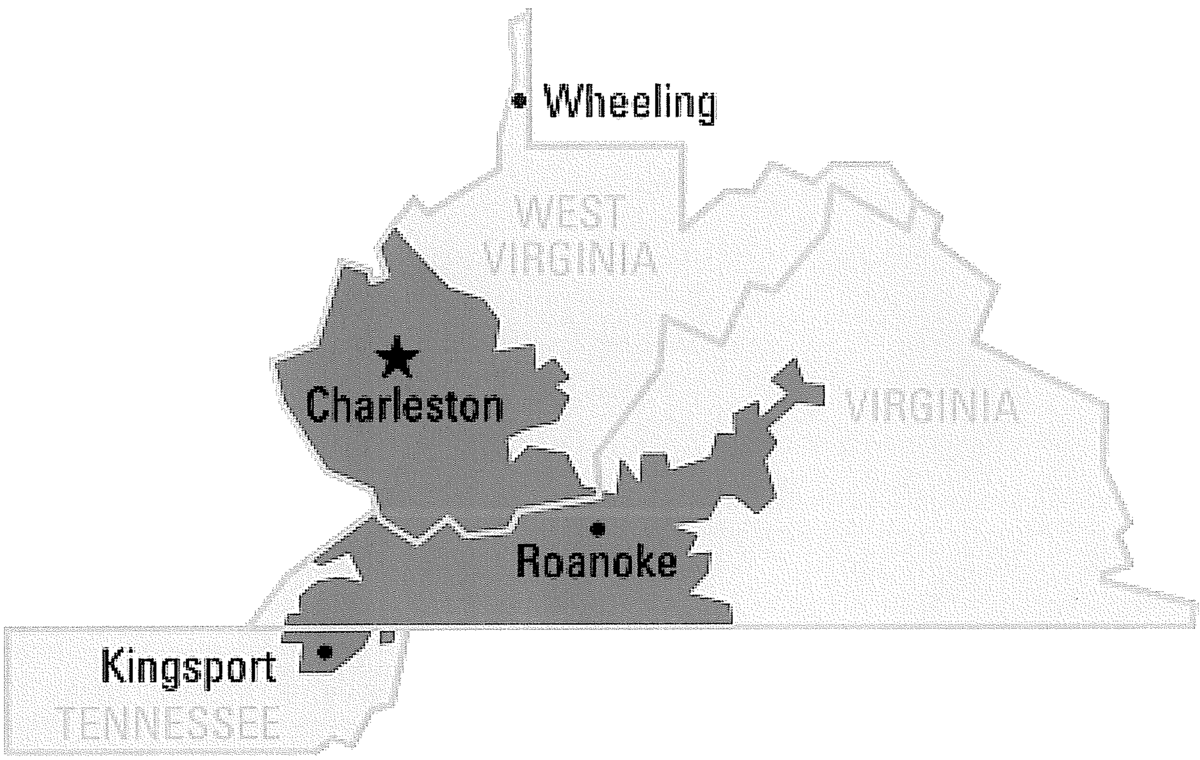


Table 1-A outlines key statistics for APCo West Virginia.

Table 1-A. APCo Key Statistics[7]

2007 electrical sales in megawatt hours:	38,443,670 (Total APCo)
	19,728,770 (W.Va.)
Average use per residential customer:	15,489 kWh per year (W.Va.)
Average cost per kilowatt-hour (residential):	5.99 cents (W.Va.)
Size of service area (asset):	8,455 square miles (W.Va.)
Communities served:	217 (W.Va.)
Net plant in service APCo:	$6 billion
Size of distribution system:	18,982 miles (W.Va.)
Size of transmission system:	2,835 miles (W.Va.)
Total AEP Employees:	2,911 (W.Va.)

Study Goals and Approach

The overall goals of the DSM potential study are to:

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

Summit Blue undertook the DSM potential study in the following key tasks:

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

[7] http://www.appalachianpower.com/about/serviceTerritory/docs/AppalachianPowerFactSheet2007.pdf

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

1.2 Volume 1: 2009 to 2013 DSM Action Plan Report Organization

The remainder of APCo West Virginia's Volume 1: DSM Action Plan is divided into the following sections:

Section 2: Portfolio Development provides an overview of the process used and considerations in developing this portfolio of programs.

Sections 3 & 4: Program Portfolio Summary provides a high-level overview of the selected portfolio of programs.

Section 5: Portfolio Summary Results details the summary results of portfolio electric savings, investment allocations and benefit-cost results.

Section 6: Program Descriptions presents detailed program plans for consumer, business and multi-sector programs.

Section 7: Portfolio Implementation presents an overview of the approach to delivering the proposed programs through a combination of in-house staff resources and third-party implementation contractors.

Section 8: Evaluation, Measurement and Verification provides a comprehensive overview to the various levels of EM&V activities to carry out to ensure programs are achieving intended goals with the minimum of program expenditures.

Section 9: Glossary defines key terms used in the report.

Volume 2 – 2009 to 2028 DSM Potential Study: presents the DSM potential study results.

Volume 3 – Appendices A-G: includes 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), Measure Descriptions and Characterizations (Appendix D), Program Results Summary (Appendix E), SB-RAM Input Summary & Measure Tracking Summary (Appendix F), and References (Appendix G).

2 Portfolio Development

Based on a national review of leading energy efficiency programs, a balanced portfolio of DSM programs has been developed that will achieve significant and immediate energy savings, while establishing trade ally and retailer partnerships resulting in lasting market transformation. These programs would target all major sectors and customer classes, including low-income and small business customers.

The underlying concept is to offer a diverse portfolio of "tried and true" major programs (some of which include sub-program components) across the residential, commercial and industrial sectors. The portfolio includes several pilot programs targeting experimental opportunities as well as a broad-based education and awareness program offering.

2.1 Portfolio Goals and Objectives

High level efficiency-related goals and objectives for the Portfolio would be as follows:

- Design and implement a diverse group of programs that provide opportunities for participation for all customers.
- When feasible, maximize opportunities for program coordination with other efficiency programs to yield maximum benefits.
- Maximize program savings at a minimum cost by striving to achieve comprehensive cost-effective savings opportunities.
- Provide APCo West Virginia customers with a single website to access information on all efficiency programs (residential and business) for electricity savings opportunities.
- Expand the energy efficiency infrastructure in the State - for example, increasing the number of available qualified contractors.
- Transform the market for efficient technologies and highly qualified efficiency-oriented trade allies (such as electricians, HVAC contractors, builders, architects and engineers).
- Inform and educate customers and students to enable them to use energy more efficiently

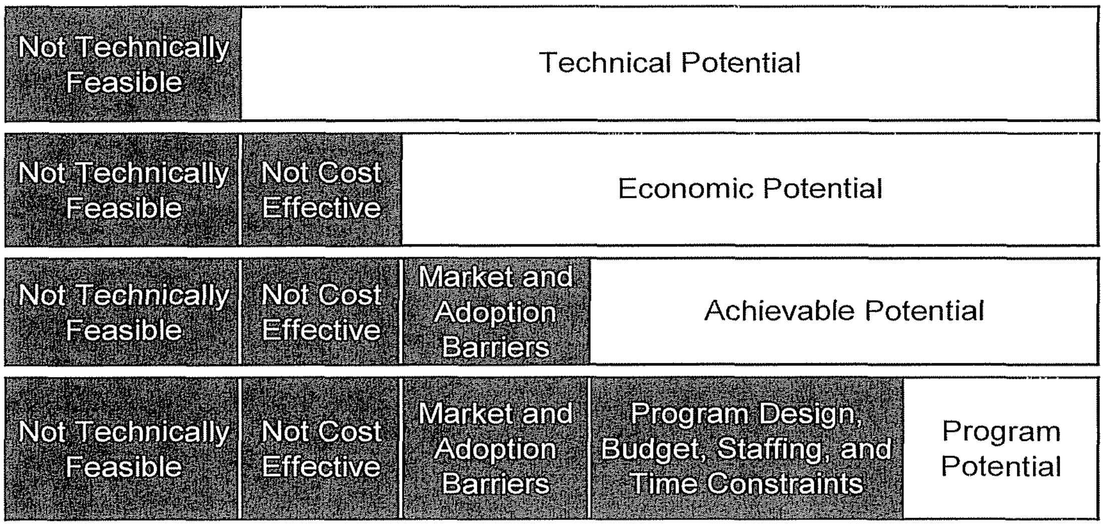
2.2 Planning Process

APCo West Virginia hired Summit Blue Consulting, a nationally recognized leader in the energy efficiency field, to assist with the design and preparation of this DSM Action Plan.

APCo West Virginia's suggested portfolio of programs incorporates elements of the most successful energy efficiency programs across North America into program plans designed for the West Virginia market and APCo West Virginia customers in particular. A substantial amount of information including evaluation studies was used to develop specific programs for APCo West Virginia. Summit Blue also used a benchmarking process to review the most successful energy efficiency programs from across the country, with a focus on successful Midwest programs to help shape the portfolio.

As detailed in Figure 2-1, 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 are 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. APCo West Virginia's DSM Action Plan is focused on capturing cost-effective *program potential* in its service territory.

Figure 2-1. 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.

2.3 Portfolio Risk Management

In 2009, the economy is in the midst of a severe economic recession. In this economic environment, convincing business customers to voluntarily take on additional debt for the installation of cost-effective measures, even with very short pay-back periods, would be very challenging. Summit Blue developed a balanced portfolio of programs that provides opportunities for participation at multiple levels. By proposing a multi-faceted and broad portfolio of programs, the plan set forth here would capitalize on those segments of the market who may be willing to invest in energy efficiency given the challenging economic landscape. In balance, this would provide APCo West Virginia with its best available plan, given the uncertainties identified in the study, to achieve energy efficiency goals.

The following strategies should help minimize the risks associated with this 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 DSM 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

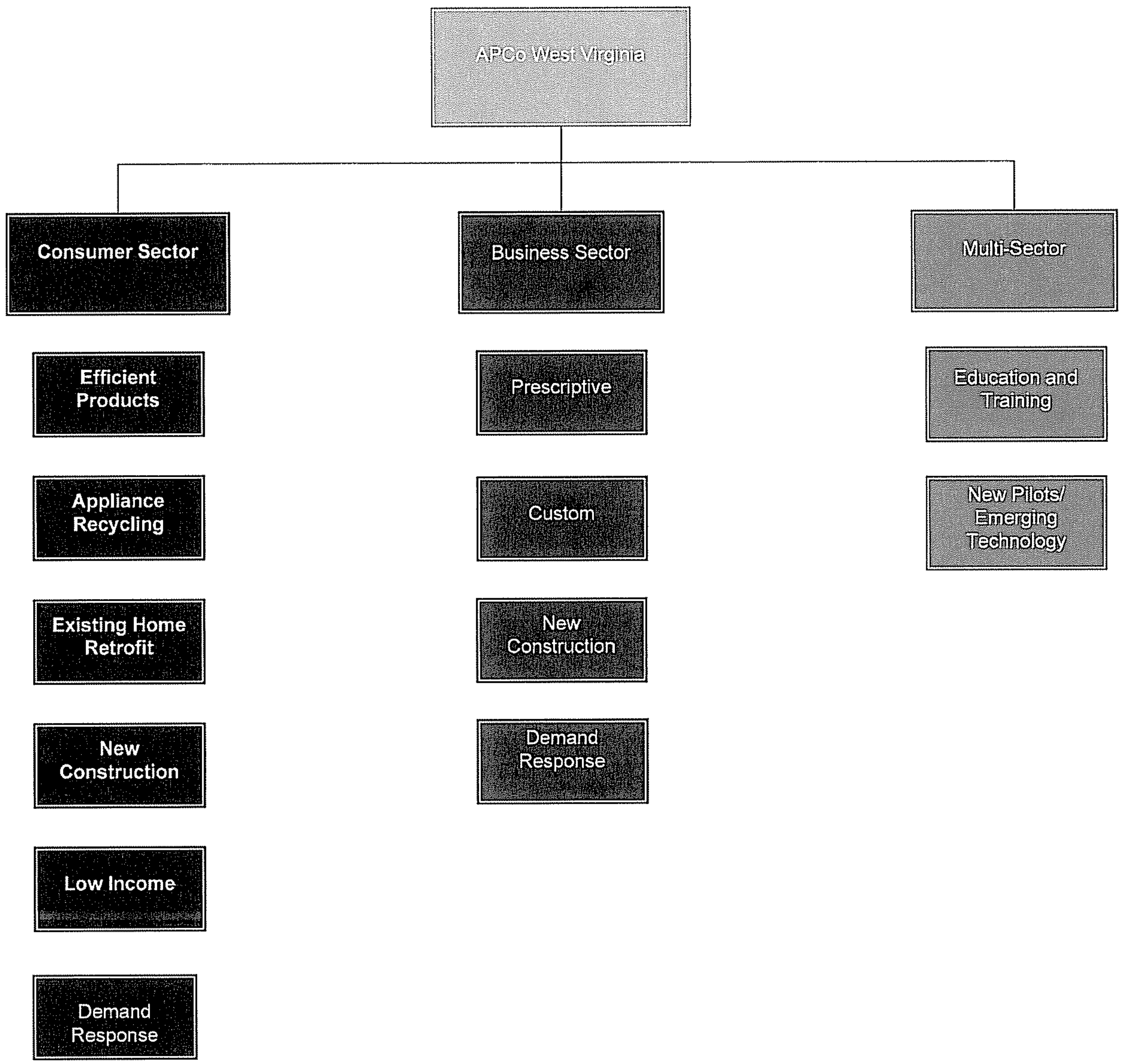
- Setting up post installation inspection procedures and data to collect before inspections begin.
- Anticipating and preparing for stronger than expected market response
- Conducting adequate market checks on standard practices and energy efficient product availability.
- Developing incentive structures 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.

3 Program Portfolio Summary

The following section presents a brief introduction to the Action Plan's efficiency and demand response programs. As demonstrated in Figure 3-1, the portfolio of programs can be divided into consumer, business and multi- sectors with utility administrative functions providing support across for all program areas.

It is important to note that, for the purposes of presenting the details of this portfolio, the word "program" is used to define a specific market sector or technology end-use type and to detail projected savings, costs and cost-effectiveness. For planning purposes, it is helpful to separate the portfolio into these multiple "programs". Upon implementation, however, it would be a priority to present the programs in a market oriented manner - that is, a range of efficiency opportunities to address entire sectors which Summit Blue believes would make customer participation more straightforward.

Figure 3-1. APCo West Virginia Portfolio of Programs



4 DSM 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 proposed as guidelines for more detailed program planning; they are not intended to be operational *per se*. The intent of the portfolio presented here is to provide a sense of scope and scale, and convey the general schedule and resources needed to quickly gain a foothold in the various markets in which the programs will operate.

The performance targets of the program plans are based on normal economic conditions and the ability to overcome a variety of market barriers and perceived risks customers have regarding energy efficiency improvements and load management. Problems commonly encountered that affect delivery may occur and dampen program performance and include a variety of real and perceived risks in undertaking efficiency improvements or participating in load management programs:

- Reliability of the efficiency improvement, whether real or perceived
- Fit with existing facilities and processes
- Return on investment and cash flow effects compared to other financial and operating priorities
- Unfamiliarity with the technology leading to non-participation
- Availability of funds or credit to purchase the improvement
- Concern about occupant comfort and other aesthetics

Overall, a portfolio is presented that covers a broad range of demographic, business, facility, and end-use markets. The proposed portfolio of programs can be divided into consumer, business and multi-sectors with utility administrative functions providing support across for all program areas. APCo West Virginia would maintain, as part of its functionality, the education, training and emerging technology ("R&D") budgets. These efforts would leverage existing AEP corporate connections and efforts to maximize impact of these outreach and education efforts. The following section presents a summary of the services offered in each program.

4.1 Programs Summary

Consumer Sector

Efficient Products: This program would 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 promotes convenient recycling for CFLs at local retailers.

For appliances, the program uses 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 would 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 would 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 would provide incentives to remove working units from service and fully recycle their materials. The program includes an environmentally responsible turnkey pick-up and recycling service.

Home Retrofit: This program produces 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 would 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 would be 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: This program provides 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 would coordinate low-income services with local weatherization providers to provide comprehensive assistance at lower administrative[8] costs.

Energy Conservation Kits: This program 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: This program produces 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 would 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 would 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 also would be provided.

Residential Demand Response: This includes a Direct Load Control (DLC) Program to residential customers with central air conditioners, electric resistance heat or electric water heaters.

[8] Administrative costs in this study are all costs for a given program aside from customer incentives: planning, marketing and sales, business process administration such as rebate processing, and evaluation, measurement, and verification. General overhead costs such as general DSM department overheads, general education/training and pilot program funding are estimated separately from specific programs, but are included in the overall portfolio benefit-cost analysis.

Business Sector

Prescriptive Incentive: This program generates energy savings for all business customers through the promotion of high-efficiency standardized equipment not requiring substantial engineering. Three primary objectives would 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 would be offered to customers.

Custom: This program assists 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 would identify more complex energy savings projects, provide economic analysis and aid in the completion of the incentive application. Incentives would be based on energy savings on a per kWh and per kW basis for installed measures.

C&I New Construction: This 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.

C&I Demand Response: The program includes a Direct Load Control (DLC) Program to non-residential customers with packaged air conditioning, electric resistance heat or electric water heaters, specifically targeting small C&I customers.

Multi-Sector

General Energy Education: Grade 4^{th}-8^{th} Energy Education for Elementary Education Classrooms. The program intent is to influence students and their families to take actions that can reduce their home energy use and increase efficiency. The implementation contractor would work directly with the West Virginia Department of Education to introduce the program to schools throughout the State. All educational materials and take-home efficiency kits will be free of charge to the schools.

Training: The program coordinates the consumer and C&I training programs offered, or supported, by the utility. These programs would be APCo West Virginia sponsored and draw from corporate account managers and marketing departments. Initial trainings would likely work with commercial and municipal building engineers (such as the Building Operator Certification training) as well as consumer HVAC and weatherization contractors. The goal would be to broaden APCo West Virginia's reach to its customers and to provide assistance for customers seeking higher efficiency trained contractors.

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 residential energy use. Initially the program would focus on proven programs that capture significant energy savings. Later other innovative technologies, including solid state lighting, plug load and consumer electronics, could be explored.

The program plans below greater detail on the programs summarized above according to:

- Objectives
- Target Markets

- Duration
- Description
- Incentive Strategy
- Eligible measures
- Implementation Strategy
- Marketing Strategy
- Milestones
- EM&V Strategy
- APCo West Virginia Administrative Requirements
- Budget
- Savings Targets
- Benefit-cost Test Results

5 DSM Portfolio Summary Results

5.1 Portfolio Framework & Summary

Under the portfolio developed, a total $128 million (2009$) would be invested on energy efficiency programs during calendar years 2009 to 2013, assuming all programs within the suggested portfolio could be implemented expeditiously. The division of targeted efficiency program investment between residential and business customers is commensurate with the relative contribution to the DSM portfolio.

The plan maximizes the amount of program funds that go directly to customers through rebates and incentives, training and technical assistance, and customer and trade ally education. This portfolio also takes into account the realities of program start-up costs and funds needed to adequately plan, develop, deliver, and evaluate quality programs. The balance of the expenditures would be applied to program administration[9] including staffing.

Customer incentive levels and other program elements would be reviewed and modified on an annual basis to reflect changes in market conditions or implementation processes in order to maximize cost-effective savings.

[9] Administrative costs in this study are all costs for a given program aside from customer incentives: planning, marketing and sales, business process administration such as rebate processing, and evaluation, measurement, and verification. General overhead costs such as general DSM department overheads, general education/training, and pilot program funding are estimated separately from specific programs, but are included in the overall portfolio benefit-cost analysis.

Table 5-A shows the overall estimated electric savings goals as percent of sales.

Table 5-A. Savings Goals and Efficiency Portfolio Investment – 2009 to 2013

Consumer Sector (incremental annual net savings at generator)	2009	2010	2011	2012	2013	2009-2013 Total
Energy Savings (GWh) (1)	18.7	29.9	40.2	42.6	49.7	181.2
% of Total Sector Loss-Adjusted Sales	0.30%	0.48%	0.64%	0.68%	0.78%	-
Winter Demand Savings (MW) (1)	11.6	13.5	15.2	17.7	23.8	81.7
% of Total Sector Loss-Adjusted Sales	0.67%	0.77%	0.87%	1.01%	1.34%	-
Total Cost (2009$ million) (2)	$4.8	$6.1	$7.7	$9.9	$12.7	$41.3
Business Sector (incremental annual net savings at generator)	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013 Total**
Energy Savings (GWh) (1)	39.1	53.1	68.0	72.9	92.2	325.3
% Savings of Sector Sales	0.29%	0.40%	0.51%	0.54%	0.68%	-
Winter Demand Savings (MW) (1)	13.6	15.6	16.8	16.6	20.2	82.8
% Savings of Sector Sales	0.95%	1.08%	1.16%	1.14%	1.38%	-
Total Cost (2009$ million)	$7.9	$10.3	$12.9	$16.8	$22.6	$70.5
Total (incremental annual net savings at generator)	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013 Total**
Energy Savings (GWh) (1)	57.8	83.0	108.2	115.5	141.9	506.4
% Savings of Sector Sales	0.29%	0.42%	0.55%	0.59%	0.72%	-
Winter Demand Savings (MW) (1)	25.2	29.1	32.0	34.2	44.0	164.5
% Savings of Total Sales	0.79%	0.91%	1.00%	1.06%	1.36%	-
Total Cost (2009$ million)	$12.8	$16.4	$20.6	$26.7	$35.3	$111.9
Other Costs (2009$ million) (2)	$3.0	$3.2	$3.0	$3.2	$3.8	$16.3
Portfolio Total Investment (2009$)	**$15.8**	**$19.6**	**$23.6**	**$29.9**	**$39.1**	**$128.2**

Table 5-1 Notes:

(1) Savings are not projected for Low Income Energy Conservation Kits. APCo West Virginia would 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) Other Costs include support and other services, including: APCo West Virginia DSM Department, General Education/Training/Media, Low Income Energy Conservation Kits, and Pilot Program Fund.

5.2 Benefit-Cost Analysis Background

On behalf of APCo West Virginia, Summit Blue has estimated the energy savings, costs and net benefits associated with each of the programs included in the proposed portfolio of programs. The following section presents the benefit-cost results.

Types of Benefit-Cost Tests

As shown in Table 5-B, there are five major benefit-cost tests commonly utilized in the energy efficiency industry, each of which addresses different perspectives. Regardless of which perspective is used, benefit-cost ratios greater than or equal to 1.0 are considered beneficial. While various perspectives are often referred to as tests, the following list of criteria demonstrates that decisions on program development go beyond a pass/fail test.

Table 5-B. Comparative Benefit-Cost Tests

	Participant Test	Rate Impact Measure Test	Total Resource Cost Test	Program Administrator Cost Test (Utility Test)	Societal Test
BENEFITS:					
Reduction in Customer's Utility Bill	X				
Incentive Paid by Utility/Program Administrator	X				
Any Tax Credit Received	X		X		
Avoided Supply Costs		X	X	X	X
Avoided Participant Costs	X		X		X
Participant Payment to Utility (if any)		X		X	
External Benefits					X
COSTS:					
Utility Admin Costs		X	X	X	X
Participant Costs	X		X		X
Incentive Costs				X	
External Costs					X
Lost Revenues		X			

Summit Blue evaluated the cost-effectiveness of the measures, programs and overall portfolio based on the following standard tests:

The Utility System Resource Cost Test ("UCT", also referred to as the Program Administrator Test) measures the net benefits of a demand-side management ("DSM") program as a resource option based on the costs and benefits incurred by the utility (including incentive costs) and excluding any net costs incurred by the customer participating in the efficiency program. The benefits are the avoided supply costs of energy and demand, the reduction in transmission, distribution, generation and capacity valued at marginal costs for the periods when there is a load reduction. The costs are the program costs incurred by the utility, the incentives paid to the customers, and the increased supply costs for the periods in which load is increased.

The Total Resource Cost Test ("TRC") is a test that measures the total net resource expenditures of a DSM program from the point of view of the utility and its ratepayers. Resource costs include changes in supply and participant costs. A DSM program, which passes the TRC test (i.e., a ratio greater than 1.0) is viewed as beneficial to the utility and its customers because the savings in electric costs outweigh the DSM costs incurred by the utility and its customers.

The Participant Cost Test ("PCT") illustrates the relative magnitude of net benefits that go to participants compared to net benefits achieved from other perspectives. While called a "participant" perspective, it is not necessarily a perspective indicating whether customers participate. The implied discount rate can vary substantially between customers. More importantly, many customers do not even know what a present- value benefit-cost analysis is let alone feel confident in making decisions based on it. Consequently, a simple payback (years) net of incentive has been shown to provide further guidance on customer participation. The benefits derived from this test reflect reductions in a customer's bill and energy costs plus any incentives received from the utility or third parties, and any tax credit. Savings are based on gross revenues. Costs are based on out-of-pocket expenses from participating in a program, plus any increases in the customer's utility bill(s).

The Rate Impact Measure ("RIM") Test measures the change in utility energy rates resulting from changes in revenues and operating costs. The higher the RIM test, the less impact there is on increasing energy rates. While the RIM results provide a guide as to which technology has more impact on rates, generally it is not considered a pass/fail test. Instead, the amount of rate impact is usually considered at a policy level. The policy level decision is whether the entire portfolio's impact on rates is so detrimental that some net benefits have to be forgone.

5.3 Benefit-Cost Test Results

As detailed in Table 5-C, the 2009-2013 DSM portfolio of programs passes the total resource cost test with a ratio of 2.2.

Table 5-C. Summary of Program Benefit-Cost Test Results – 2009 to 2013

Consumer Sector	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Rate Impact Measure Test (RIM)
Products	2.3	3.4	6.3	0.5
Recycling	1.0	0.9	na	0.0
Retrofit	2.4	3.6	3.6	0.9
Low Income	2.4	3.6	3.9	0.8
New Construction	2.4	3.7	6.8	0.5
Demand Response	1.5	4.2	1.5	1.1
Consumer Sector Total	**2.3**	**3.6**	**4.0**	**0.7**
Business Sector	**Total Resource Cost Test (TRC)**	**Utility Cost Test (UCT)**	**Participant Cost Test (PCT)**	**Rate Impact Measure Test (RIM)**
Prescriptive	2.2	3.5	3.3	0.8
Custom	1.6	2.3	3.5	0.6
New Construction	1.4	2.2	2.8	0.6
Demand Response	1.6	2.3	0.7	2.0
Business Sector Total	**1.9**	**2.9**	**2.9**	**0.8**
PORTFOLIO TOTAL	**2.16**	**3.30**	**3.86**	**0.73**

5.4 Benefit-Cost Methodology

The Summit Blue Resource Assessment Model SB-RAM is a model based on the integration of DSM 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, DSM technology data, past DSM program accomplishments, and decision maker variables that help drive the market potential scenarios.

The baseline estimates of building stocks and equipment saturations came from the results of the on-site audits conducted by Summit Blue. SB-RAM also used the electricity forecast, avoided cost forecast, and electricity prices as described in Chapter 5, above.

SB-RAM estimates technical, economic, and achievable DSM resource potential as defined below:

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

- **Economic DSM potential** describes the amount of technical DSM potential that is "cost-effective," as defined by the results of the TRC test (or other preferred cost effectiveness 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 DSM programs. The costs for the TRC test are the DSM measure costs, plus the DSM program administration costs. The TRC test does not consider economic or market barriers to customers installing DSM measures.

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

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

- **Replace on Burnout ("ROB")** means that a DSM 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 DSM 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

SB-RAM employs several financial tests, including the cost effectiveness tests described in Chapter 5: the TRC, PAC, participant, and RIM tests.

Simple Customer Payback

The decision model of SB-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.

DSM Measure Levelized Cost/kWh

DSM supply curves are based on the DSM measure cost per kWh, levelized over the lifetime of the measure. It is calculated by multiplying DSM measure costs by the Capital Recovery Factor ("CRF"), then dividing by the first year kWh savings.

Discount Rate

There is a time value of money because money spent in the future does not have the same value as money spent today. This time value is represented by a discount rate (analogous to an interest rate). Economic equations use the discount rate to convert all costs and benefits to a "present value" for comparing alternative costs and benefits. Summit Blue used a uniform discount rate of 8.1% for both energy efficiency programs and supply side resources.

Avoided and Energy Costs

DSM avoided cost benefits fall into two categories, avoided capacity benefits, and avoided energy costs. Avoided capacity benefits are the benefits derived from deferring the need to build new generating plants in the future. Avoided capacity values were based on APCo West Virginia projections of future power plant costs considering expected level of capacity available over future years, and the costs of that capacity.

Administration,[10] Implementation, and Direct Costs

Each program's administration, implementation, and direct costs were allocated to the technologies delivered by the program in the ratio of the incentive investment to the total incentive investment for the program. The result is that individual technology benefit/cost ratios can appear low simply because administration or implementation costs have been allocated to the technology beyond the specific technology costs. On the one hand, this allocation helps ensure the overall cost-effectiveness of a program by guiding selection of technologies with sufficient benefits to support program delivery costs. This still allows technologies with a

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[10] Administrative costs in this study are all costs for a given program aside from customer incentives: planning, marketing and sales, business process administration such as rebate processing, and evaluation, measurement, and verification. General overhead costs such as general DSM department overheads, general education/training, and pilot program funding are estimated separately from specific programs, but are included in the overall portfolio benefit-cost analysis.

benefit-cost ratio less than 1.0 to be included as needed to meet other goals in addition to portfolio cost-effectiveness requirements. APCo West Virginia support services that are not specific to individual programs are added as costs at the portfolio level for all programs.

Program Development

Program development involves the selection of technologies to include in a program, estimates of participation levels and estimates of program costs. It is obviously necessary for a portfolio of programs to be cost-effective. However, there are multiple and often contradictory perspectives on cost effectiveness. Alternative perspectives are described below. The primary cost-effectiveness perspective in the portfolio is the total resource cost test perspective. Fortunately, it is possible to achieve required cost-effectiveness at a portfolio level while also considering other important criteria. The following criteria also were considered in developing programs:

- Achieving more benefits net of cost is a higher priority than a high benefit-cost ratio.
- The portfolio must provide opportunities for specific customer sectors to participate.
- Long term contribution of a technology is important to program success and to future cost reductions.
- Consideration of different benefit-cost perspectives is necessary.

6 DSM Program Plans

Preliminary program plans represent an interim step between the measure-specific number produced by the DSM potential analysis and the detailed plans needed to implement the programs. The plans developed for this study are based on best-practice programs, with the concepts outlined in a strategic manner. The plans are proposed as guidelines for more detailed program planning; they are not intended to be operational *per se*. 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.

The performance targets of the program plans are based on normal economic conditions and the ability to overcome a variety of market barriers and perceived risks customers have regarding energy efficiency improvements and load management. Problems commonly encountered that affect delivery may occur and dampen program performance and include a variety of real and perceived risks in undertaking efficiency improvements or participating in load management programs:

- Reliability of the efficiency improvement, whether real or perceived
- Fit with existing facilities and processes
- Return on investment and cash flow effects compared to other financial and operating priorities
- Unfamiliarity with the technology leading to non-participation
- Availability of funds or credit to purchase the improvement
- Concern about occupant comfort and other aesthetics

Overall, a portfolio that covers a broad range of demographic, business, facility, and end-use markets is presented:

- Commercial & Industrial
    - Prescriptive Incentive Program: Covers a variety of standardized equipment types not requiring substantial engineering.
    - Custom Program: Covers specialized efficiency improvement projects not covered by the Prescriptive Program.
    - New Construction Program: Provides facility design assistance to capture long-term architectural and facility systems efficiency opportunities.
    - Direct Load Control Program: Offers financial incentives to customers with qualifying packaged air conditioning (for summer load cycling via smart thermostats) and winter electric space and water heating load cycling.
- Residential
    - Home Retrofit Program: Home energy audit and follow-up insulation, lighting and heating system retrofits.
    - New Construction Program: Incentives and guidance for design and construction of high-efficiency homes.

- Refrigerator/Freezer Recycling Program: Incentives to remove working units from service and fully recycle their materials.
- Residential Efficient Products Program: Incentives to purchase a variety of standardized equipment types not requiring substantial engineering.
- Residential Low Income Program: Free-of-charge services and products to improve the electric efficiency of qualifying low-income customers.
- Residential Direct Load Control Program: Offers financial incentives to customers with central air conditioners (for summer load cycling via smart thermostats) and winter electric space and water heating load cycling.

The preliminary plans below provide:

- Objectives
- Target markets
- Goals and objectives
- Duration
- Description
- Incentive strategy
- Eligible measures
- Implementation strategy
- Marketing strategy
- Milestones
- Administrative requirements
- Budget
- Savings targets
- Benefit-cost test results

6.1 Consumer Programs

6.1.1 Residential Efficient Products Program

Objective

Produce long-term electric energy savings in the residential sector by increasing the market share of high-efficiency lighting products, home appliances sold through retail sales channels, and promoting the purchase and installation of HVAC and domestic hot water heating equipment.

Target Market

Lighting: Residential customers purchasing light bulbs and fixtures through retail sales channels. Residential rental property owners and customers living in rental properties also would be eligible to purchase efficient lighting products, as well as small commercial customers.

Appliances: Customers in the market for new refrigerators and freezers. Residential rental property owners would be eligible as well.

As new technology and/or proven program design options (e.g., lift-based incentive) become available, the program may target the purchase of other high-efficiency appliances and/or consumer electronics. At this time however, options are limited to the aforementioned products due to economic considerations (i.e., baseline market share is already high or the difference in consumption between the baseline and "high efficiency" does not warrant attention by the program).

HVAC and Domestic Hot Water: Customers installing new evaporative coolers and geothermal heat pumps in single-family homes and multifamily dwellings of three units or less would be eligible for incentives. Residential customers installing new water heating equipment would be eligible, both in the replacement market (through plumbing contractors as well as the Do-it-Yourself retail channel) and the new construction market (through contractors).

Program Duration

The Efficient Products Program would be an ongoing element of the program portfolio.

Program Description

Lighting: The Efficient Products Program would provide incentives and marketing support through retailers to build market share and usage of ENERGY STAR® lighting products. The program targets the purchase of lighting products through in-store promotion as well as special sales events. Customer incentives facilitate the increased purchase of high-efficiency products while in-store signage, sales associate training and support makes provider participation easier. The program would also provide convenient recycling for CFLs at local retailers.

Appliances: The program would use a retail channel-based strategy to influence the purchase of high efficiency appliances and electronics. Since appliance standards and the market share of high-efficiency appliances are gradually increasing, qualifying models would be specified and marketing will be targeted. The program initially provides incentives to customers encouraging purchasing high-efficiency refrigerators and freezer. In future years, the program may target other cost-effective options for high-efficiency appliances and electronics.

HVAC and Domestic Hot Water: The program would affect the purchase and installation of evaporative coolers and geothermal heat pumps through a combination of market push and pull strategies that stimulate demand while simultaneously increasing market provider investment in stocking and promoting high efficiency products. The program would work through two distinct market channels – plumbing contractors and the retail Do-it-Yourself stores.

Incentive Strategy

Several incentive strategies could be employed to address current market conditions:

LIGHTING

CFL Markdowns: The markdown approach would be the primary driver of volume within the lighting program. With a markdown approach, APCo West Virginia would reimburse select retailers for discounting the cost of CFLs or other products by a specified dollar amount per unit during special limited term promotions. The qualifying product would be listed at a lower retail price on store shelves or marked down automatically at the register. At the end of every month, the retailer provides a point of sale report and would be reimbursed for the discount provided on each unit that they sold. This strategy eliminates costs associated with mail-in rebate fulfillment, printing claim forms and setting up store locations, and is very cost-effective if APCo West Virginia can capitalize on economies of scale by coordinating promotions with neighboring utilities. Volume would be controlled by allocating a specific number of CFLs that each retailer may discount, in advance of the promotion, and by offering discounts on a "while supplies last" basis.

Markdown promotions ideally should be arranged with retailers six months in advance to accommodate their marketing plans and allow sufficient time to procure product. APCo West Virginia dollars may be leveraged through a request for proposal (RFP) process to gain retailer and manufacturer contributions of financial and logistical support for promotions. For example, retailers may be asked to bid on access to APCo markdown dollars based on how much they are willing to further reduce prices below normal retail rates or manufacturer offers to dispatch field representative to stores to stock shelves and train sales associates. Retailers must provide shipping documentation showing that the store received a specified number of units and monthly point of sale report showing the number of units sold.

Lighting Fixture and Ceiling Fan Markdowns: Similar to the CFL markdown model, the program would work with retailers to provide a discount on select ENERGY STAR products at the point of sale.

LED Holiday Lights Markdown: Similar to the CFL, fixture, and fan markdown promotion, the program would work with retailers to provide a discount on select products at the point of sale.

CFL Coupons: This incentive strategy would provide instant-rebate coupons on ENERGY STAR qualified CFLs at participating retailers who are unable to provide point of sale data in conjunction with markdown style promotions. A quantity restriction of twelve (12) CFLs per residential customer per year will be imposed to help maximize installation rates and a limit of 24 CFLs per commercial customer per year. Customers desiring more than the specified limit will be encouraged to call the program, explain their circumstance, and seek permission. Special bonus incentives may be offered for the purchase of CFL multipacks (e.g., 4-pack, 6-pack).

Lighting Fixture and Ceiling Fan Coupons: Customers could utilize instant rebate coupons available from retailers who are unable to provide point of sale data in conjunction with markdown promotions.

LED Holiday Lights Coupons: Instant rebate coupons would be available in stores that may be used to claim cash-back incentives from retailers who are unable to accommodate the requirements of markdown style promotions. This incentive strategy would only be available during the holiday season each year and should be considered a public relations activity as this product will not generate significant energy savings.

Pilot Program with Lighting Showrooms: Program field representatives would work with several lighting showrooms by providing training support and a salesperson incentive to promote the sale and installation of ENERGY STAR fixtures.

Lift-based Incentive: Although the incentive strategies outlined here assume a transfer payment to the retailer or customer based on a dollar amount per every unit purchased, APCo West Virginia may consider moving to a lift-based incentive strategy in future years. With a lift based incentive strategy APCo would work with retailers to establish baseline market share for eligible products and negotiate an incentive for every unit sold above the baseline. The objective is to maximize the net to gross (savings) ratio by providing a greater incentive for the retailer to increase the share of targeted products they sell each year as those below the baseline may be considered largely free-riders. This approach is being tested by other utilities and implementation contractors in the country. APCo West Virginia may want to follow the results of these pilots and revisit this incentive strategy within one to two years, depending on the results of pilot efforts.

HVAC AND DOMESTIC HOT WATER

HVAC contractors would be able to apply the appropriate incentive to the customer invoice and submit to APCo West Virginia for reimbursement or the customer may submit a mail-in rebate application. In addition, the incentive design may employ a smaller additional incentive (e.g., $25 to $50/unit) directly to the HVAC contractor to further elicit program participation if necessary.

Mail-in incentive applications would be available at point-of-sale in retail stores that sell qualifying water heaters for the Do-it-Yourself market. Plumbing contractors would be able to apply the appropriate incentive to the customer invoice and submit to APCo West Virginia for reimbursement or the customer may submit a mail-in rebate application.

A $50 incentive would be paid to retailers or contractors who apply the incentive to the customer's invoice. This incentive would serve as additional motivation for market providers to stock eligible products and to further reduce the first cost burden on the customer. The incentive would be paid to the vendor (i.e., contractor or retailer) not the salesperson, which is necessary to avoid time-consuming efforts to secure market provider agreement to offer incentives to salespeople. The vendor may choose to pass the incentive on to their salespeople.

Eligible Measures

The measures listed below have been specified for planning purposes. APCo West Virginia would revise eligible measures as needed in accordance with current market conditions, technology development, EM&V results, and program implementation experience. Within the program period of this plan, it is likely that LED bulbs technology will continue to improve and become more cost-effective, as replacement for incandescent or CFL, and promoted in the future. Currently, it is premature to forecast a start date.

Note that the CFL incentive amount listed below is an average. Incentive amounts offered in conjunction with markdown promotions may vary based on agreements negotiated with retailers.

Measures addressed could include:

- CFL Lamp (average values)
- CFL Fixture
- Ceiling Fan w/ CFL Lamp Kit
- LED Holiday Lights
- Refrigerator
- Freezer
- Electric Hot Water Heater
- Whole House Evaporative Cooler
- Geothermal Heat Pump

Implementation Strategy

Lighting - Key Elements

Retailer/manufacturer recruitment for markdown component: APCo West Virginia's implementation contractor would issue an RFP to solicit retailer/manufacturer participation for the markdown component of the program. The RFP would specify program requirements such as product specifications, performance criteria, product stocking objectives, data sharing requirements, and the option of participating in the bulb-recycling component of the program. In addition, it would provide the points on which retailers and their manufacturer partners may compete for access to the programs including financial and logistical support.

It is important to note that markdown promotions may be arranged with "big box" retailers through central corporate offices while retailers with franchise based business models (e.g., Ace Hardware and True Value) may require the additional step of contacting individual store locations to secure their participation. In the case of franchise retailers, APCo West Virginia may work through corporate offices to make a product available and to communicate the availability of the program to individual stores, but independently-owned and operated stores often need additional contact to ensure follow through.

Retailer recruitment, education and outreach: APCo West Virginia implementation contractor would utilize field representatives to recruit retailers for participation in both the instant rebate and markdown components of the program as well as special turn-in events and pilot projects. Field representatives would maintain regular contact with participating retailers to ensure the following:

(1) Retail sales staff are informed about the program offering, rebate process, and benefits of qualifying products.

(2) Retailers have an adequate supply of program marketing materials and coupons.

(3) Point-of-purchase displays are visible and qualifying products are stocked in accordance with retailer commitments.

(4) Retailers concerns and issues are addressed promptly.

(5) Retailers are informed well in advance of planned promotional activities and cooperative advertising opportunities.

Incentive processing: APCo West Virginia's implementation contractor would manage prompt processing of retailer/customer incentive payments. As prompt incentive payment is essential to retailer/customer satisfaction, the implementation contractor would establish protocols that expedite payment.

CFL Bulb recycling: APCo West Virginia's implementation contractor would deploy recycling bins for CFL bulb collection at all participating retailers. These bins may be purchased in conjunction with a turnkey service that allows the retailer to mail a full bin to the recycling company and receive an empty bin in return. Retailers would be given training on proper sealing, labeling, and transportation for the bins.

Implementation-related administrative requirements would be handled by a third party implementation contractor, selected through a competitive bid process. The implementation contractor would be responsible for:

- Retailer/manufacturer recruitment, negotiation, and support
- Field services
- Marketing strategy
- Recommending content for marketing materials and advertising
- Management of bulb recycling
- Rebate processing
- Data tracking and reporting
- Budget tracking and reporting
- Contact (call) center services
- Customer satisfaction/Problem resolution
- Measurement and verification

Appliances - Key Elements

Retailer recruitment, education and outreach. APCo West Virginia's implementation contractor would utilize field representatives to facilitate the recruitment of participating retailers. The field representatives would maintain regular contact with participating retailers to ensure the following:

(1) Retail sales staff are informed about the program offerings, rebate application process, and benefits of ENERGY STAR qualifying products.
(2) Sufficient host retailer(s) are recruited for the special turn-in events to meet the program's unit goal. Depending on the level of interest among retailers, it is expected that events would be scheduled with 5-10 retailers in various locations throughout the service territory.
(3) Retailers have an adequate supply of program marketing materials and application forms.
(4) Recycling services are provided to retailers and meet their needs.
(5) Point-of-purchase displays are visible and qualifying products are stocked in accordance with retailer commitments.
(6) Retailers concerns and issues are addressed promptly.
(7) Retailers are informed well in advance of planned promotional activities and cooperative advertising opportunities.

Incentive coordination and processing: APCo West Virginia's implementation contractor would coordinate the delivery of rebate coupons and materials to participating retailers and will manage prompt processing of incentive payments. As prompt incentive payment is essential to retailer/customer satisfaction, the implementation contractor would establish processes and procedures that expedite payment.

Appliance turn-in and recycling: APCo West Virginia's implementation contractor would work with all host retailer(s) to coordinate the logistics of the turn-in component of the promotion. The contractor would also coordinate the collection, transportation and recycling of turned-in units through a private recycling firm.

Coordination with the Refrigerator/Freezer Recycling Program. APCo West Virginia's implementation contractor would coordinate all activity with this program's recycling contractor so that customers are aware that they can also have their older dehumidifiers/room air conditioners picked up at their home if they have already scheduled an appointment for removal of a refrigerator/freezer.

Strategies to limit free ridership and promote spillover include:

- Educational messages in retail stores raise awareness of energy consumption on older appliances and encourage consideration of early replacement

APCo West Virginia would manage the development and placement of marketing materials for distribution by the implementation contractor.

HVAC and Domestic Hot Water - Key Elements

Contractor recruitment, education and outreach. APCo West Virginia's implementation contractor would utilize field representatives to facilitate the recruitment of HVAC and plumbing contractors and retail Do-it-Yourself stores to participate in the program. The field representative would maintain regular contact with participating contractors to ensure the following:

(1) All contractors/stores are informed about the program offering and incentive application process.

(2) Contractors/stores have an adequate supply of program marketing materials and application forms.

(3) Qualifying equipment is readily stocked.

(4) Contractors'/stores' concerns and issues are addressed promptly.

(5) Contractors/stores are informed of cooperative advertising opportunities.

Application processing: APCo West Virginia's implementation contractor would coordinate processing of all rebate applications, verification of eligibility and prompt delivery of rebate checks to contractors/customers.

Strategies to limit free ridership and promote spillover include:

- Incentives only for high-efficiency equipment
- Incentives set high enough to encourage purchases that wouldn't have happened without the rebate
- Incentive claims must be submitted within 60 days of purchase

Marketing Strategy

Marketing activities related to the development and placement of collateral materials, advertising, media outreach, and public relations would be managed by APCo staff.

Lighting - Key Elements

- Point-of-purchase displays
- Cooperative advertising with retailers
- Direct consumer marketing through APCo's website and newsletter
- Mass-market advertising through bill inserts, radio, newspaper, and/or television

The program would be marketed in-store through displays, signage, and other materials that would be developed in cooperation with participating retailers. Materials would employ a strong consumer education component emphasizing the benefits of high-efficiency lighting products (e.g., lifetime dollar savings, energy savings, longer life, safety, appropriate light quality, etc.). Marketing materials would leverage the ENERGY STAR Brand, which enjoys a high level of consumer recognition and favorable associations.

Cooperative advertising support (e.g., APCo West Virginia pays 50% of the cost of advertising space dedicated to the program) would be offered to retailers as an incentive for them to promote the program. This is an important strategy as retailers best know their customers and cost-effective means of communicating with them. Terms for participation would require that advertisements include key product features and benefits and clearly communicate APCo West Virginia's sponsorship of cash-back incentives through specified language and/or the use of the APCo's logo. Cooperative advertising terms and conditions would also require pre-approval by the implementation contractor or APCo to ensure advertisements are consistent with the intent of the program and to ensure APCo's Brand integrity.

APCo would post information about the ongoing mail-in rebate offers and markdown promotions on the company's website and in its newsletter. Advertising and other promotional activities would refer customers to the webpage or toll free number for more information on incentive offers, participating retailers, and product information.

Bill inserts and mass media advertising developed and placed by APCo West Virginia would support spring and fall markdown campaigns, with the bulk of volume and therefore advertising targeted to the fall timeframe. Bill inserts and mass media advertising (e.g. radio, print, and/or television) would be employed to promote the availability of APCo -sponsored discounts at participating retail locations. Because it would be necessary to target stores within APCo West Virginia's service territory to minimize the participation of ineligible customers, messaging would indicate discounts are available from participating retailers (e.g. participating Ace Hardware, Wal-Mart, and Target locations) and refer customers to a toll free number or the program webpage for a list of participating store locations. In addition to promoting the availability of financial incentives, advertising would promote the key features and benefits of targeted products, focusing primarily on CFLs.

Appliances - Key Elements

- Annual mailing of packets including incentive claim forms and other collateral materials to retailers
- Direct consumer marketing through APCo's website and newsletter bill insert
- Press releases
- In-store point-of-purchase displays
- Cooperative advertising with retailers
- Outside banners for turn-in events

All marketing materials would carry a strong consumer education message emphasizing the benefits of high efficiency appliances and early replacement with ENERGY STAR qualified models (lifetime dollar savings, energy savings, water savings, lower noise, etc.). Marketing materials would leverage the ENERGY STAR brand, which enjoys a high level of consumer recognition and favorable associations.

HVAC - Key Elements

- Annual mailing of packets including incentive claim forms and other collateral materials to HVAC contractors
- Rebate applications and program information available on-line
- Distribution of collateral materials to HVAC contractors through field representatives
- Direct consumer marketing through APCo's website and newsletter bill insert.
- Press releases
- Mass media advertising

HVAC equipment would be primarily marketed through local contractors, the most direct influencers of customer purchase decisions. Contractors would receive educational materials to share with their customers through an initial mailing campaign, kick-off meetings, and in-person visits by trade allies. Further, the program would employ a top down communication strategy involving the recruitment of HVAC equipment manufacturer and distributor representatives to support the program by passing information on to the contractors they serve.

The website would contain all necessary information about the program and incentive offers. Mass media advertising (e.g., print, radio, and television) would promote the availability of incentive offers along with the benefits associated with targeted products.

Domestic Hot Water - Key Elements

- Annual mailing of packets including incentive claim forms and other collateral materials to retailers and plumbing contractors
- Distribution of collateral materials to retailers and contractors through field representatives
- Direct consumer marketing through APCo's website and newsletter bill insert
- Press releases
- Mass media advertising

High efficiency water heating equipment would be marketed through two market channels: plumbing contractors and retail Do-it-Yourself stores. Contractors and retailers would receive educational materials to share with their customers.

The website would contain all necessary information about the program as well as a list of participating contractors. Press releases and mass media advertising would promote the availability of consumers incentives along with key benefits associated with targeted products.

Milestones

Table 6-A. Project Milestones

Lighting Tasks	Timeframe
DSM Plan Approval	TBD
Issue RFP to select retailer partners for fall campaign.	1 month
Selection of Program Implementation Contractor.	3 months
Complete negotiations with retailer partners for fall markdown campaign.	3 ½ months
Develop and distribute instant rebate coupon materials for ongoing use.	5 months
Recruit and secure product orders from independent retailers for fall campaign.	5 months
Issue RFP to select retailer partners for winter LED holiday light campaign	5 months
Complete negotiations with retailer partners for holiday light campaign.	6 months
Complete development of marketing materials and advertising for fall campaign.	6 months
Distribution of marketing materials to retailers for fall campaign.	7 months
Kick-off fall campaign; run on while-supplies- last basis.	7 months
Issue RFP to select retailer partners for spring markdown campaign	7 months
LED holiday lighting campaign kick-off	9 months
Complete negotiations with retailers for spring campaign.	10 months
Recruit and secure product orders from independent retailers for fall campaign.	11 months
Distribution of marketing materials to retailers for spring campaign.	1 year
Kick-off spring campaign.	13 months
Appliance Tasks	**Timeframe**
DSM Plan Approval	TBD
Selection of Program Implementation Contractor	3 months
Program planning and materials	6 months
Program launch – distribute materials to retailers	7 months
HVAC Tasks	**Timeframe**
DSM Plan Approval	TBD
Selection of Program Implementation Contractor	3 months
Program planning and materials	6 months
Initial mailing of program materials to contractors.	7 months
Telephone calls to targeted contractors to ensure they receive materials and to answer questions.	7 ½ months
In person outreach to contractors begins.	7 ½ months
Domestic Hot Water Tasks	**Timeframe**
DSM Plan Approval	TBD
Selection of Program Implementation Contractor	3 months
Program planning and materials	6 months
Initial mailing of materials to retailers and contractors	7 months
Follow-up telephone calls to contractors and retailers	7 ½ months
In person visits to retailers and contractors begins	7 ½ months

EM&V Strategy

All evaluation activities would be conducted by a third party contractor selected through a competitive bidding process. An integrated evaluation approach would 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 process evaluation would be conducted during the first program year and then coordinated with follow-on 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. Wherever it is possible, practical, and appropriate, evaluation activities would be conducted in conjunction with other utilities and agencies in the State to share funding of studies and help ensure consistency.

Self-report surveys with both participants and nonparticipants would be used to assess free riders/spillover as well as program delivery issues such ease of purchase and satisfaction of the products under normal use conditions. These surveys would be enhanced by collecting market data and assessing trends. Interviews with program mangers, the implementation contractor and trade allies such as retailers would be conducted to assess the operational conditions of the program and to identify ways to improve the program. These surveys would be enhanced by collecting market data and assessing trends.

Lighting: The overall goal of the impact evaluation would 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. Deemed savings would be determined by a literature and data review, analysis of program records and conducting a light logger study with a selected sample of participants. Primary research to assess the impact of variables such as baseline bulb conditions, CFL use and storage conditions, and location would also be conducted.

Appliances: The overall goal of the impact evaluation would 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. Deemed savings would be determined by a literature and data review, analysis of program records and conducting research and analysis of a sample of appliances turned in for recycling.

HVAC: The overall goal of the impact evaluation would be to assess the degree of change in sales of more efficient HVAC equipment above what would have occurred in the market without the program, validate/calibrate the deemed savings values, and determine program cost-effectiveness. Primary impact metrics are increase in sales/penetration of more efficient HVAC equipment, savings per unit, program participants, net-to-gross ratio and program cost-effectiveness.

A market practice baseline study of sales of higher efficiency HVAC equipment would be conducted and changes in sales of equipment will be tracked by regular interviews with contractors. Estimates of deemed savings would be assessed through a literature and data review and field research of a sample of participants.

Water Heating: The overall goal of the impact evaluation would be to assess the energy savings for each type of water heating system and determine program cost-effectiveness. Primary impact metrics are savings per efficient system, program participants, net-to-gross ratio and program cost-effectiveness. Field research of a sample of participants and non-participants would be conducted to determine the impact of variables such as age and size of equipment replaced, income levels, and number of members of the household. This information would be input to an econometric/billing analysis of a sample of participants and non-participants to determine energy savings for the different types of water heating systems.

Administrative Requirements

APCo West Virginia would be responsible for general administrative oversight of the program portfolio. It is estimated that a 0.75 full-time equivalent (FTE) would be required for program oversight. Key oversight functions include:

- Recruitment, selection, and management of the implementation contractor(s)
- Coordination of marketing strategy/public relations among programs and market sectors
- Development and placement of marketing materials with input from the implementation contractor.
- Coordination of all educational services
- Data warehousing
- Recruitment, selection, and management of the evaluation contractor
- Goal achievement within budget

Budget

Table 6-B. Incremental Annual Budgets

Incremental Annual Budget – Total					
2009	2010	2011	2012	2013	Total 2009-2013
$690,676	$1,187,034	$1,797,934	$2,143,230	$2,231,704	$8,050,577

Incremental Annual Budget – Customer Incentive					
2009	2010	2011	2012	2013	Total 2009-2013
$325,831	$547,639	$868,630	$1,093,746	$1,144,953	$3,980,798

Incremental Annual Budget – Administrative					
2009	2010	2011	2012	2013	Total 2009-2013
$364,845	$639,395	$929,304	$1,049,484	$1,086,750	$4,069,779

Winter Savings Targets

Table 6-C. Incremental Net Annual Energy and Peak Demand Savings at Generator

Incremental Annual Energy Savings Net MWh (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
8,292	15,985	23,233	19,791	20,587	87,887

Incremental Annual Peak Demand Savings Net kW (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
806	1,585	2,199	1,790	1,867	8,247

Benefit-Cost Test Results

Table 6-D. Benefit-Cost Test Results

Benefit-Cost Test	2009-2013 Benefit-Cost Test Ratio
Total Resource Cost Test (TRC)	2.3
Utility System Resource Cost	3.6
Participant	6.3
Rate Impact Measure (RIM)	0.5

6.1.2 Residential Refrigerator/Freezer Turn-In Recycling Program

Objective

Produce long-term electric energy savings in the residential sector by permanently removing operable second refrigerators and freezers from the power grid and recycling them in an environmentally safe manner.

Target Market

Residential or small commercial customers who are currently operating second refrigerators and/or freezers.

Program Duration

The Refrigerator/Freezer Turn-In Program would be an ongoing element of the program portfolio.

Program Description

The average household replaces a refrigerator every ten years. However, many of the refrigerators being replaced are still functioning, so they often become backup appliances – energy guzzlers in basements and garages – or sold in a used-market. The Turn-In Program would be established to target those "second" refrigerators and freezers, providing the dual benefit of cutting energy consumption and keeping the appliances out of the used-market. Research results from impact evaluations on five refrigerator recycling programs indicate significant savings potential for this program. An appliance-recycling contractor provides turn-key implementation services that include verification of customer eligibility, scheduling of pick-up appointments, appliance pick-up, and recycling services.

Incentive Strategy

The customer would be offered free pick up and recycling of their old operable second refrigerators and freezers. Typically the customer would pay a municipal fee for appropriate disposal of the unit so the free service provides an additional value to the customer of approximately $35. In addition, the customer would be offered a cash rebate to further motivate the turn-in of operable units.

Eligible Measures

The measures listed below have been specified for planning purposes. The utility would revise eligible measures as needed in accordance with current market conditions, technology development, EM&V results, and program implementation experience.

Implementation Strategy

Key elements of the implementation strategy include:

- ***Turn-key appliance pick-up/recycling:*** The utility would select an implementation contractor to provide comprehensive, turn-key implementation services from eligibility verification and scheduling of pick-ups to proper disposal and recycling of turned-in appliances.

- ***Incentive coordination and processing***: The utility's implementation contractor would coordinate prompt processing of incentive payments. As prompt incentive payment is essential to retailer/customer satisfaction, the implementation contractor will establish protocols and service level requirements that expedite payment.

To minimize free-ridership, the program would use marketing messages targeted at consumers with "second" refrigerators and freezers. Mass marketing emphasizing the cost of operating second refrigerators/freezers also has the potential to increase spillover impacts. The program would not be marketed at retail point-of-sale, thus avoiding the situation where retailers are only promoting the service as convenient disposal for an appliance they are replacing regardless of the program.

Implementation-related administrative requirements would be handled by a third party implementation contractor, selected through a competitive bid process. The implementation contractor would be responsible for:

- Management of the scheduling, pick-up, and appliance recycling processes
- Marketing strategy and messaging
- Incentive processing
- Data tracking and reporting
- Budget tracking and reporting
- Contact (call) center services
- Managing public relations
- Customer satisfaction/Problem resolution

APCo West Virginia would manage the development and placement of promotional materials, advertising, and public relations activities.

Marketing Strategy

All marketing materials would carry a strong consumer education message emphasizing the cost of operating "second" refrigerators and freezers and older, inefficient appliances, the benefits of early replacement with ENERGY STAR qualified models, and the importance of proper disposal and recycling of older units. Marketing materials would leverage the ENERGY STAR brand, which enjoys a high level of consumer recognition and favorable associations. Key elements of the marketing strategy include:

- Direct consumer marketing through the utility's website and bill insert newsletter
- Website links to EPA's new "ENERGY STAR Recycle My Old Fridge Campaign" at www.recyclemyoldfridge.com. Includes calculators to estimate savings
- Press releases
- Mass media advertising including print, radio, and/or television.

Milestones

Table 6-E. Project Milestones

Task	Timeframe
DSM Plan Approval	TBD
Selection of program implementation contractor	1 year
Program materials and advertising developed and placed	1 ½ years
Program Launch – Marketing	2 years
First Appliance Pick-Up	2 years

EM&V Strategy

All evaluation activities would be conducted by a third party contractor selected through a competitive bidding process. An integrated evaluation approach would 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 would be to validate/calibrate the deemed savings values and determine program cost-effectiveness. Primary impact metrics are savings per unit, program participants, net-to-gross ratio and program cost-effectiveness. Deemed savings for refrigerators and freezers would be determined by a literature and data review, analysis of program records and testing a sample of equipment picked up for recycling. Primary research may be conducted to determine the impact of variables such as size of refrigerator, effective life of the equipment, and owner utilization. Self-report surveys with both participants and nonparticipants would be used to assess free riders/spillover, program awareness, barriers to participation, participant satisfaction, and other process efficiency issues. Interviews would also be conducted with program managers and implementation contractors. These surveys would be enhanced by collecting market data and assessing trends.

The process evaluation would be conducted during the first program year and then coordinated with follow-on 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. Wherever it is possible, practical, and appropriate, evaluation activities would be conducted in conjunction with other utilities and agencies in the State to share funding of studies and help ensure consistency.

Administrative Requirements

The utility would be responsible for general administrative oversight of the program portfolio, which would require approximately 0.25 FTE, to address the following:

- Recruitment, selection, and management of the implementation contractor(s)
- Coordination of marketing strategy/public relations among programs and market sectors
- Development and placement of marketing materials and advertising
- Data warehousing
- Recruitment, selection, and management of the evaluation contractor

- Goal achievement within budget

Budget

Table 6-F. Incremental Annual Budgets

Incremental Annual Budget – Total					
2009	2010	2011	2012	2013	Total 2009-2013
$66,277	$221,470	$214,374	$207,623	$201,059	$910,803

Incremental Annual Budget – Customer Incentive					
2009	2010	2011	2012	2013	Total 2009-2013
$10,196	$36,912	$35,729	$34,604	$33,510	$150,951

Incremental Annual Budget – Administrative					
2009	2010	2011	2012	2013	Total 2009-2013
$56,080	$184,558	$178,645	$173,019	$167,549	$759,852

Winter Savings Targets

Table 6-G. Incremental Net Annual Energy and Peak Demand Savings at Generator

Incremental Annual Energy Savings Net MWh (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
266	964	933	903	875	3,941

Incremental Annual Peak Demand Savings Net kW (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
27	98	95	92	89	402

Benefit-Cost Test Results

Table 6-H. Benefit-Cost Test Results

Benefit-Cost Test	2009-2013 Benefit-Cost Test Ratio
Total Resource Cost Test (TRC)	1.1
Utility System Resource Cost	0.9
Participant	N/A
Rate Impact Measure (RIM)	0.0

6.1.3 Residential Home Retrofit Program

Objective

Produce long-term electric energy savings in the residential sector by helping customers analyze their energy use and recommending appropriate weatherization measures and the installation of high-efficiency lighting, appliances, and other equipment.

Target Market

Residential customers in existing single family homes and duplexes. The program targets promotion to customers with both above average consumption and mean household income to maximize savings impacts and the percentage of customers who implement improvements.

Program Duration

Components of the Home Retrofit Program would be phased in over three years in order to allow time for the development of contractor infrastructure sufficient to meet the program goals.

Program Description

The Home Retrofit Program would utilize a three-phase approach to capture savings in the single-family existing homes market.

Phase 1: On-Line Energy Analysis. Consumers would be invited to participate in an on-line energy analysis, the product of which is a report that explains how their electric bill is calculated, how their energy costs compare to other homes/businesses in the area, and disaggregates the various uses for electricity in their home to help them understand how they are using it. In addition, the report provides a prioritized list of recommended energy efficiency improvements that may reduce the customer's energy consumption. Armed with this information, consumers are better equipped to make informed decisions in managing their consumption, and identifying and prioritizing improvements.

A low-cost energy efficiency kit (e.g., two CFLs, one low-flow shower head, two faucet aerators) would be offered as an incentive for customers to complete a comprehensive online audit. Industry standard online audit software typically offers multiple levels of specificity that allow the customer to improve the accuracy of the report by providing additional data for analysis. Customers willing to complete the most comprehensive audit are more likely to install low-cost measures given the effort required.

Phase 2: Home Walk-Through Energy Analysis: The implementation contractor would provide customers with a one hour walk-through audit of their home, the product of which is a report detailing opportunities to improve their energy efficiency. The auditor would collect data on each home for use in identifying cost effective energy efficiency improvements using modeling software. The product of the audit would be a report that prioritizes potential improvements, estimates their cost after utility incentives are applied, and estimates the resulting energy cost savings and payback timeframe. The auditor would also install appropriate low-cost measures including CFLs and water-saving devices as a condition for participation in the initial audit.

The use of a blower door test at the time of the initial audit could be an area of discussion between APCo and the selected implementation contractor, as this detail of the program design could be an optional feature.

The implementation contractor would provide customers with two options for completing improvements identified through the energy audit. They may either:

(1) choose a contractor from a prequalified list of contractors with pre-negotiated rates in which case the program will manage the project to provide a turn-key service, or

(2) select a contractor from another list of pre-approved contractors as qualified by APCo.

However, customers would need to solicit quotes for work from contractors on their own, or choose to go into the marketplace and select and manage their own contractors. The utility would consider a small fee for the walk-through analysis, reimbursable if the customer proceeds with a number of recommended measures.

Prequalified "captive" contractors would be selected through a competitive bid process based on their level of expertise and piecemeal price for specified improvements. Utilizing a core group of captive contractors to provide turnkey direct installation services would improve installation rates as the time and effort required to select and manage contractors is a key barrier to consumers implementing improvements. Further, it would allow the utility to closely manage customer service and quality control to ensure measures are properly installed. Finally, it is expected that the utility would negotiate more favorable rates with captive contractors than customers would be able to secure in the open market due to the volume of work the program will generate. While initially it is anticipated that the implementation contractor would be the lead in conducting the audit and negotiating and selecting "captive contractors", it is envisioned that overtime, this function would be transferred to leading private sector contractors who can provide a similar service.

Potential improvements that are not immediately addressed by consumers would be tracked and the data used for hyper-accurate targeting of future promotion. For example, APCo West Virginia may implement an ongoing direct mail campaign including a letter that is periodically sent to a customer reminding them of the additional energy cost they have incurred as a result of not implementing an improvement. Bonus incentives may be offered during limited term promotions in conjunction with the campaign as a means to ramp up participation and manage goals and budgets.

Phase 3: Home Performance with ENERGY STAR: The utility's implementation contractor would assist with the coordinated development of a statewide network of independent contractors who are trained and mentored on the delivery of a comprehensive energy analysis and measure installation under the Home Performance with ENERGY STAR model. This phase would be staged over three years, focusing initially on training contractors to Building Performance Institute (BPI) standards on building science, and over time focusing on marketing and incentive packages to accelerate customer awareness and demand. Customers would pay a market-based fee for the analysis and may receive partial reimbursement when recommendations are implemented.

Financial incentives for building shell measures would be available to homeowners, along with the lighting, appliance, and equipment incentives outlined in the market-channel programs. The utility may also offer low-interest financing in lieu of rebates.

Incentive Strategy

The on-line energy analysis would be provided free of charge to all residential customers. The walk-through energy analysis would have a fee associated with it (e.g., $150) in order to represent the value of the service to customers and help screen those that are unlikely to implement improvements. Participants who implement at least $1,000 worth of measures as a result of the analysis would have the audit fee reimbursed. The comprehensive home performance analysis would have a market-based fee structure, again with reimbursement for measures implemented.

Consumers would also receive financial incentives for implementing the building shell measures listed below. The utility may also offer low interest financing through local financial institutions as an alternative to cash-back incentives.

Eligible Measures

The measures listed below have been specified for planning purposes. The utility would revise eligible measures as needed in accordance with current market conditions, technology development, EM&V results, and program implementation experience.

Measures addressed will include:

- Low Cost Measure Kit
- Attic Insulation
- Basement Wall Insulation
- Crawlspace Insulation
- Sidewall Insulation
- Air Infiltration Reduction
- Furnace replacement

Implementation Strategy

Key elements of the implementation strategy include:

- ***Purchase and installation of On-Line Energy Analysis.*** The utility would purchase online audit software from a credible vendor. The cost for the on-line analysis will be accounted for in this program and with associated savings.
- ***Hiring and training of energy advisors for walk-through analysis.*** For Phase 2 of the program, APCo West Virginia's implementation contractor would recruit and train a team of residential energy advisors to deliver walk-through analyses and provide direct installation of low-cost measures. The contractor would also develop/provide a report format for the customer and arrange competitive pricing with local contractors for the weatherization work.
- ***Captive installation contractor recruitment and training.*** APCo West Virginia's implementation contractor would facilitate the recruitment of HVAC, water heating, and insulation contractors to provide turn-key services through a competitive bid process which will be conducted on an annual basis. These contractors would be provided with training on best practices and will be subject to quality control inspections to ensure the quality of work and integrity of savings claimed.
- ***Market based contractor training.*** The implementation contractor would provide opportunities for any interested contractor to receive training on best practices and program terms and conditions to also become a qualified contractor

- ***Application processing***. APCo West Virginia's implementation contractor would coordinate processing of all incentive applications, verification of eligibility and prompt delivery of rebate checks to contractors/customers.
- ***Development of market-based infrastructure of Home Performance contractors.*** APCo West Virginia's implementation contractor may coordinate with other State utilities to develop a strategy and system for recruiting and training Home Performance contractors.
- ***Collaboration with other utilities***: APCo would collaborate with other utilities when feasible to ensure coordination of home energy analyses so that both electric measures are addressed.

Strategies to limit free ridership and promote spillover include:

- The program would charge a fee for walk-through audits to represent the value of the service and to target customers who want to take action but feel they need more information before they're able to act.
- The program would offer incentives at a sufficient level to motivate customers who would not implement improvements in the absence of the program due to the first cost barrier.
- The program would utilize APCo's customer billing information to identify targeted high-use customers who are most likely to benefit from the audit program. Under confidentiality agreements, this data would be made available to the utility's implementation contractors to assist with targeted program marketing and research.

Implementation-related administrative requirements would be handled by a third party implementation contractor, selected through a competitive bid process. The implementation contractor would be responsible for:

- Energy Advisor recruitment and training
- Walk-through analysis, report, and scheduling tool
- Marketing strategy and materials
- Field services
- Contractor/store education, training and outreach
- Rebate processing
- Assist with development of network of Home Performance providers
- Data tracking and reporting
- Budget tracking and reporting
- Contact (call) center services
- Managing public relations
- Customer satisfaction/Problem resolution

Marketing Strategy

Three key marketing strategies are expected to drive participation in the program:

- Direct mail campaign targeted to specific geographic areas
- Utility newsletter bill inserts
- Program webpage
- Press releases in targeted communities

- Mass media advertising
- Through non-captive contractors

The program would rely primarily on targeted direct mail campaign to generate participation as this strategy allows for targeting by geographic area and customer and therefore greater control of workflow than mass media efforts. It is necessary to concentrate efforts on specific geographic areas to improve efficiency by ensuring auditors do not travel further than necessary between audits. Customers may be targeted for 2-3 successive mailings to maximize close rates. Utility bill inserts, mass media advertising, and press releases to targeted areas may be used on a limited basis to ramp up production as needed.

The program webpage and online bill analysis system would also promote the availability of the program to interested customers.

Contractors would be provided with information about the availability of the program and utility incentives through direct mail and periodic initiations to training sessions.

Milestones

Table 6-I. Project Milestones

Task	Timeframe
DSM Plan Approval	TBD
Selection of Program Implementation Contractor	3 months
Phase 1: On-Line Energy Analysis available to customers	8 months
Phase 2: Walk-through energy analysis available	8 months
Phase 2: Financial incentives for building shell measures available	1 year
Phase 3: Initial development of network of comprehensive Home Performance providers	2 years

EM&V Strategy

All evaluation activities would be conducted by a third party contractor selected through a competitive bidding process. An integrated evaluation approach would 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, market, and process evaluations.

The overall goal of the impact evaluation would be to assess the development of the market infrastructure, savings for the program measures, and program cost-effectiveness. Primary impact metrics are energy savings per unit, program/contractor participants, net-to-gross ratio and program cost-effectiveness. Energy savings would be determined by a literature and data review, billing analysis of participants compared to non-participants and conducting field research with a selected sample of participants. A baseline market survey of contractors would be conducted to determine current practices; this survey will be repeated regularly to assess changes in the market infrastructure. Self-report surveys with both participants and non-participants would be used to assess free riders/spillover and process variables such as barriers to participation, and satisfaction with the program delivery. In addition the process evaluation would interview program mangers and other trade allies to assess the delivery approach and operations. These surveys would be enhanced by collecting market data and assessing trends through secondary literature research.

The process evaluation would be conducted during the first program year and then coordinated with follow-on 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. Wherever it is possible, practical, and appropriate, evaluation activities would be conducted in conjunction with other utilities and agencies in the state to share funding of studies and help ensure consistency.

Administrative Requirements

The utility would be responsible for general administrative oversight of the program portfolio which will require 0.25 FTE to address the following:

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

Budget

Table 6-J. Incremental Annual Budgets

Incremental Annual Budget – Total					
2009	2010	2011	2012	2013	Total 2009-2013
$1,522,492	$1,690,103	$2,021,534	$2,700,284	$3,803,563	$11,737,977

Incremental Annual Budget – Customer Incentive					
2009	2010	2011	2012	2013	Total 2009-2013
$724,996	$845,051	$1,010,767	$1,350,142	$1,901,782	$5,832,739

Incremental Annual Budget – Administrative					
2009	2010	2011	2012	2013	Total 2009-2013
$797,496	$845,051	$1,010,767	$1,350,142	$1,901,782	$5,905,238

Winter Savings Targets

Table 6-K. Incremental Net Annual Energy and Peak Demand Savings at Generator

Incremental Annual Energy Savings Net MWh (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
5,843	7,324	8,980	12,392	16,452	50,992

Incremental Annual Peak Demand Savings Net kW (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
4,254	4,925	5,731	7,387	10,770	33,067

Benefit-Cost Test Results

Table 6-L. Benefit-Cost Test Results

Benefit-Cost Test	2009-2013 Benefit-Cost Test Ratio
Total Resource Cost Test (TRC)	2.4
Utility System Resource Cost	3.6
Participant	3.6
Rate Impact Measure (RIM)	0.9

6.1.4 Residential Low Income Program

Objective

Generate energy savings for residential low-income customers through installation of a wide range of cost-effective weatherization upgrades and other measures in eligible dwellings.

Enhance services available to low-income customers in APCo West Virginia service territory through a coordinated effort with local weatherization providers in order to provide comprehensive assistance at lower administration costs.

Target Market

The ***APCo Low Income Program*** targets moderate and high use customers with total annual household at or below 200% of federal poverty guidelines who receive electric service from APCo West Virginia. Services would be targeted to diverse segments of the population including those living in single family and multi-family buildings, homeowners and renters, and to the extent possible – age and geographic diversity. Customers between 200% and 225% of federal poverty level who are high use would be eligible for services with co-payment.

Program Duration

To be determined.

Program Description

The Low Income Program is designed to provide home energy services to APCo West Virginia customers with limited income to assist them in reducing their electric energy use and managing their utility costs. This program would help facilitate the implementation of cost-effective electrical energy-savings measures in residential low-income households.

The APCo West Virginia program would be based on successful low-income programs of other utilities. In recognition of the need for effective integration with existing services, the program has the following components:

Measures addressed will include:

- High Use Baseload service is targeted toward eligible customers with high electric baseload (non heating/cooling) usage, defined as greater than 8,000 kWh/year, and includes extensive lighting retrofits, replacement of inefficient refrigerators and freezers, electric hot water reduction measures, and energy education.
- Moderate Use Baseload service is targeted toward eligible customers with annual baseload usage of between 4,000 and 8,000 kWh and includes the same measures as the High Use program, but allows for a more streamlined energy audit process.
- Targeted Energy Efficiency (TEE) service is targeted toward eligible customers with moderate or high electric heating and cooling loads (defined as greater than 6,000 kWh/yr in heating or cooling) that, in addition to the baseload measures, provides weatherization of the building shell including insulation and air sealing.

Low-income customers would not be required to pay for any portion of the cost of measures installed through the program. While the plan anticipates APCo playing an important role as a key program partner, it is understood that an independent implementation contractor would retain overall responsibility for program administration.

Incentive Strategy

Equipment and installation costs for all eligible measures would be provided free to eligible customers and properties. All funding for the program would be provided by APCo West Virginia.

Eligible Measures

The measures listed below have been specified for planning purposes. The utility would revise eligible measures as needed in accordance with current market conditions, technology development, EM&V results, and program implementation experience.

Each of the program channels is summarized below as they are planned to be delivered to customers along with the associated measures. The list below has been specified for planning purposes only. The utility would establish eligible measures and incentive levels as needed in accordance with current market conditions, planning studies, technology development, EM&V results, and program implementation experience.

Electric Baseload Measures

- Compact fluorescent lamps (screw-in and pin-based fixtures)
- Refrigerator and freezer replacement
- Low-flow showerheads
- Faucet aerators
- Water heater insulation
- Pipe insulation
- Tank temperature turn reduction
- Water bed mattress pads

Weatherization Measures

- High-efficiency furnace with ECM motor
- Attic and wall insulation
- Crawlspace insulation
- Air sealing
- Duct sealing

Implementation Strategy

Program administration and implementation would be conducted by a qualified implementation contractor. The implementation contractor would be responsible for:

- Administrative coordination with local agencies
- Marketing strategy and materials
- Payment processing
- Data tracking and reporting
- Budget tracking and reporting
- Contact (call) center services

- Managing public relations
- Customer satisfaction/problem resolution

Implementation would be managed by qualified, third-party contractor(s) selected through a competitive bid process. The utility's implementation contractor would schedule a visit with the customers and send out a crew of installers to deliver services on a case-by-case basis. Most customers would receive one in-home visit. This visit would include an introduction to the program, an analysis of the customer's usage, an energy tour, energy education and an action plan. Following the visit, all customers would receive at least one follow-up contact. The follow-up contact can be via mail, phone, or in-person, based on an assessment of which would be of most benefit to the customers. The purpose of this follow-up is to complete the installation of efficiency measures, to remind customers of their responsibilities and to review the benefits of the program.

Key elements of the implementation strategy include:

- ***Coordination*** with the local weatherization providers to subsidize the installation of all cost-effective electric measures, including CFLs, refrigerator replacement and weatherization measures that can reduce electric heating use. Payments would be made directly to the weatherization agency for all implemented electric measures. Funds would also be available to supplement the agency's educational services currently provided. Agencies would be responsible for all necessary data collection (forms to be developed by APCo West Virginia and the implementation contractors), providing a detailed breakdown of measures installed, invoices, customer release forms, and other information deemed necessary by APCo West Virginia to document energy savings and cost.
- ***Recruitment and hiring of private-sector contractors*** by APCo West Virginia's implementation contractor(s), using a competitive bid process to engage private-sector contractors to manage work in areas where local providers are unable to manage the volume of additional homes.
- ***Target*** occupants of single and multi-family properties with low-income residents to provide the turnkey direct install services for individual living units and common areas.
- ***Training*** will be available for all staff, as insured by the implementation contractor. Additionally, the implementation contractor would provide in-field monitoring and training, to ensure that field staff is finding all cost-effective opportunities for measures, as well as educating customers on energy savings actions. Where deficiencies are seen, the implementation contractor would provide supplemental training.

Marketing Strategy

Currently customers are selected and recruited based on an analysis of Percentage of Income Payment Plan (PIPP) customer electric usage data provided by the utilities to the State agency that coordinates low income weatherization program services. The APCo Low Income Program would recruit customers based on an analysis of Percentage of Income Payment Plan (PIPP), for those customers falling under 175% of poverty level. Additionally, the APCo Low Income Program would serve customers up to 200% of poverty level, who are currently outside the reach of current programs.

Additional marketing efforts would target those hard-to-reach segments of the population and would build on existing efforts and be closely coordinated with local providers. Key elements of the marketing strategy include:

- Targeted outreach through local agencies

- Websites and newsletters
- Press release
- Posters in municipal buildings

Milestones

Table 6-M. Project Milestones

Tasks	Timeframe
DSM Plan Approval	TBD
Selection of Program Implementation Contractor	3 months
Initial meetings with local weatherization agencies	4 months
Program launch	6 months

EM&V Strategy

All evaluation activities would be conducted by a third party contractor selected through a competitive bidding process. An integrated evaluation approach would 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, 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 would be to validate/re-calibrate the deemed energy savings values, verify installation and determine program cost-effectiveness. Primary impact metrics are savings per unit, program participants, and program cost-effectiveness. Surveys with program managers, contractors, owners of multi-family properties and other trades allies would be conducted to address process efficiency such as ease of participation, satisfaction, the operational conditions of the program and ways to improve the program.

The process evaluation would be conducted during the first program year and then coordinated with follow-on 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. Wherever it is possible, practical, and appropriate, evaluation activities would be conducted in conjunction with other utilities and agencies in the state to share funding of studies and help ensure consistency.

Administrative Requirements

The utility will be responsible for general administrative oversight of the program which would require 1.0 FTE to address:

- Recruitment, selection, and management of the implementation contractor(s)
- Coordination of marketing strategy/public relations among programs and market sectors
- Development and placement of marketing materials with input from the implementation contractor.
- Coordination of all educational services
- Data warehousing
- Recruitment, selection, and management of the evaluation contractor

- Goal achievement within budget

Budget

Table 6-N. Incremental Annual Budgets

Incremental Annual Budget – Total					
2009	2010	2011	2012	2013	Total 2009-2013
$1,813,112	$2,073,927	$2,526,252	$3,313,837	$4,589,968	$14,317,095

Incremental Annual Budget – Customer Incentive					
2009	2010	2011	2012	2013	Total 2009-2013
$863,187	$1,030,244	$1,254,901	$1,654,880	$2,296,498	$7,099,709

Incremental Annual Budget – Administrative					
2009	2010	2011	2012	2013	Total 2009-2013
$949,925	$1,043,683	$1,271,351	$1,658,958	$2,293,470	$7,217,386

Winter Savings Targets

Table 6-O. Incremental Net Annual Energy and Peak Demand Savings at Generator

Incremental Annual Energy Savings Net MWh (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
4,057	5,396	6,984	8,576	11,059	36,072

Incremental Annual Peak Demand Savings Net kW (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
2,429	2,821	3,318	4,200	6,121	18,889

Benefit-Cost Test Results

Table 6-P. Benefit-Cost Test Results

Benefit-Cost Test	2009-2013 Benefit-Cost Test Ratio
Total Resource Cost Test (TRC)	2.4
Utility System Resource Cost	3.6
Participant	3.9
Rate Impact Measure (RIM)	0.8

6.1.5 Residential New Construction Program

Objective

Produce long-term electric energy savings in the residential sector by affecting the construction of single family homes and duplexes that meet the ENERGY STAR National Performance Path efficiency standard.

Target Market

New homebuilders. Although all builders are eligible to participate, the program will specifically target all outreach activities to those builders who are not currently Tier 1 ENERGY STAR partners, meaning not every home they build meets the standard.

Program Duration

New construction services would be an ongoing element of the program portfolio. Services would begin in Year 1, though due to the long lead time required to train builders, for them to sell customers new ENERGY STAR homes, and to build the homes, we do not anticipate significant savings from this program until at least summer 2010.

Program Description

The New Construction program would recruit and educate select builders and their trades on the benefits associated with ENERGY STAR homes and building practices designed to improve upon baseline efficiency. Builders would be provided with financial incentives to meet the ENERGY STAR standard and to install premium-level efficient equipment.

The program would 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 would gain access to cash-back incentives designed to cover approximately 30% of the cost to upgrade and certify each home. In addition, they would be provided with personalized training on marketing ENERGY STAR to customers, the ENERGY STAR building standards, and building practices designed to meet them.

Incentive Strategy

A tiered incentive structure is planned for the New Construction program: $500 for ENERGY STAR Homes that achieve a HERS Rating Index ≤ 85, and $1000 for ENERGY STAR Homes that achieve a HERS Score ≤ 70. The intent is to encourage builders to strive for the higher standard (i.e. lower score), which results in nearly twice the first year savings. Builders would have to meet all requirements of the ENERGY STAR National Performance Path standard.

Due to economic conditions in APCo West Virginia's service territory, builders would also be allowed to participate in prescriptive incentive offers through the water heating and HVAC programs regardless if the technologies they claim incentives on were installed as part of the requirement to meet the ENERGY STAR homes standard. To be clear, double dipping would be allowed, at least at the out-set of the program as a way to jump-start program participation.

The program would also provide an incentive of $100 to Home Energy Raters on up to 5 ratings done for builders who have not previously achieved the ENERGY STAR standard.

Eligible Measures

The measures listed below have been specified for planning purposes. The utility would revise eligible measures as needed in accordance with current market conditions, technology development, EM&V results, and program implementation experience.

Implementation Strategy

Key elements of the implementation strategy include:

- ***Recruit/train team of Home Energy Raters.*** The utility's implementation contractor would need to identify existing resources with appropriate training and experience. New raters may need to be trained as well to RESNET standards. This can be done simultaneously with builder recruitment.
- ***Outreach to targeted builders.*** The utility's implementation contractor would utilize experienced field representatives to meet with builders, promote the benefits of ENERGY STAR homes, and generate interest in the program.
- ***Conduct builder training on marketing ENERGY STAR homes.*** Participating builder training efforts would focus first on the benefits associated with ENERGY STAR from the customer perspective including: improved efficiency, comfort, safety, and durability. Sales training would equip each builder with methods to "up sell" their customers on investing in meeting the ENERGY STAR standard. Builders would also be educated regarding the opportunity to improve their business by differentiating themselves using the nationally recognized ENERGY STAR Brand.
- ***Conduct builder training on the ENERGY STAR performance standard.*** The second phase of the training process would focus on the ENERGY STAR standard and building practices designed to meet it. Key topics would include techniques for improving the building shell to minimize thermal loss and air infiltration, the thermal bypass checklist, and identifying high efficiency equipment and the principals of proper installation.
- ***Coach and mentor participating builders and raters.*** Once the initial training is complete, the program would provide technical assistance, market recognition and financial incentives to participating builders and their trade partners, and raters on an ongoing basis.

Strategies to limit free ridership and promote spillover include:

- To minimize free ridership, the program would target builders who do not currently meet the ENERGY STAR standard. Secondary targets would include builders who currently meet the ENERGY STAR standard, but only on a minority of homes. It is important to note that builders who already meet the ENERGY STAR standard on a majority of their homes would still be eligible to receive the incentives under this proposed scope of work. However all outreach would be targeted to builders who are unlikely to be free riders in order to achieve a balance between customer equity and maximizing net energy savings.
- To further limit free ridership, builders must install both a high efficiency water heater and furnace in each home to qualify for the new construction incentive.

Implementation-related administrative requirements would be handled by a third party implementation contractor, selected through a competitive bid process. The implementation contractor would be responsible for:

- Managing subcontractors
- Budget tracking
- Contact (call) center services

- Enforce customer service standards
- Data tracking systems
- Onsite verification of incentive claims
- Managing public relations
- Problem resolution
- Manage and oversee procurement
- Supporting evaluation activities

Marketing Strategy

The program would be marketed to select builders primarily through direct business-to-business contacts. The utility's implementation contractor would develop opportunities to present the program at builder and other trade association meetings, and to place information in association newsletters. The program would be marketed to consumers at Home Shows, Parade of Homes, and other home-building focused events.

Milestones

Table 6-Q. Project Milestones

Task	Timeframe
DSM Plan Approval	TBD
Selection of Program Implementation Contractor	3 months
Program planning and materials	7 months
Initial mailing to builders	8 months
Kickoff meetings with builders/trades	9 months
Program launch – new home season	9 months

EM&V Strategy

All evaluation activities would be conducted by a third party contractor selected through a competitive bidding process. An integrated evaluation approach would 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 would 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. Deemed savings would be determined by a literature and data review, analysis of program records and conducting a field research study with a selected sample of participants. Primary market research (self-report surveys) with both participants and non-participants would be used to assess free riders/spillover, awareness of the program, ease of participation and satisfaction with the program and other process efficiency issues. Interviews with program mangers, the implementation contractor, home builders, raters, and other market players would be conducted to assess the operational conditions of the program and to identify ways to improve the program delivery and participation. These surveys would be enhanced by collecting market data and assessing trends.

The process evaluation would be conducted during the first program year and then coordinated with follow-on 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. Wherever it is possible, practical, and appropriate, evaluation activities would be conducted in conjunction with other utilities and agencies in the state to share funding of studies and help ensure consistency.

Administrative Requirements

The utility will be responsible for general administrative oversight of the program portfolio which would require 0.25 FTE to address the following:

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

Budget

Table 6-R. Incremental Annual Budgets

Incremental Annual Budget – Total					
2009	2010	2011	2012	2013	Total 2009-2013
$19,223	$16,303	$6,336	$99,377	$79,868	$221,108

Incremental Annual Budget – Customer Incentive					
2009	2010	2011	2012	2013	Total 2009-2013
$9,154	$8,151	$3,168	$49,689	$39,934	$110,096

Incremental Annual Budget – Administrative					
2009	2010	2011	2012	2013	Total 2009-2013
$10,069	$8,151	$3,168	$49,689	$39,934	$111,012

Winter Savings Targets

Table 6-S. Incremental Net Annual Energy and Peak Demand Savings at Generator

Incremental Annual Energy Savings Net MWh (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
234	216	86	967	759	2,262

Incremental Annual Peak Demand Savings Net kW (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
22	20	8	84	67	201

Benefit-Cost Test Results

Table 6-T. Benefit-Cost Test Results

Benefit-Cost Test	2009-2013 Benefit-Cost Test Ratio
Total Resource Cost Test (TRC)	2.4
Utility System Resource Cost	3.7
Participant	6.8
Rate Impact Measure (RIM)	0.5

6.1.6 Residential Load Cycling Program

Objective

To produce long-term electric demand savings in the residential sector by encouraging APCo West Virginia residential customers to both shift their load away from peak demand periods and to reduce overall demand on the system during that peak period. This program also aims to increase the knowledge of the benefits of demand response within the residential customer base.

Target Market

The Residential Load Cycling Program targets existing APCo West Virginia residential customers with electric hot water heaters, central air conditioning (CAC) or heat pump systems (HPs), in single-family housing.

Program Duration

The Load Cycling Program would be an ongoing element of the program portfolio.

Program Description

The Load Cycling Program would provide rate discounts to residential customers for allowing APCo West Virginia to cycle customers' electric hot water heaters, central air conditioners or heat pumps during peak summer or peak winter demand periods. Equipment control would either be done through enhanced programmable thermostats or installed switches to the air conditioning or heat pump system.

The program includes customer educational and promotional pieces designed to assist home owners in understanding the program and its benefits, including website content, brochures, and other targeted program material. The program would also provide a marketing mechanism for HVAC and domestic hot water equipment vendors, distributors, and contractors to promote direct load control technologies to residential end-users.

Certain barriers exist to the adoption of load cycling equipment, including lack of awareness/knowledge about the benefits and costs of load cycling technologies and technology performance uncertainties. This program is designed to help overcome these barriers and encourage greater adoption of enabling technologies in the residential market. This would be addressed through targeted education and economic incentives, combined with customer follow-up and on-going support.

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

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

Incentive Strategy

The primary incentives for this program are rate discounts of $12.50 per unit per summer or winter month for residential customers for air conditioning or heat pumps and $12.20 per electric hot water heater. Customers may also be provided with a $150 remote-controlled thermostat, free of charge, in homes with central air conditioning or heat pumps in certain zip codes, given optimal thermostat signal reception.

Eligible Measures

Single family customers with electric hot water heating, central air conditioning or heat pump units would be eligible to receive either APCo-specified switching technology and/or enhanced programmable thermostats. The table below shows the cost of the program incentive and the technology cost incurred by APCo for switch or programmable thermostat technology.

Implementation Strategy

Designated APCo West Virginia staff would provide the following implementation activities: program administration, marketing, vendor referrals, application and incentive processing, coordination of education and training program, participation tracking and reporting, quality control, and technical support.

Alternatively, APCo West Virginia could outsource the program to an "implementation contractor". APCo West Virginia would also likely want to sub-contract the DLC switch installation to HVAC, hot water heating, or electrical contractors.

The Residential Load Cycling Program includes customer educational pieces that are designed to communicate the function and benefits of the enabling technologies, the incentives that are being offered, and how the program as a whole functions in concert with the customer's electricity use. This type of education and promotion is also provided to trade allies and HVAC/hot water heating equipment contractors.

Marketing Strategy

The marketing and communications strategy would be designed to educate residential customers about the participation process and benefits of the Load Cycling Program. The strategy would include targeted outreach to customers directly and to customers via local HVAC and hot water heating businesses. Specifically, the marketing and communications strategy would include:

- Customer and HVAC/hot water heating trade ally brochure(s)
- Web content on program
- Direct mail and outreach to customers, including: targeted brochures detailing how they can apply to program and the benefits of program
- Program application forms, worksheets, contact information
- APCo website content that includes full program details, contact information, downloadable materials and applications, and links to other relevant service and information resources

The marketing strategy would also identify key customer segments and groups for target marketing and would prepare specific outreach activities for these customers.

APCo would design and develop the content, messaging, branding, and calls-to- action for all of the marketing and communication materials used to promote the program.

HVAC/hot water heating companies/contractors that sell and maintain central air conditioning or heat pump systems would be targeted and trained to advise their residential customers about the Load Cycling Program as the customer purchases, replaces, or repairs a given system. HVAC/hot water heating companies/contractors would receive educational materials to share with their customers through an initial mailing campaign, kick-off meetings, and in-person visits by trade allies.

Milestones

The following chart shows the timeline for the key program milestones and program advancement activities. These dates are subject to change, but it is essential that the program is launched with sufficient lead time for the heating season.

Table 6-U. Project Milestones

Tasks	Timeframe
DSM Plan Approval	TBD
Selection of Program Implementation Contractor	3 months
Program planning and materials	7 months
Initial mailing to A/C contractors/trade allies	8 months
Kickoff meetings with contractors/trade allies	9 months
Program launch – heating or cooling season	9 months

EM&V Strategy

All evaluation activities would be conducted by a third party contractor selected through a competitive bidding process. An integrated evaluation approach would 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 would 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. Deemed savings would be determined by a literature and data review, analysis of program records and conducting a field research study with a selected sample of participants. Primary market research (self-report surveys) with both participants and non-participants would be used to assess free riders/spillover, awareness of the program, ease of participation and satisfaction with the program and other process efficiency issues. Interviews with program mangers, the implementation contractor, home builders, raters, and other market players would be conducted to assess the operational conditions of the program and to identify ways to improve the program delivery and participation. These surveys would be enhanced by collecting market data and assessing trends.

The process evaluation would be conducted during the first program year and then coordinated with follow-on 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. Wherever it is possible, practical, and appropriate, evaluation activities would be conducted in conjunction with other utilities and agencies in the state to share funding of studies and help ensure consistency.

Administrative Requirements

APCo would be responsible for general administrative oversight of the program portfolio. It is estimated that a 0.5 full-time equivalent (FTE) would be required for program oversight. Key oversight functions include:

- Recruitment, selection, and management of the implementation contractor(s)
- Coordination of marketing strategy/public relations among programs and market sectors
- Development and placement of marketing materials with input from the implementation contractor
- Coordination of all educational services
- Data warehousing
- Recruitment, selection, and management of the evaluation contractor
- Goal achievement within budget

Budget

Table 6-V. Incremental Annual Budgets

Incremental Annual Budget – Total					
2009	2010	2011	2012	2013	Total 2009-2013
$717,733	$950,148	$1,155,643	$1,432,144	$1,816,575	$6,072,242

Incremental DLC Credits					
2009	2010	2011	2012	2013	Total 2009-2013
$236,519	$471,687	$697,076	$939,308	$1,228,400	$3,572,989

Incremental Annual Budget – Administrative					
2009	2010	2011	2012	2013	Total 2009-2013
$481,213	$478,462	$458,567	$492,836	$588,175	$2,499,253

Winter Savings Targets

Table 6-W. Incremental Net Annual Energy and Peak Demand Savings at Generator

Incremental Annual Peak Demand Savings Net kW (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
4,029	4,006	3,839	4,126	4,925	20,925

Benefit-Cost Test Results

Table 6-X. Benefit-Cost Test Results

Benefit-Cost Test	2009-2013 Benefit-Cost Test Ratio
Total Resource Cost Test (TRC)	1.5
Utility System Resource Cost	4.2
Participant	1.5
Rate Impact Measure (RIM)	1.1

6.2 Commercial & Industrial Programs

6.2.1 C&I Prescriptive Incentive Program

Objective

Generate energy savings for all commercial and industrial (C&I) customers through promotion of high efficiency electric lighting, HVAC, and motors. There are three primary objectives for this program:

- Increase the market share of commercial grade high efficiency technologies sold through market channels.
- Increase the installation rate of high efficiency technologies in C&I facilities by businesses that would not have done so in the absence of the program.
- Improve operating energy efficiency of existing long life equipment to ensure peak operating efficiency for C&I customers.

Target Market

All C&I customers would be eligible to participate in this incentive program when they purchase qualifying equipment or services. Generally, the program is designed to offer cross cutting technologies that address a variety of market sectors and industries. Proactive outreach efforts will utilize a targeted strategy to influence specific market participants.

- Market Providers (wholesalers, distributors, contractors, trade allies, and retailers that market qualifying technologies) of various products would be recruited to promote program awareness and participation among their end-use customers.
- High-impact/high-need customer sectors (such as schools, municipal buildings, hospitals, food service, and hospitality) to influence implementation of high efficiency equipment who would not have done so in the absence of the program.

Program Duration

The C&I Prescriptive Incentive Program would be an ongoing element of the program portfolio.

Program Description

Prescriptive incentive programs are designed to work through existing market channels to affect the installation of targeted technologies. Overall, market channels have a consistent means to drive customers to action and therefore apply to each of the market channels listed below unless otherwise noted. Regardless of the channel, each offers high efficiency technology alternatives to their standard equipment offerings.

The program would affect the purchase and installation of high-efficiency technologies through a combination of market push and pull strategies that stimulate market demand while simultaneously increasing market provider investment in stocking and promoting them in defined market channels. Additionally, vendors who service and maintain existing high energy use equipment such as HVAC technologies would be tapped to secure energy savings of operational equipment not ready for retrofit or replacement. These services would be offered in the market channel. The respective equipment would be delivered to the market.

The program would increase demand by educating C&I customers about the energy and money saving benefits associated with efficient products and equipping market providers to communicate those benefits directly to their customers. To address the first-cost barrier for customers, the program would utilize financial incentives (i.e., cash-back mail-in rebates) averaging 20% to 40% of the incremental cost of purchasing qualifying technologies.

The program would stimulate market provider investment in stocking and promoting efficient products through a targeted outreach effort. The program implementation staff will employ field sales representatives to proactively train and equip market providers to convey the energy and money saving benefits to consumers and communicate equipment eligibility requirements. Further, the existence of cash-back incentives will elevate efficiency to a competitive issue that would naturally motivate market providers to stock and promote targeted products.

The program would also address the C&I customers who would benefit from tune-up and corrective action to increase the efficiency of existing HVAC equipment in order to increase operational performance. Market providers would educate customers of the importance and benefits of equipment maintenance. Field representatives would also proactively train and equip the service provider.

Incentive Strategy

Three incentive strategies would allow the greatest flexibility to target opportunities and control participation levels:

- Cash-back mail-in incentives equal to 20% to 40% of the incremental cost to purchase energy efficient products will be offered. Tiered incentive approaches could also be designed to promote investment in premium efficiency equipment and multi-measure projects as conditions change over time. Technologies that pass cost-effectiveness testing are listed below.
- Special incentive "bonuses" for customers may be offered for limited-time promotions to increase installation of key technologies. A special incentive for market providers (or "Spiff") could be considered if sales fall below goal for any technologies.
- For certain measures (e.g., high performance T-8's and CFL's) and market areas, the program may directly buy-down the incremental cost of the measures at the point of sale, as such, significantly reducing the administrative burden for trade allies participating in the program.

Eligible Measures

The C&I Prescriptive Incentive Program targets measures where the unit energy savings can be reliably predicted and therefore standard per-measure savings ("deemed savings") and incentive levels can be established. This simplifies the application process and reduces non-incentive costs. The prescriptive program and associated measures would be delivered in a market channel fashion as market providers offer goods and services.

Each of the program channels is summarized below as they are planned to be delivered to customers along with the associated measures. The list below has been specified for planning purposes only. The utility would establish eligible measures and incentive levels as needed in accordance with current market conditions, planning studies, technology development, EM&V results, and program implementation experience.

Lighting Measures

- Compact fluorescent lamps (screw-in and pin-based fixtures)
- LED exit sign
- High-performance T8 fixtures
- T5 fluorescent fixtures
- High-bay fluorescent fixtures
- Pulse start metal halide
- Electronic dimming ballast
- Delamping with reflectors
- Occupancy sensors

HVAC Measures

- High efficiency packaged HVAC equipment (PTAC, Rooftop units)
- Adding an economizer
- Programmable thermostat
- Reflective window film
- Cool roof replacing a standard roof
- AC Tune-up with advanced diagnostics

Motors and Drives Measures

- NEMA Premium® motors
- Adding electronic adjustable speed drive to fans and pumps (variable frequency drives under 200 hp controlled)

Implementation Strategy

Key elements of the implementation strategy include:

- ***Outreach to Market Providers.*** The program would utilize field representatives to inform and recruit participating market providers. Outreach would include orientation meetings and conducting in-person visits aimed at training and equipping market providers to communicate program information to customers. Field representatives would ensure that providers have an updated stock of program materials. Key market providers that would be targeted include:
  - Lighting distributors, wholesalers, and electrical contractors
  - HVAC distributors, mechanical contractors, and service providers
  - Motors/Variable Frequency Drive distributors and retailers
  - Select consumer retailers that sell to contractors and businesses

- ***Outreach to Targeted Customers.*** The program implementation staff would work with APCo account managers to get information to business and institutional customers. The target contacts will be in-house energy managers, facility managers, building operators, and related personnel tied to facility operation. The program implementation staff and/or APCo account managers would assist C&I customers in determining whether the prescriptive incentives or a custom approach would be most appropriate for their operations. The program implementation staff would assist customers as necessary with incentive application requirements.

All program-specific administrative requirements would be handled internally by a third party implementation contractor selected through a competitive bid process. The implementation staff would be responsible for:

- Marketing strategy and materials
- Market provider outreach, recruitment, and training
- Trade Ally relations and problem resolution
- Product eligibility knowledge and communication
- Reporting to utility
- Maintain and manage database

Marketing Strategy

The C&I Prescriptive Incentive Program would employ the following marketing strategies:

- ***Engage Market Providers.*** Outreach and training would be provided to a targeted group of providers that have business motivations for promoting prescriptive incentives to their customers. They would be equipped with marketing and promotional materials (e.g., product sheets, incentive forms, case studies) and training on program terms and conditions. Outreach activities will include:
    - Mailing program materials
    - Follow-up telephone calls
    - Orientation meetings
    - In person visits by field representatives

- ***Directly Market to Targeted Customers.*** Depending on potential budget limitations, APCo may decide to initially pursue a targeted marketing strategy with business customers to ensure that the program is not over-subscribed. Initial targeted customer sectors might include schools, municipal office buildings, retail, food service, and lodging. Outreach activities would include:
    - In-person visits by APCo account managers to the top business consumers.
    - Walk-through energy audits for the top business consumers to identify opportunities for efficiency improvements.
    - Targeted advertising in trade and business publications.
    - Outreach to trade and business associations to recruit their assistance in distributing information about programs through existing communication channels.
    - Promotions by trade allies.
- Provide ***Complete Website Presence.*** The C&I Prescriptive Incentive Program would be comprehensively outlined on the APCo website. Customers and market providers will be able to review qualifying measures and download incentive applications.

Cooperative Advertising. APCo may consider the option of cooperative marketing with interested equipment distributors in the promotion of high efficiency equipment.

Milestones

Table 6-Y. Project Milestones

Task	Timeframe
DSM Plan Approval	TBD
Selection of Program Implementation Contractor	3 months
Program Materials Developed	4 months
Initial mailing to market providers	5 months
Program Launch – umbrella marketing begins	5 months
Follow-up telephone calls to market providers	6 months
Market provider orientation meetings	6 months

EM&V Strategy

All evaluation activities would be conducted by a third party contractor selected through a competitive bidding process. An integrated evaluation approach would 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*** would be to validate/calibrate the deemed savings values and determine program cost-effectiveness. Self-report surveys with both participants and nonparticipants may be used to assess free riders/spillover. The participant and nonparticipant surveys would also address program awareness, barriers to participation, participant satisfaction, and process efficiency. These surveys would be enhanced by collecting market data and assessing trends as well as interviews with program staff, vendors, manufacturers, and other trade allies.

- The ***process evaluation*** would be conducted during the first program year and then coordinated with follow-on 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. Wherever it is possible, practical, and appropriate, evaluation activities would be conducted in conjunction with other utilities and agencies in the state to share funding of studies and help ensure consistency.

Administrative Requirements

APCo would be responsible for general administrative oversight of the program portfolio. It is estimated that a 0.75 full-time equivalent (FTE) would be required for program and contractor oversight and 0.5 FTE for administrative support. Key oversight functions include:

- Recruitment, selection, and management of an implementation support contractor(s)
- Coordination of marketing strategy/public relations among programs and market sectors
- Development and placement of marketing materials with input from the implementation contractor.
- Coordination of all educational services

- Data warehousing
- Recruitment, selection, and management of the evaluation contractor
- Goal achievement within budget

APCo and its implementation contractor would follow industry best practices during final program design and start-up to ensure success, including:

- Following an integrated evaluation approach as described above.
- Assessing current market conditions for energy efficiency product availability and pricing.
- Account manager and customer service training.
- Completing all program procedures from marketing through verification and payment and conducting a dry-run prior to launch.
- Preparing for stronger or weaker than expected participant response.

Budget

Table 6-Z. Incremental Annual Budgets

Incremental Annual Budget – Total					
2009	2010	2011	2012	2013	Total 2009-2013
$2,829,483	$3,567,256	$4,268,875	$5,111,194	$6,637,753	$22,414,561

Incremental Annual Budget – Customer Incentive					
2009	2010	2011	2012	2013	Total 2009-2013
$1,675,785	$2,101,408	$2,429,107	$3,016,424	$4,213,102	$13,435,826

Incremental Annual Budget – Administrative					
2009	2010	2011	2012	2013	Total 2009-2013
$1,153,698	$1,465,848	$1,839,768	$2,094,770	$2,424,651	$8,978,735

Winter Savings Targets

Table 6-AA. Incremental Net Annual Energy and Peak Demand Savings at Generator

Incremental Annual Energy Savings Net MWh (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
26,220	36,646	45,994	39,489	45,294	193,644

Incremental Annual Peak Demand Savings Net kW (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
4,273	5,956	6,977	5,322	6,458	28,986

Benefit-Cost Test Results

Table 6-BB. Benefit-Cost Test Results

Benefit-Cost Test	2009-2013 Benefit-Cost Test Ratio
Total Resource Cost Test (TRC)	2.2
Utility System Resource Cost	3.5
Participant	3.3
Rate Impact Measure (RIM)	0.8

6.2.2 C&I Custom Program

Objective

Influence C&I customers to elect and install high efficiency technologies not addressed through other C&I programs when considering equipment retrofits or energy saving process improvements. Many C&I efficiency projects involve multiple technologies resulting in interactive effects in which savings need to be calculated on a project basis. This program offers incentives that are customized to the specific results of the energy saving technologies implemented.

Target Market

The C&I Custom Program would be available to all commercial and industrial customers. Emphasis would be placed on targeting customers whose opportunities could most benefit from a custom approach. This would include customers that have had in-depth energy audits or have identified unique opportunities to improve efficiency but have not taken action. In addition, larger customers serviced by account managers would be emphasized in the early years of the program. In future program years, smaller consumption accounts would be proactively targeted. Direct customer outreach would target decision makers within the customers' organization including: energy managers, facility managers, financial and operations managers, chief engineer and facility/property managers, maintenance supervisors, and building operators. Target markets would include manufacturing facilities, hospitals, schools, hospitality, large offices, and large government facilities.

Program Duration

The C&I Custom Program would be an ongoing element of the program portfolio.

Program Description

The C&I Custom Program is designed to address any cost-effective electricity saving measure not addressed through other APCo West Virginia programs, including prescriptive rebates. Projects in the Custom Program are more complex and address a system or process most often requiring unique design and technology solutions for each participant, so specific savings and incentives are determined when the project is specified. Major end-use system redesigns, including appropriate lighting system redesigns, are potential candidates for this program.

Fuel switching, natural gas saving measures, and previously completed projects would not be eligible measures in the C&I Custom Program. All technologies would be subject to eligibility and verification of savings projections.

In order to minimize free ridership, the C&I Custom Program project eligibility rules would be designed to motivate market providers and customers to: (1) pursue projects that they would otherwise not have implemented, (2) pursue these projects sooner than they otherwise would have, or (3) implement equipment/measures at a higher efficiency level than they otherwise would have.

Incentive Strategy

Customers would be eligible for incentive payments as a percentage of avoided costs. The specific incentive design is to be determined; however, separate incentive components for energy and demand savings could be considered as well as or instead of a simpler incentive based on the Custom Project's demand impact (the typical approach used in other Custom programs). The incentive design would be determined according to the relative importance of energy and demand impacts, respectively. With separate incentives for energy and demand, APCo can adjust incentive payment rates in response to progress toward achieving energy or demand impact goals.

Limitations may be placed on C&I Custom Program incentives, including:

◦ Maximum project incentive:	$250,000/year
◦ Maximum customer incentive:	$500,000/year
◦ Minimum project payback:	1 year
◦ Maximum % of incremental cost:	50%
◦ Maximum % of total project cost:	30%

The maximum incentive a customer may receive is the lesser of the amount listed above. The program implementation staff would work closely with prospective customers to determine if the project qualifies for financial incentives and to assist them in completing an incentive application.

There would also be grants to co-fund select feasibility studies and audits up to a maximum utility contribution of $15,000 to assist customers in identifying energy savings opportunities and to determine their potential. APCo West Virginia would refund part of the customer's share of the study cost if identified projects are implemented, as an inducement to act on study recommendations.

In future years, APCo West Virginia may decide to offer an energy efficiency RFP process for larger projects that would exceed the project maximum listed above. In an RFP solicitation, customers or energy efficiency service providers would be allowed to develop proposals and submit them to the utility for consideration in the C&I Custom Program. The incentive cost would be proposed as part of the submitted proposal and participants chosen based on project cost-effectiveness.

Implementation Strategy

Delivery of the C&I Custom Program would be achieved through the combined efforts of APCo West Virginia energy efficiency program and marketing groups, APCo account managers, and an implementation contractor hired through a competitive bidding process.

APCo West Virginia staff and the implementation contractor would work to generate awareness of the C&I Custom Program among customers and market providers of energy efficiency services and equipment. Several approaches to outreach would be employed which will evolve as the program matures, as described in the marketing strategy below. The objective of outreach activities is to identify and develop custom projects for further analysis.

Outreach by the APCo account managers would be emphasized in the early stages to expedite previously identified potential for projects that have been stalled at large customers. Greater emphasis would be placed on generating energy efficiency service provider referrals in 2010 and beyond to expand participation and reduce costs as the APCo West Virginia's network of program allies grows.

APCo West Virginia and the implementation contractor would work with customers and market providers to identify and pre-qualify prospective projects. This may involve completing custom engineering calculations that assess the energy savings potential, payback horizon, project eligibility, and incentive amount.

If the project is deemed eligible, the customer would be offered the opportunity to submit a more detailed Custom Program Application for measure incentives, or if further analysis is required, to submit an application for a feasibility study grant. Both applications would provide the guidelines for developing detailed project documentation for review by the program.

Once received, the Custom Program applications (for measure or study grants) would receive technical review by the implementation contractor. If the application is approved, the implementation contractor would issue a grant approval letter describing the terms for acceptance of the project. The customer would have a limited time (30 days) to sign the acceptance offer to reserve incentive funding. Upon customer signature of the incentive offer the customer would have a limited period of time (6 months) to complete the project to be eligible for reimbursement, or request a limited time extension.

Once projects are completed, the implementation contractor would assist the customer to verify the installation to ensure program integrity before issuing payment. Post installation inspections and documentation review would be completed by the implementation contractor to ensure the project is operating as intended. The inspection and documentation review may result in modifications to claimed savings and incentive amount. The implementation contractor would submit final incentive claims to APCo West Virginia for payment.

All program-specific administrative requirements would be handled by a third party implementation contractor, selected through a competitive bid process. The implementation contractor would be responsible for:

- Marketing strategy and messaging
- Market provider outreach, recruitment, and training
- Project identification assistance and pre-qualification screening
- Administrative and technical assistance to customers in completing program applications
- Technical review of applications
- Program participant communications
- Post installation inspections and review
- Incentive claim requests
- Quality assurance of project and technology eligibility
- Data tracking and reporting
- Budget tracking and reporting
- Managing public relations
- Customer satisfaction and problem resolution

Marketing Strategy

The marketing for the C&I Custom Program involves multiple strategies to locate project opportunities that can be unique and site-specific. A direct networking approach would be employed with customers that have completed energy audits or have assigned account managers. Marketing via direct mail to energy efficiency service providers, local economic development organizations, and other business and professional associations would be included in the recruiting approach to expand the outreach to a wider base of customers. In addition, the program would be promoted through advertising in targeted media including professional society newsletters, business journals, press releases, and media outreach.

This strategy for prospecting for projects is highly dependent upon referrals and networking with program allies and utility staff to identify projects that have high probability of implementation. Custom projects can have longer lead times for implementation due to feasibility and design studies, equipment purchasing lead times, installation timelines, and capital equipment planning and approval cycles. As a result, it would be advisable to begin aggressive marketing early in the program in order to fill the pipeline with projects in the 2009 calendar year and to queue projects for the escalation of program goals in future years.

Milestones

Table 6-CC. Project Milestones

Task	Timeframe
DSM Plan Approval	TBD
Selection of Program Implementation Contractor	3 months
Program Materials Developed	4 months
Program Launch – Marketing	4 ½ months

EM&V Strategy

All evaluation activities would be conducted by a third party contractor selected through a competitive bidding process. An integrated evaluation approach would 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, as well as conducting primary and secondary research as part of impact and process evaluations.

- The overall goal of the ***impact evaluation*** would be to validate/calibrate the deemed savings values and determine program cost-effectiveness. Self-report surveys with both participants and nonparticipants may be used to assess free riders/spillover. The participant and nonparticipant surveys would also address program awareness, barriers to participation, participant satisfaction, and process efficiency. These surveys would be enhanced by collecting market data and assessing trends as well as interviews with program staff, vendors, manufacturers, and other trade allies.

- The ***process evaluation*** would be conducted during the first program year and then coordinated with follow-on 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. Wherever it is possible, practical, and appropriate, evaluation activities would be conducted in conjunction with other utilities and agencies in the state to share funding of studies and help ensure consistency.

Administrative Requirements

Initial program administration would be conducted by APCo West Virginia and key account representatives. During 2009, APCo would contract with, and transfer day-to day program administration to a third-party. To develop and manage the third-party implementation, it is estimated that 1.0 FTE equivalent would be required for program oversight. Key oversight functions include:

- Recruitment, selection, and management of the implementation contractor(s)
- Coordination of marketing strategy/public relations among programs and market sectors
- Development and placement of marketing materials with input from the implementation contractor.

- Coordination of all educational services
- Data warehousing
- Recruitment, selection, and management of the evaluation contractor
- Goal achievement within budget

APCo and its implementation contractor would follow industry best practices during final program design and start-up to ensure success, including:

- Following an integrated evaluation approach as described above.
- Account manager and customer service training.
- Establishing requirements for supporting documentation, analysis methods, and reporting requirements on technical studies.
- Completing all program procedures from marketing through verification and payment and conducting a dry-run prior to launch.
- Preparing for stronger or weaker than expected participant response.

Budget

Table 6-DD. Incremental Annual Budgets

Incremental Annual Budget – Total					
2009	2010	2011	2012	2013	Total 2009-2013
$2,336,478	$2,767,515	$3,579,251	$5,130,878	$7,327,511	$21,141,634

Incremental Annual Budget – Customer Incentive					
2009	2010	2011	2012	2013	Total 2009-2013
$1,203,080	$1,452,761	$1,818,504	$2,562,941	$3,788,786	$10,826,073

Incremental Annual Budget – Administrative					
2009	2010	2011	2012	2013	Total 2009-2013
$1,133,398	$1,314,754	$1,760,747	$2,567,937	$3,538,725	$10,315,561

Winter Savings Targets

Table 6-EE. Incremental Net Annual Energy and Peak Demand Savings at Generator

Incremental Annual Energy Savings Net MWh (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
12,880	16,434	22,009	32,099	44,234	127,657

Incremental Annual Peak Demand Savings Net kW (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
957	1,276	1,779	2,509	3,208	9,729

Benefit-Cost Test Results

Table 6-FF. Benefit-Cost Test Results

Benefit-Cost Test	2009-2013 Benefit-Cost Test Ratio
Total Resource Cost Test (TRC)	1.6
Utility System Resource Cost	2.3
Participant	3.5
Rate Impact Measure (RIM)	0.6

6.2.3 C&I New Construction Program

Objective

The objective of this program is to work through the design community to influence owners to capture immediate and long-term energy efficiency and peak load reduction opportunities that are available during the design and construction of new buildings, additions, and renovations in the non-residential market. To secure these opportunities it is necessary to overcome barriers such as resistance in the design community to adopt new practices, reluctance by owners to accept increased first cost for efficient options, removing proposed measures through value engineering, and tendency to design individual systems for worst-case conditions rather than efficiency of an integrated system over the range of expected operating conditions.

Target Market

Any-size commercial, industrial, government (local, state, and federal), or institutional new construction project in the planning or early design-stage will be considered, provided the design team and owner are willing to pursue an integrated design strategy and improve multiple building systems. To be eligible, major renovations would be required to involve a change in occupancy classification or affect at least two of these three systems: building envelope, HVAC systems, or lighting systems. Projects would have to be pre-approved for participation.

Program Duration

The C&I New Construction Program would be an ongoing element of the program portfolio. Services would begin in 2009, though due to the long lead time required to identify project leads, to work with projects in the design phase, and to construct the buildings, significant savings from this program would not be anticipated until at least mid-year 2010. From design phase meetings to payment of incentives at building completion requires from 6 months to 3 years, averaging 12 months to 18 months. In addition, and as reflected by the early years' program budgets and impacts, there is little new construction forecast in the area and so the program would be slower in ramping its impacts up until economic conditions improve and new construction again becomes significant.

Program Description

The program would capture energy efficiency and peak load reduction opportunities through a comprehensive effort to influence building design and construction practices. The program would work with design professionals and construction contractors to influence prospective building owners and developers to construct high performance buildings that provide improved energy efficiency, systems performance, and comfort. Energy saving targets would be accomplished by stimulating incremental improvements of efficiency in lighting, HVAC, and other building systems. The program would seek to capture synergistic energy savings by encouraging the design and construction of buildings as integrated systems. A variety of different commercial new construction guidelines exist to provide design targets: LEED®; Advanced Buildings®, ASHRAE Advanced Energy Design Guides, Green Globes®, etc.

An important focus of efforts would be moving the knowledge gained by designers and architects through program participation into their standard construction practices. The program has been designed to integrate educational activities into implementation while achieving energy savings from active construction projects.

Program resources to achieve energy saving and market transformation objectives are applied through four primary offerings to participants (participants include design team members, contractors, owners, and developers):

- Targeted ***Education, Information, and Outreach*** on integrated design practices and benefits will be provided directly to participants through the program and to the broader market by coordinating with outside efforts. Program staff time and resources would focus on information dissemination and teach/learn-by-example during projects with program participants. To encourage market transformation while recruiting program participants, the program would coordinate with outside efforts including LEED, Advanced Buildings, ASHRAE, AIA, and others. The credibility and relationships built through involvement in outside efforts will help the program recruit construction projects that are early in the design process, when opportunities to integrate energy saving measures into the project are greatest.
- The program would offer ***Technical Assistance Services*** to provide capabilities that are not yet fully adopted in the market. Services may include facilitation in the design process, reviewing plans and construction bid documents, assisting with design selections, analyzing energy savings, and verifying installation and operation of measures. Technical assistance may be provided by the program administrator or by third-parties contracted for their special expertise.
- The program would offer financial ***Design Incentives*** to the design team to help offset the costs of developing designs that provide as-built performance which is more energy efficient than their standard practice designs. Payments to the primary design team member would be made after the start of construction once program payment criteria have been met.
- The program would offer financial ***Measure Incentives*** to owners and developers to help reduce cost barriers to adopting electric energy saving measures that have not yet been accepted as standard practice for construction. Payments would be made after the program verifies that measures are installed and fully operating or capable of full operation in the case of seasonal uses.

Technical assistance, design incentives, and measure incentives would be offered in varying degrees on individual projects to balance the program resources applied with the potential for saving energy and changing behavior. The program would channel projects through one of two participation approaches:

- ***Comprehensive "Whole Building" Approach*** offers the highest level of technical assistance and financial incentives for custom design solutions. This approach allows the design team the greatest flexibility to meet energy performance goals by adopting integrated design solutions analyzed through whole-building energy simulations. This approach is chosen when project size, schedule, complexity, and interest level justify a high level of program resources to achieve the full benefits of integrated building design.
- ***Systems Approach*** provides a menu of financial incentives and technical assistance to encourage integrated design at the system and component level. Measure incentives are paid for meeting the performance criteria described in program materials for system and component performance. Design incentives are available for employing the integrated design approaches and meeting the program threshold requirements. This approach is chosen when there is opportunity to achieve energy savings through integrated design, but the project size or schedule warrants a more streamlined approach.

Building size, project type, design stage, and project opportunities would guide the selection of participation approach offered on the project. This determination would be made by the program on a case-by-case basis. Generally, new construction and major "gut" renovation projects over 75,000 square feet will be channeled to the Comprehensive Approach when there is commitment by the owner and design team in the pre-design or schematic design stage to explore a wide range of design options. New construction and major renovation projects smaller than 75,000 square feet would most often be channeled to the Systems Approach, as would projects larger than 75,000 square feet that do not justify the Comprehensive Approach. Single end-use lighting or HVAC projects or those too late in design to follow an integrated approach would be referred to prescriptive rebate programs.

Incentive Strategy

To minimize free-ridership, it is intended that design team and measure incentives cover 50% or more of incremental cost. Incentives are set relative to a baseline for cost and energy performance developed to reflect current practice in the service territory. The default baseline would be current state energy code, standard practice determined by research or EM&V, or legally required design specifications. Pre-approval is required for all incentives.

Of the pool of financial incentive dollars available for a project, the program would direct up to approximately 30% toward design team incentives and technical studies and 70% to efficiency measures. In the Comprehensive Approach, design team incentives would be set at up to 10% of a project's measure incentive. Prescriptive design incentives may be considered over time to encourage certain measures and design approaches. The program would provide energy modeling as an incentive to participate or offer the design team a nominal incentive to follow program compliance and reporting requirements when conducting owner-funded simulations.

The Comprehensive Approach would have a measure incentive structure that pays independently for kWh and kW, to give flexibility to design teams to make design trade-offs. A separate kW component would encourage consideration of advanced HVAC designs such as geothermal systems or downsizing HVAC. The program would set the incentive at $0.05/kWh + $150/kW, a level comparable to successful programs operated in the Midwest. A single tier is the simplest approach for design teams and owners to comprehend and react to when considering alternative designs.

The Systems Track would use the same dollars per unit incentives as the C&I Prescriptive program, with some exceptions. Lighting needs to have a program check to limit the lighting power density by building type (design watts per square foot) to ensure there are savings relative to the energy code. Lighting power density improvements would be paid at the rate of 15 cents per square foot for designs that achieve savings of 15% to 25% below code, depending on building type. An incentive based on square feet would give maximum flexibility to design teams to pick the most appropriate fixtures for their project. Occupancy sensors are standard practice for new construction in certain building types and would not eligible for incentives in those cases.

During the program, baseline assumptions would be monitored and revised as necessary to more accurately represent current standard practice. Incentives would be adjusted as needed in response to market acceptance, evaluation feedback, changing baseline practices, and state energy code upgrades.

Eligible Measures

Cost-effective electrical efficiency and peak load reduction measures that improve upon the program's baseline are eligible for consideration in the program. Fuel switching (electric to alternative fuel) measures, hybrid fuel and grid connected renewable energy systems would not be eligible for incentives through this program. Peak reduction measures that result in negative net kWh savings (e.g., thermal cool storage and some geothermal HVAC systems) would be eligible but have the total incentive reduced at the per kWh incentive rate.

Implementation Strategy

To maximize program effectiveness, an implementation contractor with in-house new construction design and analysis capabilities and experience would be selected to implement the program. The implementation contractor would provide staff to conduct program management, tracking, marketing, and implementation. Implementation staff would provide technical assistance services to participants, assist participants with program requirements, conduct technical assistance and simulation services, oversee contract technical specialists, perform quality control duties, and inspect measure installations.

Marketing Strategy

A key element for success in the program is securing the involvement of the professional design community early in the design process of construction projects. Project recruitment would be a byproduct of the educational effort on sustainable design targeting the design community. Projects sought would be those early in the design phase and where program intervention could produce significant energy and demand savings. The program would employ lunch and learn presentations, individual contact, and outreach through professional organizations to engage design professionals. The program would coordinate with locally active education efforts.

The design community would be a key resource in reaching building owners and developers, and the program would actively assist the design community in educating owners on the benefits of high performance buildings.

Milestones

Table 6-GG. Project Milestones

Task	Timeframe
DSM Plan Approval	TBD
Selection of Program Implementation Contractor	3 months
Program Materials Developed	5 months
Program Launch – Marketing	6 months

EM&V Strategy

APCo West Virginia would hire an independent evaluator to provide ongoing input on quality assurance, project documentation requirements, and savings verification as well as conduct program evaluation. An integrated evaluation approach would 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, and establishing tracking metrics.

The baseline for all projects in the C&I New Construction Program would be the more efficient of what the participant would do absent the program intervention or code required minimums. A baseline would be established and documented for each project that enters the program. Energy savings would be claimed relative to the project-specific baseline. If a design team does not have a base design to analyze, a default minimum baseline would be used. The initial default minimum program baseline would be set at current state energy code.

Administrative Requirements

APCo West Virginia would be responsible for oversight of the implementation contractor, managing the tracking system, and providing funds for administration, marketing, implementation, and incentive check disbursement. It is estimated that a 0.25 full-time equivalent (FTE) would be required for program oversight. The implementation contractor responsibilities include ongoing program design, marketing materials, program marketing and implementation, project management and QA/QC, customer and contractor dispute resolution, tracking and reporting, site verification of installed measures, incentive amount approval, and program goal achievement.

APCo and its implementation contractor would follow industry best practices during final program design and start-up to ensure success, including:

- Following an integrated evaluation approach as described above
- Account manager and customer service training
- Establishing requirements for supporting documentation, analysis methods, and reporting requirements on technical studies
- Completing all program procedures from marketing through verification and payment and conducting a dry-run prior to launch.
- Preparing for stronger or weaker than expected participant response

Budget

Table 6-HH. Incremental Annual Budgets[11]

Incremental Annual Budget – Total					
2009	2010	2011	2012	2013	Total 2009-2013
$2,892	$4,486	$0	$174,308	$361,709	$543,395

Incremental Annual Budget – Customer Incentive					
2009	2010	2011	2012	2013	Total 2009-2013
$1,377	$2,243	$0	$87,154	$180,854	$271,629

Incremental Annual Budget – Administrative					
2009	2010	2011	2012	2013	Total 2009-2013
$1,515	$2,243	$0	$87,154	$180,854	$271,766

[11] 2011 budgets reflect the potentials analysis that shows no new construction in that year. It is anticipated that program activities would be modest until the economy turns upward, but would not be entirely stopped in that year.

Winter Savings Targets

Table 6-II. Incremental Net Annual Energy and Peak Demand Savings at Generator[12]

Incremental Annual Energy Savings Net MWh (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
22	36	0	1,268	2,643	3,970

Incremental Annual Peak Demand Savings Net kW (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
2	2	0	68	141	212

Benefit-Cost Test Results

Table 6-JJ. Benefit-Cost Test Results

Benefit-Cost Test	2009-2013 Benefit-Cost Test Ratio
Total Resource Cost Test (TRC)	1.4
Utility System Resource Cost	2.2
Participant	2.8
Rate Impact Measure (RIM)	0.6

[12] As with the budget in the early years, impacts are projected to be modest due to a lack of new construction being forecast in the area.

6.2.4 C&I Direct Load Control Program

Objective

To encourage APCo West Virginia's C&I customers to both shift their load away from peak demand periods (summer or winter) and to reduce overall demand on the system during that peak period. This program also aims to increase the knowledge of the benefits of demand response within the non-residential customer base.

Target Market

The C&I Direct Load Control (DLC) program targets non-residential customers in the APCo West Virginia service territory with central air conditioning or heat pump systems, specifically targeting small C&I customers, with larger account managed customers being the secondary target market. Electric water heaters also have load control potential and could be added, depending upon the enabling technology employed by the program.

Program Duration

The C&I Direct Load Control Program would be an ongoing element of the program portfolio.

Program Description

The DLC program would provide rate discounts to participants who allow APCo West Virginia to cycle its customer's air conditioners or heat pumps during periods of summer or winter peak system demand. The program is designed to:

- Install the enabling technologies used for this program, including installed switches to the HVAC system and/or enhanced programmable thermostats.
- Provide incentives to facility owners and operators for the installation of the enabling technologies.
- Provide a marketing mechanism for HVAC equipment vendors, distributors and contractors to promote direct load control technologies to end users.
- Overcome market barriers, including:
  - Customers' lack of awareness and knowledge about the benefits and cost of DLC, and
  - Performance uncertainty associated with DLC projects.
- Ensure that the participation process is clear, easy to understand and simple.

Certain barriers exist to the adoption of DLC equipment, including lack of awareness/knowledge about the benefits and costs of DLC technologies and technology performance uncertainties. This program is designed to help overcome these market barriers and encourage greater adoption of DLC equipment in the C&I market.

The program would be structured as a broadly applicable C&I DLC program since the demand savings for HVAC equipment is similar across many C&I market segments. APCo West Virginia could make participating in this program a condition of service for new construction customers. Having a simple program structure and rate discount provides customers with certainty and ease of use regarding the rate discount they will receive for installing an enabling technology.

The program's actual demand and energy savings would be determined through the program evaluation.

Incentive Strategy

A rate discount of approximately $5 per ton of air conditioning per peak month would be the primary incentive for this program, although specific cycling strategies that achieve higher savings may be provided a higher incentive.

Eligible Measures

APCo West Virginia would specify complying DLC switching technology and/or enhanced programmable thermostats that would be installed in the program.

Implementation Strategy

Program implementation activities include administration, marketing, vendor referrals, application and incentive processing, coordination of education and training activities, participation tracking and reporting, quality control, and technical support. APCo West Virginia account representatives are expected to promote the program to their customers. Alternatively, APCo could outsource the program to an "implementation contractor". APCo West Virginia would likely sub-contract the DLC switch installations to HVAC or electrical contractors.

The C&I DLC program includes customer educational and promotional pieces designed to assist facility owners, operators and decision makers with the information necessary to install DLC in their facilities. The program also would include customer and trade ally education to assist with understanding the enabling technologies that are being promoted, the incentives that are offered, and how the program functions.

Marketing Strategy

The marketing and communications strategy would be designed to inform customers of the availability and benefits of the program and how they can participate in the program. The strategy would include outreach to customers directly and via HVAC companies. The APCo website would direct customers to information about the program. More specifically, the marketing and communications plan would include:

- Direct mail and outreach to customers and customer representatives. Marketing activities would include:
  - Brochures that describe the benefits and features of the program including program application forms and worksheets. The brochures will be mailed upon demand.
  - Targeted direct mailings used to educate customers on the benefits of the program and explaining how they can apply.
  - APCo website content providing program information resources, contact information, downloadable application forms and worksheets, and links to other relevant service and information resources.
  - Presentations by the program manager to key customers and customer groups to actively solicit their participation in the program.
- The marketing strategy would identify key customer segments and potentially geographical areas for targeted marketing, and will prepare specific outreach activities for these customers.

APCo would design and develop the content, messaging, branding, and calls to action of all of the marketing and collateral materials used to promote the program.

Milestones

Table 6-KK. Project Milestones

Task	Timeframe
DSM Plan Approval	TBD
Selection of Program Implementation Contractor and Enabling Technologies	4 months
Final Program Design and Materials Developed	6 months
Program Launch	7 months

EM&V Strategy

All evaluation activities would be conducted by a third party contractor selected through a competitive bidding process. An integrated evaluation approach would 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 load reduction values; as well as conducting primary and secondary research as part of impact and process evaluations.

- The overall goal of the ***impact evaluation*** would be to validate/calibrate the deemed load reduction values and determine program cost-effectiveness. Self-report surveys with both participants and nonparticipants may be used to assess net impacts. The participant and nonparticipant surveys would also address program awareness, barriers to participation, participant satisfaction, and process efficiency. These surveys would be enhanced by collecting market data and assessing trends as well as interviews with program staff, vendors, manufacturers, and other trade allies.
- The ***process evaluation*** would be conducted during the first program year and then coordinated with follow-on 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. Wherever it is possible, practical, and appropriate, evaluation activities would be conducted in conjunction with other utilities and agencies in the state to share funding of studies and help ensure consistency.

Administrative Requirements

It is estimated that a 0.5 full-time equivalent (FTE) would be required for program management, and 0.5 FTE will be required for administrative tasks. Designated APCo West Virginia staff person(s) would provide program administration, marketing, vendor referrals, application and incentive processing, coordination of education and training activities, participation tracking and reporting, quality control, and technical support. APCo West Virginia account representatives are expected to promote the program to their customers. Alternatively, APCo West Virginia could outsource the program to an "implementation contractor". APCo West Virginia would likely want to sub-contract the DLC switch or enhanced thermostat installations to HVAC or electrical contractors.

APCo West Virginia and its implementation contractor would follow industry best practices during final program design and start-up to ensure success, including:

- Following an integrated evaluation approach as described above.
- Confirming enabling technology performance.
- Account manager and customer service training.
- Completing all program procedures from marketing through verification and payment and conducting a dry-run prior to launch.
- Preparing for stronger or weaker than expected participant response.

Budget

Table 6-LL. Incremental Annual Budgets

Incremental Annual Budget – Total					
2009	2010	2011	2012	2013	Total 2009-2013
$2,768,762	$3,967,251	$5,062,370	$6,422,065	$8,223,806	$26,444,255

Incremental Annual DLC Credits					
2009	2010	2011	2012	2013	Total 2009-2013
$1,208,793	$2,413,088	$3,569,719	$4,815,004	$6,303,228	$18,309,832

Incremental Annual Budget – Administrative					
2009	2010	2011	2012	2013	Total 2009-2013
$1,559,969	$1,554,163	$1,492,651	$1,607,062	$1,920,578	$8,134,423

Winter Savings Targets

Table 6-MM. Incremental Net Annual Energy and Peak Demand Savings at Generator

Incremental Annual Peak Demand Savings Net kW (at Generator)					
2009	2010	2011	2012	2013	Cumulative Total 2009-2013
8,404	8,373	8,041	8,658	10,347	43,822

Benefit-Cost Test Results

Table 6-NN. Benefit-Cost Test Results

Benefit-Cost Test	2009-2013 Benefit-Cost Test Ratio
Total Resource Cost Test (TRC)	1.6
Utility System Resource Cost	2.3
Participant	0.7
Rate Impact Measure (RIM)	2.0

6.3 Multi-Sector Programs

6.3.1 Energy Education and Training Program

Objective

The Energy Education and Training programs are designed to build customer awareness of energy efficiency in general as well as APCo West Virginia programs to begin market transformation and build demand.

Target Market

Media outreach and advertising is primarily for the mass market, but training is targeted to larger C&I customers.

Program Duration

These programs would be directly managed by APCo West Virginia and are expected to be ongoing. These new programs should have a goal of increasing the adoption of the efficiency programs as well as bringing APCo West Virginia's commitment to efficiency to its customers.

Program Description

APCo West Virginia would plan a media campaign and training effort to address the lack of awareness of their customer base to these new programs in a variety of ways. In addition, general energy education should be a key focus. The development and distribution of targeted marketing materials and participation in promotional events should be a primary focus.

There are several barriers to the adoption of energy efficiency. In some cases it is simple lack of awareness or misinformation. In other cases, it is a lack of contractor or professional contractors to make efficiency a realistic decision choice. For other cases, many technology choices are made spur-of-the-moment or in a fail-and-replace scenario where the person or contractor contacted are aware of the portfolio programs and make the efficient decision. In all cases, these programs should further APCo West Virginia's commitment to efficiency and bridge the portfolio program goals and the consumer lack of adoption.

Incentive Strategy

The goals and needed incentives would vary by program supported and will be clearly stated, along with goals with regard to customers reached, people trained, items sold/given away or whatever the program's incentives and strategy call for.

Eligible Measures

Each supported program would have its own specific measures, eligibility and other measure requirements. In the Energy Education Program, the following are the measure details.

Implementation Strategy

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

Implementation-related administrative requirements would be handled by APCo West Virginia, 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 would have a specific marketing strategy that would be stated in the description of the program and agreed upon by APCo West Virginia.

Milestones

Table 6-00. Project 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

All evaluation activities would be conducted by a third party contractor selected through a competitive bidding process. An integrated evaluation approach would 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 would 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 would 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 would be conducted to assess the operational conditions of the program and to identify ways to improve the program. These surveys would be enhanced by collecting market data and assessing trends.

The process evaluation would 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.

Administrative Requirements

It is estimated that a 1.0 full-time equivalent ("FTE") would be required for program management. APCo West Virginia 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

Budget

Table 6-PP. Incremental Annual Budgets

Incremental Annual Budget – Total					
2009	2010	2011	2012	2013	Total 2009-2013
$2,000,000	$1,500,000	$1,250,000	$1,250,000	$1,250,000	**$7,250,000**

Winter Savings Targets

N/A

Benefit-Cost Test Results

N/A

6.3.2 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

APCo West Virginia would 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, APCo West Virginia would initiate research and analysis of other innovative technologies and strategies to reduce residential energy consumption. These efforts would be ongoing and pilot programs rolled out as appropriate.

Program Description

The following pilot programs represent new initiatives and technology approaches APCo West Virginia could pursue, among others, 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.
- 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

Incentive Strategy

N/A

Eligible Measures

N/A

Implementation Strategy

N/A

Marketing Strategy

N/A

Milestones

N/A

EM&V Strategy

N/A

Administrative Requirements

It is estimated that a 1.0 full-time equivalent ("FTE") would be required for program management. APCo West Virginia will be responsible for general administrative oversight of the 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

Budget

Table 6-QQ. Incremental Annual Budgets

Incremental Annual Budget – Total					
2009	**2010**	**2011**	**2012**	**2013**	**Total 2009-2013**
$150,000	$300,000	$300,000	$300,000	$300,000	**$1,350,000**

Winter Savings Targets

N/A

Benefit-Cost Test Results

N/A

6.4 Program Cost Summary

The estimated investment for these programs, in 2009 dollars, would be approximately $15.8 million in 2009, $19.6 million in 2010, $23.6 million in 2011, $29.9 million in 2012, and $39.1 million in 2013, for a total $128 million; this is shown in Table 6-RR. The projected investments include 10% one-time startup costs (included in program administration[13] costs) for the first year of program implementation.

[13] Administrative costs in this study are all costs for a given program aside from customer incentives: planning, marketing and sales, business process administration such as rebate processing, and evaluation, measurement and verification. General overhead costs such as general DSM department overheads, general education/training and pilot program funding are estimated separately from specific programs, but are included in the overall portfolio benefit-cost analysis.

Table 6-RR. Estimated Annual Total Investments by Program for APCo West Virginia (2009$)

Consumer Sector	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013**	**% of Portfolio Total**
Products	$690,676	$1,187,034	$1,797,934	$2,143,230	$2,231,704	$8,050,577	6.3%
Recycling	$66,277	$221,470	$214,374	$207,623	$201,059	$910,803	0.7%
Retrofit	$1,522,492	$1,690,103	$2,021,534	$2,700,284	$3,803,563	$11,737,977	9.2%
Low Income	$1,813,112	$2,073,927	$2,526,252	$3,313,837	$4,589,968	$14,317,095	11.2%
New Construction	$19,223	$16,303	$6,336	$99,377	$79,868	$221,108	0.2%
Demand Response	$717,733	$950,148	$1,155,643	$1,432,144	$1,816,575	$6,072,242	4.7%
Consumer Sector Total	**$4,829,512**	**$6,138,984**	**$7,722,073**	**$9,896,496**	**$12,722,738**	**$41,309,802**	**32.2%**
Business Sector	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013**	**% of Portfolio Total**
Prescriptive	$2,829,483	$3,567,256	$4,268,875	$5,111,194	$6,637,753	$22,414,561	17.5%
Custom	$2,336,478	$2,767,515	$3,579,251	$5,130,878	$7,327,511	$21,141,634	16.5%
New Construction	$2,892	$4,486	$0	$174,308	$361,709	$543,395	0.4%
Demand Response	$2,768,762	$3,967,251	$5,062,370	$6,422,065	$8,223,806	$26,444,255	20.6%
Business Sector Total	**$7,937,615**	**$10,306,509**	**$12,910,496**	**$16,838,446**	**$22,550,779**	**$70,543,845**	**55.0%**
Other Costs	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013**	**% of Portfolio Total**
APCo West Virginia DSM Department	$750,000	$1,250,000	$1,250,000	$1,500,000	$2,000,000	**$6,750,000**	5.3%
General Education/ Training/Media	$2,000,000	$1,500,000	$1,250,000	$1,250,000	$1,250,000	**$7,250,000**	5.7%
Energy Conservation Kits	$150,000	$200,000	$200,000	$200,000	$200,000	**$950,000**	0.7%
Pilot Program Fund	$150,000	$300,000	$300,000	$300,000	$300,000	**$1,350,000**	1.1%
Other Costs Total	**$3,050,000**	**$3,250,000**	**$3,000,000**	**$3,250,000**	**$3,750,000**	**$16,300,000**	**12.7%**
PORTFOLIO TOTAL	**$15,817,127**	**$19,695,493**	**$23,632,569**	**$29,984,941**	**$39,023,517**	**$128,153,647**	**100.0%**

7 PORTFOLIO IMPLEMENTATION

APCo West Virginia would implement the proposed portfolio of programs through a combination of in-house utility staff and competitively selected third-party implementation contractors. APCo West Virginia would issue Requests for Proposals ("RFP"s) to qualified firms related to RFPs for the delivery of similar programs targeting specific sectors. Summit Blue believes that by issuing multiple RFPs, it would 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, Summit Blue anticipates the process of issuing RFPs, evaluating responses and negotiating contracts along with associated program start-up time could result in 2009 launch date, at the earliest, for some programs (dependent upon those factors previously mentioned in Section E.3., Portfolio Implementation) . The remaining programs would 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 would be preparation of detailed implementation plans. APCo West Virginia would 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 Management

APCo West Virginia would 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, APCo West Virginia would plan to engage third-party implementation contractors. Contractors would be selected through a competitive request for proposal process for delivery of programs.

APCo West Virginia would anticipate providing high-level administrative, contract management, program design and marketing oversight of the selected implementation contractors. A portfolio of this proposed size and scope would require careful management oversight. APCo West Virginia would 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.

APCo West Virginia staff would also 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, APCo West Virginia would 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 engagement 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 APCo West Virginia'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.
- Guidance and direction on new initiatives or strategies proposed by the implementation contractors.
- Communication to implementation contractors about other APCo West Virginia initiatives that may provide opportunities for cross-program promotion.
- Review and approval of printed materials and advertising plans.
- Evaluation of portfolio and program effectiveness and recommended modifications to programs and approach as needed.
- Periodic review of program metrics, conduct investment analysis, and review of evolving program design.

7.3 Survey of Existing Utility Programs Staffing

In an effort to better assist APCo West Virginia in preparing for the launch and maintaining of efficiency programs, Summit Blue created a survey and contacted several utilities who are running efficiency programs to help guide planning efforts for APCo West Virginia's staffing and departmental functions. 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 7-A represents the results received.

Table 7-A. 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 differences 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 7-B shows the staffing levels as compared to the size of the efficiency portfolio (measured in dollars).

Table 7-B. 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 and the rest are 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) portfolios, 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.

7.4 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, APCo West Virginia would work with regional, state, and national programs and partners to optimize cooperative marketing programs and campaigns. Marketing efforts will be designed to dovetail with other organization and government agency efforts to achieve energy efficiency, other statewide or regional efficiency programs and campaigns, including any ultimately initiated by the West Virginia PSC.

7.5 Tracking and Reporting

APCo West Virginia should consider building a comprehensive internal tracking and reporting system to record all activities from the DSM portfolio of programs. Data tracking systems are being used successfully in numerous other states, and APCo West Virginia would benefit from the learning that has occurred there. Implementation contractors would be responsible for tracking and reporting energy efficiency program activities by entering details of each project into the comprehensive data tracking system. The system would allow customized reporting to meet any reporting requirements in a quick, transparent and accurate manner.

7.6 Midstream Adjustments

While this plan presents detailed information on approach, energy efficiency measures and proposed incentive levels, the State of the West Virginia economy along with unforeseen changing market conditions, would require regular review and revisions of portions of this plan to reflect new information. As such, adjustments to these programs would likely be necessary.

7.7 Inter-Utility Coordination

APCo West Virginia would work with other utilities to maximize the effectiveness of the programs; and regular communication and coordination will be necessary. APCo West Virginia would collaborate with others to provide effective programs, reporting and evaluation processes, as well as exchange ideas for the benefit of its customers.

7.8 Leveraging Other Efficiency Initiatives

Several entities are promoting energy efficiency including: the state government; Southeast Energy Efficiency Alliance ("SEEA"); U.S. Environmental Protection Agency and U.S. Department of Energy's "ENERGY STAR" brand; as well as Federal tax credits. APCo West Virginia and its implementation contractors should work diligently to remain aware and up-to-date and to cooperate with efficiency efforts being directed at West Virginia energy users. Wherever feasible, co-marketing efforts should 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. APCo West Virginia should help its customers maximize the energy efficiency incentives available.

7.9 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 would be cultivated and nurtured through numerous methods to ensure effective communication in both directions. Trade allies would 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, coordination, "listening sessions," and frequent communications would be emphasized with these key partners to advance program goals. A schedule of meetings, workshops, educational seminars, program update breakfasts, and clear and concise program descriptions would be distributed to the trade allies at the program kick off meetings. Ongoing training and program updates also would be a key part of program delivery.

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

8.1 Overview

Program evaluation, measurement, and verification ("EM&V") activities are central to the success of APCo West Virginia's portfolio and would 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 DSM 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.

Most evaluation activities would 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 APCo West Virginia, 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.

8.2 Approach to Evaluation

The overall suggested 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.

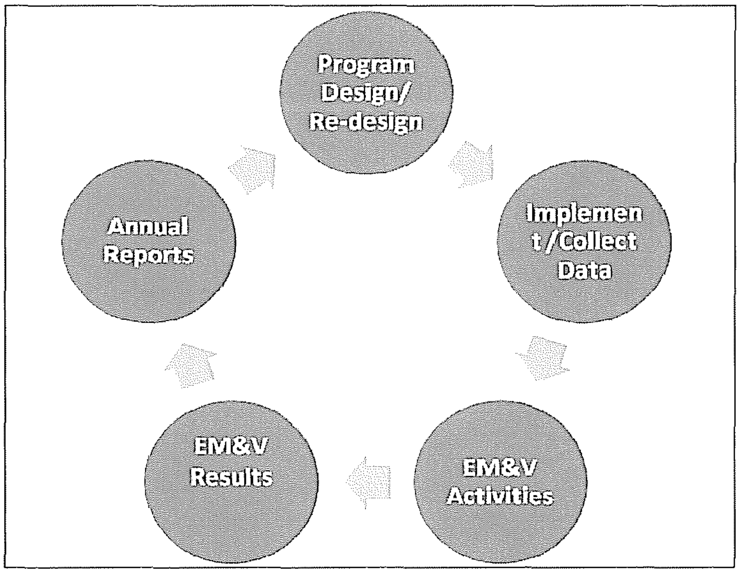
EM&V plans are designed to mitigate these problems. The process by which this is done is to integrate select data collection within the program implementation process and to provide near real-time feedback on key indicators of program progress. EM&V processes that take an "integrated data collection" ("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 the 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 8-1 below shows the program evaluation cycle.

Figure 8-1. Steps of the EM&V process



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

- EM&V related activities

- Project savings verification and due diligence
- Independent program evaluations
- Independent assessment of annual program impacts
- Internal quality assurance and control
- Coordination of evaluation activities with other players

8.3 Examples of EM&V Related Activities

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

- Development of an APCo West Virginia specific Measures Database savings estimates for prescriptive measures in a Technical Reference Manual ("TRM"). The TRM would 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.

8.4 Project Savings Verification and Due Diligence

APCo West Virginia would 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 would vary by program and are necessary to assure customer eligibility, completion of installations, and the reasonableness and accuracy of savings. The activities that APCo West Virginia would 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.

8.5 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, DSM 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 DSM portfolio
- Process evaluation to indicate how well programs are working to achieve objectives
- Identification of important opportunities for improvement

8.6 Assessment of Annual Impacts

APCo West Virginia's EM&V contractor would 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, would result in numerous areas where improvements and refinements to the APCo West Virginia deemed measure database are necessary.

In addition to the procedures outlined above for verifying savings from the portfolio, APCo West Virginia would 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. APCo West Virginia would produce scheduled reports on all customer interactions, including customers recruited, incentive applications received, incentives processed, and installations verified, and would establish procedures for ongoing verification.

APCo West Virginia would 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. APCo West Virginia would 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.

9 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: 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 DSM 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:

Appalachian Power Co – West Virginia

2009 to 2028

DSM Potential Study

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APCo West Virginia has a mix of over 400,000 residential, commercial, and industrial customers. APCo West Virginia provides low electric rates in West Virginia, ensures high levels of customer satisfaction, and provides reliable utility service to its customers, which include more than 200 communities.

APCo West Virginia commissioned this market potential study, which also includes an action plan for demand-side management (DSM). The DSM Action Plan details a diverse portfolio of electric energy efficiency and demand response programs APCo West Virginia may offer. Ultimate program plans would be available for all customer classes, including low-income residential. This volume reports the potentials study underlying the Action Plan, which is reported in Volume 1 of the overall study report.

The DSM market potentials study and the portfolio of electric DSM programs was developed with the experienced guidance of an outside consultant, Summit Blue Consulting ("Summit Blue"). Summit Blue drew upon successful programs from other states, particularly the Midwest, and their combined program design and implementation experience with other utilities in crafting a portfolio of programs for APCo West Virginia.

Summit Blue believes this portfolio provides a menu of proven programs that will directly help participating customers save money on their energy bills. The plan is based on a five year horizon, predicated on beginning in 2009, and represents one option APCo could consider for implementation in West Virginia. In any event, the ultimate plan portfolio assumes that appropriate regulatory approvals and cost recovery are granted.

E EXECUTIVE SUMMARY

Demand-side management ("DSM") represents an important resource for APCo West Virginia, one growing increasingly important as fuel and commodity prices become more volatile and greenhouse gas regulation becomes more likely. Estimates of DSM 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 DSM potential in APCo West Virginia's service territory by Summit Blue Consulting.

This Potentials Study presents detailed information on the technical, economic and program market potential for DSM in APCo's West Virginia service area.

DSM Action Plan Portfolio Summary

If APCo West Virginia elects to implement the portfolio developed from the program market potentials results reported in this volume, in its entirety, the portfolio would equate to an investment of $128 million (2009$) on energy efficiency and demand response programs over a five-year period. Over this same time frame, Summit Blue estimates these programs would result in 506 GWh and 164 MW cumulative annual net savings at the generator. The division of DSM program investment between residential and business customers is commensurate with the relative contribution to the portfolio.

Table E-1 provides the projected savings and associated funding for 2009 to 2013.

Table E-1. Savings Goals and Efficiency Portfolio Investment – 2009 to 2013

Consumer Sector (incremental annual net savings at generator)	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013 Total**
Energy Savings (GWh) (1)	18.7	29.9	40.2	42.6	49.7	181.2
% of Total Sector Loss-Adjusted Sales	0.30%	0.48%	0.64%	0.68%	0.78%	-
Winter Demand Savings (MW) (1)	11.6	13.5	15.2	17.7	23.8	81.7
% of Total Sector Loss-Adjusted Sales	0.67%	0.77%	0.87%	1.01%	1.34%	-
Total Cost (2009$ million) (2)	$4.8	$6.1	$7.7	$9.9	$12.7	$41.3
Business Sector (incremental annual net savings at generator)	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013 Total**
Energy Savings (GWh) (1)	39.1	53.1	68.0	72.9	92.2	325.3
% of Total Sector Loss-Adjusted Sales	0.29%	0.40%	0.51%	0.54%	0.68%	-
Winter Demand Savings (MW) (1)	13.6	15.6	16.8	16.6	20.2	82.8
% of Total Sector Loss-Adjusted Sales	0.95%	1.08%	1.16%	1.14%	1.38%	-
Total Cost (2009$ million)	$7.9	$10.3	$12.9	$16.8	$22.6	$70.5
Total (incremental annual net savings at generator)	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013 Total**
Energy Savings (GWh) (1)	57.8	83.0	108.2	115.5	141.9	506.4
% of Total Sector Loss-Adjusted Sales	0.29%	0.42%	0.55%	0.59%	0.72%	-
Winter Demand Savings (MW) (1)	25.2	29.1	32.0	34.2	44.0	164.5
% of Total Sector Loss-Adjusted Sales	0.79%	0.91%	1.00%	1.06%	1.36%	-
Total Cost (2009$ million)	$12.8	$16.4	$20.6	$26.7	$35.3	$111.9
Other Costs (2009$ million) (2)	$3.0	$3.2	$3.0	$3.2	$3.8	$16.3
Portfolio Total Investment (2009$)	**$15.8**	**$19.6**	**$23.6**	**$29.9**	**$39.1**	**$128.2**

Table E-1 Notes:
(1) Savings are not projected for Low Income Energy Conservation Kits. APCo West Virginia would 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) Other Costs include support and other services, including: APCo West Virginia DSM Department, General Education/Training/Media, Low Income Energy Conservation Kits, and Pilot Program Fund.

Incentive levels and other program elements would be reviewed and adjusted to reflect changes in market conditions or implementation processes in order to maximize cost-effective savings, including considerations for APCo staffing as programs grow over time.

Figure E-1 presents the strategic portfolio structure, including six consumer sector and four commercial and industrial sector programs, as well as two multi-sector programs: education and training and new pilots/emerging technology. APCo West Virginia would 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; these costs are included in the reported program budgets.

Figure E-1. DSM Action Plan Portfolio Structure – 2009 to 2013

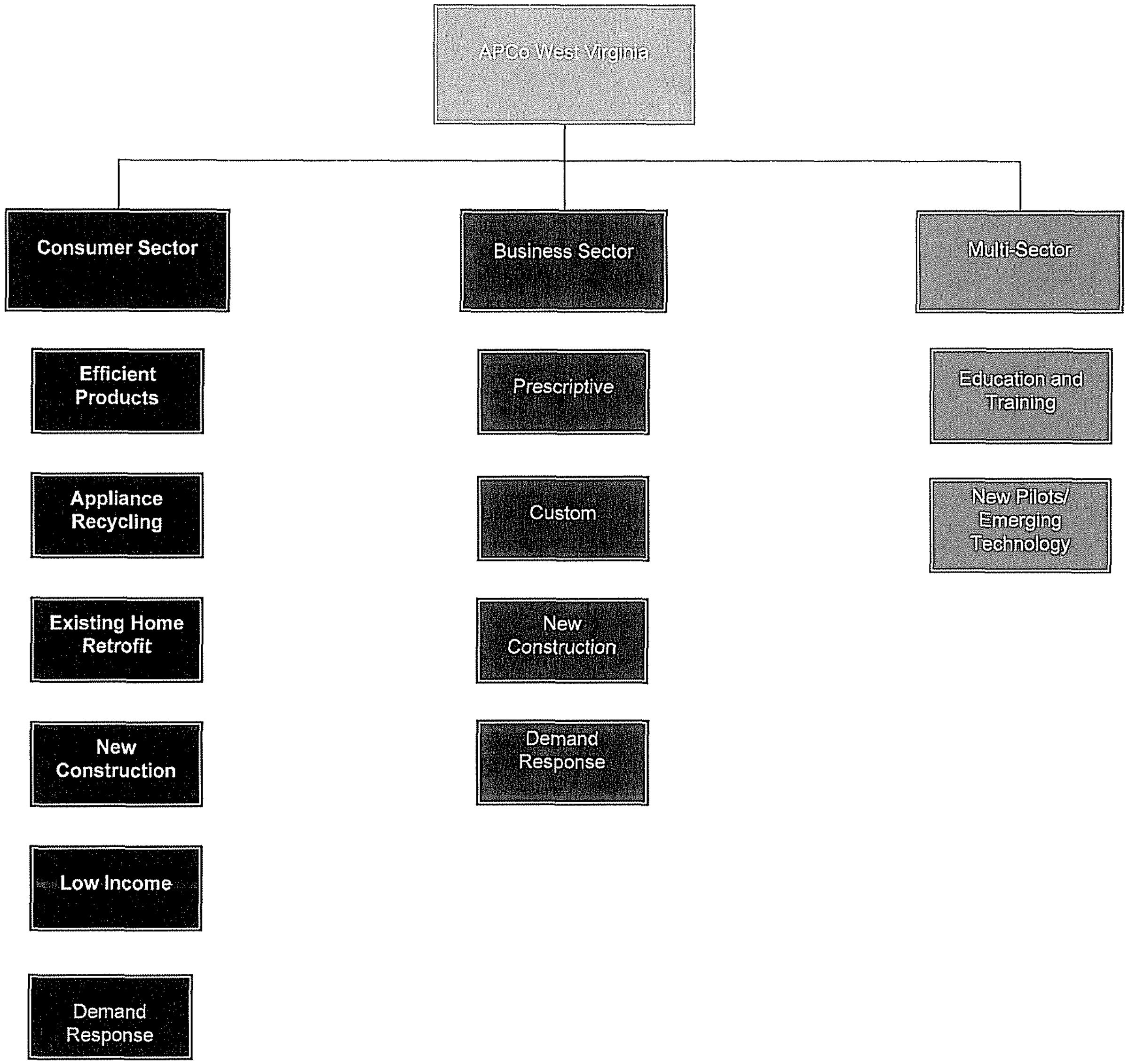


Table E-2 presents the projected MWh energy savings, Total Resource Cost ("TRC") Test results, Net Present Value Benefits in 2009$ million, Lifetime MWh Energy Saved, and Lifetime Cost of Saved Energy in 2009$ per kWh over the five-year period from 2009 to 2013.

Table E-2. Annual Incremental Net Energy (MWh) Savings at Generator – 2009 to 2013[1]

Consumer Sector	2009	2010	2011	2012	2013	2009-2013 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$/kWh) With DR	Lifetime Cost of Saved Energy (2009$/kWh) Without DR
Products	8,292	15,985	23,233	19,791	20,587	87,887	17.4%	2.3	$23.97	686	$0.012	$0.012
Recycling	266	964	933	903	875	3,941	0.8%	1	$0.42	20	$0.046	$0.046
Retrofit	5,843	7,324	8,980	12,392	16,452	50,992	10.1%	2.4	$42.33	771	$0.015	$0.015
Low Income	4,057	5,396	6,984	8,576	11,059	36,072	7.1%	2.4	$25.59	496	$0.029	$0.029
New Construction	234	216	86	967	759	2,262	0.4%	2.4	$1.18	35	$0.006	$0.006
Demand Response	0	0	0	0	0	0	0.0%	1.5	$4.81	0		
Consumer Sector Total	18,692	29,885	40,215	42,629	49,732	181,153	35.8%	2.3	$98.30	2,008	$0.021	$0.018
% of Total Sector Loss-Adjusted Sales	0.30%	0.48%	0.64%	0.68%	0.78%	Note: savings from Low income Energy Conservation Kits are not projected.						

Business Sector	2009	2010	2011	2012	2013	2009-2013 Total	Percent of Portfolio Total	Total Resource Cost Test Ratio (TRC)	Net Present Value	Lifetime Energy Saved	Lifetime Cost of Saved Energy (2009$/kWh) With DR	Lifetime Cost of Saved Energy (2009$/kWh) Without DR
Prescriptive	26,220	36,646	45,994	39,489	45,294	193,644	38.2%	2.2	$66.91	1,857	$0.012	$0.012
Custom	12,880	16,434	22,009	32,099	44,234	127,657	25.2%	1.6	$17.69	1,778	$0.012	$0.012
New Construction	22	36	0	1,268	2,643	3,970	0.8%	1.4	$2.81	104	$0.005	$0.005
Demand Response	0	0	0	0	0	0	0.0%	1.6	$17.30	0		
Business Sector Total	39,122	53,117	68,004	72,856	92,171	325,270	64.2%	1.9	$104.71	3,739	$0.019	$0.012
% of Total Sector Loss-Adjusted Sales	0.29%	0.40%	0.51%	0.54%	0.68%							
PORTFOLIO TOTAL	**57,814**	**83,003**	**108,218**	**115,485**	**141,902**	**506,423**	**100.0%**	**2.2**	**$203.01**	**5,747**	**$0.022**	**$0.017**

[1] Revised March 3, 2010 to be consistent with all AEP jurisdictions' presentation of these data.

Table E-3 presents the projected winter peak demand kW savings levels over the five-year period from 2009 to 2013.

Table E-3. Annual Incremental Net Winter Peak Demand (kW) Savings at Generator – 2009 to 2013

Consumer Sector	2009	2010	2011	2012	2013	2009-2013 Total	Percent of Portfolio Total
Products	806	1,585	2,199	1,790	1,867	8,247	5.0%
Recycling	27	98	95	92	89	402	0.2%
Retrofit	4,254	4,925	5,731	7,387	10,770	33,067	20.1%
Low Income	2,429	2,821	3,318	4,200	6,121	18,889	11.5%
New Construction	22	20	8	84	67	201	0.1%
Demand Response	4,029	4,006	3,839	4,126	4,925	20,925	12.7%
Consumer Sector Total	**11,566**	**13,456**	**15,191**	**17,680**	**23,838**	**81,731**	**49.7%**
% of Total Sector Loss-Adjusted Sales	0.67%	0.77%	0.87%	1.01%	1.34%		

Note: savings from Low income Energy Conservation Kits are not projected

Business Sector	2009	2010	2011	2012	2013	2009-2013 Total	Percent of Portfolio Total
Prescriptive	4,273	5,956	6,977	5,322	6,458	28,986	17.6%
Custom	957	1,276	1,779	2,509	3,208	9,729	5.9%
New Construction	2	2	0	68	141	212	0.1%
Demand Response	8,404	8,373	8,041	8,658	10,347	43,822	26.6%
Business Sector Total	**13,635**	**15,607**	**16,798**	**16,557**	**20,154**	**82,750**	**50.3%**
% of Total Sector Loss-Adjusted Sales	0.95%	1.08%	1.16%	1.14%	1.38%		
PORTFOLIO TOTAL	**25,201**	**29,063**	**31,989**	**34,236**	**43,992**	**164,481**	**100.0%**
% of Total Portfolio Loss-Adjusted Sales	0.79%	0.91%	1.00%	1.06%	1.36%		

DSM Investment

The estimated investment for these programs for 2009 to 2013, in 2009 dollars, would be approximately $16 million in 2009, $20 million in 2010, $24 million in 2011, $30 million in 2012, and $39 million in 2013, for a total $128 million, as shown in Table E-4. The projected investments include one-time startup costs for the first year of program implementation.

Table E-4. Estimated Annual Total Investments by Program for APCo West Virginia (2009$)

Consumer Sector	2009	2010	2011	2012	2013	2009-2013	% of Portfolio Total
Products	$690,676	$1,187,034	$1,797,934	$2,143,230	$2,231,704	$8,050,577	6.3%
Recycling	$66,277	$221,470	$214,374	$207,623	$201,059	$910,803	0.7%
Retrofit	$1,522,492	$1,690,103	$2,021,534	$2,700,284	$3,803,563	$11,737,977	9.2%
Low Income	$1,813,112	$2,073,927	$2,526,252	$3,313,837	$4,589,968	$14,317,095	11.2%
New Construction	$19,223	$16,303	$6,336	$99,377	$79,868	$221,108	0.2%
Demand Response	$717,733	$950,148	$1,155,643	$1,432,144	$1,816,575	$6,072,242	4.7%
Consumer Sector Total	**$4,829,512**	**$6,138,984**	**$7,722,073**	**$9,896,496**	**$12,722,738**	**$41,309,802**	**32.2%**
Business Sector	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013**	**% of Portfolio Total**
Prescriptive	$2,829,483	$3,567,256	$4,268,875	$5,111,194	$6,637,753	$22,414,561	17.5%
Custom	$2,336,478	$2,767,515	$3,579,251	$5,130,878	$7,327,511	$21,141,634	16.5%
New Construction	$2,892	$4,486	$0	$174,308	$361,709	$543,395	0.4%
Demand Response	$2,768,762	$3,967,251	$5,062,370	$6,422,065	$8,223,806	$26,444,255	20.6%
Business Sector Total	**$7,937,615**	**$10,306,509**	**$12,910,496**	**$16,838,446**	**$22,550,779**	**$70,543,845**	**55.0%**
Other Costs	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013**	**% of Portfolio Total**
APCo West Virginia DSM Department	$750,000	$1,250,000	$1,250,000	$1,500,000	$2,000,000	$6,750,000	5.3%
General Education/ Training/Media	$2,000,000	$1,500,000	$1,250,000	$1,250,000	$1,250,000	$7,250,000	5.7%
Energy Conservation Kits	$150,000	$200,000	$200,000	$200,000	$200,000	$950,000	0.7%
Pilot Program Fund	$150,000	$300,000	$300,000	$300,000	$300,000	$1,350,000	1.1%
Other Costs Total	**$3,050,000**	**$3,250,000**	**$3,000,000**	**$3,250,000**	**$3,750,000**	**$16,300,000**	**12.7%**
PORTFOLIO TOTAL	**$15,817,127**	**$19,695,493**	**$23,632,569**	**$29,984,941**	**$39,023,517**	**$128,153,647**	**100.0%**

These cost estimates are high-level for strategic planning and initial organizational development purposes. To firm up cost estimates and make any necessary budget and schedule changes, it is assumed that APCo West Virginia would issue RFP(s) for implementation contractors to bid on the work, and require them to submit more detailed budgets along with estimated savings and implementation schedules. Any adjustments to the cost recovery mechanism, including load management rate discounts, are assumed to be trued up on an annual basis.

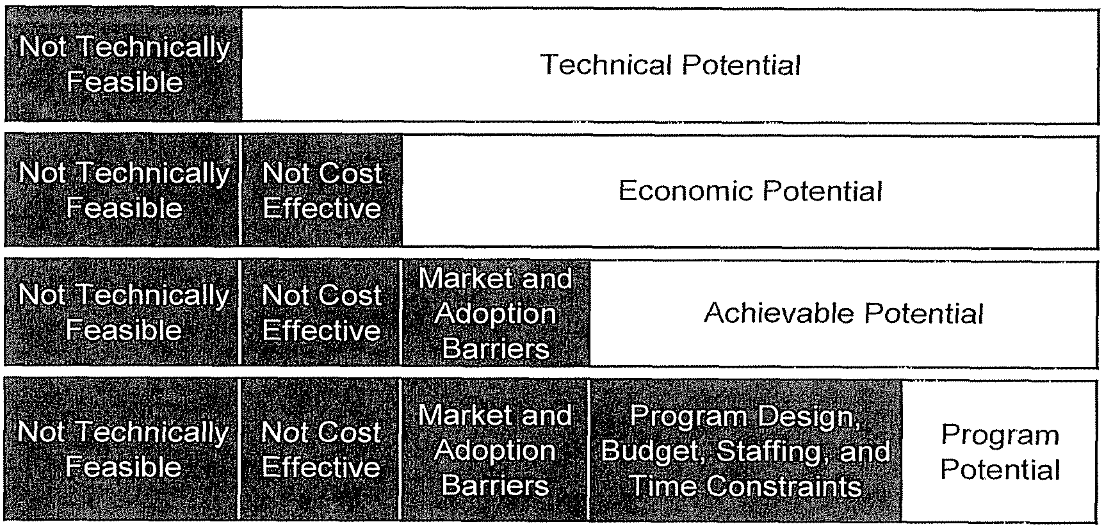
The next section discusses the approach to estimating DSM potential. After that section, there is an overview of DSM Potential results for 2009 to 2028, followed by program plans, and finally, conclusions and recommendations.

E.1 Approach to Estimating DSM Potential

APCo West Virginia's suggested program portfolio was developed by incorporating elements of the most successful energy efficiency programs across North America into program plans designed for the West Virginia market and APCo West Virginia customers in particular. A benchmarking process was to review the selected programs, with a focus on successful Eastern and 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. APCo West Virginia's DSM Action Plan is focused on capturing cost-effective *program potential* in its service territory. 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 DSM potential study with the following key tasks:

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

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 APCo West Virginia service territory 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 APCo West Virginia 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 DSM measures.

E.1.2 Characterize the DSM Measures

Characterization of DSM 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 DSM measures for this study. For the DSM measures having impacts that do not vary with climate, the team used engineering estimates and publicly available and well-respected sources, such as the California Database on Energy-Efficiency Resources ("DEER") database. The team adjusted the DEER energy and demand impacts for APCo West Virginia'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 APCo West Virginia to estimate DSM measure per unit savings.

For DSM 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 DSM measure lifetimes, a combination of resources was used, including manufacturer data, typical economic depreciation assumptions, and the California DEER database.

E.1.3 DSM Benchmarking and Best Practices Assessment

To ensure that the DSM potential estimates that Summit Blue developed for APCo West Virginia are reasonable and appropriate, and to identify the best practices regarding DSM programs, the team conducted a benchmarking assessment on other utilities' and agencies' DSM programs. Summit Blue 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.

For the 14 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 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 DSM programs for an extended period. Since these organizations have been conducting electricity DSM programs, savings have been realized 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.

E.1.4 Benefit-Cost Analysis

The measures were evaluated with respect to each of the four main standard benefit-cost tests.[2]

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 DSM 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 DSM 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 DSM program administrative costs.[3]

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[2] 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.

[3] Administrative costs in this study are all costs for a given program aside from customer incentives: planning, marketing and sales, business process administration such as rebate processing, and evaluation, measurement and verification. General overhead costs such as general DSM department overheads, general education/training, and

In line with standard industry practice, Summit Blue used the TRC test to determine which DSM programs to include in APCo West Virginia's portfolio of DSM programs. The RIM test is a more restrictive test that is only used as the main DSM benefit-cost test in very few states.[4] All of the measures passed the TRC test. The portfolio of DSM programs that Summit Blue developed is quite cost effective by industry standards. Table E-5 presents the overall benefit cost ratios for the consumer sector, the commercial and industrial sector, and the overall portfolio.

Table E-5. Cost-effectiveness Ratios – 2009 to 2013

Consumer Sector	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Rate Impact Measure Test (RIM)
Products	2.3	3.4	6.3	0.5
Recycling	1.0	0.9	na	0.0
Retrofit	2.4	3.6	3.6	0.9
Low Income	2.4	3.6	3.9	0.8
New Construction	2.4	3.7	6.8	0.5
Demand Response	1.5	4.2	1.5	1.1
Consumer Sector Total	**2.3**	**3.6**	**4.0**	**0.7**
Business Sector	**Total Resource Cost Test (TRC)**	**Utility Cost Test (UCT)**	**Participant Cost Test (PCT)**	**Rate Impact Measure Test (RIM)**
Prescriptive	2.2	3.5	3.3	0.8
Custom	1.6	2.3	3.5	0.6
New Construction	1.4	2.2	2.8	0.6
Demand Response	1.6	2.3	0.7	2.0
Business Sector Total	**1.9**	**2.9**	**2.9**	**0.8**
PORTFOLIO TOTAL	**2.2**	**3.3**	**3.9**	**0.7**

E.1.5 Estimate DSM Program Potentials

Summit Blue developed estimates of DSM measure potentials in terms of technical, economic, and "achievable" potential (the program results that are realistic for APCo West Virginia to achieve through

pilot program funding are estimated separately from specific programs, but are included in the overall portfolio benefit-cost analysis.

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

cost-effective DSM 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 DSM potential estimates. These estimates will assume that adequate funding is available to achieve the DSM potentials and that APCo West Virginia is able to achieve "best practice" DSM program performance within three to four years.

2. A high case estimate based on the experience of the best of the best utilities' DSM program results.

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

E.2 DSM Potential Results

The cumulative net annual DSM potential savings (Base Case Scenario Market Potential) in 2028 is estimated to be approximately 2,460 GWh at generator, about 11% of forecast sales, and 488 MW at generator, about 14% of peak winter demand, as shown in Table E-6.

Table E-6 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 uncertain than the market potential results, since surveys of APCo West Virginia'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 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 37.5% of incremental measure costs.

Table E-6. Projected Cumulative Annual Net Savings at Generator and Costs – 2012, 15-Year & 20-Year Plans

Year-End 2012	Energy Efficiency				Demand Response		Costs		
Potential Scenario	Cumulative Annual Net Energy Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Estimated Costs - EE	Estimated Cost - DR	Estimated Total Costs
	GWh	% of Forecasted Sales	MW	% of Forecasted Sales	MW	% of Forecasted Sales	Total Cost Over Term		
Residential									
Technical	1,845	29%	716	41%	315	18%	NA	NA	NA
Economic	1,208	19%	493	28%	315	18%	NA	NA	NA
High Case	373	6%	133	8%	24	1%	$73,451,644	$6,383,501	$79,835,145
Base Case	131	2%	42	2%	16	1%	$19,040,572	$4,255,667	$23,296,240
Low Case	76	1%	25	1%	12	1%	$10,590,802	$3,191,750	$13,782,552
C&I									
Technical	4,123	31%	372	26%	998	69%	NA	NA	NA
Economic	3,096	23%	315	22%	998	69%	NA	NA	NA
High Case	784	6%	103	7%	50	3%	$140,666,753	$27,330,674	$167,997,426
Base Case	233	2%	29	2%	33	2%	$29,772,616	$18,220,449	$47,993,065
Low Case	145	1%	18	1%	25	2%	$16,121,347	$13,665,337	$29,786,684
Total									
Technical	5,968	30%	1,087	34%	1313	41%	NA	NA	NA
Economic	4,304	22%	808	25%	1313	41%	NA	NA	NA
High Case	1,157	6%	235	7%	74	2%	$214,118,397	$33,714,175	$247,832,571
Base Case	365	2%	71	2%	49	2%	$48,813,188	$22,476,116	$71,289,305
Low Case	221	1%	43	1%	37	1%	$26,712,149	$16,857,087	$43,569,236

(1) Numbers in this table do not include Demand Response programs and Low Income Energy Conservation Kits. APCo West Virginia would 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; these costs are included in this table. Forecasted sales are adjusted for losses.

(2) Costs in this table are not included for: APCo West Virginia DSM Department, General Education/Training/Media, Demand Response programs, Low Income Energy Conservation Kits, and Pilot Program Fund.

Table E-6, continued.

15 Year Plan	Energy Efficiency				Demand Response		Costs		
Potential Scenario	Cumulative Annual Net Energy Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Estimated Costs - EE	Estimated Cost - DR	Estimated Total Costs
	GWh	% of Forecasted Sales	MW	% of Forecasted Sales	MW	% of Forecasted Sales	Total Cost Over Term		
Residential									
Technical	1,872	28%	715	38%	312	16%	NA	NA	NA
Economic	1,221	19%	492	26%	312	16%	NA	NA	NA
High Case	1,121	17%	476	25%	109	6%	$256,473,807	$61,930,823	$318,404,630
Base Case	644	10%	247	13%	73	4%	$109,741,756	$41,287,215	$151,028,971
Low Case	418	6%	152	8%	54	3%	$61,145,972	$30,965,412	$92,111,383
C&I									
Technical	4,197	29%	375	24%	998	64%	NA	NA	NA
Economic	3,154	22%	318	20%	998	64%	NA	NA	NA
High Case	2,663	18%	284	18%	230	15%	$546,729,871	$295,196,650	$841,926,521
Base Case	1,291	9%	140	9%	154	10%	$203,122,160	$196,797,766	$399,919,926
Low Case	783	5%	86	5%	115	7%	$103,398,755	$147,598,325	$250,997,080
Total									
Technical	6,068	29%	1,090	32%	1310	38%	NA	NA	NA
Economic	4,375	21%	810	23%	1310	38%	NA	NA	NA
High Case	3,784	18%	760	22%	339	10%	$803,203,678	$357,127,473	$1,160,331,151
Base Case	1,935	9%	387	11%	226	7%	$312,863,915	$238,084,982	$550,948,897
Low Case	1,202	6%	238	7%	170	5%	$164,544,727	$178,563,736	$343,108,464

Table E-6, continued.

20 Year Plan	Energy Efficiency				Demand Response		Costs		
Potential Scenario	Cumulative Annual Net Energy Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Estimated Costs - EE	Estimated Cost - DR	Estimated Total Costs
	GWh	% of Forecasted Sales	MW	% of Forecasted Sales	MW	% of Forecasted Sales	Total Cost Over Term		
Residential									
Technical	1,893	28%	717	37%	310	16%	NA	NA	NA
Economic	1,232	18%	492	25%	310	16%	NA	NA	NA
High Case	1,216	18%	510	26%	139	7%	$277,088,368	$103,080,138	$380,168,506
Base Case	802	12%	311	16%	93	5%	$138,229,606	$68,720,092	$206,949,698
Low Case	560	8%	201	10%	70	4%	$81,191,360	$51,540,069	$132,731,429
C&I									
Technical	4,241	28%	377	23%	998	62%	NA	NA	NA
Economic	3,189	21%	320	20%	998	62%	NA	NA	NA
High Case	3,102	21%	319	20%	296	18%	$628,201,307	$502,490,077	$1,130,691,385
Base Case	1,658	11%	177	11%	197	12%	$262,508,581	$334,993,385	$597,501,966
Low Case	1,036	7%	111	7%	148	9%	$138,218,766	$251,245,039	$389,463,804
Total									
Technical	6,134	28%	1,094	31%	1308	37%	NA	NA	NA
Economic	4,421	20%	812	23%	1308	37%	NA	NA	NA
High Case	4,318	20%	830	23%	435	12%	$905,289,675	$605,570,215	$1,510,859,891
Base Case	2,460	11%	488	14%	290	8%	$400,738,187	$403,713,477	$804,451,663
Low Case	1,596	7%	313	9%	218	6%	$219,410,126	$302,785,108	$522,195,234

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

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

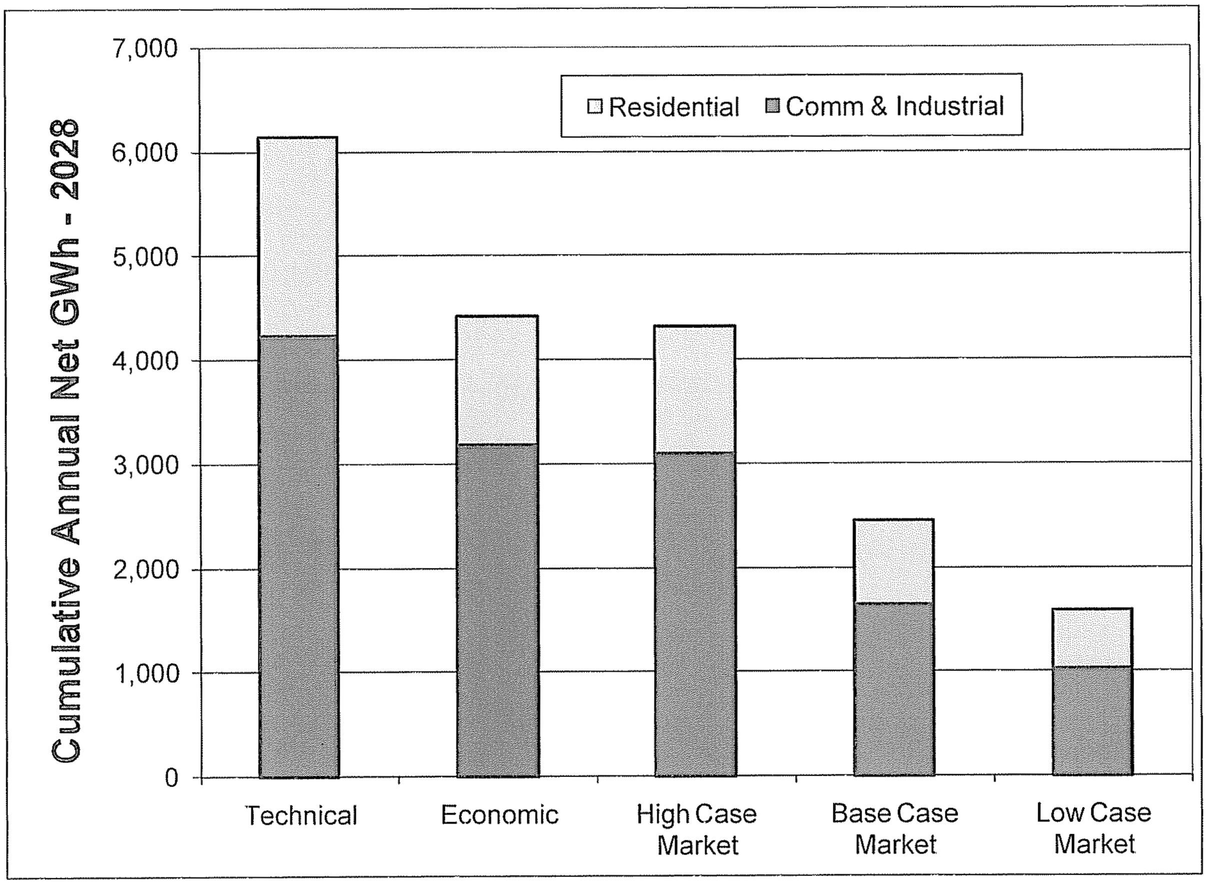


Figure E-4. Cumulative Annual Net Winter Peak MW Demand Savings in 2028 – at Generator

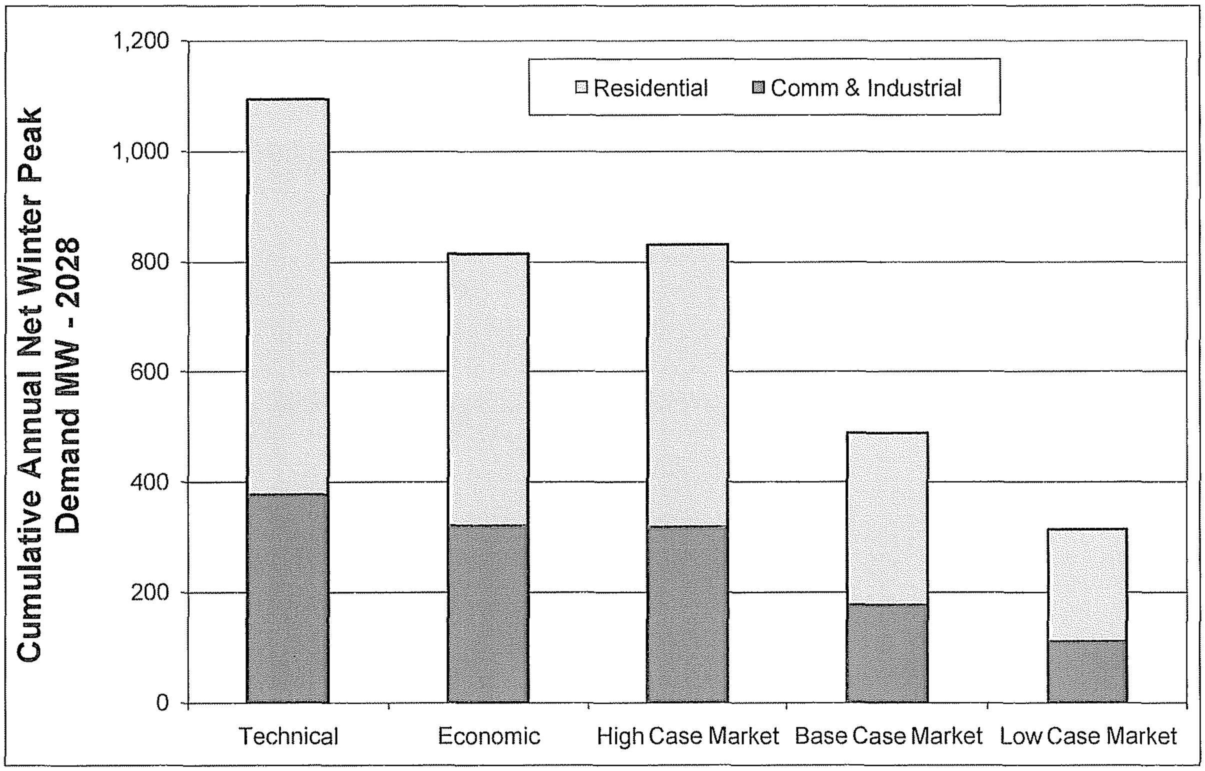
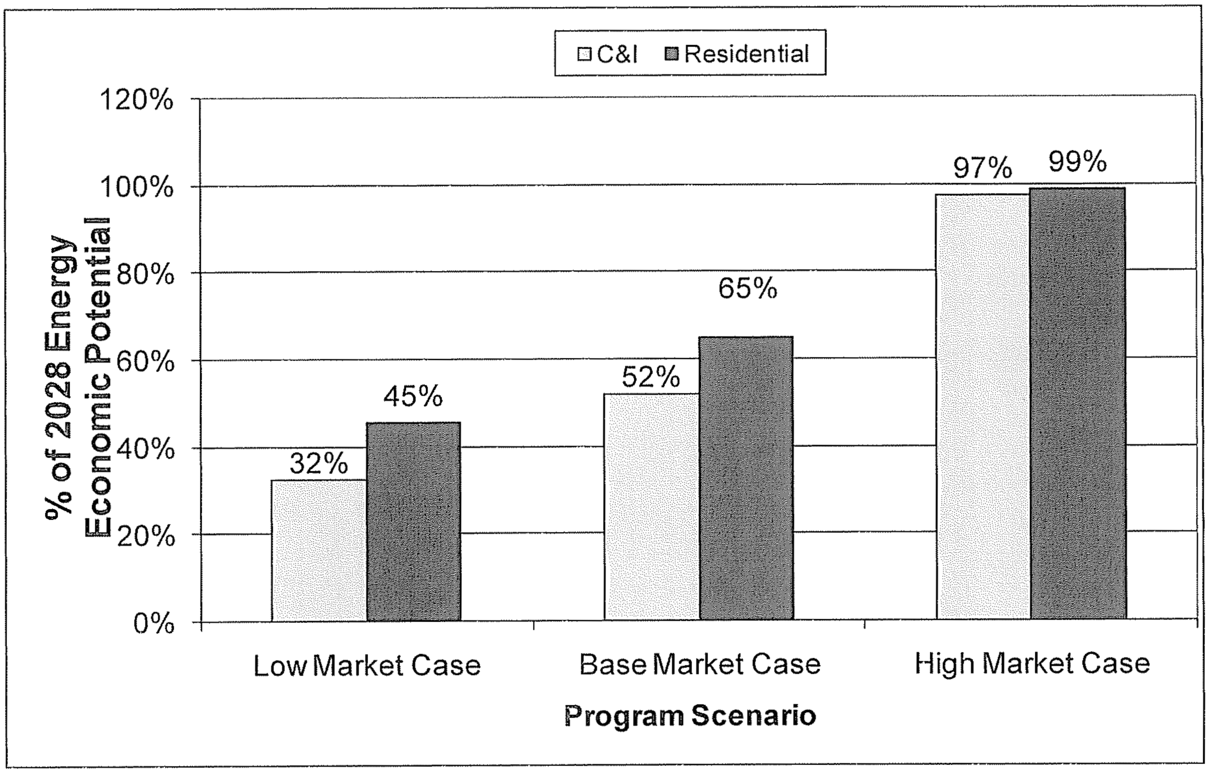


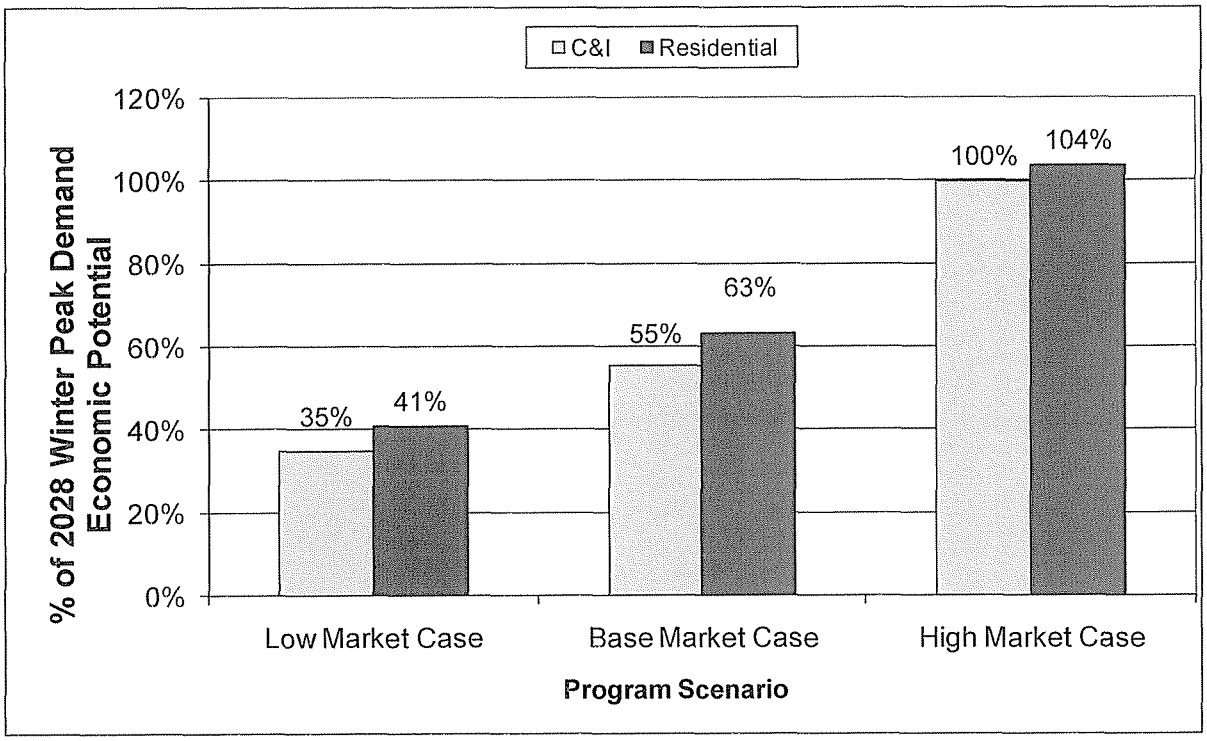
Figure E-5 and Figure E-6 show the cumulative Market Potential[5] as a percent of the Economic Potential for energy efficiency.

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



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

Figure E-6. Market Potential Net Winter Peak Demand Savings at Generator as Percent of Economic Potential in 2028[6]



E.3 Overview of Program Plans

The plans developed from this potentials 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. APCo West Virginia's portfolio of programs can be divided into consumer, business and multi-sectors with utility administrative functions providing support across all program areas. APCo West Virginia would maintain as part of its functionality the education, training and emerging technology budgets. These efforts would leverage existing AEP corporate connections and efforts to maximize impact of these outreach and education efforts.

Consumer Sector

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[6] The high market case shows =/>100% of economic potential, because demand response program impacts are included in the High Market Case, but are not included in the Economic Potential.

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: produces 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; and Phase 3: Home Performance Retrofit with ENERGY STAR.

Low Income: provides 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.

Residential Demand Response: includes a Direct Load Control (DLC) Program to residential customers with central air conditioners, electric heat pumps and central electric resistance heat or electric water heaters.

Business Sector

Prescriptive Incentive: generates energy savings for all business customers through the promotion of high-efficiency standardized equipment not requiring substantial engineering. Three primary objectives 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 will be offered to customers.

Custom: assists 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 would be based on energy savings on a per kWh and per kW basis for installed measures.

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.

C&I Demand Response: includes a Direct Load Control (DLC) Program to non-residential customers with packaged air conditioning, electric resistance heat, or electric water heaters, specifically targeting small C&I customers.

Multi-Sector

General Energy Education: This program coordinates APCo West Virginia's efforts to create customer awareness for the programs, enhance demand, and educate customers on energy efficiency.

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

New Pilots/Emerging Technology: The program objective would be 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, could be explored.

Portfolio Implementation

This plan assumes that APCo West Virginia implements the proposed portfolio of programs through a combination of in-house utility staff and competitively selected third-party implementation contractors. APCo West Virginia would issue Requests for Proposals ("RFP"s) to qualified firms related to multiple RFPs for the delivery of similar programs targeting specific sectors. By issuing multiple RFPs, it should be possible to obtain more competitive, cost-effective and qualified implementation responses.

Implementation contractors would be eligible to respond to one or all of the RFPs. The process of issuing RFPs, evaluating responses and negotiating contracts along with associated program start-up time could result in 2009 launch dates, at the earliest for some programs. However, it is also recognized that it will take some time for APCO West Virginia to finalize any proposed program portfolio and to obtain necessary regulatory approvals, including appropriate cost recovery. This could, and likely will, push initial program implementation beyond calendar year 2009. The remaining programs would begin at a later time 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 APCo West Virginia portfolio. EM&V would 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 would 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 APCo West Virginia EM&V budget is assumed to be approximately 3-5% of the overall portfolio investment. Summit Blue has included appropriate costs in the proposed budgets for comprehensive EM&V.

All evaluation activities would 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 would 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 would detail all measure savings assumptions, including base efficiency, high efficiency, measure size, measure life, free ridership, and spillover estimates.
- Interfaces with the 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.

Program and Portfolio Risk

Through 2009, the economy will likely remain in a severe economic recession. In this economic environment, APCo West Virginia'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, would be very challenging. APCo West Virginia asked Summit Blue 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, the plan set forth here would capitalize on those segments of the market who may be willing to invest in energy efficiency given the challenging economic landscape. In balance, this would provide APCo West Virginia with its best available plan, under the economic constraints mentioned above, to achieve energy efficiency goals.

The following strategies should help minimize the risks associated with this suggested 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 DSM 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 DSM potential (Base Case Scenario Market Potential) identified in this study represents energy reductions of around 12% for APCo West Virginia residential customers and 11% for commercial and industrial customers below forecasted levels and known enacted energy codes and standards by 2028, or about 0.5% per year. This magnitude of savings has been achieved by best practice program portfolios in the Midwest, Northeast and Western U.S. Winter peak demand and annual energy reductions of the magnitudes found for the Base Market Potentials case are being achieved by a variety of utilities.

The largest sources of uncertainty regarding the estimates that Summit Blue has developed to date for APCo West Virginia stem from using secondary information to profile APCo West Virginia's customers. It is uncertain how well the primarily regional and national estimates used for current DSM measure saturations apply to APCo West Virginia'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 DSM benchmarking analysis results presented in this report should give APCo West Virginia management confidence that a variety of utilities in the region and throughout the country are achieving large-scale results from their DSM 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 DSM program plans that Summit Blue developed are based on the best practice results from the analysis of utility DSM 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 DSM programs often make significant periodic investments to develop and update secondary best-practice and primary market research data to aid their DSM program planning. For example, Xcel Energy in Minnesota conducts large-scale market assessments and DSM potential studies that include significant on-site customer data collection every five to ten years. The Iowa utilities conduct DSM potential studies about every five years to support their periodic DSM program filings with their regulators. These utilities collected significant customer data as part of their 2008 DSM 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; and
- Engage in long-term organizational development to assure performance and APCo West Virginia brand continuity, as well as strong internal oversight over the life of the portfolio.

1 INTRODUCTION

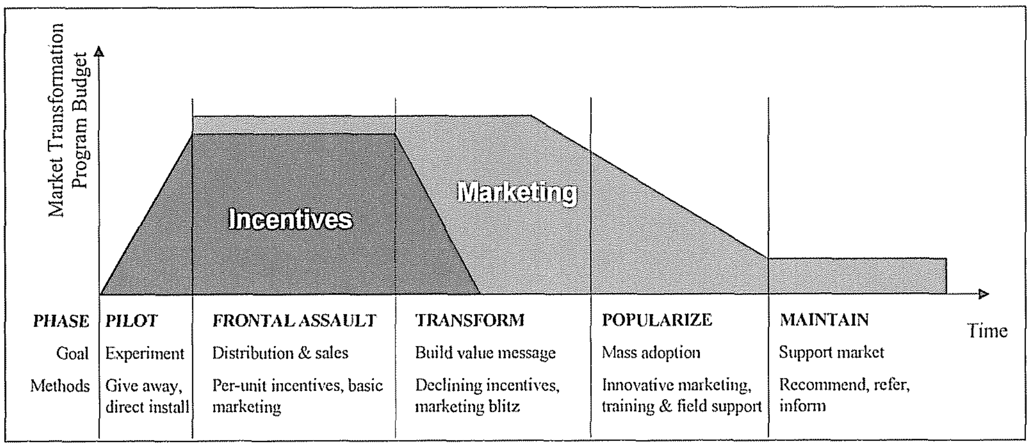
APCo West Virginia is a large provider of electric service with a mix of 400,000 residential, commercial and industrial customers.

The following DSM 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. Summit Blue Consulting anticipates that, prior to actual program implementation, portions of this plan will need to be revised to reflect better information or changing market conditions.

On behalf of APCo West Virginia, Summit Blue Consulting (Summit Blue) has designed a comprehensive portfolio of DSM 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, it is anticipated that, over time, investment in energy efficiency measures would follow a predictable path of market transformation that has been experienced in other jurisdictions. With sustained levels of investment, promotion of efficient measures would in the early years focus on immediate up-front incentives to stimulate the marketplace. Over time, funds could 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 could be transferred to new program areas and new technologies and, if appropriate, the process would repeat. Each series of the market transformation process could 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 APCo West Virginia, one growing increasingly important as fuel and commodity prices become more volatile and greenhouse gas regulation becomes more likely. Estimates of DSM 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 DSM potential in APCo West Virginia's service territory by Summit Blue Consulting.

1.1 APCo West Virginia Overview

As described on Appalachian Power Company's website, the Company overall has about one million customers (about 400,000 of those being in West Virginia) and 8,000 megawatts of generation. Figure 1-2 presents APCo's service territory, which includes a large geographic area in West Virginia. APCo West Virginia provides power to more than 200 communities.

Figure 1-2. Appalachian Power Company Service Territories

Table 1-1 outlines key statistics for APCo West Virginia.

Table 1-1. APCo Key Statistics[7]

2007 electrical sales in megawatt hours:	38,443,670 (Total APCo)
	19,728,770 (W.Va.)
Average use per residential customer:	15,489 kWh per year (W.Va.)
Average cost per kilowatt-hour (residential):	5.99 cents (W.Va.)
Size of service area (asset):	8,455 square miles (W.Va.)
Communities served:	217 (W.Va.)
Net plant in service APCo:	$6 billion
Size of distribution system:	18,982 miles (W.Va.)
Size of transmission system:	2,835 miles (W.Va.)
Total AEP Employees:	2,911 (W.Va.)

Study Goals and Approach

The overall goals of the DSM potential study are to:

- Assess the technical, economic, and achievable potential for the residential, commercial, and industrial sectors.
- Develop high-level DSM program plans.

Summit Blue undertook the DSM potential study in the following key tasks:

- Develop baseline consumption profiles, and develop initial building simulation model specifications.
- Characterize the DSM measures.
- Conduct a DSM benchmarking and best practices analysis.
- Conduct benefit-cost analysis.
- Estimate DSM potentials.

[7] http://www.appalachianpower.com/about/serviceTerritory/docs/AppalachianPowerFactSheet2007.pdf.

- 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 APCo West Virginia's Volume 2: 2009 to 2028 DSM Potential Study is divided into the following sections:

Section 2: Baseline Consumptions Profiles discusses baseline consumption profiles and initial building simulation model specifications for APCo West Virginia.

Section 3: DSM Measure Characterizations provides details on the DSM measures.

Section 4: Benchmarking and Best Practice Results provides a discussion of benchmarking and best practice results.

Section 5: DSM Measure Cost-effectiveness Analysis presents the cost effectiveness analysis.

Section 6: DSM Potential Methodology and Results presents the approach used to conduct the DSM potential analysis and the results of different scenarios. Detailed data are provided in a set of separately bound and electronic appendices.

Section 7: Glossary defines key terms used in the report.

Volume 1 – 2009 to 2028 DSM Action Plan: presents the DSM plan for the first five years, 2009 to 2013.

Volume 3 – Appendices A-G: includes 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), Measure Descriptions and Characterizations (Appendix D), Program Results Summary (Appendix E), SB-RAM Input Summary & Measure Tracking Summary (Appendix F), and References (Appendix G).

2 BASELINE CONSUMPTION PROFILES

One of the most important aspects of any planning study, including DSM potential studies, is to develop a clear understanding of the starting point. Planning studies that miss their mark often start with inaccurate assumptions about baseline conditions from which forecasts are developed.

Summit Blue staff reviewed and processed the initial data collected to develop residential and commercial market profiles containing the following elements:

1. Customer counts, sales, and peak demands for residential and commercial customers by major market segment.
2. Historic usage and company forecasts of customer counts, sales, and peak demands for each market sector and segment, if available, for the next ten years.
3. Trends in electric use per customer and overall electric use by market sector and segment, if available, will be identified from the information above.
4. Customer facility characteristics, such as size, and building shell elements, such as insulation.
5. Customer energy using equipment saturations and DSM measure saturations.

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 Appalachian Power Company – West Virginia (APCo - WV) service territory. Key data sources included:

- Electricity sales data provided by APCo - WV.
- 2006 Residential Appliance Saturation Survey for APCo - WV.
- Utility-level electricity sales data by sector from Form EIA-826, Annual Electric Power Industry Report, file 2. http://www.eia.doe.gov/cneaf/electricity/page/eia826.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 South Atlantic[8] 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/ South Atlantic [1] census division.

[8] Includes the states of DE, MD, DC, VA, WV, NC, SC, GA, and FL.

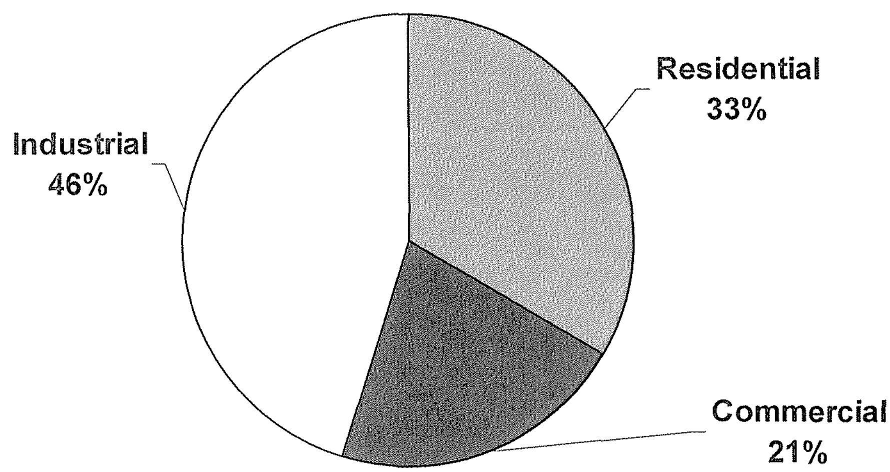
- 2002 Manufacturing Energy Consumption Survey (MECS), by census region produced by the Energy Information Agency (EIA), US Department of Energy (US-DoE), http://www.eia.doe.gov/emeu/mecs/ South Census Region.[9]
- 2008 Building America Benchmark (BABM). http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/42662.pdf.

The methodology used started with sales and customer count data from APCo – WV. These data were cross verified with EIA reported data. Table 2-1 and Figure 2-1 below are based on EIA sales data and Appalachian Power Company - WV customer counts by sector 2007.

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

Market Sector	Sales MWh	Customers	kWh per Customer
Residential	5,839,208	376,766	15,498
Commercial	3,752,355	65,710	57,105
Industrial	7,907,040	1,503	5,262,005
Total Billed	**17,498,603**	**443,979**	

Figure 2-1. Market Profile – Electricity Sales



[9] Includes the states of DE, MD, DC, VA, WV, NC, SC, GA, FL, TX, OK, AR, LA, MS, AL, TN, and KY.

2.1.1 Residential Sector Market Profile

The residential sector market profile is built up out of four major sources. APCo - WV total consumption and customer number data for 2006-2007 were used for baseline annual electricity consumption. APCo - WV monthly residential load data for 2007-2008 were used to generate the monthly electricity consumption profile. The 2006 APCo - WV Residential Appliance Saturation Survey data were 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 APCo - WV system-level residential electricity consumption by month for 2007-2008. The household total electricity consumption by month was calculated from these data. Four seasonal end uses were tabulated (heating, cooling, hot water, and lighting) in addition to the non-seasonal end uses (including 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.

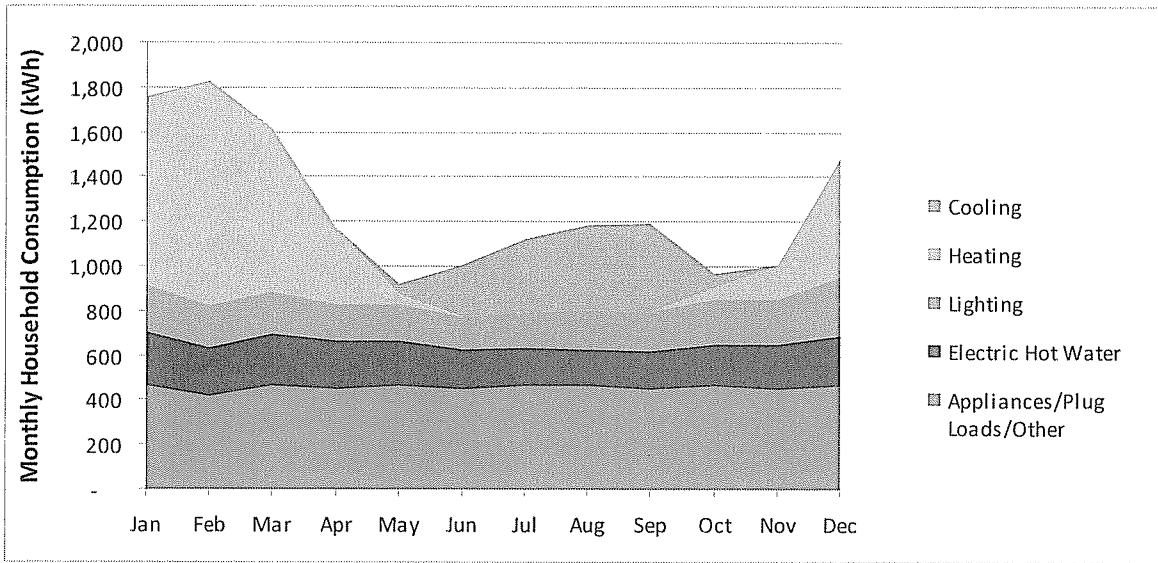
Lighting. Annual lighting consumption per household was estimated using the BABM. Lighting use increased during the winter months due to less daylight. The seasonal lighting variation profile was derived from a recent California CFL monitoring study, with an addition to December for holiday lighting. 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 Figure 2-2.

Figure 2-2.Residential Monthly Electricity End use Breakdown

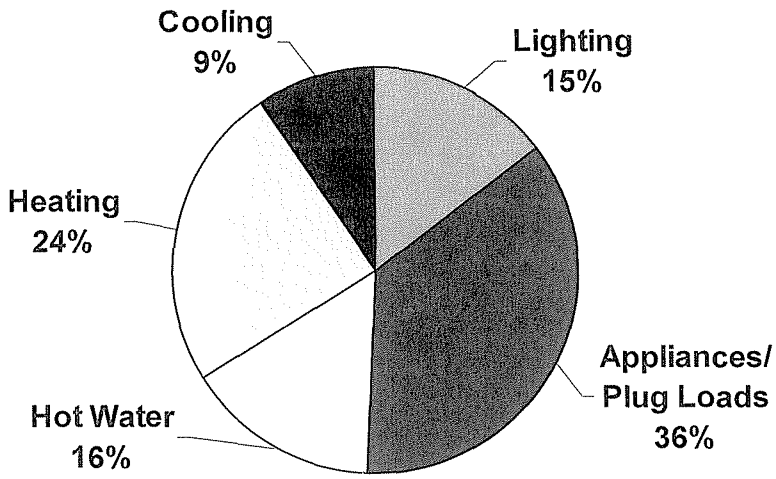


The saturation rates of electric end uses among electricity customers are indicated in Table 2-2 below. These reflect the saturation rate of an end use among only APCo - WV residential electricity customer households (HH below). The intensity of each electric end use was calculated by multiplying the Unit Energy Consumption (UEC) for each end use by the saturation rates among APCo - WV residential electricity customers. Ultimately, this gives the amount of electricity sold by APCo - WV 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)	APCO - WV Sales (GWh)
Lighting	100.0%	1.25	1.25	844
Appliances/Plug Loads	100.0%	3.05	3.05	2,061
Hot Water	59.4%	2.25	1.34	905
Heating	50.1%	4.14	2.07	1,403
Cooling	90.4%	0.89	0.80	542
Total			**8.51**	**5,754**

Figure 2-3. Residential Market Profile – Electricity Sales



2.1.2 Commercial and Industrial Sector Market Profiles

Commercial and Industrial sector profiles were built starting with segment-level sales data provided by APCo - WV. The detailed data represent most industrial customers and a large portion of commercial customers. The data represent almost 96% of all commercial customers, and more than 82% of all commercial sales when compared to 2007 EIA data. Summit Blue assumed the rest of the commercial sector was represented proportionally with the data provided. The detail of these data provide good insight into the size and consumption of these sectors.

For the commercial sector the APCo - WV 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 APCo - WV 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 APCo - WV region. Differences between BEDB and ECSs were attributed to climate and climate driven loads – heating and cooling. These two resources together 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 APCo - WV.

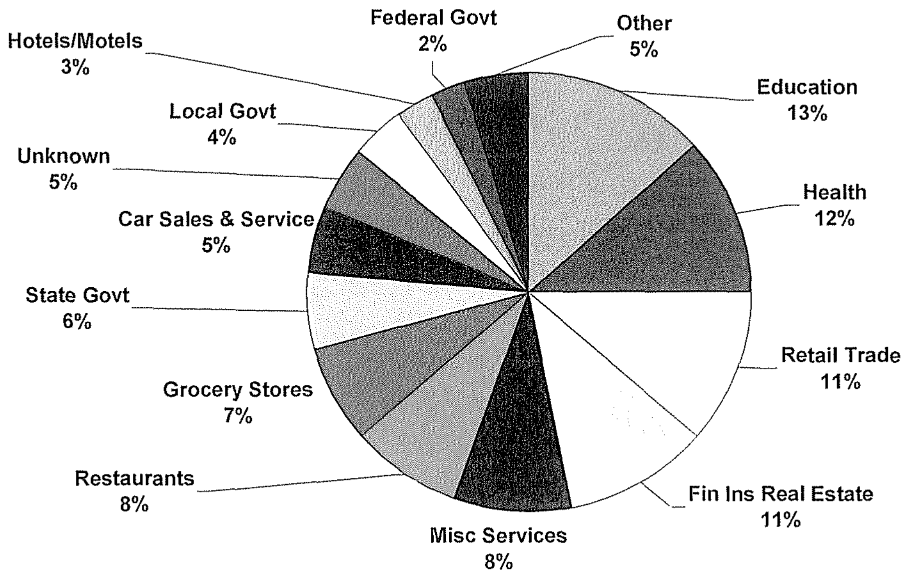
Secondary resources for manufacturing market shares are much less regionally specific. The Manufacturing Energy Consumption Survey (MECS) publishes census region data at a highly aggregated level and manufacturing segment data on a national level. However, the consumption data are broken out into useful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

The following table shows the share of electricity consumed by the commercial sector broken out by 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. See Table 2-3 and Figure 2-4.

Table 2-3. Commercial Sector Breakout – Electricity

End use	APCo - WV Sales Share	APCo - WV Sales (MWh)
Education	13.2%	495,403
Health	11.8%	442,274
Retail Trade	11.4%	428,469
Fin Ins Real Estate	10.5%	395,810
Misc Services	8.5%	317,674
Restaurants	8.1%	304,910
Grocery Stores	7.3%	275,309
State Govt	5.6%	209,867
Car Sales & Service	4.8%	181,505
Unknown	4.7%	177,461
Local Govt	4.0%	151,916
Hotels/Motels	2.8%	103,971
Federal Govt	2.4%	90,595
Entertainment	2.3%	85,045
Whlse Trade-Durable	1.5%	56,672
Whlse Trade-NonDurable	0.7%	25,842
Museum/Zoo	0.2%	8,114
Services NEC	0.0%	1,454
Total	**100%**	**3,752,355**

Figure 2-4. Commercial Sector Breakout – Electricity Sales

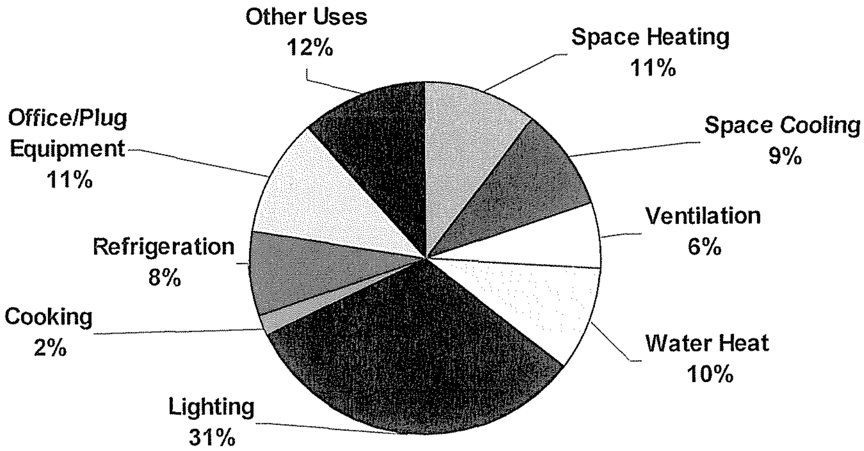


Energy use by commercial segment is disaggregated into constituent end-uses and combined with equipment penetrations to determine the Market Profile by end-use in Table 2-4. These values bound the saving potential for each end use.

Table 2-4. Commercial Market Profile – Electricity

End use	Share (% of sq.ft.)	UECs (kWh/sq.ft.)	Intensity (kWh/sq.ft.)	APCo - WV Sales (GWh)
Space Heating	46%	4.4	2.0	398.7
Space Cooling	91%	2.0	1.8	348.9
Ventilation	100%	1.2	1.2	228.9
Water Heat	58%	3.1	1.8	356.6
Lighting	100%	6.2	6.2	1,210.5
Cooking	22%	1.8	0.4	77.6
Refrigeration	45%	3.3	1.5	291.6
Office/Plug Equipment	87%	2.3	2.0	397.5
Other Uses	100%	2.3	2.3	442.2
Total			**19.1**	**3,752**

Figure 2-5. Commercial Market Profile - Electricity

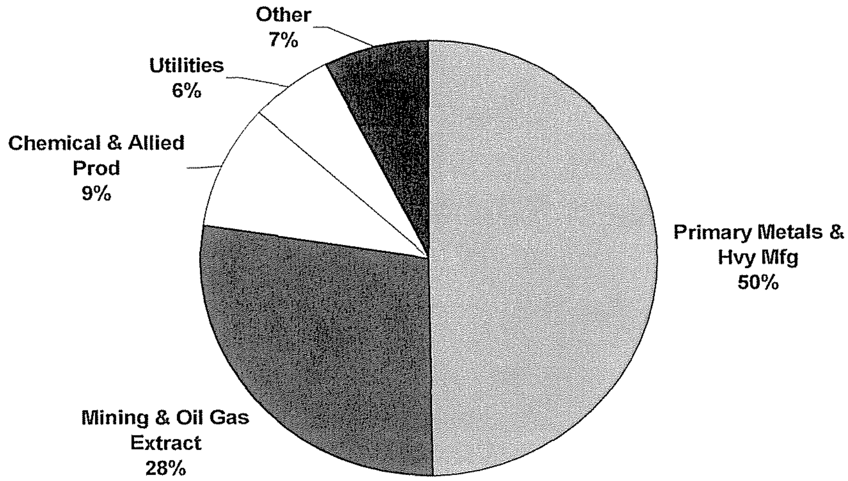


Data provided by APCo - WV break out industrial sales into 17 market segments shown below. The sector is dominated by Primary Metals & Heavy Manufacturing and Mining & Extraction with more than 49% and 27% of total industrial sales, respectively.

Table 2-5. Industrial Sector Breakout – Electricity

End use	APCo - WV Sales Share	APCo - WV Sales (MWh)
Primary Metals & Hvy Mfg	49.8%	3,934,222
Mining & Oil Gas Extract	27.7%	2,192,462
Chemical & Allied Prod	9.2%	730,596
Utilities	5.8%	459,114
Transport Mfg	1.5%	121,669
Communication Equip	1.5%	117,788
Wood Products	1.2%	94,827
Transportation	1.2%	93,354
Refining & Rubber	0.6%	49,924
Food and Kindred Products	0.3%	27,605
Heavy Const	0.3%	27,574
Fine Instrumentation	0.2%	18,599
Paper Mills & Products	0.2%	15,101
Electronic Mfg	0.2%	12,737
Farm Fish Forest	0.1%	9,820
Light Mfg	0.0%	1,061
Mfg Clothing Apparel	0.0%	585
Totals	100.0%	**7,907,040.0**

Figure 2-6. Industrial Sector Breakout – Electricity Sales

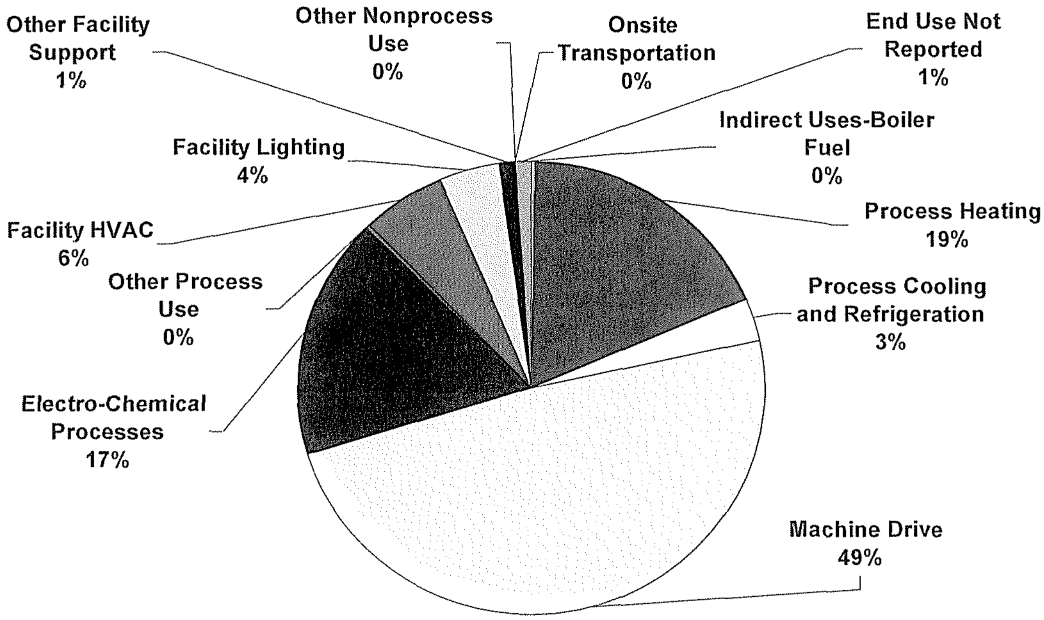


On an end use basis, Machine Drives dominate the industrial market profile with lesser contributions from Process Heating and Facility Lighting and HVAC. See Table 2-6 and Figure 2-7.

Table 2-6. Industrial Market Profile – Electricity

End use	APCo - WV Shares	APCo - WV Sales (GWh)
Indirect Uses-Boiler Fuel	0.3%	24
Process Heating	18.2%	1,442
Process Cooling and Refrigeration	3.2%	256
Machine Drive	48.4%	3,825
Electro-Chemical Processes	17.3%	1,366
Other Process Use	0.2%	19
Facility HVAC	5.8%	460
Facility Lighting	4.3%	340
Other Facility Support	1.0%	81
Onsite Transportation	0.1%	5
Other Nonprocess Use	0.1%	6
End Use Not Reported	1.0%	82
Total	**100.0%**	**7,907**

Figure 2-7. Industrial Market Profile – Electricity Sales



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 APCo - WV 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 provide adequate information alone. 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 APCo - WV.
- 2005 Residential Energy Consumption Survey (RECS), Energy Information Administration. http://www.eia.doe.gov/emeu/recs/recs2005/hc2005_tables/detailed_tables2005.html South Atlantic 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/ South Atlantic 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 saturation of inefficient equipment in the residential sector is based on a 2006 MEEA Midwest Residential Market Assessment.[10] The non-residential estimates of the inefficient fraction for heating, cooling, and water heat end uses are based on a Summit Blue Consulting report for the Kansas Energy Council.[11] 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.

[10] Virginia, Tennessee, and West Virginia were not in the scope of the MEEA study; however, we are confident that the study's saturations provide a reasonable proxy.

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

Table 2-7. Residential Technology Shares

End use	Technology	Electric Customer Technology Share	Fraction not efficient
Cooling	Heat pump	26%	97%
	Central AC	45%	96%
	Room AC	19%	63%
	None	10%	0%
Space heat	Heat Pump	26%	97%
	Electric Furnace	24%	0%
	Natural Gas furnace/Boiler	46%	73%
	Other Fuel	4%	NA
Lighting*	Incandescent	66%	100%
	Compact Fluorescent Light (CFL)	1%	0%
	Halogen	3%	100%
	Fluorescent	29%	90%
Water Heater	Electric	59%	71%
	Gas/Propane/LPG	41%	90%
Appliances	Dishwasher	65%	63%
	Clothes Washer	97%	NA
	Primary Freezer	56%	82%
	Second Freezer	6%	82%
	Electric Dryer	94%	94%
	1st Refrigerator	99%	69%
	2nd Refrigerator	21%	69%

** Lighting was not included in 2006 APCo - WV RASS data. Lighting is based on 2007 BEDB.*

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 for the fraction of inefficient equipment (see Table 2-8).

Table 2-8. Non-Residential Technology Shares

End use	Technology	Electric Customer Technology Share	Fraction not efficient
Space heat	Heat Pump	31%	88%
	Other Electric	12%	0%
	Gas Furnace	39%	88%
	Gas Boiler	14%	90%
Cooling	Heat Pump	27%	88%
	Packaged Direct Expansion (DX)	42%	88%
	Chiller	29%	88%
	Other	2%	88%
Water heating	Electric	47%	90%
	Gas	53%	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.

3 DSM MEASURE CHARACTERIZATIONS

After estimating baseline consumption, characterization of DSM 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.

3.1 DSM Measure List

The first step in the DSM 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 a DSM 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 DSM 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.[12] 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

[12] 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% 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.

3.2 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.

3.2.1 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 DSM measure per unit savings. We first developed building prototypes based on the APCo-WV's 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 APCo-WV's data and using Charleston, WV weather data, and then we estimated the DSM measure savings impacts using the building simulation software.

3.2.2 Climate-Independent Measures

For the climate-*independent* DSM measures, Summit Blue used many resources, including the U.S. Department of Energy ENERGY STAR Program,[13] the California Database of Energy Efficiency Resources (DEER),[14] 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

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

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

impacts for the APCo-WV's 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.

3.2.3 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. APCo-WV is a dual peaking utility with winter and summer peaks only about 200 megawatts different. Much of the winter peak is associated with electric space heat and domestic water heating. The winter peak typically occurs when outdoor temperatures make heat pumps ineffective, so electric resistance is the dominant space heat type at system peak. The summer peak is associated with air conditioning loads on hot summer days. Summit Blue characterized direct load control (DLC) measures for devices that would affect either or both peaks – primarily residential and small commercial air conditioning in the summer and electric space heat and domestic hot water in the winter. Our estimates for costs and savings are based on *ex post* results from other utilities using a 50% cycling regimen.

3.3 DSM Measure Costs and Lifetimes

For DSM 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 DSM 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 DSM characterization are presented in Appendix C with the measure descriptions.

4 BENCHMARKING AND BEST PRACTICE RESULTS

To ensure that the DSM 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. We note that there is a dearth of winter-peak oriented DSM portfolios generally, and few regional comparisons available, which made for greater uncertainty of the benchmarking results.

The results suggest the performance benchmarks that a new DSM 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.

4.1 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 4-1 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 4-1. 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		
Xcel Energy	MN		
Wisconsin Focus on Energy	WI		
West			
Arizona Public Service	AZ		
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.

4.2 Methodology

This section describes the methodology used to collect data and to 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,[15]
- Energy savings,
- Peak demand savings, and
- 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, and
- 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, and
- 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, and
- 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, and
- Divided DSM expenditures by DSM peak demand savings, \$/kW.

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

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

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

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 costs 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.[16]

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.

4.3 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 4-2 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).

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

Table 4-2. DSM Environment by State

State/ Province	Year Began	Energy Savings as % of Sales	DSM Environment[17]
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.
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."[18]
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

[17] See Violette (2006) for a complete discussion of state DSM environments.
[18] See Maine Public Utilities Commission (2007) for a complete discussion of Maine's DSM environment.

State/ Province	Year Began	Energy Savings as % of Sales	DSM Environment[17]
			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.
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	2000	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.
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.

4.4 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 identifies organizations that achieve above typical savings at below typical costs (i.e., organizations with best practice portfolios). See Appendices for complete data and statistics.

4.4.1 Electricity DSM Results Over All Sectors

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

Table 4-3 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 4-3. 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

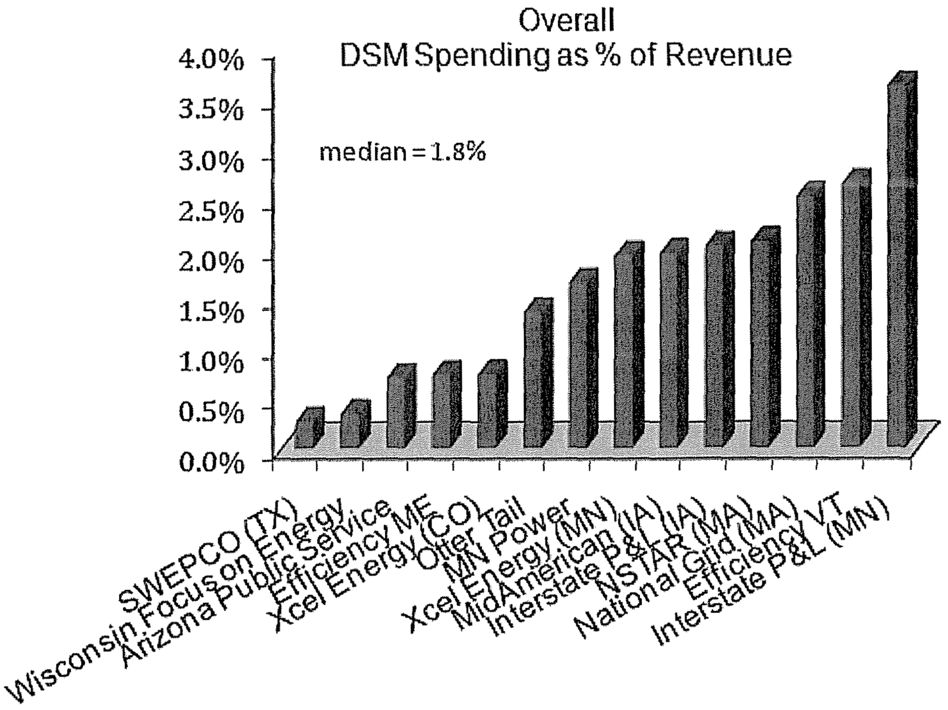
Notes: Cost of first year savings should not be confused with a levelized cost of conserved energy. Assuming an average program life of ten years and a 9% discount rate, dividing the cost of first year energy savings by 6.0 approximates the levelized cost of conserved energy.

4.4.2 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 4-1 below shows the distribution of spending on electricity DSM as a percentage of annual revenues. Organizations with spending rates in the top quartile are NSTAR (MA), National Grid (MA), Efficiency VT, and Interstate P&L (MN), which has the highest spending rate, double the median.

Figure 4-1. IOU & Agency Electricity DSM Spending as % of Revenue

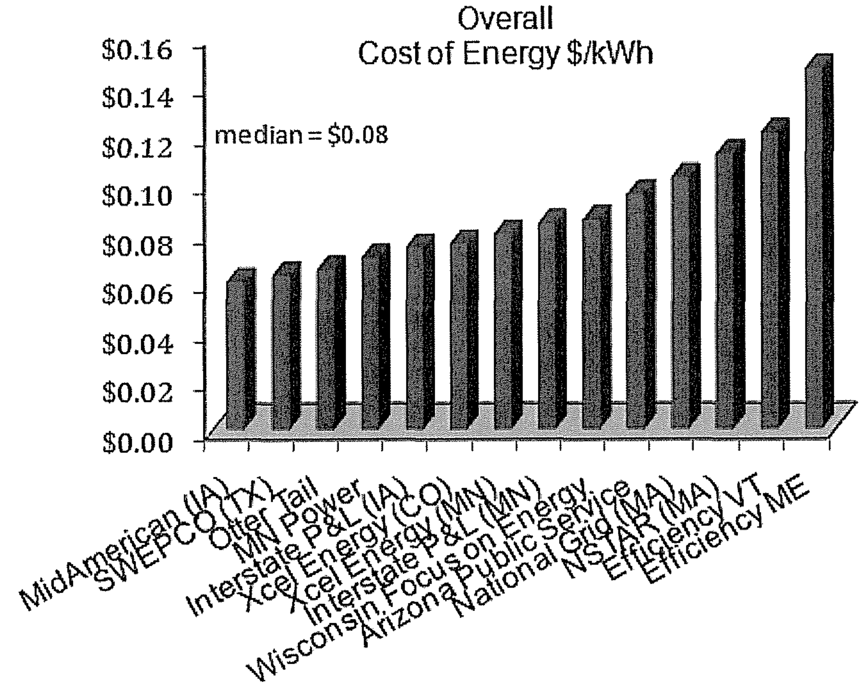


4.4.3 Cost of Electricity

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 4-2). Organizations with energy costs in the bottom quartile are MN Power, Otter Tail, SWEPCO (TX), and MidAmerican (IA).

Figure 4-2. IOU & Agency Cost of Electricity

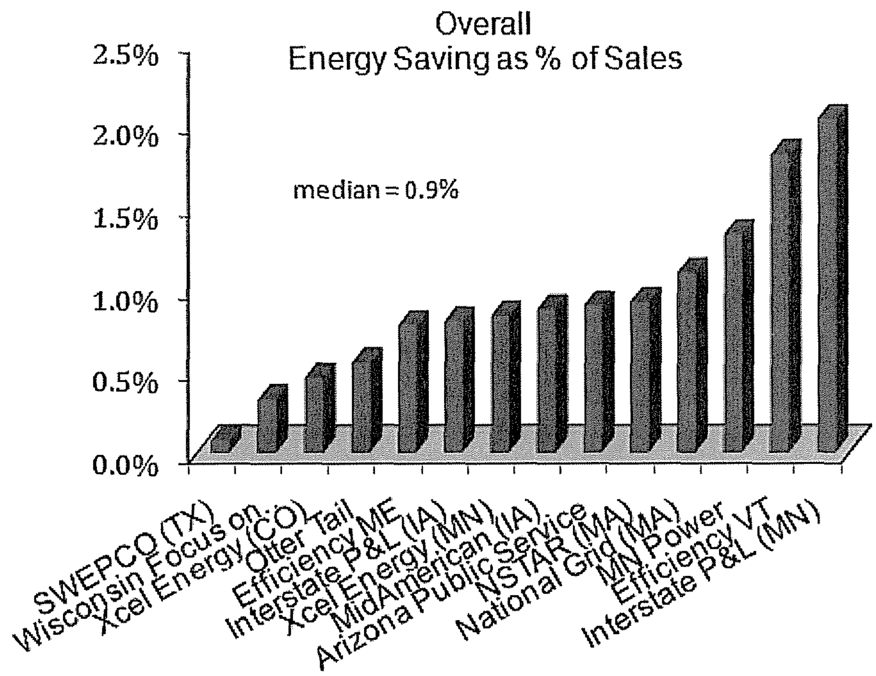


4.4.4 Electric Energy and Peak Demand Savings

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 4-3).

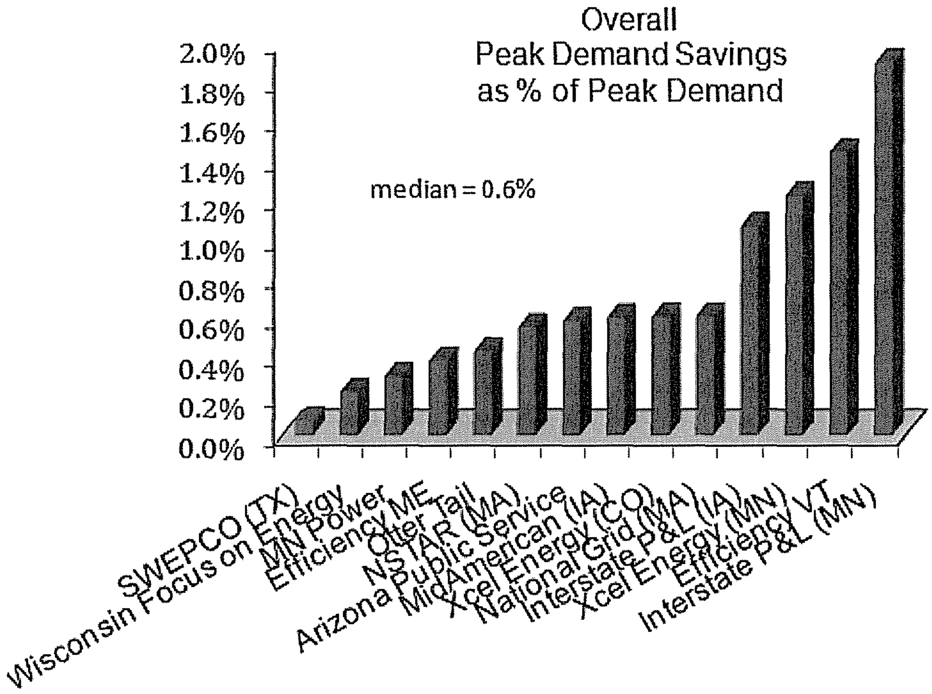
Figure 4-3. IOU & Agency Electricity DSM Energy Savings as % of Sales--First Year[19]



For the IOUs and agencies reviewed, Figure 4-4 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.

[19] Savings reported for Wisconsin Focus on Energy exclude non-tracked energy impacts.

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

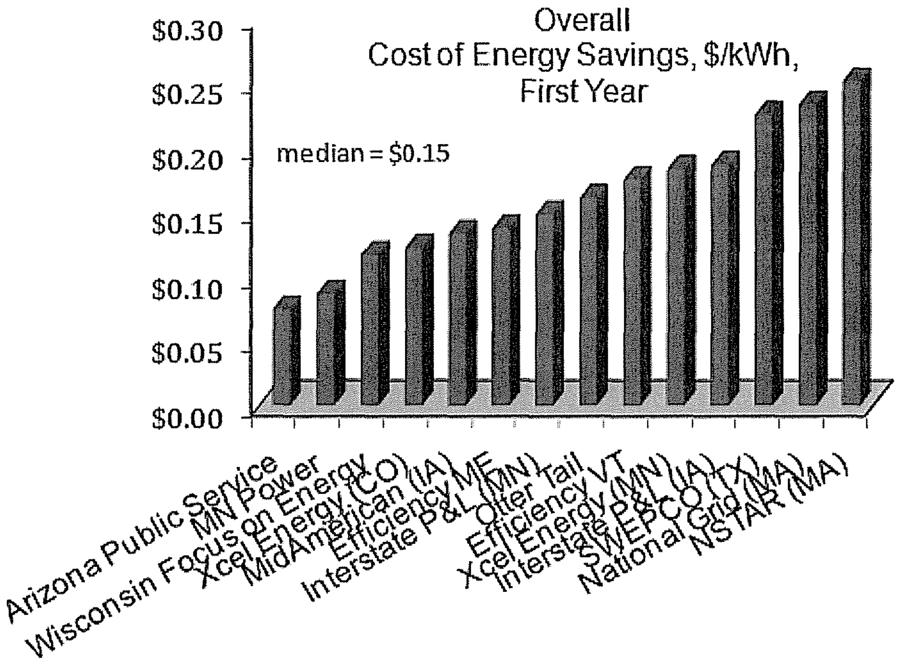


4.4.5 Cost of Savings

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

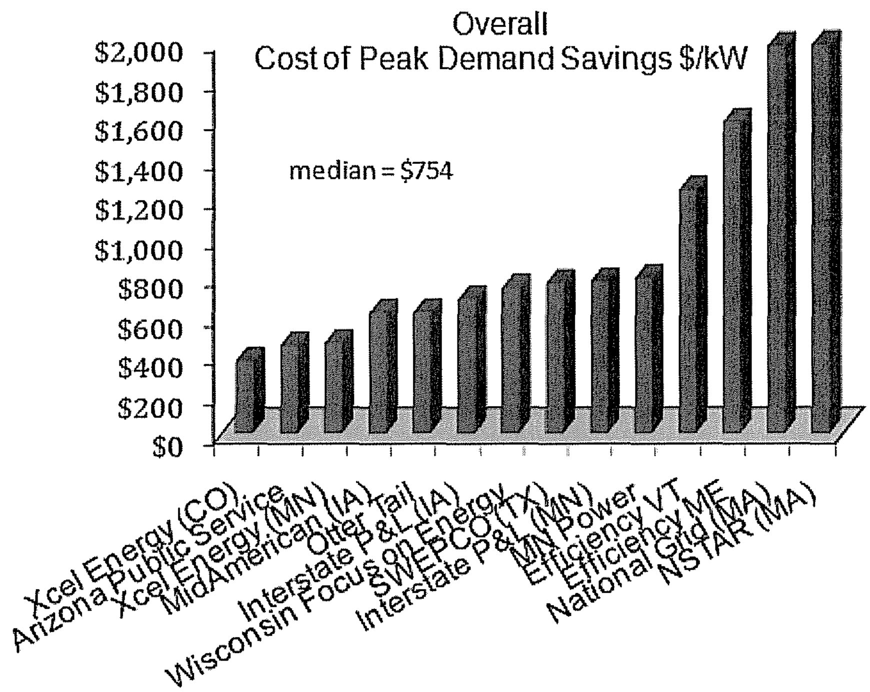
For the IOUs and agencies reviewed, the cost of first year energy savings ranges from $0.07/kWh to $0.25/kWh, with the median at $0.15/kWh (Figure 4-5). Arizona Public Service achieved the lowest cost of energy savings. MidAmerican (IA) and Interstate P&L (MN) also achieved their energy savings at costs 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 with energy savings rates (as a percentage of sales) at or above the median.

Figure 4-5. IOU & Agency Cost of Electric Energy Savings ($/kWh) First Year



For the IOUs and agencies reviewed, Figure 4-6 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 4-6. IOU & Agency Cost of Peak Demand Savings ($/kW)



4.4.6 Identifying Best Practice DSM Organizations

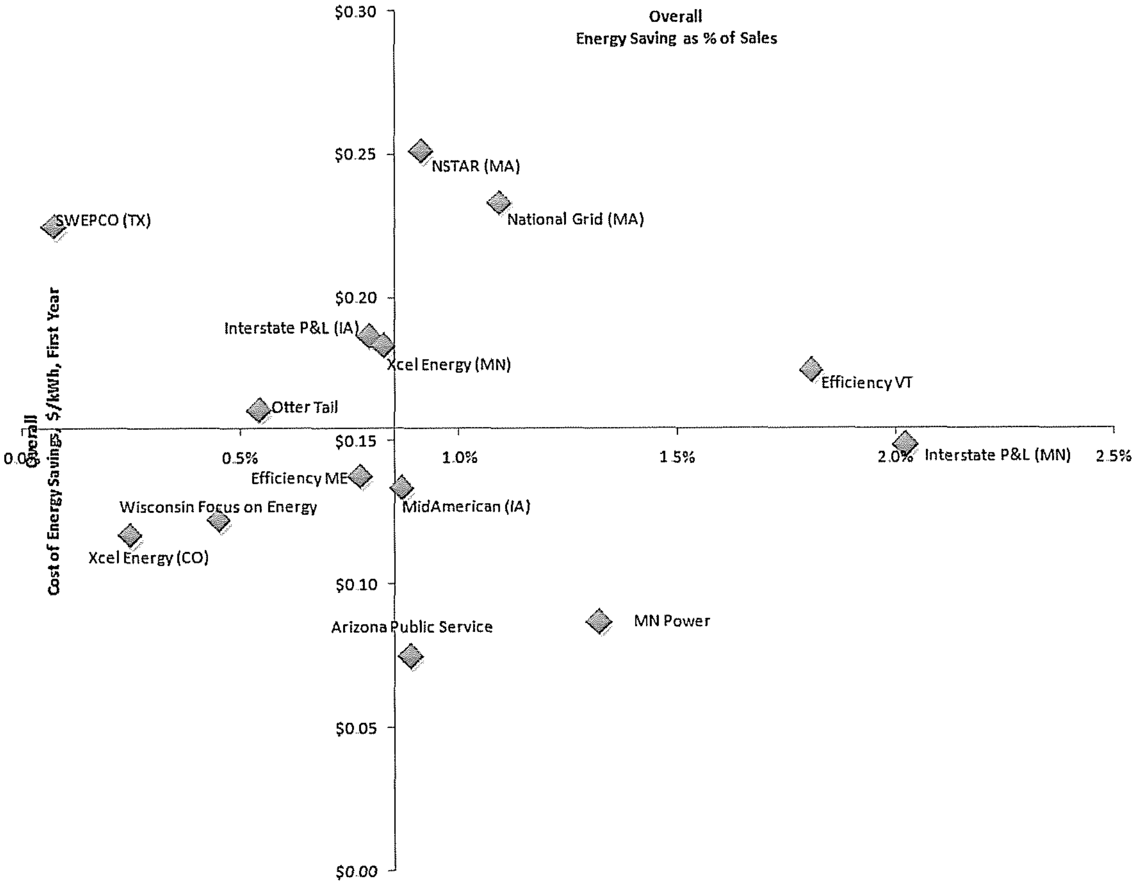
This section identifies the organizations that achieved above median saving at or below median costs.

For the IOUs and agencies reviewed, the scatter plot in Figure 4-7 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 4-7. 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 4-8 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:[20]

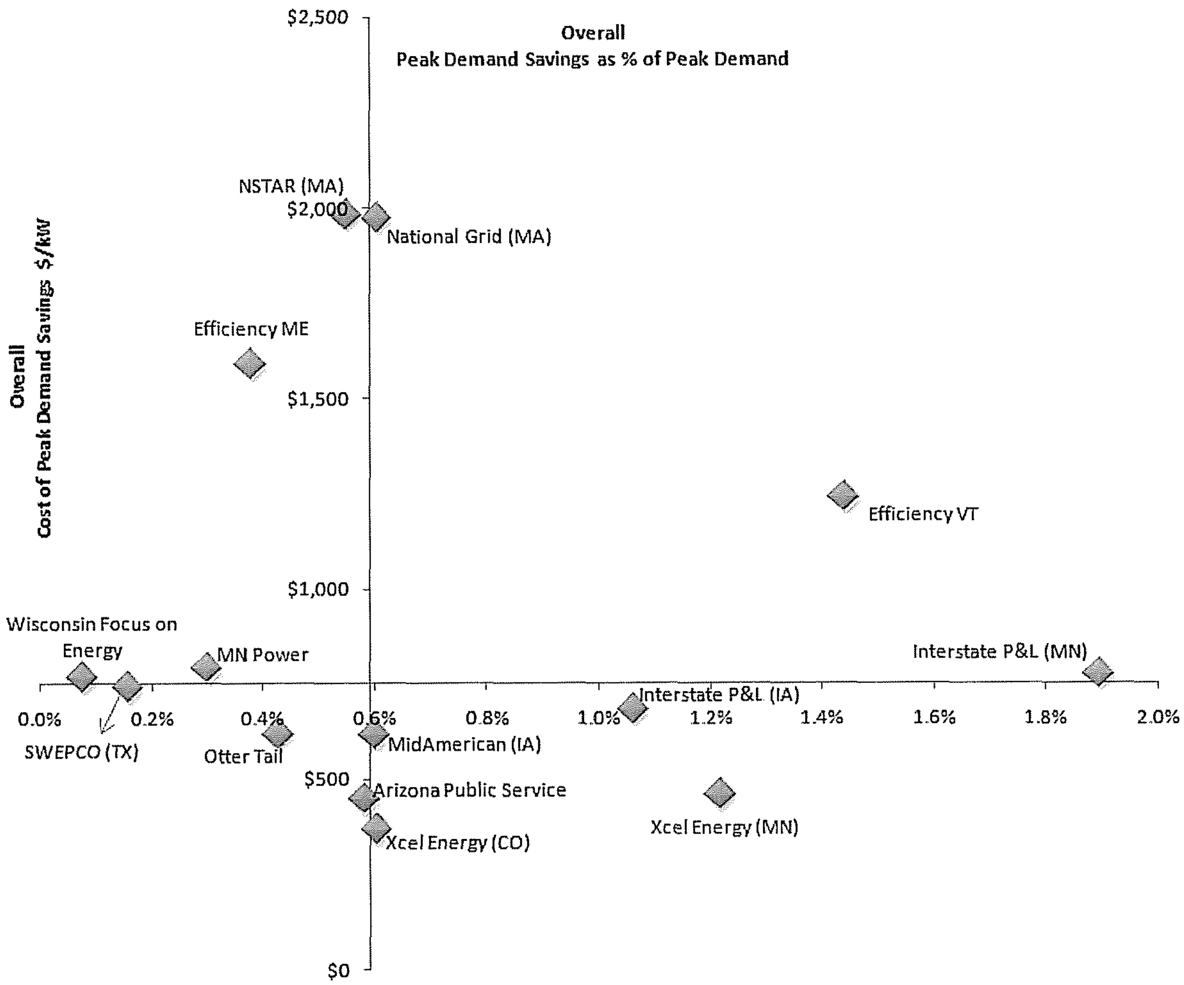
1. Interstate P&L (MN): 1.9%, $774/kW
2. Xcel Energy (MN): 1.2%, $457/kW
3. Interstate P&L (IA): 1.1%, $683/kW
4. Xcel Energy (CO): 0.6%, $367/kW
5. Arizona Public Service: 0.6%, $447/kW
6. MidAmerican (IA): 0.6%, $616/kW

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

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

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 4-8. IOU & Agency Scatter Plot of Peak Demand Savings and First Year Costs ($/kW)



4.5 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.

4.5.1 C&I Sector

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

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

Table 4-4. Medians for C&I Results

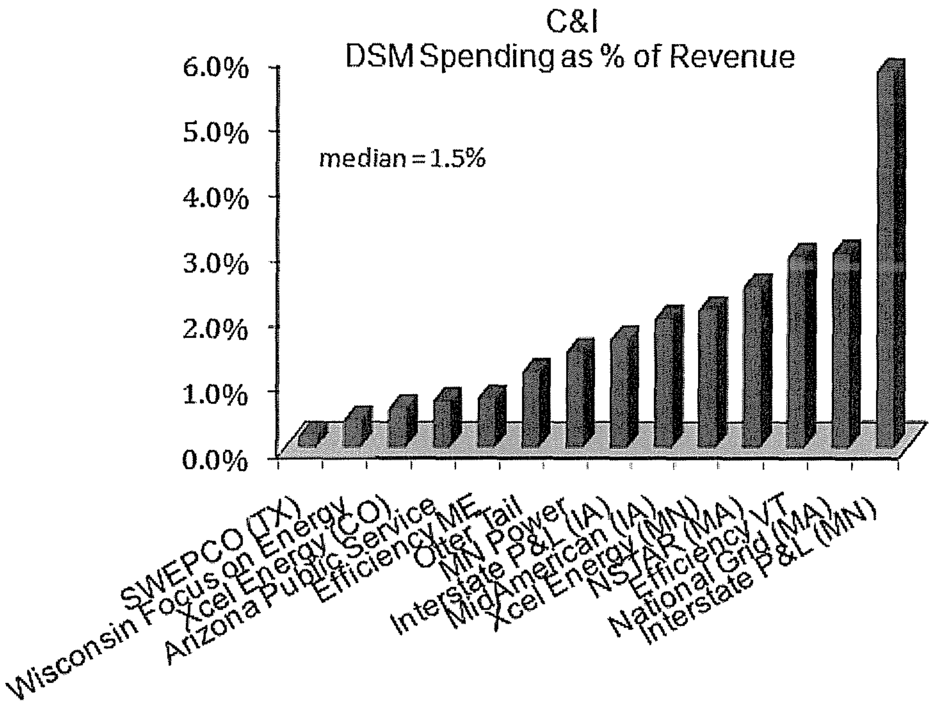
Spending as % of Revenue	Electric Energy Savings as % of Sales	Peak Demand Savings as % of Peak Demand	Cost of Savings	
			$/kWh	$/kW
1.5%	*0.7%*	*0.6%*	*$0.13*	*$676*

C&I Electricity DSM Spending

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 4-9). 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 (Figure 4-9).

Figure 4-9. IOU & Agency C&I Electricity DSM Spending as % of Revenue

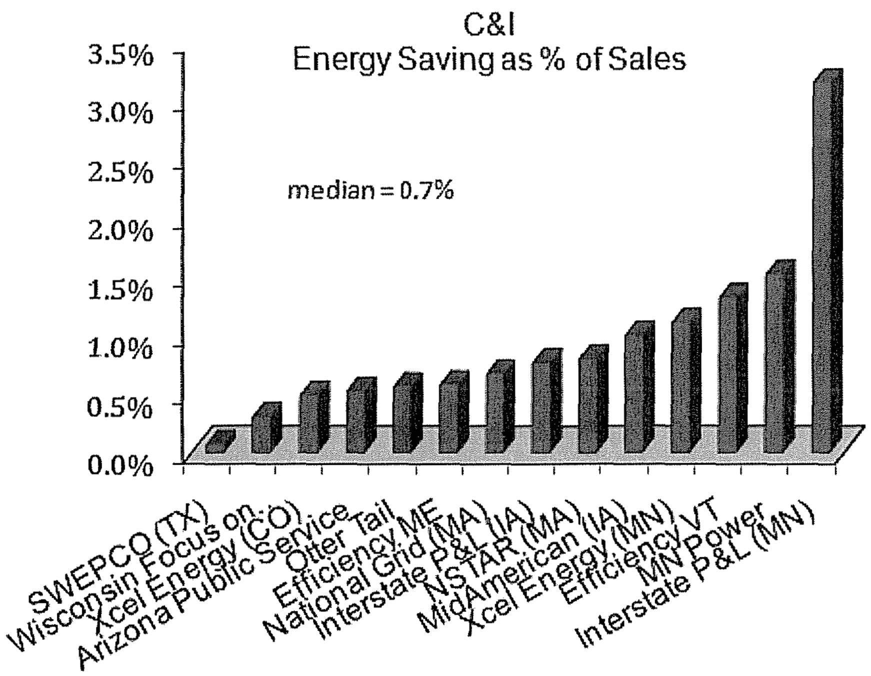


C&I Electric Energy Savings

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.

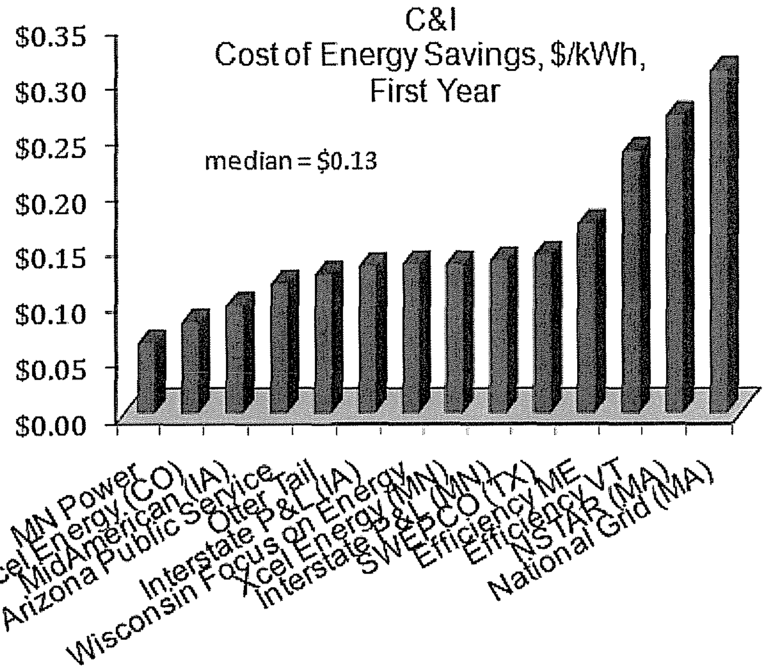
For the IOUs and agencies reviewed, Figure 4-10 shows the energy savings as a percentage of sales in the C&I sector. Energy savings as a percentage of sales ranges from 0.1% to 3.1% with the median at 0.7%. Interstate P&L (MN) has the highest savings rate, more than four times the median, and has the 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 4-10. 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 4-11). MN Power achieved its 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 4-11. IOU & Agency C&I Cost of Electric Energy Savings ($/kWh) First Year



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

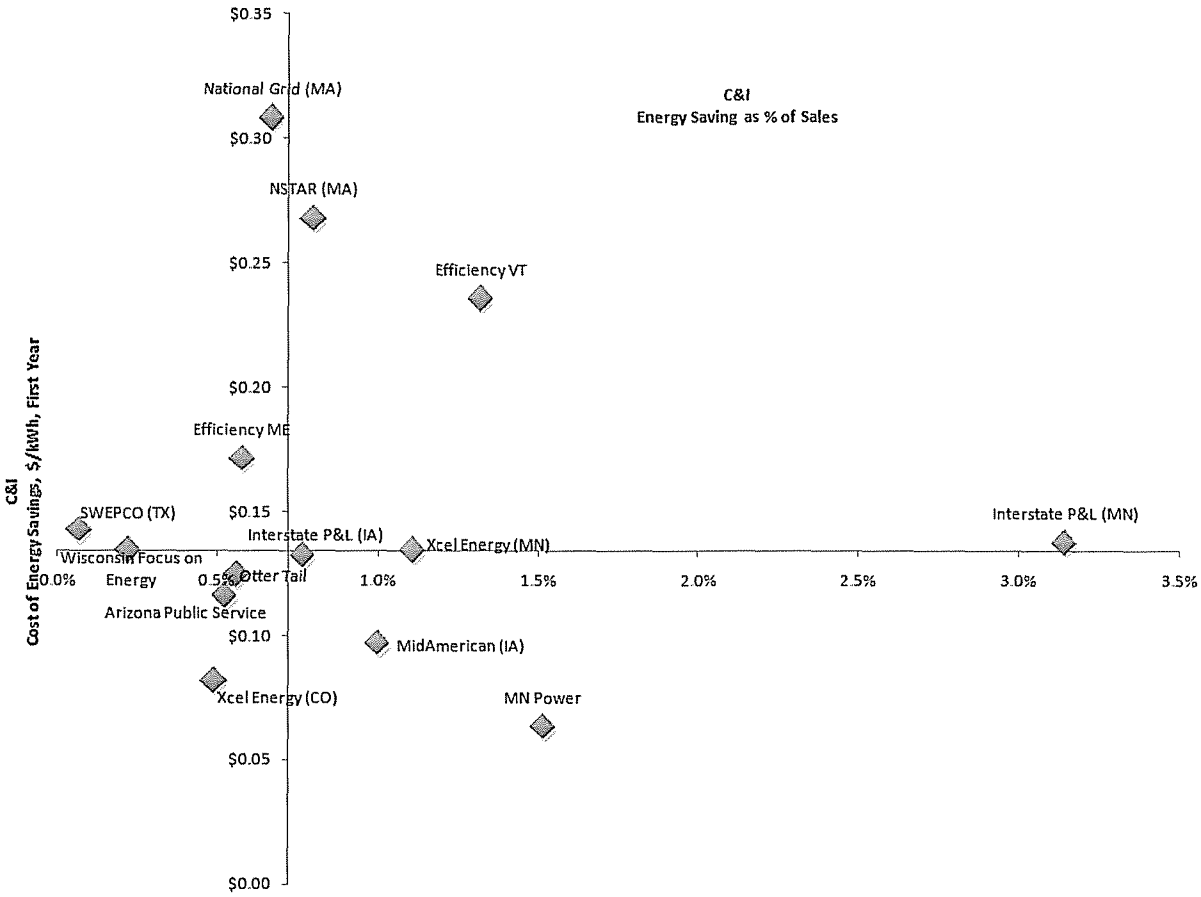
This section identifies the organizations with DSM programs that achieved above median energy savings (as a percentage of sales) at or below median costs for the C&I customer sector.

For the IOUs and agencies reviewed, the scatter plot shown in Figure 4-12 illustrates where each organization falls relative to median energy savings and median costs. Interstate P&L (MN) achieved the greatest 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/kWh
3. Xcel Energy (MN): 1.1%, $0.13/kWh
4. MidAmerican (IA): 1.0%, $0.10/kWh
5. Interstate P&L (IA): 0.8%, $0.13/kWh

Interstate P&L (MN), MN Power, and Interstate P&L (IA) achieved most of their low-cost savings through their custom incentives programs. Xcel Energy (MN) and MidAmerican (IA)'s low-cost savings were achieved primarily by their lighting programs.

Figure 4-12. IOU & Agency Scatter Plot of C&I Electric Energy Savings and First Year Costs ($/kWh)



For the IOUs and agencies reviewed, Table 4-5 and Table 4-6 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 new construction program, Energy Design Assistance, and from its three lighting programs: CEE One-Stop Shop, a small business direct install program; Energy Management Systems, an automated control system for building lighting and other building systems; and Lighting Efficiency, a prescriptive incentives program. Like Xcel Energy (MN), MidAmerican (IA) achieved significant savings from its new construction program. But most of MidAmerican (IA)'s C&I energy savings was achieved by its prescriptive incentive program, Nonresidential Equipment. In that program, variable speed drives accounted for 67% of program energy savings at only 32% of program incentive costs, and lighting accounted for 26% of program energy savings at 34% of program incentive costs.

Table 4-5. IOU & Agency Electric Energy Savings for C&I Programs as % of Sales[21]

C&I Program/Measures	Interstate P&L (IA)	Interstate P&L (MN)	MidAmerican (IA)	MN Power	Xcel Energy (MN)
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%		0.01%
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%

As seen in Table 4-6 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.

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

Table 4-6. IOU & Agency Costs of C&I Electric Energy Savings by Type of Program First Year[22]

C&I	Interstate P&L (IA)	Interstate P&L (MN)	MidAmerican (IA)	MN Power	Xcel Energy (MN)
Program/Measures					
Lighting	*	$0.21	*		$0.16
Cooling/Heating/Roofing	*	*			$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

C&I Peak Demand Savings

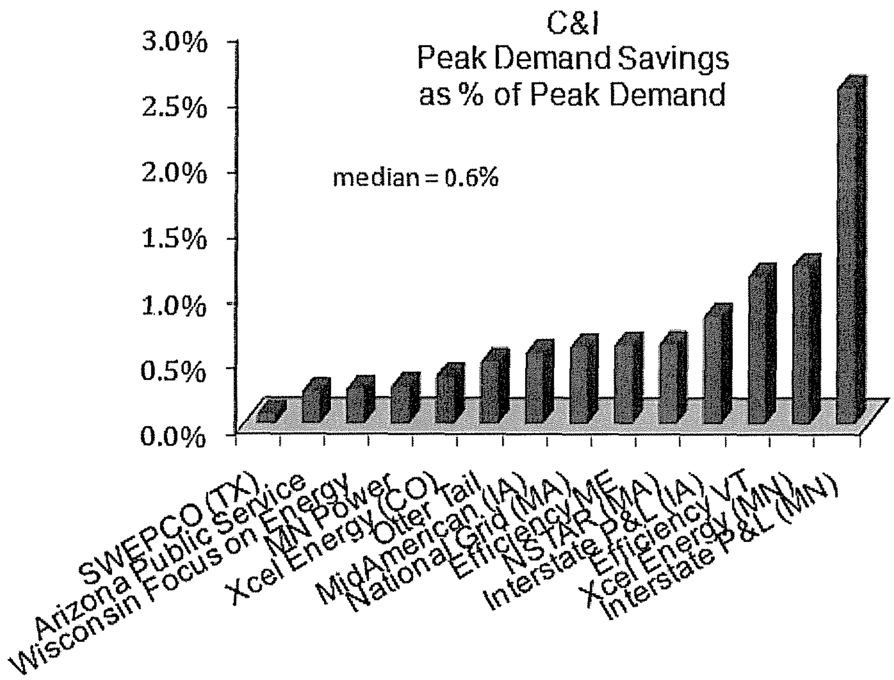
This section reviews the peak demand saved (as a percentage of peak demand) and the costs of peak demand savings achieved by DSM programs in the C&I customer sector.

For the IOUs and agencies reviewed, Table 4-13 below shows DSM incremental peak demand savings as a percentage of annual peak demand for the C&I customer sector.[23] 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.

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

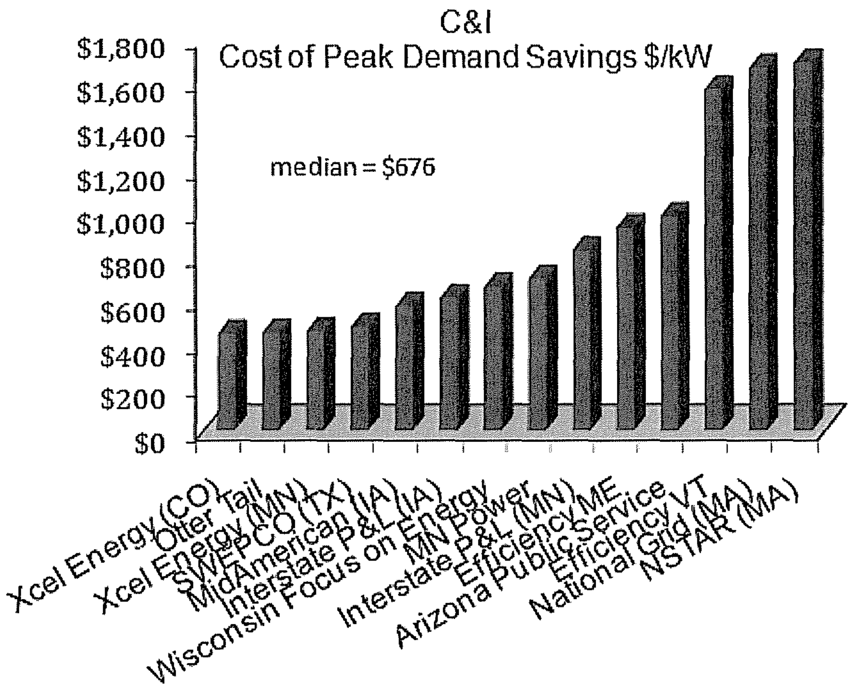
[23] As sector-level peak demand data were unavailable, estimates were made factoring overall system peak demand by the ratio of sector-level energy sales to overall energy sales.

Figure 4-13. IOU & Agency C&I Peak Demand Savings as % of Peak Demand



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 4-14). 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), SWEPCO (TX), MidAmerican (IA), Interstate P&L (IA), and Wisconsin Focus on Energy, 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 4-14. 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.

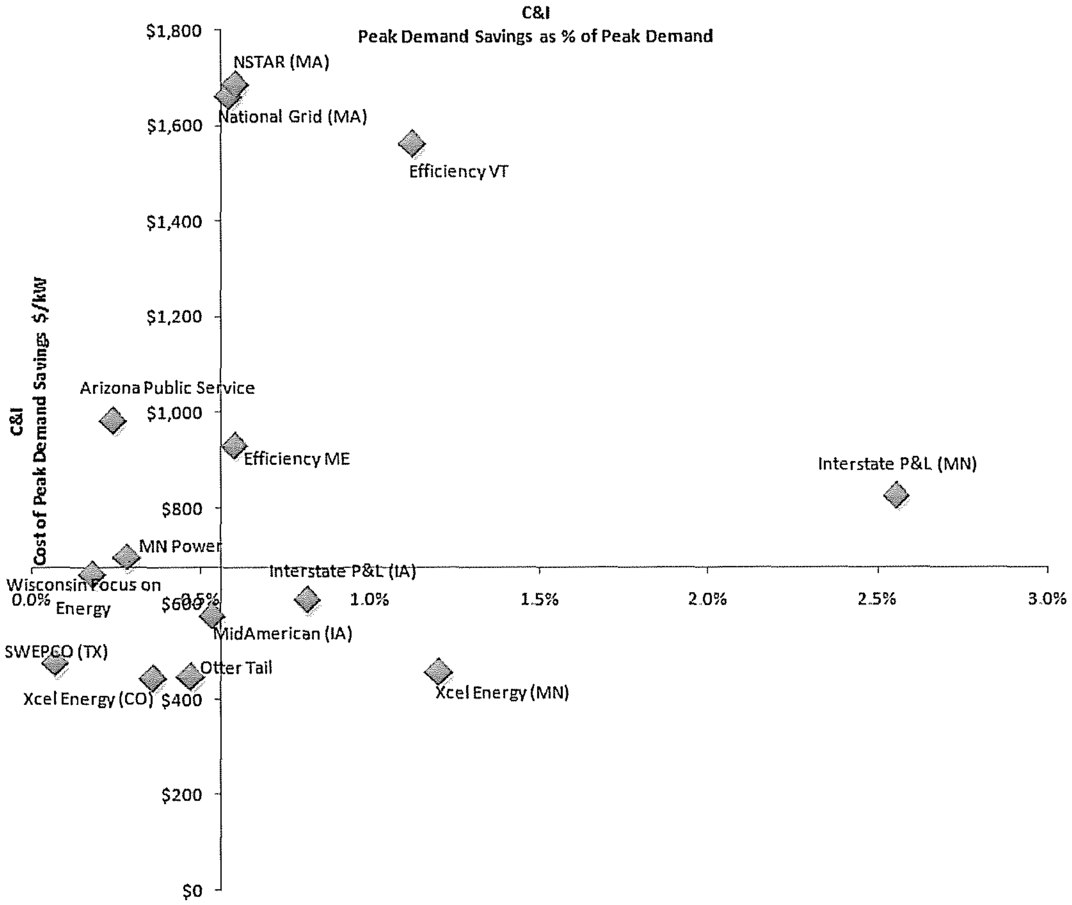
For the IOUs and agencies reviewed, the scatter plot shown in Figure 4-15 illustrates where each organization falls relative to median peak demand savings and median costs in the C&I sector. Interstate P&L (MN) achieved the greatest peak demand savings rate, but achieved those savings at costs above the median. Xcel Energy (MN) and Interstate P&L (IA) achieved above median peak demand savings rates at below median costs:[24]

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.

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

Figure 4-15. Scatter Plot of C&I Peak Demand Savings and First Year Costs ($/kW)



For the IOUs and agencies reviewed, Table 4-7 and Table 4-8 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 its 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 4-7. C&I Percentage of Peak Demand Savings by Type of Program[25]

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		
Custom Rebates	0.42%	0.04%
Energy Audit		
New Construction	0.07%	0.28%
Agriculture	0.04%	
C&I Interruptible Rates	0.14%	0.29%
C&I Direct Load Control		0.11%
Total C&I Savings (MW)	18.8	72.5
Peak Demand (MW)	2,293.5	6,020.3
C&I Savings as % of Peak Dema	0.82%	1.20%

Table 4-8 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 near 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 rate and direct load control programs.

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

Table 4-8. Costs of C&I Peak Demand Savings by Type of Program[26]

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		$239
Total C&I Savings (MW)	18.8	72.5
Total Costs ($M)	11.4	32.9
Costs of C&I Savings ($/kW)	$605	$454

4.5.2 Residential Sector

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

Table 4-9 shows the median result for spending, savings, and costs for the residential sector for the reviewed organizations.

Table 4-9. 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

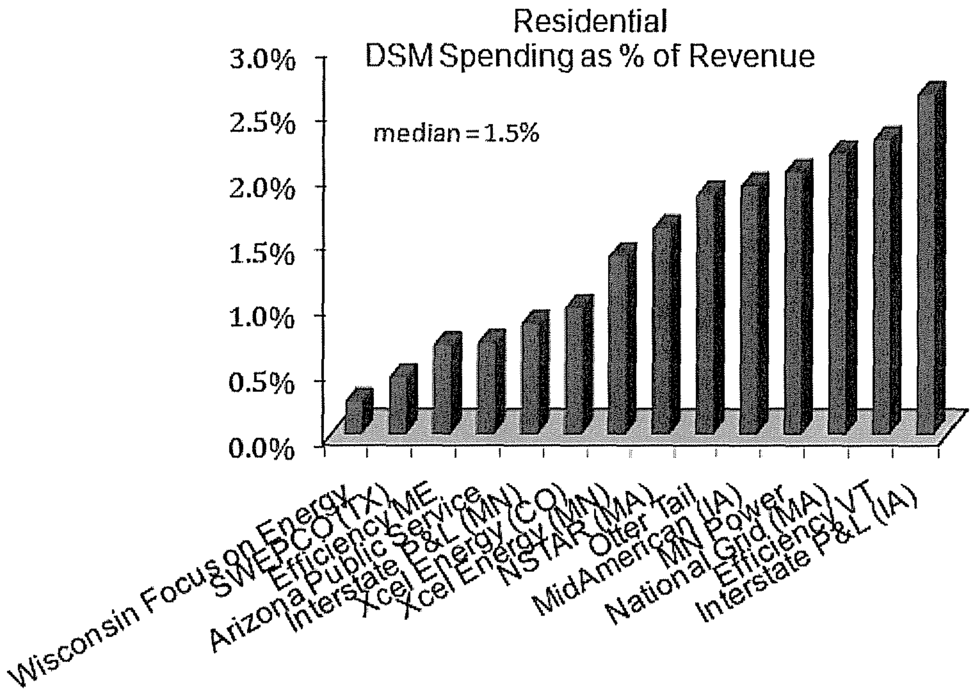
This section reviews DSM spending for the residential customer sector as a percentage of residential revenue.

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 4-16). Organizations with spending rates in the top quartile are MN Power, National Grid (MA), Efficiency VT, and Interstate P&L (IA); National Grid (MA), Efficiency VT, and Interstate P&L (IA)

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

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 4-16. IOU & Agency Residential Electricity DSM Spending as % of Revenue

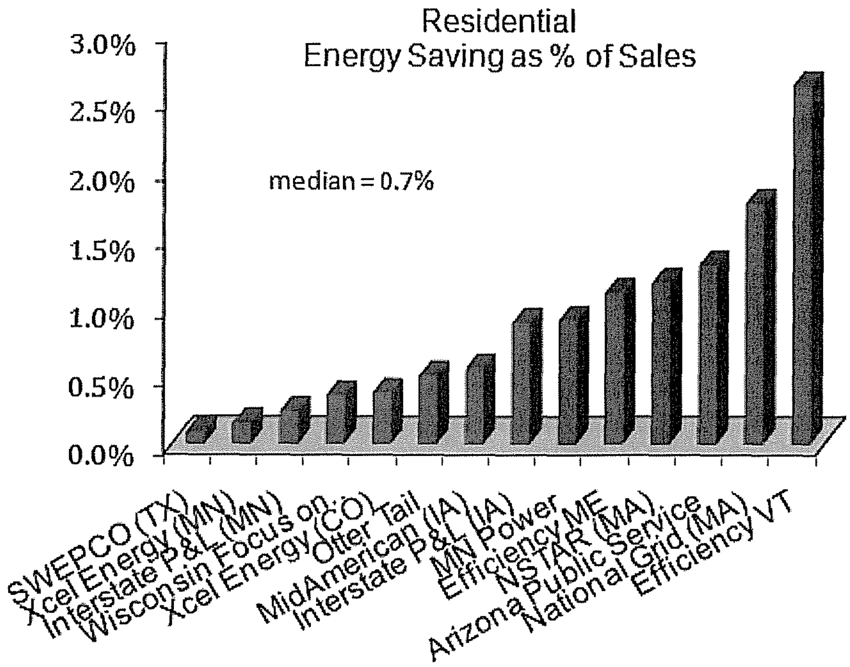


Residential Electric Energy Savings

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.

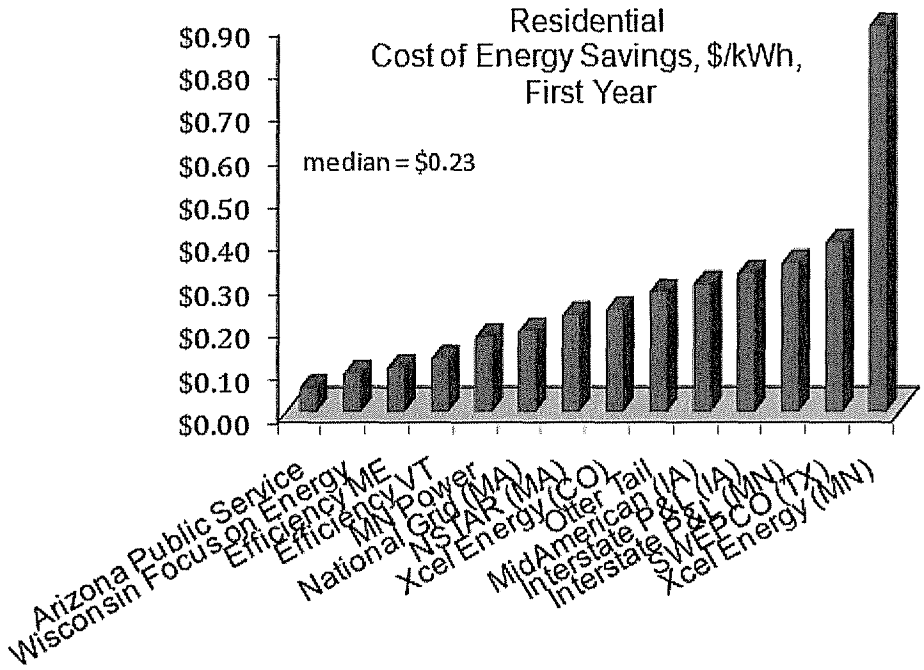
For the IOUs and agencies reviewed, Figure 4-17 shows the energy savings as a percentage of sales in the residential sector. Energy savings as a percentage of sales ranges from 0.1% to 2.6%, with the median at 0.7%. Efficiency VT has the highest savings rate, more than triple the median; National Grid (MA) has an energy savings rate more than twice the median. Efficiency ME, Arizona Public Service, and NSTAR (MA) achieved above median energy savings, around 1.2% of sales. MN Power and Interstate P&L (IA) achieved median energy savings, about 0.9% of sales.

Figure 4-17. 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 4-18). 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 4-18. IOU & Agency Residential Costs of Electric Energy Savings ($/kWh) First Year



Residential DSM Programs with High Energy Savings and Low Costs

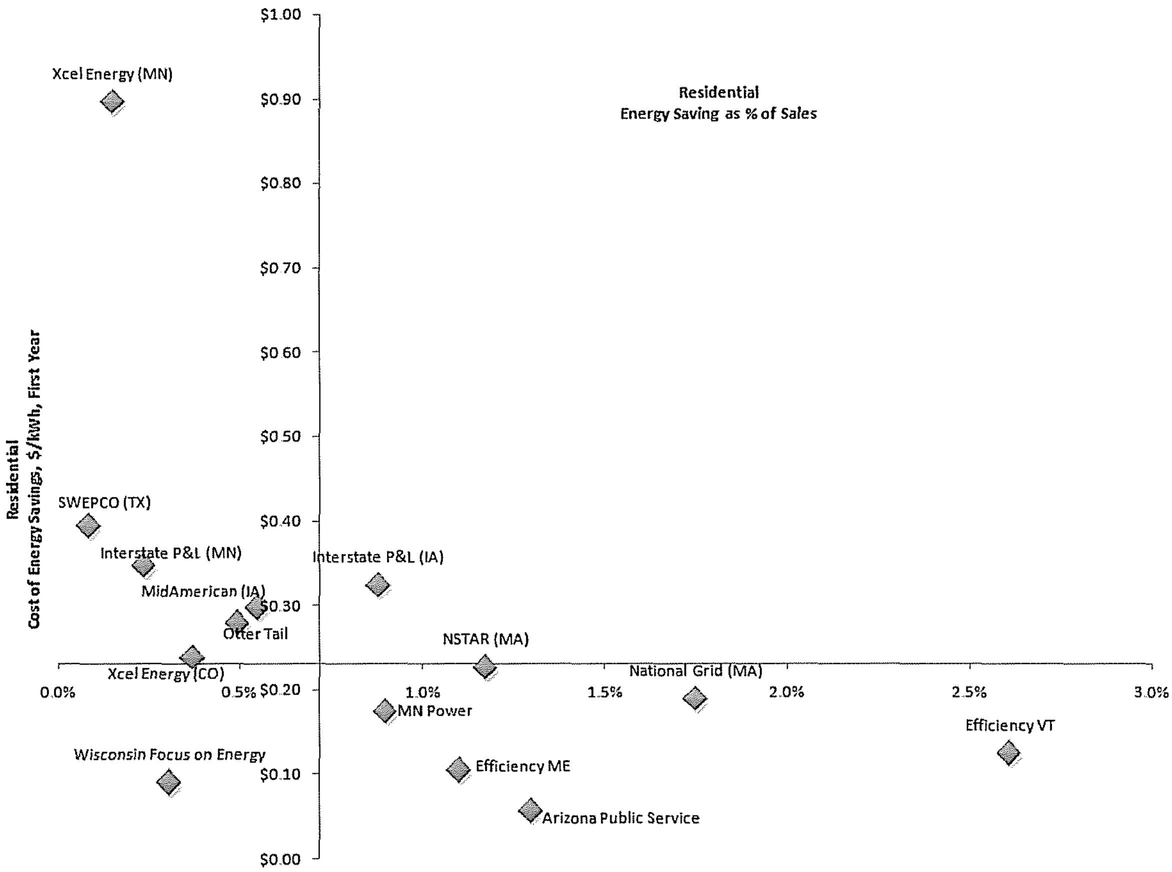
This section identifies the organizations with DSM programs that achieved above median energy savings (as a percentage of sales) at or below median costs for the residential customer sector.

For the IOUs and agencies reviewed, the scatter plot shown in Figure 4-19 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

These six organizations achieved above median energy savings (as a percentage of sales) at below median costs principally with their lighting programs.

Figure 4-19. IOU & Agency Scatter Plot of Residential Electric Energy Savings and First Year Costs ($/kWh)



For the IOUs and agencies reviewed, Table 4-10 and Table 4-11 below show program-level energy savings and costs of 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 ES 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 programs, but at above median costs. Efficiency VT's New Construction program also earned significant energy savings, but at above median costs.

Table 4-10. IOU & Agency Electric Energy Savings for Residential Programs as % of Energy Sales[27, 28]

Residential Program/Measures	Arizona Public Service	Efficiency ME	Efficiency VT	MN Power	National Grid (MA)	NSTAR (MA)
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				0.25%		
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 Resider	1.30%	1.10%	2.61%	0.90%	1.75%	1.17%

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27 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).

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

Table 4-11. IOU & Agency Costs of Residential Electric Energy Savings by Type of Program[29] [30]

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.

For the IOUs and agencies reviewed, Figure 4-20 below shows DSM incremental peak demand savings as a percentage of annual peak demand for the residential customer sector.[31] 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.

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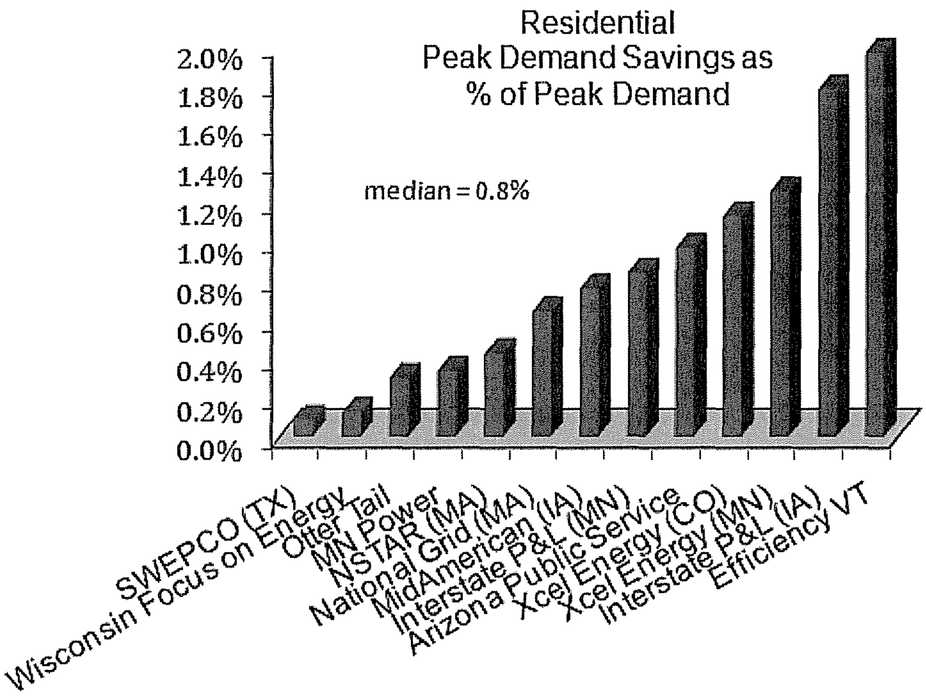
[29] For the MA utilities, indirect impact costs include evaluation, shareholder's incentives, and, for only NSTAR, incentive tax liability costs.

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

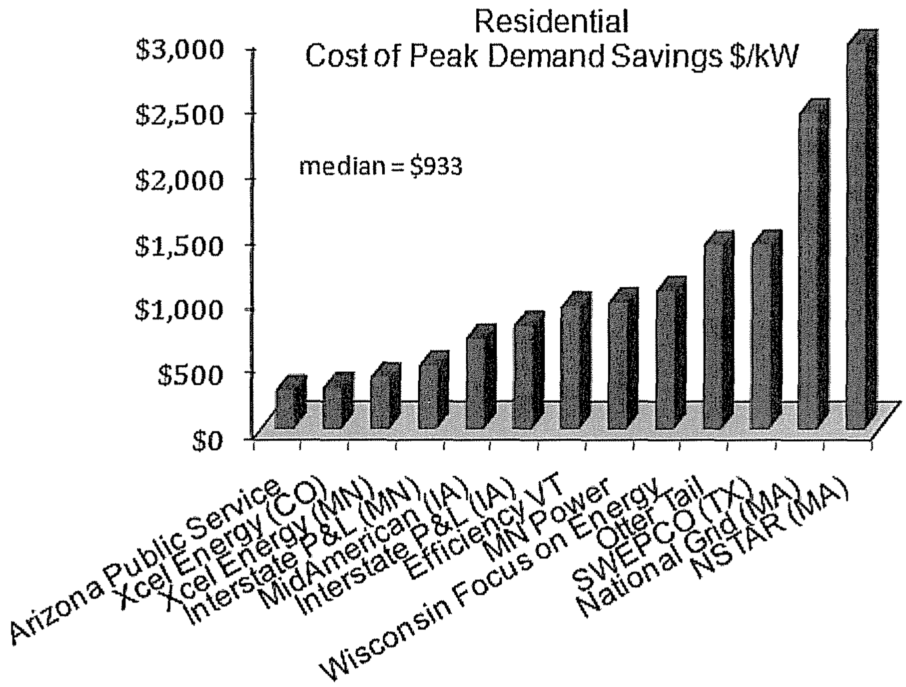
[31] As sector-level peak demand data were unavailable, estimates were made factoring overall system peak demand by the ratio of sector-level energy sales to overall energy sales.

Figure 4-20. IOU & Agency Residential Peak Demand Savings as % of Peak Demand



For the IOUs and agencies reviewed, shown below in Figure 4-21, costs of peak demand savings range 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 and 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 measures, as did Arizona Public Service and Interstate P&L (MN).

Figure 4-21. 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 4-22 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) conserved a high percentage of peak demand at low costs in the residential sector. These two and the other organizations that achieved at or above median percentage of peak demand conserved at or below median costs are listed below:[32]

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

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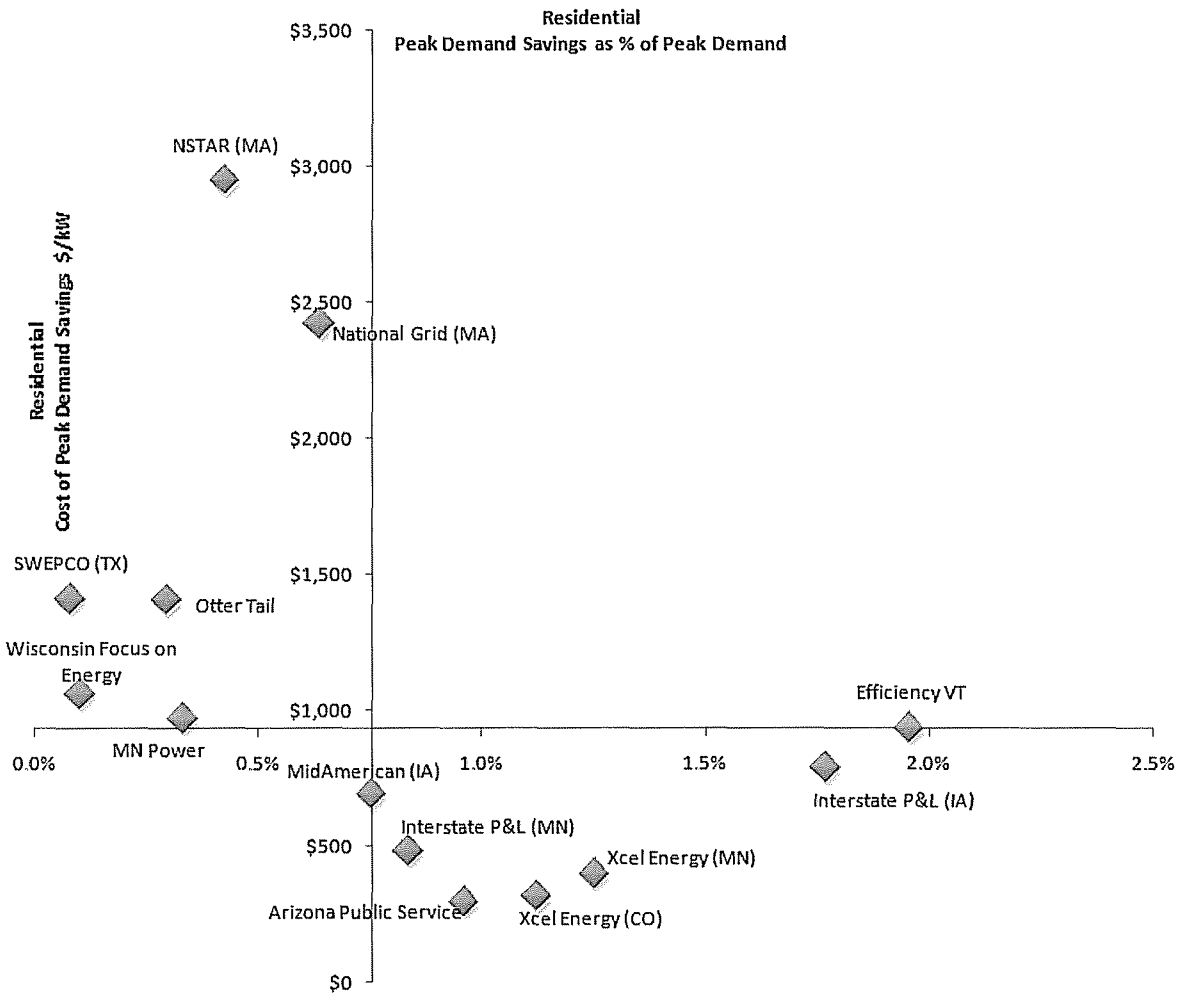
[32] All of these IOUs were summer peaking in 2007.

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.

Figure 4-22. IOU & Agency Scatter Plot of Residential Peak Demand Savings and First Year Costs ($/kW)



For the IOUs and agencies reviewed, Table 4-12 and Table 4-13 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 4-12. IOU & Agency Residential Peak Demand Savings by Type of Program[33]

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%				
ES Appliances		0.05%	0.01%	0.01%			
Water Heating		<.01%	<.01%				
Energy Audit			0.10%	0.03%	0.18%		<.01%
Combination							
Low Income	<.01%		0.09%	0.01%	0.02%		0.01%
New Construction	0.08%	0.14%	0.23%		0.32%		<.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)	3,519.0	367.9	791.5	66.1	1,714.6	2,223.9	2,484.7
Residential Savings as % of Peak D	0.96%	1.96%	1.77%	0.84%	0.75%	1.12%	1.25%

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

Table 4-13. IOU & Agency Costs of Residential Peak Demand Savings by Type of Program[34]

Residential Program/Measures	Arizona Public Service	Efficiency VT	Interstate P&L (IA)	Interstate P&L (MN)	MidAmerican (IA)	Xcel Energy (CO)	Xcel Energy (MN)
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	$298
Total Residential Savings (MW)	33.9	7.2	14.0	0.6	12.9	25.0	31.2
Total Costs ($M)	$10.0	$6.7	$11.0	$0.3	$8.9	$7.9	$12.4
Costs of Residential Savings ($/kW)	$296	$933	$787	$481	$691	$314	$398

4.6 Summary of Results and their Relationship to Potential Estimates

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

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

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 energy savings at best practice levels after an initial ramp up period of three to four years.

Thus, energy savings of the best practice organizations are used to calibrate the DSM potential model for AEP APCo-West Virginia such that energy savings ramp up to best practice levels in four to five years. In particular, for the C&I sector, energy savings ramp up to the average savings level of North East best practice organizations in four to five years, and for the residential sector, energy savings ramp up to best practice savings levels.

For program costs, benchmarking data are used as guidelines in the potential estimation process. A discussion of this process and a review of program costs with respect to benchmarked program costs follow. Here "benchmarked" refers to all organizations reviewed in the study; "best practice" refers to those organizations which achieved high savings at low costs in a given sector.

Benchmarked Program Costs as Guidelines in Potential Estimate Process

Benchmarked program costs are used as guidelines in the potential estimation process. Benchmarked program costs are not used as inputs that drive SB-RAM outputs for costs. (In contrast, a key input that drives SB-RAM costs is incremental measure cost from the measure characterization analysis: incentive = 50% * incremental measure cost, administrative costs < incentive costs.) Benchmarked program costs, however, are used to check the reasonableness of SB-RAM outputs. Where SB-RAM results conflict with benchmarked results, the model is revisited to adjust program costs so that they better align with the benchmarks.

Costs comparisons are best done on a case by case basis because programs can vary greatly in ways that affect costs (for example, by end use mix, whether the program includes measures for low income customers, extent to which services are included in the incentives, etc.), and benchmarked costs are more meaningful as guiding ranges than as point estimates.

As a whole, program costs reflect the following expectations:

1. Non-incentive costs will be greater than best practice, due to start up costs;

2. Incentive costs are likely a higher percentage of incremental measure costs than are best practice incentive costs; and

3. Incremental measure costs have gone down since 2007.

C&I Program Costs

Prescriptive

Total program costs for the Prescriptive program are generally within the range of best practice prescriptive program costs. In 2009, Prescriptive program costs start near the top range of best practice costs, decrease over three years, then increase after the 2012 lighting standards. Incentive costs for the Prescriptive program are also within the range of best practice costs. However, administrative costs are higher than the best practice prescriptive programs; this is expected from a start up program that has aggressive savings goals and the extensive marketing required to meet those goals. Over 2009-2013, incentive costs follow program costs, initially decreasing then increasing after the new lighting standards take effect.

Custom

Total program costs for the Custom program are above the range of best practice costs; they are, however, similar to Xcel Energy (CO)'s custom costs. Incentive costs are within the range of best practice costs, but administrative costs are greater than best practice costs. The costs of the Custom program were adjusted to be higher than best practice costs to reflect AEP Ohio's forecasts on customer willingness, given the recession.

New Construction

Total program costs for the New Construction program are within the range of best practice costs. Potential costs start near the bottom range of best practice costs and increase slightly after the 2012 lighting standards. The total program costs and the ratio of incentive:administrative costs are similar to those of Xcel Energy (MN), except that the New Construction costs are somewhat higher, as would be expected due to start up costs and higher incentive costs.

Total C&I Costs

Total program costs for all C&I programs combined are above the range of best practice costs but are within the range of costs of the northeastern IOUs and agencies.

Residential Program Costs

Efficient Products

Total program costs for the Efficient Products program are generally within the range of best practice prescriptive program costs. In 2009, Efficient Products costs start in the top half of best practice costs, decrease slightly, then increase after the 2012 lighting standards. Incentive and administrative costs for the Efficient Products program are also within the range of best practice costs. Over 2009-2013, incentive costs follow program costs, increasing after the new lighting standards take effect.

Home Retrofit

Total program costs for the Home Retrofit are considerably lower than the best practice retrofit programs. This is principally because the end use mix of Home Retrofit is dominated by lighting, resulting in costs lower than most retrofit programs. Thus, Home Retrofit costs are less than best practice retrofit program costs, but are more than best practice prescriptive program costs. The ratio of administrative costs to incentive costs is in line with best practice cost ratios. Over 2009-2013, incentive costs and total program costs for Home Retrofit follow the cost pattern of a program dominated by lighting, increasing after the new lighting standards.

Low Income

Total program costs for the Efficient Products program are within the wide range of best practice low income program costs. Incentive costs for the Low Income program are also within the range of best practice costs. Non-incentive costs are higher than best practice as is expected from a start up program.

New Construction

Total program costs for the New Construction program are considerably lower than best practice costs. This is because the program is dominated by lighting, thus, its costs and administrative:incentive cost ratio are very similar to best practice prescriptive costs and cost ratios.

Total Residential Costs

Total program costs for all residential programs combined are near the top range of best practice costs, more similar to the northeastern best practice IOUs than to the other best practice organizations.

Figures A-2 and A-3 in the Appendix show annual program costs per kWh for 2009-2013 with costs of similar programs of best practice organizations and other organizations.

See Appendices B and C for a full discussion of best practice programs and their cost components.

5 DSM 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.

5.1 Model Inputs

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

5.1.1 General Inputs

Key general inputs are:

- **Avoided energy costs.** These reflect costs for new energy avoided or deferred by DSM measures. Annual averaged avoided energy costs, per APCo West Virginia, start at \$0.0463/kWh on-peak and \$0.0497/kWh off-peak in 2009 and are escalated over the forecast period. Tables 5-1 and 5-2 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 DSM measures. A value of \$35/kW-year was the initial-year value used for 2009.

- **Electricity prices.** These reflect the average retail price paid by APCo West Virginia customers. We used a 2009 value of \$0.0723/kWh for residential and \$0.0464/kWh (and \$4.75/kW demand) for non-residential, escalated at 3.1% per APCo West Virginia's projections.

Table 5-1. Avoided Costs – Residential

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Avoided Costs - Energy ($/kWh):																				
Summer-On:	$0.036	$0.035	$0.035	$0.033	$0.036	$0.036	$0.048	$0.049	$0.052	$0.053	$0.054	$0.056	$0.057	$0.059	$0.061	$0.063	$0.064	$0.066	$0.068	$0.069
Summer-Off:	$0.030	$0.030	$0.031	$0.029	$0.031	$0.031	$0.044	$0.045	$0.043	$0.045	$0.046	$0.048	$0.049	$0.050	$0.052	$0.053	$0.055	$0.056	$0.057	$0.059
Winter-On:	$0.036	$0.035	$0.035	$0.033	$0.036	$0.036	$0.048	$0.049	$0.052	$0.053	$0.054	$0.056	$0.057	$0.059	$0.061	$0.063	$0.064	$0.066	$0.068	$0.069
Winter-Off:	$0.030	$0.030	$0.031	$0.029	$0.031	$0.031	$0.044	$0.045	$0.043	$0.045	$0.046	$0.048	$0.049	$0.050	$0.052	$0.053	$0.055	$0.056	$0.057	$0.059

Table 5-2. Avoided Costs – Commercial and Industrial

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Avoided Costs - Energy ($/kWh):																				
Summer-On:	$0.036	$0.035	$0.035	$0.033	$0.036	$0.036	$0.048	$0.049	$0.052	$0.053	$0.054	$0.056	$0.057	$0.059	$0.061	$0.063	$0.064	$0.066	$0.068	$0.069
Summer-Off:	$0.030	$0.030	$0.031	$0.029	$0.031	$0.031	$0.044	$0.045	$0.043	$0.045	$0.046	$0.048	$0.049	$0.050	$0.052	$0.053	$0.055	$0.056	$0.057	$0.059
Winter-On:	$0.036	$0.035	$0.035	$0.033	$0.036	$0.036	$0.048	$0.049	$0.052	$0.053	$0.054	$0.056	$0.057	$0.059	$0.061	$0.063	$0.064	$0.066	$0.068	$0.069
Winter-Off:	$0.030	$0.030	$0.031	$0.029	$0.031	$0.031	$0.044	$0.045	$0.043	$0.045	$0.046	$0.048	$0.049	$0.050	$0.052	$0.053	$0.055	$0.056	$0.057	$0.059
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
Avoided Costs - Demand ($/kW):																				
Total:	$35.00	$59.90	$58.40	$77.80	$97.10	$98.90	$100.70	$102.50	$104.40	$106.20	$108.00	$109.80	$111.60	$113.40	$115.20	$117.00	$118.80	$120.60	$122.40	$124.20

Source: APCo West Virginia.

In line with standard industry practice, Summit Blue used the TRC test to determine which DSM programs to include in APCo West Virginia's portfolio of DSM programs. The RIM test is a more restrictive test that is only used as the main DSM benefit-cost test in very few states.[35] Most of the measures passed the TRC test. The portfolio of DSM programs that Summit Blue developed is cost effective by industry standards.

Table 5-3. Summary of Program Benefit-Cost Test Results – 2009 to 2013

Consumer Sector	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Rate Impact Measure Test (RIM)
Products	2.3	3.4	6.3	0.5
Recycling	1.0	0.9	na	0.0
Retrofit	2.4	3.6	3.6	0.9
Low Income	2.4	3.6	3.9	0.8
New Construction	2.4	3.7	6.8	0.5
Demand Response	1.5	4.2	1.5	1.1
Consumer Sector Total	**2.3**	**3.6**	**4.0**	**0.7**
Business Sector	**Total Resource Cost Test (TRC)**	**Utility Cost Test (UCT)**	**Participant Cost Test (PCT)**	**Rate Impact Measure Test (RIM)**
Prescriptive	2.2	3.5	3.3	0.8
Custom	1.6	2.3	3.5	0.6
New Construction	1.4	2.2	2.8	0.6
Demand Response	1.6	2.3	0.7	2.0
Business Sector Total	**1.9**	**2.9**	**2.9**	**0.8**
PORTFOLIO TOTAL	**2.2**	**3.3**	**3.9**	**0.7**

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

5.1.2 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 DSM measure characterization chapter.

5.1.3 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 incremental 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 construction, the administrative cost was set equal to the customer incentive cost.[36] 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.

5.2 Cost-Effectiveness Results

This section summarizes the results of the cost-effectiveness analysis at the measure level. Following are four cost-effectiveness test results:[37]

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[36] Benchmarking research on costs found a wide range of percentage splits between customer incentive costs and program administration costs (defined broadly here, as noted previously):

Best Practice Programs Investment Range

Consumer Sector	% Administrative Costs	% Incentive Costs
Efficient Products	22-67%	33-78%
Home Retrofit	8-60%	40-92%
Low Income	7-49%	51-93%
New Construction	10-74%	26-90%
Business Sector	**% Administrative Costs**	**% Incentive Costs**
Prescriptive Incentive	13-65%	35-87%
Custom	27-72%	28-73%
New Construction	11-44%	54-89%

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

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 DSM 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 DSM 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 DSM program administrative costs.

In line with standard industry practice, Summit Blue primarily uses the TRC test to determine which DSM programs to include in a portfolio of DSM programs. Table 5-4 shows the cost and benefit components considered for each test.

Table 5-4. 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

5.2.1 Residential Measures

The cost-effectiveness for each of the measures was analyzed for each of the residential segments. The results for the measures for single-family existing homes (as an example) are presented in Table 5-5 through Table 5-9. A TRC test value of less than one indicates a measure which failed an initial TRC screening value of 1.0 in that housing segment. Where a measure did not pass the TRC test for any housing segment, it is excluded from the residential portfolio. An incentive cost of 50 percent of the incremental measure cost was used for residential measures in the Base scenario, except for retirement of second refrigerators and freezers. Results were also developed for three other housing types: new construction, multi-family, and mobile homes.

Table 5-5. Residential Cost-Effectiveness Ratios Winter Basis – 2009 to 2013, Single-Family Existing with Electric Heat - Lighting

	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	1.26	2.033	3.892	0.396
Electric	9-16W Screw-in CFL	1.89	2.769	6.526	0.418
Electric	17-24W Screw-in CFL	2.02	2.914	7.242	0.421
Electric	25-34W Screw-in CFL	1.69	2.553	5.598	0.413
Electric	Over 34W Screw-in CFL	1.25	2.013	3.839	0.395
Electric	9-16W Pin Based CFL	0.08	0.123	0.750	0.099
Electric	9-16W Pin Based CFL	0.14	0.214	0.936	0.149
Electric	17-24W Pin Based CFL	0.15	0.232	0.972	0.158
Electric	25-34W Pin Based CFL	0.17	0.262	1.033	0.171
Electric	35-44W Pin Based CFL	0.16	0.243	0.993	0.163
Electric	45-54W Pin Based CFL	0.27	0.399	1.310	0.220
Electric	Over 54W Pin Based CFL	0.22	0.325	1.160	0.196
Electric	9-16W Screw-in CFL - Outdoor	2.25	3.505	5.655	0.519
Electric	9-16W Screw-in CFL - Outdoor	3.26	4.620	9.580	0.538
Electric	17-24W Screw-in CFL - Outdoor	3.51	4.869	10.850	0.541
Electric	25-34W Screw-in CFL - Outdoor	3.06	4.413	8.665	0.535
Electric	Over 34W Screw-in CFL - Outdoor	2.74	4.076	7.383	0.530
Electric	9-16W Pin Based CFL - Outdoor	0.28	0.413	1.178	0.246
Electric	9-16W Pin Based CFL - Outdoor	0.48	0.719	1.680	0.330
Electric	17-24W Pin Based CFL - Outdoor	0.52	0.784	1.787	0.343
Electric	25-34W Pin Based CFL - Outdoor	0.60	0.899	1.976	0.363
Electric	35-44W Pin Based CFL - Outdoor	0.57	0.854	1.903	0.355
Electric	45-54W Pin Based CFL - Outdoor	0.94	1.417	2.828	0.426
Electric	Over 54W Pin Based CFL - Outdoor	1.07	1.604	3.134	0.441
Electric	Indoor Torchieres	0.34	0.516	1.327	0.282
Electric	Indoor Torchieres	0.62	0.923	1.980	0.372
Electric	LED night light	0.93	1.399	3.493	0.350
Electric	LED holiday lights	0.77	1.162	1.929	0.478

Table 5-6. Residential Cost-Effectiveness Ratios Winter Basis – 2009 to 2013, Single-Family Existing with Gas Heat – Lighting

	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	2.25	3.350	5.981	0.525
Gas	9-16W Screw-in CFL	3.15	4.264	10.236	0.543
Gas	17-24W Screw-in CFL	3.34	4.430	11.393	0.546
Gas	25-34W Screw-in CFL	2.88	4.008	8.738	0.539
Gas	Over 34W Screw-in CFL	2.22	3.324	5.895	0.524
Gas	9-16W Pin Based CFL	0.17	0.252	0.905	0.179
Gas	9-16W Pin Based CFL	0.29	0.439	1.204	0.257
Gas	17-24W Pin Based CFL	0.32	0.475	1.263	0.270
Gas	25-34W Pin Based CFL	0.36	0.536	1.361	0.288
Gas	35-44W Pin Based CFL	0.33	0.496	1.297	0.276
Gas	45-54W Pin Based CFL	0.54	0.815	1.809	0.353
Gas	Over 54W Pin Based CFL	0.44	0.665	1.567	0.322
Gas	9-16W Screw-in CFL - Outdoor	2.25	3.505	5.655	0.519
Gas	9-16W Screw-in CFL - Outdoor	3.26	4.620	9.580	0.538
Gas	17-24W Screw-in CFL - Outdoor	3.51	4.869	10.850	0.541
Gas	25-34W Screw-in CFL - Outdoor	3.06	4.413	8.665	0.535
Gas	Over 34W Screw-in CFL - Outdoor	2.74	4.076	7.383	0.530
Gas	9-16W Pin Based CFL - Outdoor	0.28	0.413	1.178	0.246
Gas	9-16W Pin Based CFL - Outdoor	0.48	0.719	1.680	0.330
Gas	17-24W Pin Based CFL - Outdoor	0.52	0.784	1.787	0.343
Gas	25-34W Pin Based CFL - Outdoor	0.60	0.899	1.976	0.363
Gas	35-44W Pin Based CFL - Outdoor	0.57	0.854	1.903	0.355
Gas	45-54W Pin Based CFL - Outdoor	0.94	1.417	2.828	0.426
Gas	Over 54W Pin Based CFL - Outdoor	1.07	1.604	3.134	0.441
Gas	Indoor Torchieres	0.55	0.832	1.836	0.356
Gas	Indoor Torchieres	0.99	1.489	2.891	0.439
Gas	LED night light	1.56	2.334	5.336	0.400
Gas	LED holiday lights	0.77	1.162	1.929	0.478

Table 5-7. Residential Cost-Effectiveness Ratios Winter Basis – 2009 to 2013, Single-Family Existing – Appliances & Pool Pumps

	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	0.15	0.301	0.817	0.187
Electric	Freezer Energy Star	0.36	0.684	1.262	0.287
Electric	Refrigerator, retire old	0.54	0.451	0.000	0.236
Electric	Freezer retire old	0.43	0.360	0.000	0.208
Electric	Variable Speed Drive Pool Pumps	1.10	1.895	3.194	0.386
Electric	*occ sensor power bars*	0.16	0.317	0.829	0.195
Gas	Refrigerator, replace with Energy Star	0.29	0.568	1.013	0.290
Gas	Freezer Energy Star	0.67	1.252	1.730	0.402
Gas	Refrigerator, retire old	1.05	0.872	0.000	0.352
Gas	Freezer retire old	0.84	0.696	0.000	0.320
Gas	Variable Speed Drive Pool Pumps	1.10	1.895	3.194	0.386
Gas	occ sensor power bars	0.31	0.594	1.035	0.300

Table 5-8. Residential Cost-Effectiveness Ratios Winter Basis – 2009 to 2013, Single-Family Existing – Hot Water

	Hot Water	TRC	UCT	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	2.27	3.819	4.346	0.609
Electric	Low flow showerhead	1.01	1.510	2.584	0.490
Electric	Faucet Aerators	2.30	3.755	4.576	0.608
Electric	Dishwasher - Energy Star	0.08	0.152	0.656	0.117
Electric	Drain Water Heat Recovery	0.30	0.455	1.128	0.280
Electric	Clothes Washer - Tier 3	0.38	0.732	1.124	0.340
Electric	tank insulation	1.24	1.862	3.069	0.522
Electric	pipe insulation	10.18	15.271	21.570	0.692
Gas	High Efficiency Water Heating Tank	2.27	3.819	4.346	0.609
Gas	Low flow showerhead	1.01	1.510	2.584	0.490
Gas	Faucet Aerators	2.30	3.755	4.576	0.608
Gas	Dishwasher - Energy Star	0.10	0.203	0.710	0.144
Gas	Drain Water Heat Recovery	0.30	0.455	1.128	0.280
Gas	Clothes Washer - Tier 3	0.39	0.752	1.142	0.344
Gas	*tank insulation*	1.24	1.862	3.069	0.522
Gas	pipe insulation	10.18	15.271	21.570	0.692

Table 5-9. Residential Cost-Effectiveness Ratios Winter Basis – 2009 to 2013, Single-Family Existing – HVAC & Shell

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	0.49	0.910	1.496	0.333
Electric	Central A/C - SEER 14 w/TXV	0.12	0.233	0.727	0.161
Electric	Window Upgrade	0.21	0.322	0.732	0.262
Electric	Improved Ceiling Insulation	0.28	0.422	0.824	0.318
Electric	Improved Wall Insulation	2 89	4 341	4 639	0 845
Electric	Reduce Infiltration	1.77	2.660	1.842	1.136
Electric	HVAC testing and Maintenance	2.41	3.613	7.421	0.456
Electric	Duct Repair	2.60	3.899	2.534	1.285
Electric	Energy Star Air Source Heat Pump	2.41	3.831	6.731	0.457
Gas	Room A/C - Energy Star	0.49	0.910	1.496	0.333
Gas	Central A/C - SEER 14 w/TXV	0.12	0.230	0.725	0.160
Gas	Window Upgrade	0.02	0.026	0.533	0.025
Gas	Improved Ceiling Insulation	0.01	0.022	0.522	0.021
Gas	Improved Wall Insulation	0.22	0.334	0.965	0.228
Gas	Reduce Infiltration	0.08	0.127	0.591	0.117
Gas	HVAC testing and Maintenance	0.36	0.539	1.282	0.303
Gas	Duct Repair	0.17	0.250	0.730	0.203
Electric	GSHP	0.18	0.352	0.550	0.320

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.[38]

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.

APCo West Virginia'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.

5.2.2 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

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

Overall, C&I results are shown in Table 5-10 to Table 5-13 for restaurants.[39] Where a value of less than one is shown, 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. An incentive cost of 50 percent of the incremental measure cost was used for C&I measures in the Base scenario, except for screw-in CFLs and the custom measure.

Table 5-10. Commercial Cost-Effectiveness Ratios Winter Basis – 2009 to 2013, Restaurants - Lighting

	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	2.46	2.714	16.253	0.646
Electric	CFL - Hard-wired weighted Watts	3.65	4.732	9.936	0.718
Electric	T8 Electronic Ballast - Dimming	0.42	0.786	1.025	0.408
Electric	LED Exit	0.84	1.544	1.626	0.532
Electric	T8/T5 w/Electronic Ballast	1.04	1.892	1.878	0.585
Electric	Delamping w/Reflectors (2 lamp)	1.80	3.046	3.087	0.663
Electric	Occupancy Sensor Motion Detector	0.93	1.628	1.822	0.546
Electric	50W MH HID	1.28	2.265	2.241	0.614
Electric	75W MH HID	0.56	1.064	1.044	0.533
Electric	100W MH HID	1.01	1.817	1.948	0.547
Electric	175W PS MH HID	4.88	6.347	14.155	0.687
Electric	250W PS MH HID	4.20	6.055	7.977	0.798
Electric	50W MH HID	1.04	1.923	1.546	0.693
Electric	75W MH HID	0.48	0.929	0.834	0.569
Electric	100W MH HID	0.68	1.267	1.381	0.500
Electric	175W PS MH HID	3.88	5.502	8.708	0.700
Electric	250W PS MH HID	3.73	5.836	5.050	0.951
Electric	Outdoor Lighting Controls	0.94	1.732	1.260	0.761
Electric	T5 Interior High Bay Fluorescent Fixture - four lamp	1.63	2.756	3.187	0.588
Electric	T8 Interior High Bay Fluorescent Fixture - six lamp	1.65	2.841	2.801	0.659
Gas	CFL - Screw-in weighted Watts	2.24	2.434	19.474	0.571
Gas	CFL - Hard-wired weighted Watts	4.62	5.812	11.865	0.844
Gas	T8 Electronic Ballast - Dimming	0.58	1.078	1.133	0.516
Gas	LED Exit	1.10	2.006	1.857	0.623
Gas	T8/T5 w/Electronic Ballast	1.44	2.559	2.160	0.713
Gas	Delamping w/Reflectors (2 lamp)	2.44	4.029	3.617	0.793
Gas	Occupancy Sensor Motion Detector	1.44	2.474	2.093	0.756
Gas	50W MH HID	1.76	3.056	2.596	0.747
Gas	75W MH HID	0.61	1.155	1.155	0.530
Gas	100W MH HID	1.49	2.645	2.244	0.717
Gas	175W PS MH HID	6.79	8.576	16.947	0.886
Gas	250W PS MH HID	5.02	7.006	9.506	0.862
Gas	50W MH HID	0.94	1.736	1.546	0.625
Gas	75W MH HID	0.31	0.610	0.834	0.373
Gas	100W MH HID	0.79	1.486	1.381	0.587
Gas	175W PS MH HID	4.73	6.704	8.708	0.853
Gas	250W PS MH HID	3.18	4.979	5.050	0.811
Gas	Outdoor Lighting Controls	0.52	0.953	1.260	0.419
Gas	T5 Interior High Bay Fluorescent Fixture - four lamp	2.43	4.007	3.736	0.774
Gas	T8 Interior High Bay Fluorescent Fixture - six lamp	2.12	3.560	3.271	0.746

[39] 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, are excluded from the portfolio.

Table 5-11. Commercial Cost-Effectiveness Results Winter Basis – 2009 to 2013, Restaurants – Motors & Other

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	0.98	1.822	1.403	0.710
Electric	Prem Motor > 10HP	1.55	2.779	1.998	0.820
Electric	Adjustable Speed Drives for Fans & Pumps	2.07	3.603	2.481	0.913
Electric	Compressed Air Controls	0.08	0.150	0.603	0.125
Electric	Convection Oven	0.15	0.288	0.638	0.229
Electric	Spray Nozzles for Food Service	1.62	1.942	5.978	0.607
Electric	Hot Water Circulation Pump Time Clock	1.00	1.630	2.204	0.519
Electric	Retrocommissioning	0.38	0.697	1.016	0.378
Gas	Prem Motor < =10 HP	0.98	1.822	1.403	0.710
Gas	Prem Motor > 10HP	1.55	2.779	1.998	0.820
Gas	Adjustable Speed Drives for Fans & Pumps	2.12	3.689	2.495	0.929
Gas	Compressed Air Controls	0.08	0.150	0.603	0.125
Gas	Convection Oven	0.15	0.288	0.638	0.229
Gas	Spray Nozzles for Food Service	1.62	1.942	5.978	0.607
Gas	Hot Water Circulation Pump Time Clock	1.00	1.630	2.204	0.519
Gas	Retrocommissioning	0.34	0.632	0.950	0.360

Table 5-12. Commercial Cost-Effectiveness Results Winter Basis – 2009 to 2013, Restaurants – HVAC & Shell

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 34	0 653	0 965	0 351
Electric	EMS System - Lighting & HVAC	0 75	1 293	1 696	0 478
Electric	Programmable Thermostat	2 24	3 457	4 721	0.622
Electric	Economizer	0 47	0 873	1 157	0.406
Electric	Reflective Window Film	0 00	-0 002	0 520	-0 002
Electric	Cool Roof	1 35	2 330	2 750	0 547
Electric	Tune-up/Advanced Diagnostics	0 12	0 229	0 658	0 176
Gas	Packaged Rooftop A/C 12 EER	0 34	0 654	0 965	0.351
Gas	EMS System - Lighting & HVAC	0 64	1 121	1 484	0 452
Gas	Programmable Thermostat	0 95	1 679	1 926	0.522
Gas	Economizer	0.45	0 839	1 128	0.398
Gas	Reflective Window Film	0 45	0.839	1 128	0 398
Gas	Cool Roof	1 25	2 202	2 423	0 564
Gas	Tune-up/Advanced Diagnostics	0.12	0 229	0 658	0.176

Table 5-13. Commercial Cost-Effectiveness Results Winter Basis – 2009 to 2013, Restaurants - Refrigeration

	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 mot	5.15	5.823	20.303	0.945
Electric	Single Line to Multiplex Compressor	0.07	0.141	0.584	0.121
Electric	Multiplex system with oversized condenser	0.07	0.136	0.569	0.120
Electric	High efficiency, low temperature compressor with EER of	0.50	0.913	1.037	0.483
Electric	Evap Fan Controller for Med. Temp Walk-in	3.84	4.826	9.303	0.870
Electric	Strip Curtains	1.63	1.877	7.056	0.635
Electric	Night Covers	0.66	1.285	0.594	1.091
Electric	Anti-sweat Heater Controls	0.07	0.138	0.568	0.122
Electric	Floating Head Pressure Controls	3.25	3.712	16.301	0.678
Electric	Glass Doors on Low and Med. Temperature Displays	0.07	0.147	0.581	0.127
Gas	Motor Upgrade for Fans & Compressors - ECM & PSC mot	5.15	5.823	20.303	0.945
Gas	Single Line to Multiplex Compressor	0.07	0.141	0.584	0.121
Gas	Multiplex system with oversized condenser	0.07	0.136	0.569	0.120
Gas	High efficiency, low temperature compressor with EER of	0.50	0.913	1.037	0.483
Gas	Evap Fan Controller for Med. Temp Walk-in	3.84	4.826	9.303	0.870
Gas	Strip Curtains	1.63	1.877	7.056	0.635
Gas	Night Covers	0.66	1.285	0.594	1.091
Gas	Anti-sweat Heater Controls	0.07	0.138	0.568	0.122
Gas	Floating Head Pressure Controls	3.25	3.712	16.301	0.678
Gas	Glass Doors on Low and Med. Temperature Displays	0.07	0.147	0.581	0.127

Of C&I measures screened across all building types, a majority passed the TRC test. Measures that did not pass the initial segment-level screening are identified by a <1.0 TRC result in Table 5-9 to Table 5-12. The results across all C&I building types indicate that most commercial DSM measures are cost effective in APCo West Virginia's service area.

6 DSM POTENTIAL METHODOLOGY AND RESULTS

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

6.1 Methodology – DSM RAM

This section describes the DSM potential analysis approach and method.

The Summit Blue Resource Assessment Model ("SB-RAM") is a model based on the integration of DSM measure impacts and costs, utility customer characteristics, utility load forecasts, 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, DSM technology data, past DSM program accomplishments, and decision maker variables that help drive the market potential scenarios.

The baseline estimates of building stocks and equipment saturations came from the results of the on-site audits conducted by Summit Blue. SB-RAM also used the electricity forecast, avoided cost forecast, and electricity prices, as described in Chapter 5 above.

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

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

- **Economic DSM potential** describes the amount of technical DSM potential that is "cost-effective," as defined by the results of the TRC test (or other preferred cost effectiveness 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 DSM programs. The costs for the TRC test are the DSM measure costs, plus the DSM program administration costs. The TRC test does not consider economic or market barriers to customers installing DSM measures.

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

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

- **Replace on Burnout ("ROB")** means that a DSM 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 DSM 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

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

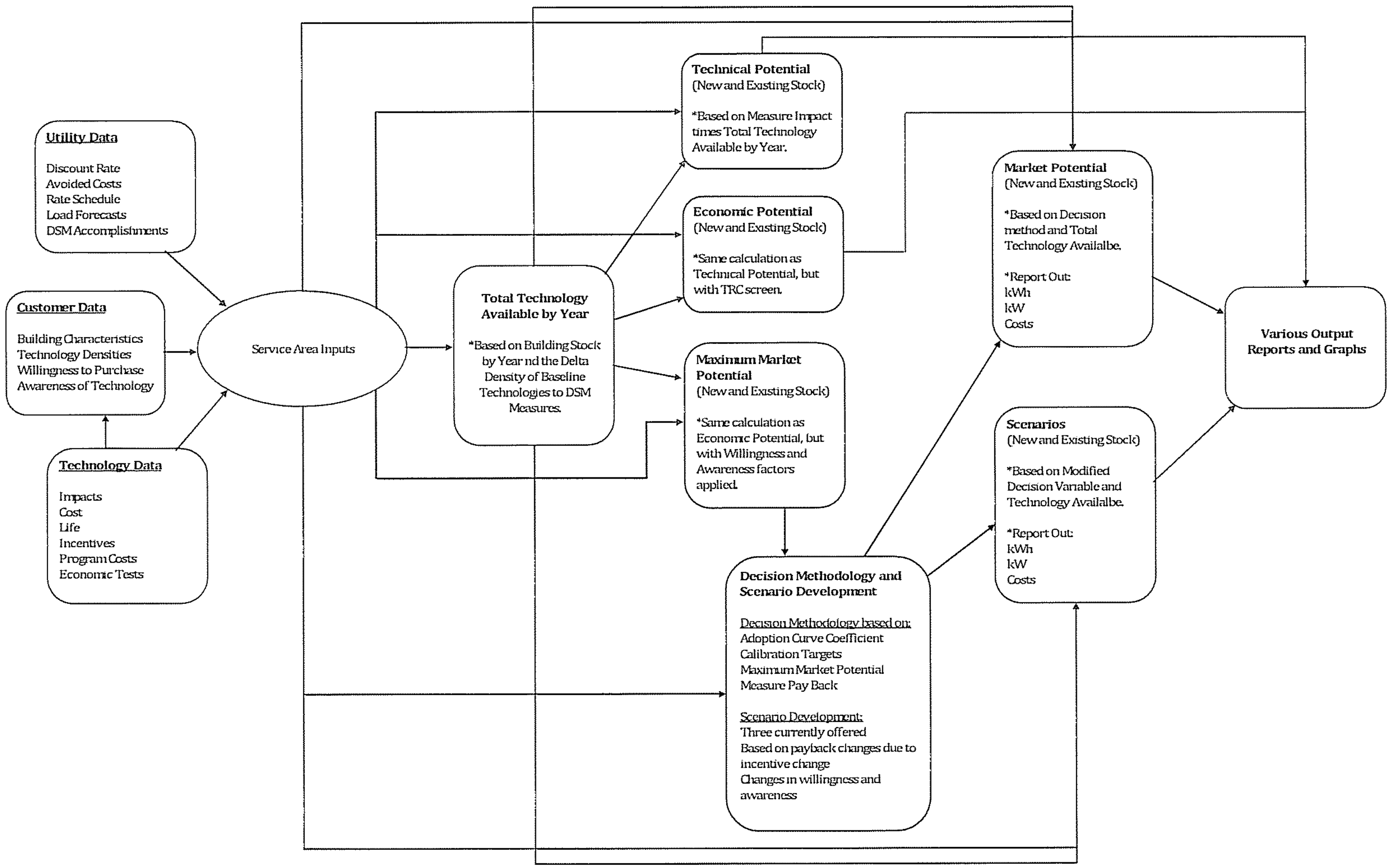
Simple Customer Payback

The decision model of SB-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.

DSM Measure Levelized Cost/kWh

DSM supply curves are based on the DSM measure cost per kWh, levelized over the lifetime of the measure. It is calculated by multiplying DSM measure costs by the Capital Recovery Factor ("CRF"), then dividing by the first year kWh savings. Figure 6-1 illustrates the flow of information in and out of SB-RAM.

Figure 6-1. SB-RAM Process Flow Overview



6.2 Overall DSM Potential Results

Based on APCo West Virginia's winter peak, the total cumulative annual net DSM potential savings at generator (Base Case Scenario Market Potential) in 2028 is estimated to be 2,460 GWh, about 11% of forecast sales, and 488 MW, about 14% of peak demand, as shown in Table 6-1. 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 6-1. Projected Cumulative Annual Net Savings at Generator and Costs – 2012, 15-Year & 20-Year Plans

Year-End 2012	Energy Efficiency				Demand Response		Costs		
Potential Scenario	Cumulative Annual Net Energy Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Estimated Costs - EE	Estimated Cost - DR	Estimated Total Costs
	GWh	% of Forecasted Sales	MW	% of Forecasted Sales	MW	% of Forecasted Sales	Total Cost Over Term		
Residential									
Technical	1,845	29%	716	41%	315	18%	NA	NA	NA
Economic	1,208	19%	493	28%	315	18%	NA	NA	NA
High Case	373	6%	133	8%	24	1%	$73,451,644	$6,383,501	$79,835,145
Base Case	131	2%	42	2%	16	1%	$19,040,572	$4,255,667	$23,296,240
Low Case	76	1%	25	1%	12	1%	$10,590,802	$3,191,750	$13,782,552
C&I									
Technical	4,123	31%	372	26%	998	69%	NA	NA	NA
Economic	3,096	23%	315	22%	998	69%	NA	NA	NA
High Case	784	6%	103	7%	50	3%	$140,666,753	$27,330,674	$167,997,426
Base Case	233	2%	29	2%	33	2%	$29,772,616	$18,220,449	$47,993,065
Low Case	145	1%	18	1%	25	2%	$16,121,347	$13,665,337	$29,786,684
Total									
Technical	5,968	30%	1,087	34%	1313	41%	NA	NA	NA
Economic	4,304	22%	808	25%	1313	41%	NA	NA	NA
High Case	1,157	6%	235	7%	74	2%	$214,118,397	$33,714,175	$247,832,571
Base Case	365	2%	71	2%	49	2%	$48,813,188	$22,476,116	$71,289,305
Low Case	221	1%	43	1%	37	1%	$26,712,149	$16,857,087	$43,569,236

(1) Numbers in this table do not include Demand Response programs and Low Income Energy Conservation Kits. APCo West Virginia would 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; these costs are included in this table. Forecasted sales are adjusted for losses.

(2) Costs in this table are not included for: APCo West Virginia DSM Department, General Education/Training/Media, Demand Response programs, Low Income Energy Conservation Kits, and Pilot Program Fund.

Table 6-2, continued.

15 Year Plan	Energy Efficiency				Demand Response		Costs		
Potential Scenario	Cumulative Annual Net Energy Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Estimated Costs - EE	Estimated Cost - DR	Estimated Total Costs
	GWh	% of Forecasted Sales	MW	% of Forecasted Sales	MW	% of Forecasted Sales	Total Cost Over Term		
Residential									
Technical	1,872	28%	715	38%	312	16%	NA	NA	NA
Economic	1,221	19%	492	26%	312	16%	NA	NA	NA
High Case	1,121	17%	476	25%	109	6%	$256,473,807	$61,930,823	$318,404,630
Base Case	644	10%	247	13%	73	4%	$109,741,756	$41,287,215	$151,028,971
Low Case	418	6%	152	8%	54	3%	$61,145,972	$30,965,412	$92,111,383
C&I									
Technical	4,197	29%	375	24%	998	64%	NA	NA	NA
Economic	3,154	22%	318	20%	998	64%	NA	NA	NA
High Case	2,663	18%	284	18%	230	15%	$546,729,871	$295,196,650	$841,926,521
Base Case	1,291	9%	140	9%	154	10%	$203,122,160	$196,797,766	$399,919,926
Low Case	783	5%	86	5%	115	7%	$103,398,755	$147,598,325	$250,997,080
Total									
Technical	6,068	29%	1,090	32%	1310	38%	NA	NA	NA
Economic	4,375	21%	810	23%	1310	38%	NA	NA	NA
High Case	3,784	18%	760	22%	339	10%	$803,203,678	$357,127,473	$1,160,331,151
Base Case	1,935	9%	387	11%	226	7%	$312,863,915	$238,084,982	$550,948,897
Low Case	1,202	6%	238	7%	170	5%	$164,544,727	$178,563,736	$343,108,464

Table 6-3, continued.

20 Year Plan	Energy Efficiency				Demand Response		Costs		
Potential Scenario	Cumulative Annual Net Energy Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Cumulative Annual Net Winter Peak Demand Savings at Generator		Estimated Costs - EE	Estimated Cost - DR	Estimated Total Costs
	GWh	% of Forecasted Sales	MW	% of Forecasted Sales	MW	% of Forecasted Sales	Total Cost Over Term		
Residential									
Technical	1,893	28%	717	37%	310	16%	NA	NA	NA
Economic	1,232	18%	492	25%	310	16%	NA	NA	NA
High Case	1,216	18%	510	26%	139	7%	$277,088,368	$103,080,138	$380,168,506
Base Case	802	12%	311	16%	93	5%	$138,229,606	$68,720,092	$206,949,698
Low Case	560	8%	201	10%	70	4%	$81,191,360	$51,540,069	$132,731,429
C&I									
Technical	4,241	28%	377	23%	998	62%	NA	NA	NA
Economic	3,189	21%	320	20%	998	62%	NA	NA	NA
High Case	3,102	21%	319	20%	296	18%	$628,201,307	$502,490,077	$1,130,691,385
Base Case	1,658	11%	177	11%	197	12%	$262,508,581	$334,993,385	$597,501,966
Low Case	1,036	7%	111	7%	148	9%	$138,218,766	$251,245,039	$389,463,804
Total									
Technical	6,134	28%	1,094	31%	1308	37%	NA	NA	NA
Economic	4,421	20%	812	23%	1308	37%	NA	NA	NA
High Case	4,318	20%	830	23%	435	12%	$905,289,675	$605,570,215	$1,510,859,891
Base Case	2,460	11%	488	14%	290	8%	$400,738,187	$403,713,477	$804,451,663
Low Case	1,596	7%	313	9%	218	6%	$219,410,126	$302,785,108	$522,195,234

Figure 6-2 and Figure 6-3 show the cumulative annual net energy and winter 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 nearly all instances, whereby free ridership is assumed for this analysis to be offset by spillover impacts. The exception is for the recycling of second refrigerators and freezers. 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 37.5% of incremental measure costs.

Figure 6-2. Cumulative Annual Net GWh Energy Savings in 2028 – At Generator

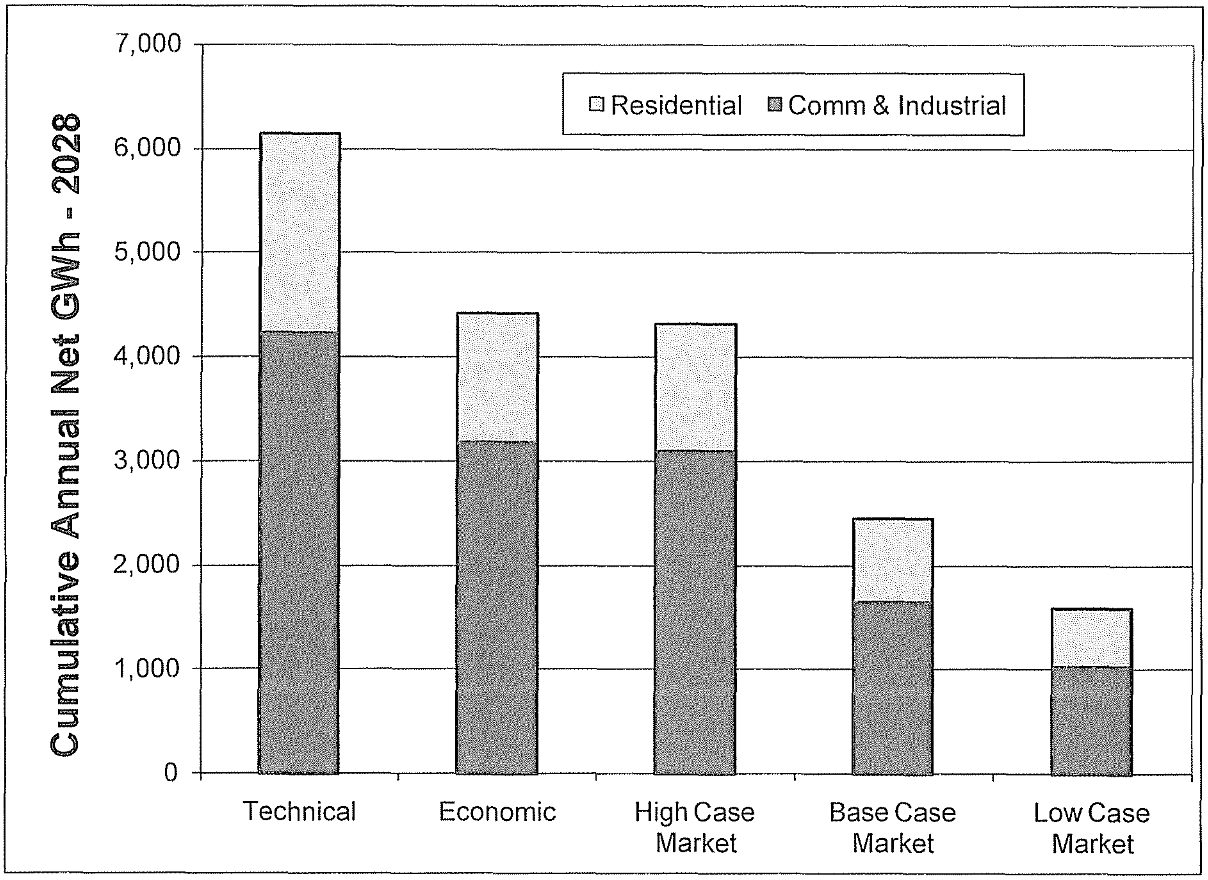


Figure 6-3. Cumulative Annual Net Winter Peak MW Demand Savings in 2028 – At Generator

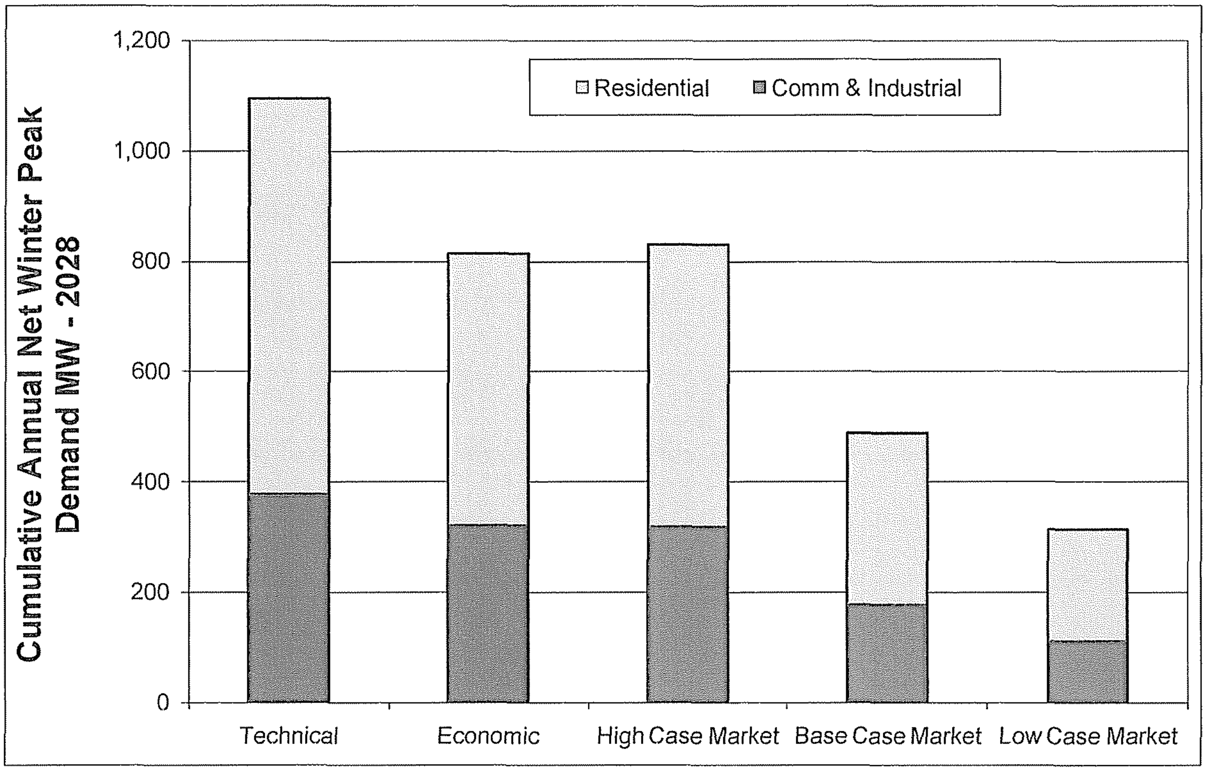
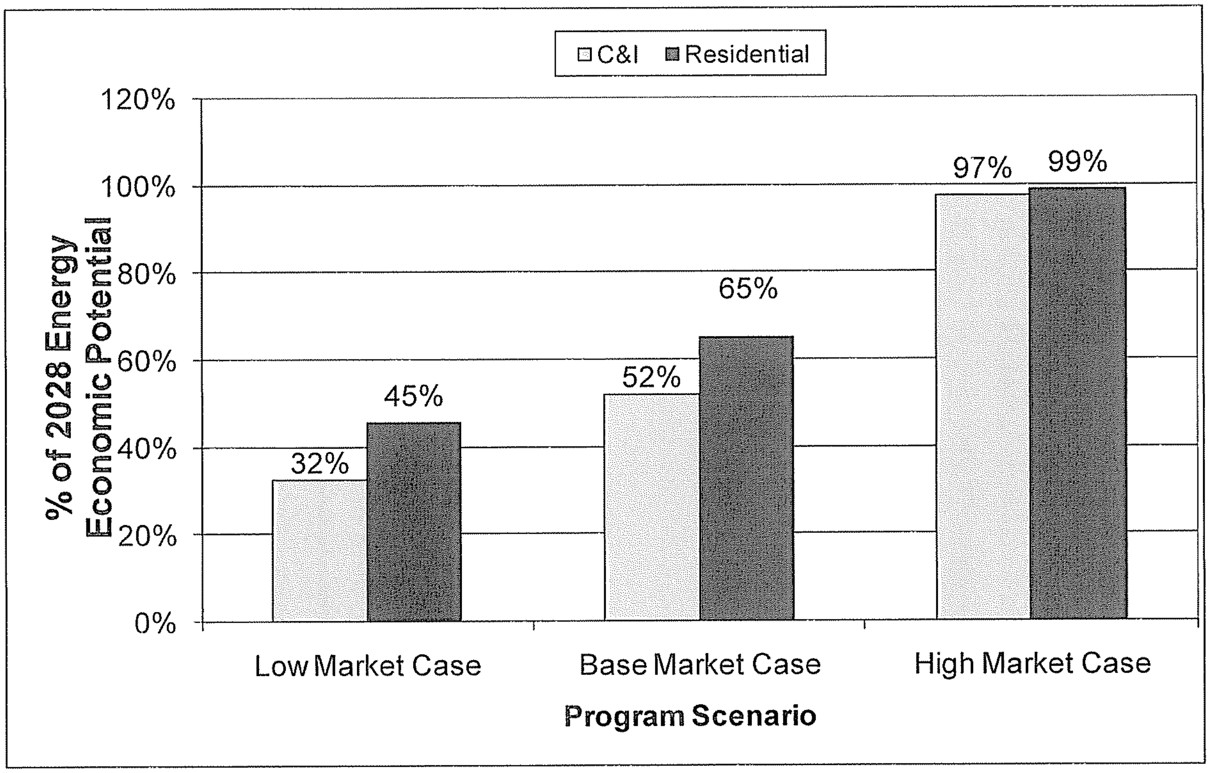


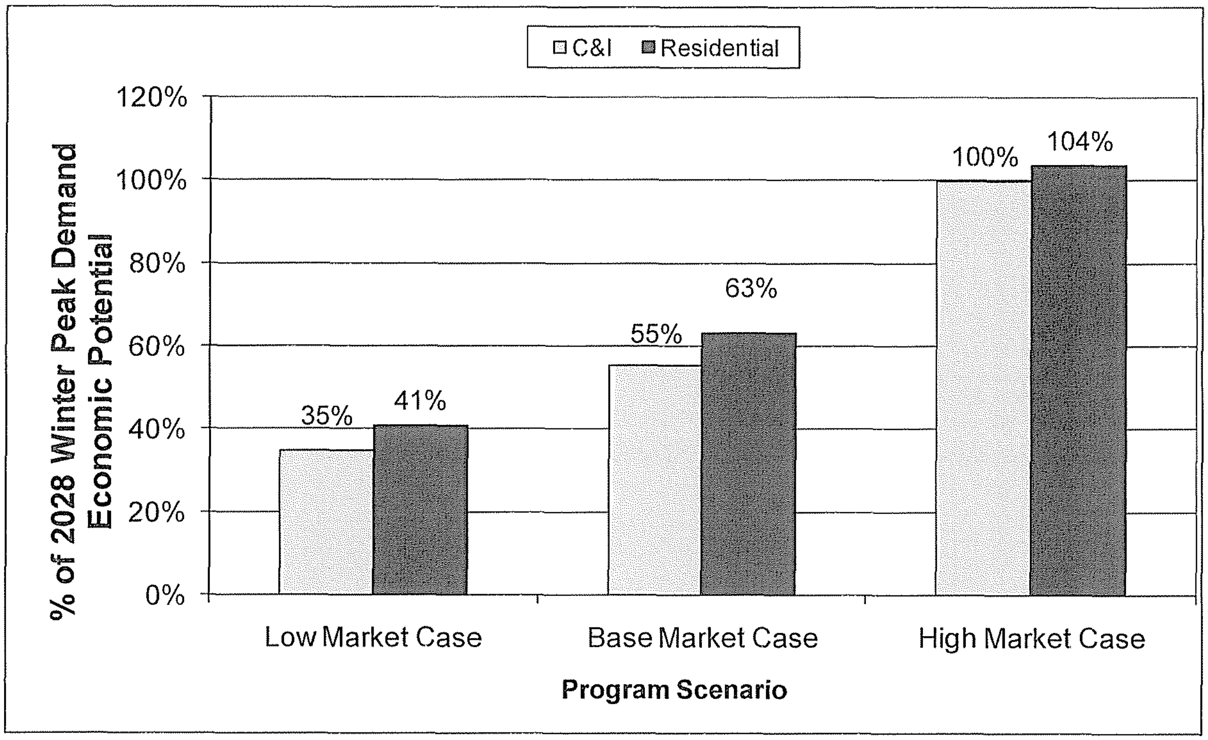
Figure 6-4 and Figure 6-5 show the cumulative Market Potential[40] as a percent of the Economic Potential for energy efficiency.

Figure 6-4. Market Potential Net Annual Energy Savings at Generator as Percent of Economic Potential in 2028



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

Figure 6-5. Market Potential Net Winter Peak Demand Savings at Generator as Percent of Economic Potential in 2028[41]



6.3 Residential DSM Potential Results

This section provides the DSM potential results for the residential sector. The total and annual incremental residential achievable DSM potential results for 20 years (2009-2028) are shown in Table 6-4 and Table 6-5. The energy values shown below are for the DSM measures' first-year, at-generator energy savings, the incremental demand savings are the winter peak coincident demand savings, and the program costs are the total estimated DSM program budgets for a given year, including rebate or other customer incentive costs, as well as administrative and implementation costs.

The total 20-year estimated residential base case market potential in 2028 is about 802 GWh in cumulative annual net savings at generator and about 311 MW of cumulative annual net winter peak demand. The annual incremental net energy savings at meter starts at 0.3% and peak out in 2015 at about 0.8% of APCo West Virginia's forecast annual residential energy sales (annual impacts begin to decline slowly thereafter as markets are saturated). 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. Cumulative demand response impacts total 93 MW in 2028, about 5% of residential winter peak demand.

[41] The high market case shows =/>100% of economic potential because demand response program impacts are included in the High Market Case, but are not included in the Economic Potential.

Table 6-4. Base Case Scenario: 2009 – 2028 Residential Cumulative Annual Net Savings at Generator and Costs

APCO West Virginia - Residential - End-Use Market Potential (Energy & Winter Demand Impacts)

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	8,185	24,166	46,856	64,280	81,896	100,115	117,881	135,099	151,832	168,170	184,350	200,212	214,416	228,389	241,342	253,731	264,193	274,514	283,696	292,332
Total Appliances & Pool Pumps	296	1,504	3,096	5,785	8,513	11,271	14,050	16,694	19,209	21,602	23,879	26,047	28,110	30,074	31,944	33,725	35,420	37,035	38,573	40,039
Total Hot Water	896	2,505	4,653	7,278	10,009	12,877	15,807	18,637	21,380	24,052	26,679	29,259	31,701	34,120	36,461	38,763	40,927	43,089	45,173	47,225
Total HVAC & Shell	9,315	20,402	34,188	54,079	80,736	110,032	140,158	168,757	195,941	221,833	246,595	270,268	292,556	313,947	334,277	353,735	371,982	389,573	406,260	422,251
TOTAL	18,692	48,578	88,792	131,421	181,153	234,295	287,897	339,187	388,362	435,656	481,502	525,786	566,783	606,529	644,023	679,953	712,522	744,210	773,702	801,847
Total as % of Sector Loss-Adjusted Sales	0.30%	0.77%	1.41%	2.08%	2.86%	3.67%	4.51%	5.30%	6.07%	6.80%	7.47%	8.10%	8.71%	9.26%	9.78%	10.25%	10.72%	11.13%	11.51%	11.83%

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	736	2,253	4,311	5,868	7,435	9,053	10,622	12,120	13,559	14,952	16,327	17,673	18,860	20,031	21,113	22,153	23,021	23,892	24,670	25,416
Total Appliances & Pool Pumps	27	126	221	314	404	491	575	657	736	812	887	959	1,028	1,096	1,161	1,224	1,286	1,345	1,403	1,458
Total Hot Water	205	574	1,065	1,666	2,292	2,949	3,620	4,268	4,896	5,507	6,109	6,700	7,259	7,813	8,349	8,876	9,372	9,867	10,344	10,814
Total HVAC & Shell	6,569	14,034	22,741	34,043	50,675	69,994	89,919	108,809	126,720	143,710	159,841	175,166	189,706	203,521	216,645	229,123	240,963	252,222	262,921	273,098
TOTAL	7,537	16,987	28,338	41,892	60,805	82,487	104,736	125,853	145,910	164,982	183,164	200,497	216,852	232,460	247,268	261,377	274,641	287,326	299,337	310,787
Total as % of Sector Loss-Adjusted Sales	0.43%	0.98%	1.62%	2.38%	3.43%	4.63%	5.85%	7.00%	8.09%	9.08%	10.00%	10.86%	11.66%	12.40%	13.09%	13.74%	14.33%	14.89%	15.41%	15.99%

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	8,185	15,982	22,690	17,424	17,616	18,219	17,766	17,218	16,732	16,338	16,180	15,863	14,204	13,973	12,952	12,389	10,463	10,321	9,183	8,635
Total Appliances & Pool Pumps	296	1,208	1,591	2,689	2,728	2,759	2,779	2,644	2,515	2,393	2,277	2,168	2,063	1,964	1,870	1,781	1,696	1,615	1,538	1,466
Total Hot Water	896	1,609	2,148	2,625	2,732	2,868	2,930	2,830	2,743	2,672	2,627	2,580	2,442	2,419	2,341	2,302	2,164	2,161	2,084	2,053
Total HVAC & Shell	9,315	11,087	13,786	19,892	26,656	29,296	30,126	28,598	27,184	25,892	24,761	23,674	22,288	21,391	20,330	19,458	18,247	17,591	16,687	15,991
TOTAL	18,692	29,886	40,216	42,629	49,732	53,142	53,601	51,290	49,175	47,295	45,846	44,284	40,996	39,747	37,494	35,930	32,569	31,688	29,492	28,145
Total as % of Sector Loss-Adjusted Sales	0.30%	0.48%	0.64%	0.68%	0.78%	0.83%	0.84%	0.80%	0.77%	0.74%	0.71%	0.68%	0.63%	0.61%	0.57%	0.54%	0.49%	0.47%	0.44%	0.42%

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	736	1,518	2,058	1,557	1,567	1,619	1,568	1,498	1,439	1,393	1,375	1,345	1,187	1,171	1,082	1,041	868	871	778	746
Total Appliances & Pool Pumps	27	98	95	93	90	87	84	82	79	77	74	72	70	67	65	63	61	59	58	56
Total Hot Water	205	369	492	601	626	657	671	648	628	612	602	591	559	554	536	527	496	495	477	470
Total HVAC & Shell	6,569	7,465	8,707	11,302	16,632	19,319	19,926	18,889	17,911	16,990	16,131	15,325	14,540	13,815	13,124	12,478	11,840	11,259	10,699	10,177
TOTAL	7,537	9,450	11,351	13,553	18,914	21,681	22,249	21,117	20,057	19,072	18,182	17,333	16,355	15,608	14,807	14,109	13,265	12,684	12,012	11,449
Total as % of Sector Loss-Adjusted Sales	0.43%	0.54%	0.65%	0.77%	1.07%	1.22%	1.24%	1.18%	1.11%	1.05%	0.99%	0.94%	0.88%	0.83%	0.78%	0.74%	0.69%	0.66%	0.62%	0.59%

Base Scenario - Winter - 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	$264,951	$489,719	$718,754	$813,284	$824,649	$857,024	$834,358	$814,806	$797,548	$784,221	$782,566	$771,711	$689,879	$683,091	$633,630	$607,594	$508,975	$504,183	$446,181	$419,287
Total Appliances & Pool Pumps	$13,392	$62,700	$105,217	$223,004	$229,063	$234,144	$238,081	$225,540	$213,662	$202,416	$191,775	$181,706	$172,149	$163,111	$154,548	$146,444	$138,745	$131,469	$124,571	$118,044
Total Hot Water	$69,033	$104,202	$154,343	$199,907	$210,741	$223,780	$230,934	$222,475	$215,065	$208,923	$204,937	$200,769	$189,559	$187,334	$180,900	$177,470	$166,371	$165,812	$159,489	$156,755
Total HVAC & Shell	$1,137,277	$1,313,371	$1,567,431	$2,119,426	$3,003,976	$3,424,393	$3,529,993	$3,349,360	$3,180,016	$3,022,261	$2,878,223	$2,741,768	$2,594,141	$2,475,044	$2,352,044	$2,242,382	$2,118,431	$2,025,576	$1,923,755	$1,835,445
TOTAL	$1,484,653	$1,969,992	$2,545,744	$3,355,620	$4,268,428	$4,739,341	$4,833,367	$4,612,181	$4,406,291	$4,217,821	$4,057,501	$3,895,954	$3,645,728	$3,508,581	$3,321,122	$3,173,890	$2,932,523	$2,827,041	$2,653,996	$2,529,532

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	$141,015	$222,751	$348,219	$393,448	$400,803	$417,114	$409,175	$406,722	$403,725	$400,900	$401,649	$396,965	$360,640	$355,947	$331,427	$315,991	$267,855	$259,993	$228,768	$209,971
Total Appliances & Pool Pumps	$57,413	$194,333	$204,986	$244,437	$241,678	$238,752	$235,486	$226,114	$217,142	$208,572	$200,421	$192,661	$185,137	$178,005	$171,163	$164,651	$158,304	$152,314	$146,550	$141,068
Total Hot Water	$49,070	$67,645	$96,624	$125,863	$132,229	$140,897	$143,942	$138,425	$133,854	$130,432	$129,012	$127,276	$118,520	$118,583	$114,373	$113,049	$104,103	$105,524	$101,142	$100,240
Total HVAC & Shell	$1,402,422	$1,623,246	$1,939,547	$2,573,544	$3,457,770	$3,890,689	$3,997,545	$3,799,535	$3,614,930	$3,444,430	$3,291,878	$3,146,496	$2,976,079	$2,852,040	$2,715,738	$2,598,738	$2,452,352	$2,357,986	$2,243,205	$2,149,063
TOTAL	$1,649,920	$2,107,975	$2,589,376	$3,337,290	$4,232,480	$4,687,452	$4,786,148	$4,570,795	$4,369,650	$4,184,334	$4,022,960	$3,863,399	$3,640,375	$3,504,576	$3,332,701	$3,192,429	$2,982,614	$2,875,817	$2,719,665	$2,600,343

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	$405,966	$712,470	$1,066,973	$1,206,731	$1,225,452	$1,274,138	$1,243,533	$1,221,528	$1,201,273	$1,185,121	$1,184,215	$1,168,677	$1,050,519	$1,039,039	$965,057	$923,585	$776,830	$764,177	$674,948	$629,259
Total Appliances & Pool Pumps	$70,805	$257,033	$310,203	$467,440	$470,741	$472,895	$473,567	$451,653	$430,804	$410,988	$392,196	$374,367	$357,286	$341,116	$325,710	$311,094	$297,049	$283,783	$271,121	$259,112
Total Hot Water	$118,103	$171,848	$250,967	$325,770	$342,969	$364,677	$374,876	$360,899	$348,919	$339,355	$333,949	$328,045	$308,079	$305,918	$295,273	$290,520	$270,474	$271,336	$260,631	$256,995
Total HVAC & Shell	$2,539,699	$2,936,617	$3,506,978	$4,692,969	$6,461,746	$7,315,083	$7,527,538	$7,148,896	$6,794,946	$6,466,691	$6,170,101	$5,888,264	$5,570,220	$5,327,084	$5,067,782	$4,841,120	$4,570,783	$4,383,562	$4,166,961	$3,984,509
TOTAL	$3,134,573	$4,077,968	$5,135,121	$6,692,911	$8,500,908	$9,426,793	$9,619,514	$9,182,976	$8,775,942	$8,402,155	$8,080,461	$7,759,352	$7,286,103	$7,013,157	$6,653,823	$6,366,319	$5,915,137	$5,702,858	$5,373,662	$5,129,874

APCO West Virginia - Residential - End-Use Market Potential (Energy & Winter Demand Impacts)

Cumulative Demand Potential (kW)

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	2,202	4,391	6,489	8,744	11,435	14,208	16,933	19,777	22,695	25,644	28,584	31,484	34,313	37,049	39,672	42,167	44,525	46,736	48,796	50,702
Water Heat LC	1,827	3,644	5,385	7,257	9,490	11,792	14,054	16,414	18,836	21,283	23,723	26,130	28,478	30,748	32,925	34,996	36,953	38,788	40,498	42,080
Total	4,029	8,035	11,874	16,001	20,925	26,000	30,987	36,192	41,531	46,926	52,308	57,614	62,791	67,797	72,597	77,164	81,477	85,524	89,294	92,781
Total as % of Loss-Adjusted Sales	0.23%	0.46%	0.68%	0.91%	1.18%	1.46%	1.73%	2.01%	2.30%	2.58%	2.85%	3.12%	3.38%	3.62%	3.84%	4.06%	4.25%	4.43%	4.60%	4.77%

Incremental Demand Potential (kW)

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	2,202	2,189	2,098	2,255	2,691	2,773	2,725	2,844	2,918	2,949	2,941	2,899	2,829	2,736	2,623	2,496	2,357	2,211	2,060	1,906
Water Heat LC	1,827	1,817	1,741	1,871	2,233	2,302	2,262	2,360	2,421	2,447	2,441	2,406	2,348	2,270	2,177	2,071	1,956	1,835	1,710	1,582
Total	4,029	4,006	3,839	4,126	4,925	5,075	4,987	5,205	5,339	5,396	5,382	5,306	5,178	5,006	4,800	4,567	4,314	4,046	3,770	3,488
Total as % of Loss-Adjusted Sales	0.23%	0.23%	0.22%	0.23%	0.28%	0.28%	0.28%	0.29%	0.30%	0.30%	0.29%	0.29%	0.28%	0.27%	0.25%	0.24%	0.23%	0.21%	0.19%	0.18%

Cumulative DLC Credits

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	$132,103	$395,553	$784,890	$1,309,520	$1,995,616	$2,848,114	$3,864,118	$5,050,766	$6,412,472	$7,951,089	$9,666,156	$11,555,186	$13,613,977	$15,836,905	$18,217,210	$20,747,252	$23,418,732	$26,222,886	$29,150,644	$32,192,760
Water Heat LC	$104,417	$312,653	$620,392	$1,035,070	$1,577,373	$2,251,204	$3,054,273	$3,992,222	$5,068,541	$6,284,693	$7,640,315	$9,133,441	$10,760,749	$12,517,793	$14,399,232	$16,399,026	$18,510,615	$20,727,072	$23,041,228	$25,445,774
Total	$236,519	$708,206	$1,405,282	$2,344,589	$3,572,989	$5,099,318	$6,918,390	$9,042,989	$11,481,014	$14,235,782	$17,306,470	$20,688,627	$24,374,726	$28,354,698	$32,616,443	$37,146,278	$41,929,347	$46,949,958	$52,191,872	$57,638,534

Incremental DLC Credits

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	$132,103	$263,450	$389,337	$524,630	$686,096	$852,498	$1,016,003	$1,186,649	$1,361,706	$1,538,617	$1,715,066	$1,889,031	$2,058,791	$2,222,928	$2,380,305	$2,530,042	$2,671,480	$2,804,154	$2,927,758	$3,042,115
Water Heat LC	$104,417	$208,236	$307,739	$414,678	$542,304	$673,831	$803,069	$937,950	$1,076,319	$1,216,152	$1,355,621	$1,493,126	$1,627,308	$1,757,045	$1,881,439	$1,999,793	$2,111,589	$2,216,457	$2,314,156	$2,404,546
Total	$236,519	$471,687	$697,076	$939,308	$1,228,400	$1,526,329	$1,819,072	$2,124,599	$2,438,025	$2,754,769	$3,070,688	$3,382,157	$3,686,099	$3,979,973	$4,261,744	$4,529,835	$4,783,069	$5,020,611	$5,241,914	$5,446,662

Cumulative Administrative Costs

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	$220,171	$439,084	$648,894	$874,384	$1,143,494	$1,420,830	$1,693,339	$1,977,748	$2,269,510	$2,564,361	$2,858,444	$3,148,385	$3,431,318	$3,704,880	$3,967,175	$4,216,736	$4,452,467	$4,673,590	$4,879,597	$5,070,192
Water Heat LC	$261,042	$520,591	$769,348	$1,036,694	$1,355,759	$1,684,577	$2,007,671	$2,344,875	$2,690,797	$3,040,380	$3,389,053	$3,732,815	$4,068,269	$4,392,612	$4,703,597	$4,999,484	$5,278,972	$5,541,143	$5,785,390	$6,011,366
Total	$481,213	$959,675	$1,418,242	$1,911,078	$2,499,253	$3,105,407	$3,701,010	$4,322,622	$4,960,307	$5,604,742	$6,247,497	$6,881,200	$7,499,588	$8,097,492	$8,670,773	$9,216,220	$9,731,439	$10,214,733	$10,664,987	$11,081,558

Incremental Administrative Costs

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	$220,171	$218,913	$209,810	$225,489	$269,110	$277,336	$272,509	$284,409	$291,763	$294,851	$294,083	$289,941	$282,933	$273,562	$262,296	$249,561	$235,730	$221,124	$206,006	$190,596
Water Heat LC	$261,042	$259,549	$248,757	$267,347	$319,065	$328,818	$323,095	$337,203	$345,922	$349,584	$348,673	$343,762	$335,454	$324,343	$310,985	$295,886	$279,489	$262,170	$244,247	$225,976
Total	$481,213	$478,462	$458,567	$492,836	$588,175	$606,154	$595,604	$621,612	$637,685	$644,434	$642,756	$633,703	$618,387	$597,904	$573,281	$545,447	$515,219	$483,294	$450,253	$416,571

Table 6-5. Residential Technical Potential Scenario: 2009 – 2028 Net Savings at Generator

Technical Potential APCO West Virginia - Residential: Winter

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	592,053	592,524	592,230	423,384	424,725	427,010	427,630	427,857	428,062	428,696	430,592	433,500	434,123	436,500	438,567	441,597	442,029	444,627	446,623	449,579
Appliances & Pool Pumps	227,778	227,826	227,676	228,356	228,780	229,553	229,710	229,722	229,726	229,889	230,519	231,523	231,682	232,490	233,183	234,233	234,321	235,211	235,879	236,901
Hot Water	400,388	400,576	400,341	401,878	402,869	404,606	405,027	405,139	405,232	405,666	407,096	409,325	409,749	411,559	413,124	415,450	415,724	417,708	419,217	421,485
HVAC & Shell	793,249	792,604	791,853	791,550	791,109	790,858	790,275	789,615	788,951	788,374	788,048	787,925	787,347	787,120	786,831	786,735	786,122	785,941	785,641	785,533
Total All	2,013,468	2,013,530	2,012,100	1,845,168	1,847,484	1,852,027	1,852,643	1,852,333	1,851,972	1,852,626	1,856,256	1,862,273	1,862,902	1,867,669	1,871,706	1,878,016	1,878,197	1,883,488	1,887,361	1,893,497
Total as % of Sector Loss-Adjusted Sales	32.09%	32.06%	32.05%	29.22%	29.15%	29.04%	29.00%	28.97%	28.94%	28.90%	28.81%	28.68%	28.64%	28.53%	28.43%	28.30%	28.27%	28.16%	28.07%	27.94%

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	59,566	59,611	59,580	43,684	43,814	44,036	44,095	44,116	44,134	44,194	44,379	44,663	44,722	44,954	45,156	45,452	45,492	45,746	45,940	46,229
Appliances & Pool Pumps	13,344	13,346	13,337	13,374	13,396	13,438	13,446	13,446	13,445	13,453	13,487	13,542	13,550	13,593	13,631	13,688	13,692	13,740	13,776	13,831
Hot Water	80,864	80,895	80,845	81,130	81,313	81,636	81,710	81,726	81,739	81,815	82,081	82,497	82,572	82,909	83,200	83,634	83,681	84,051	84,331	84,755
HVAC & Shell	579,131	578,628	578,070	577,741	577,343	577,041	576,570	576,060	575,548	575,080	574,741	574,505	574,038	573,750	573,430	573,209	572,724	572,460	572,136	571,909
Total All	732,905	732,479	731,833	715,929	715,866	716,151	715,821	715,347	714,866	714,543	714,688	715,207	714,882	715,206	715,416	715,983	715,589	715,997	716,183	716,724
Total as % of Sector Loss-Adjusted Sales	42.18%	42.11%	41.84%	40.71%	40.38%	40.16%	39.98%	39.81%	39.63%	39.33%	39.01%	38.75%	38.44%	38.16%	37.88%	37.64%	37.35%	37.11%	36.86%	36.89%

Table 6-6. Residential Economic Potential Scenario: 2009 – 2028 Net Savings at Generator

Economic Potential APCO West Virginia - Residential: Winter

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	469,846	470,362	470,169	332,111	333,413	335,589	336,223	336,493	336,742	337,390	339,205	341,958	342,594	344,855	346,829	349,694	350,153	352,618	354,526	357,322
Appliances & Pool Pumps	110,093	110,017	109,916	109,918	109,889	109,902	109,840	109,760	109,679	109,618	109,614	109,657	109,596	109,614	109,619	109,667	109,598	109,627	109,628	109,674
Hot Water	120,514	120,540	120,461	120,821	121,047	121,457	121,541	121,548	121,550	121,637	121,971	122,504	122,589	123,017	123,385	123,942	123,990	124,462	124,816	125,359
HVAC & Shell	646,143	645,611	644,998	644,728	644,353	644,123	643,639	643,096	642,549	642,069	641,783	641,652	641,172	640,961	640,703	640,593	640,086	639,911	639,645	639,525
Total All	1,346,596	1,346,530	1,345,543	1,207,578	1,208,701	1,211,072	1,211,243	1,210,896	1,210,520	1,210,714	1,212,574	1,215,771	1,215,950	1,218,447	1,220,536	1,223,897	1,223,827	1,226,618	1,228,615	1,231,880
Total as % of Sector Loss-Adjusted Sales	21.46%	21.44%	21.43%	19.13%	19.07%	18.99%	18.96%	18.94%	18.92%	18.89%	18.82%	18.72%	18.69%	18.61%	18.54%	18.44%	18.42%	18.34%	18.27%	18.18%

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	42,003	42,059	42,044	29,707	29,840	30,059	30,125	30,155	30,183	30,251	30,434	30,711	30,777	31,005	31,204	31,491	31,540	31,788	31,981	32,261
Appliances & Pool Pumps	6,904	6,901	6,895	6,899	6,901	6,906	6,904	6,901	6,897	6,895	6,899	6,907	6,905	6,911	6,916	6,925	6,922	6,930	6,934	6,943
Hot Water	27,596	27,602	27,583	27,666	27,718	27,812	27,831	27,832	27,833	27,853	27,929	28,051	28,071	28,169	28,253	28,381	28,391	28,500	28,581	28,705
HVAC & Shell	429,711	429,342	428,929	428,699	428,414	428,205	427,862	427,487	427,111	426,770	426,532	426,376	426,035	425,837	425,614	425,470	425,116	424,937	424,710	424,561
Total All	506,214	505,903	505,452	492,972	492,872	492,982	492,722	492,375	492,024	491,768	491,794	492,045	491,788	491,922	491,987	492,268	491,970	492,154	492,206	492,471
Total as % of Sector Loss-Adjusted Sales	29.13%	29.08%	28.89%	28.03%	27.80%	27.64%	27.52%	27.40%	27.27%	27.07%	26.84%	26.66%	26.44%	26.25%	26.05%	25.88%	25.68%	25.51%	25.33%	25.34%

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

APCO West Virginia - Residential - End-Use Market Potential (Energy & Winter Demand Impacts)

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	8,185	54,594	0	151,201	181,939	208,323	229,225	246,434	260,889	273,476	285,287	296,465	304,619	313,196	320,719	328,345	333,312	339,528	344,859	350,619
Total Appliances & Pool Pumps	296	2,307	5,889	13,337	19,871	25,563	30,488	34,596	38,039	40,940	43,399	45,497	47,297	48,855	50,213	51,406	52,462	53,404	54,251	55,019
Total Hot Water	896	6,078	13,118	21,275	28,903	36,120	42,681	48,498	53,693	58,386	62,726	66,748	70,175	73,444	76,393	79,179	81,480	83,785	85,850	87,847
Total HVAC & Shell	9,315	59,165	114,887	187,212	271,571	349,831	416,774	472,159	518,126	556,478	588,875	616,330	638,482	657,591	673,510	687,232	697,823	707,432	715,327	722,343
TOTAL	18,692	122,144	133,893	373,025	502,284	619,837	719,168	801,687	870,748	929,281	980,287	1,025,039	1,060,573	1,093,087	1,120,835	1,146,162	1,165,077	1,184,149	1,200,287	1,215,827
Total as % of Sector Loss-Adjusted Sales	0.30%	1.94%	3.94%	5.91%	7.93%	9.72%	11.26%	12.54%	13.61%	14.50%	15.21%	15.78%	16.30%	16.70%	17.03%	17.27%	17.54%	17.70%	17.85%	17.94%

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	736	4,312	8,760	11,581	13,947	16,039	17,746	19,201	20,469	21,610	22,706	23,763	24,576	25,427	26,191	26,960	27,505	28,149	28,713	29,306
Total Appliances & Pool Pumps	27	126	222	316	407	495	580	663	742	819	893	965	1,034	1,102	1,167	1,230	1,291	1,350	1,408	1,463
Total Hot Water	205	1,392	3,004	4,872	6,618	8,271	9,773	11,105	12,295	13,369	14,363	15,284	16,069	16,817	17,493	18,131	18,658	19,185	19,658	20,115
Total HVAC & Shell	6,569	40,140	75,199	115,827	168,446	220,473	265,233	302,008	332,289	357,279	377,964	395,125	409,290	421,046	430,784	438,878	445,513	451,024	455,567	459,339
TOTAL	7,537	45,970	87,184	132,596	189,419	245,278	293,333	332,977	365,795	393,077	415,926	435,137	450,969	464,392	475,634	485,199	492,967	499,708	505,346	510,223
Total as % of Sector Loss-Adjusted Sales	0.43%	2.64%	4.98%	7.54%	10.69%	13.75%	16.38%	18.53%	20.28%	21.64%	22.70%	23.57%	24.25%	24.78%	25.18%	25.51%	25.73%	25.90%	26.01%	26.26%

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	8,185	46,409	59,116	37,491	30,739	26,383	20,902	17,209	14,456	12,587	11,811	11,178	8,154	8,577	7,523	7,626	4,967	6,217	5,331	5,760
Total Appliances & Pool Pumps	296	2,011	3,582	7,448	6,534	5,692	4,925	4,108	3,443	2,901	2,459	2,097	1,801	1,558	1,358	1,193	1,056	942	847	768
Total Hot Water	896	5,182	7,040	8,157	7,628	7,217	6,561	5,817	5,195	4,693	4,340	4,022	3,427	3,269	2,949	2,786	2,301	2,305	2,065	1,997
Total HVAC & Shell	9,315	49,850	55,907	72,140	84,358	78,260	66,943	55,386	45,967	38,352	32,396	27,455	22,152	19,109	15,919	13,722	10,591	9,609	7,895	7,016
TOTAL	18,692	103,452	125,644	125,237	129,259	117,552	99,331	82,520	69,061	58,533	51,006	44,752	35,534	32,513	27,748	25,327	18,915	19,073	16,138	15,541
Total as % of Sector Loss-Adjusted Sales	0.30%	1.65%	2.00%	1.98%	2.04%	1.84%	1.55%	1.29%	1.08%	0.91%	0.79%	0.69%	0.55%	0.50%	0.42%	0.38%	0.28%	0.29%	0.24%	0.23%

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	736	3,577	4,448	2,822	2,366	2,092	1,708	1,455	1,267	1,141	1,096	1,057	813	851	764	770	545	644	564	593
Total Appliances & Pool Pumps	27	99	96	94	91	88	85	82	79	77	74	72	70	67	65	63	61	59	57	56
Total Hot Water	205	1,187	1,612	1,868	1,747	1,653	1,502	1,332	1,190	1,075	994	921	785	749	675	638	527	528	473	457
Total HVAC & Shell	6,569	33,571	35,059	40,628	52,619	52,027	44,760	36,774	30,282	24,990	20,685	17,161	14,164	11,756	9,738	8,094	6,635	5,511	4,543	3,772
TOTAL	7,537	38,433	41,215	45,412	56,822	55,859	48,055	39,644	32,818	27,282	22,849	19,211	15,832	13,423	11,242	9,565	7,768	6,742	5,638	4,676
Total as % of Sector Loss-Adjusted Sales	0.43%	2.21%	2.36%	2.58%	3.21%	3.13%	2.68%	2.21%	1.82%	1.50%	1.25%	1.04%	0.85%	0.72%	0.60%	0.50%	0.41%	0.35%	0.29%	0.25%

High Scenario - Winter - 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	$264,951	$2,473,640	$3,207,552	$2,453,415	$2,402,904	$2,035,641	$1,556,248	$1,241,442	$1,012,944	$866,029	$820,904	$787,156	$522,592	$585,420	$505,128	$533,647	$296,319	$431,149	$360,670	$414,773
Total Appliances & Pool Pumps	$13,392	$221,083	$472,888	$1,087,857	$946,020	$815,431	$696,723	$570,127	$467,426	$384,079	$316,416	$261,454	$216,739	$180,371	$150,742	$126,591	$106,836	$90,699	$77,467	$66,609
Total Hot Water	$69,033	$656,078	$911,136	$1,070,447	$997,207	$938,006	$850,255	$747,818	$661,726	$591,509	$540,418	$494,954	$418,109	$393,230	$350,360	$326,716	$265,776	$262,726	$231,601	$221,102
Total HVAC & Shell	$1,137,277	$8,858,814	$9,501,410	$11,488,181	$14,294,288	$13,843,182	$11,901,117	$9,809,835	$8,105,850	$6,719,567	$5,606,536	$4,690,000	$3,836,669	$3,232,635	$2,683,066	$2,262,229	$1,809,735	$1,557,252	$1,281,257	$1,093,814
TOTAL	$1,484,653	$12,209,614	$14,092,985	$16,099,901	$18,640,419	$17,632,261	$15,004,343	$12,369,222	$10,247,947	$8,561,184	$7,284,274	$6,233,564	$4,994,109	$4,391,655	$3,689,297	$3,249,184	$2,478,666	$2,341,827	$1,950,996	$1,796,298

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	$141,015	$921,882	$1,204,489	$1,093,825	$873,319	$728,848	$549,442	$428,954	$340,497	$282,022	$259,928	$243,349	$150,420	$169,179	$140,519	$149,311	$69,104	$114,866	$91,690	$110,796
Total Appliances & Pool Pumps	$57,413	$226,437	$284,607	$434,820	$393,920	$356,066	$321,309	$284,697	$254,274	$228,904	$207,687	$169,655	$174,653	$161,756	$150,673	$141,129	$132,709	$125,399	$118,906	$113,154
Total Hot Water	$49,070	$272,991	$369,746	$440,660	$410,316	$389,200	$349,163	$306,622	$271,762	$244,631	$227,651	$212,218	$174,499	$169,536	$151,293	$144,524	$112,310	$117,357	$103,003	$101,528
Total HVAC & Shell	$1,402,422	$6,589,460	$7,252,452	$8,823,201	$10,583,577	$10,225,432	$8,836,188	$7,342,026	$6,123,306	$5,133,505	$4,347,566	$3,696,958	$3,045,206	$2,625,876	$2,217,087	$1,917,614	$1,546,873	$1,384,182	$1,167,436	$1,035,701
TOTAL	$1,649,920	$8,010,769	$9,111,295	$10,792,606	$12,261,133	$11,699,646	$10,056,102	$8,362,299	$6,989,839	$5,889,062	$5,042,832	$4,342,380	$3,544,777	$3,126,347	$2,659,572	$2,352,679	$1,860,996	$1,741,803	$1,481,034	$1,361,178

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	$405,966	$3,395,521	$4,412,041	$3,547,240	$3,276,224	$2,764,489	$2,105,690	$1,670,396	$1,353,441	$1,148,051	$1,080,832	$1,030,505	$673,012	$754,598	$645,647	$682,958	$365,423	$546,015	$452,360	$525,569
Total Appliances & Pool Pumps	$70,805	$447,519	$757,495	$1,522,677	$1,339,940	$1,171,498	$1,018,032	$854,824	$721,700	$612,983	$524,103	$451,309	$391,392	$342,127	$301,415	$267,721	$239,545	$216,098	$196,373	$179,763
Total Hot Water	$118,103	$929,069	$1,280,882	$1,511,107	$1,407,523	$1,327,206	$1,199,418	$1,054,440	$933,488	$836,140	$768,069	$707,172	$592,608	$562,766	$501,653	$471,240	$378,085	$380,083	$334,604	$322,630
Total HVAC & Shell	$2,539,699	$15,448,274	$16,753,862	$20,311,382	$24,877,865	$24,068,615	$20,737,305	$17,151,861	$14,229,157	$11,853,072	$9,954,102	$8,386,958	$6,881,875	$5,858,510	$4,900,153	$4,179,844	$3,356,608	$2,941,434	$2,448,693	$2,129,515
TOTAL	$3,134,573	$20,220,384	$23,204,280	$26,892,407	$30,901,552	$29,331,807	$25,060,445	$20,731,522	$17,237,786	$14,450,245	$12,327,106	$10,575,944	$8,538,886	$7,518,001	$6,348,869	$5,601,763	$4,339,662	$4,083,630	$3,432,030	$3,157,476

APCO West Virginia - Residential - End-Use Market Potential (Energy & Winter Demand Impacts)

Cumulative Demand Potential (kW)

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	3,303	6,586	9,733	13,116	17,152	21,312	25,400	29,666	34,043	38,465	42,877	47,226	51,470	55,573	59,508	63,251	66,787	70,104	73,194	76,053
Water Heat LC	2,741	5,466	8,078	10,885	14,235	17,688	21,081	24,621	28,253	31,924	35,585	39,195	42,717	46,122	49,388	52,495	55,429	58,182	60,747	63,119
Total	6,044	12,052	17,812	24,001	31,388	39,001	46,481	54,287	62,296	70,389	78,462	86,420	94,187	101,696	108,895	115,746	122,216	128,286	133,941	139,172
Total as % of Loss-Adjusted Sales	0.35%	0.69%	1.02%	1.36%	1.77%	2.19%	2.60%	3.02%	3.45%	3.87%	4.28%	4.68%	5.06%	5.43%	5.77%	6.08%	6.38%	6.65%	6.89%	7.16%

Incremental Demand Potential (kW)

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	3,303	3,284	3,147	3,382	4,037	4,160	4,088	4,266	4,376	4,423	4,411	4,349	4,244	4,103	3,934	3,743	3,536	3,317	3,090	2,859
Water Heat LC	2,741	2,725	2,612	2,807	3,350	3,453	3,392	3,541	3,632	3,671	3,661	3,610	3,522	3,406	3,265	3,107	2,935	2,753	2,565	2,373
Total	6,044	6,009	5,759	6,189	7,387	7,613	7,480	7,807	8,009	8,093	8,072	7,959	7,766	7,509	7,200	6,850	6,471	6,070	5,655	5,232
Total as % of Loss-Adjusted Sales	0.35%	0.35%	0.33%	0.35%	0.42%	0.43%	0.42%	0.43%	0.44%	0.45%	0.44%	0.43%	0.42%	0.40%	0.38%	0.36%	0.34%	0.31%	0.29%	0.27%

Cumulative DLC Credits

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	$198,154	$593,330	$1,177,335	$1,964,280	$2,993,424	$4,272,171	$5,796,176	$7,576,149	$9,618,709	$11,926,634	$14,499,233	$17,332,780	$20,420,966	$23,755,358	$27,325,816	$31,120,878	$35,128,098	$39,334,330	$43,725,966	$48,289,140
Water Heat LC	$156,625	$468,979	$930,588	$1,552,604	$2,366,060	$3,376,806	$4,581,409	$5,988,334	$7,602,812	$9,427,040	$11,460,472	$13,700,161	$16,141,123	$18,776,690	$21,598,848	$24,598,539	$27,765,922	$31,090,608	$34,561,842	$38,168,661
Total	$354,779	$1,062,309	$2,107,922	$3,516,884	$5,359,484	$7,648,977	$10,377,585	$13,564,483	$17,221,520	$21,353,674	$25,959,705	$31,032,941	$36,562,089	$42,532,048	$48,924,664	$55,719,417	$62,894,020	$70,424,937	$78,287,808	$86,457,801

Incremental DLC Credits

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	$198,154	$395,176	$584,005	$786,945	$1,029,144	$1,278,747	$1,524,005	$1,779,973	$2,042,559	$2,307,925	$2,572,600	$2,833,546	$3,088,186	$3,334,392	$3,570,458	$3,795,063	$4,007,220	$4,206,231	$4,391,637	$4,563,173
Water Heat LC	$156,625	$312,354	$461,609	$622,017	$813,456	$1,010,746	$1,204,603	$1,406,925	$1,614,478	$1,824,228	$2,033,432	$2,239,689	$2,440,962	$2,635,567	$2,822,158	$2,999,690	$3,167,383	$3,324,686	$3,471,234	$3,606,819
Total	$354,779	$707,530	$1,045,613	$1,408,962	$1,842,600	$2,289,493	$2,728,608	$3,186,898	$3,657,037	$4,132,153	$4,606,032	$5,073,236	$5,529,148	$5,969,959	$6,392,616	$6,794,753	$7,174,603	$7,530,917	$7,862,871	$8,169,992

Cumulative Administrative Costs

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	$330,257	$658,626	$973,341	$1,311,575	$1,715,241	$2,131,245	$2,540,009	$2,966,622	$3,404,266	$3,846,542	$4,287,666	$4,722,577	$5,146,977	$5,557,320	$5,950,763	$6,325,104	$6,678,700	$7,010,385	$7,319,395	$7,605,288
Water Heat LC	$391,562	$780,886	$1,154,021	$1,555,041	$2,033,639	$2,526,865	$3,011,507	$3,517,312	$4,036,195	$4,560,570	$5,083,580	$5,599,223	$6,102,404	$6,588,918	$7,055,396	$7,499,226	$7,918,459	$8,311,714	$8,678,085	$9,017,049
Total	$721,820	$1,439,512	$2,127,363	$2,866,617	$3,748,880	$4,658,110	$5,551,516	$6,483,934	$7,440,461	$8,407,112	$9,371,246	$10,321,800	$11,249,381	$12,146,238	$13,006,159	$13,824,330	$14,597,159	$15,322,100	$15,997,480	$16,622,337

Incremental Administrative Costs

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	$330,257	$328,369	$314,715	$338,234	$403,665	$416,004	$408,764	$426,613	$437,644	$442,276	$441,124	$434,911	$424,400	$410,342	$393,443	$374,341	$353,596	$331,685	$309,010	$285,894
Water Heat LC	$391,562	$389,324	$373,135	$401,020	$478,597	$493,226	$484,642	$505,805	$518,883	$524,375	$523,009	$515,643	$503,181	$486,514	$466,478	$443,830	$419,233	$393,256	$366,371	$338,964
Total	$721,820	$717,692	$687,851	$739,254	$882,263	$909,230	$893,406	$932,418	$956,527	$966,651	$964,134	$950,554	$927,581	$896,856	$859,921	$818,171	$772,829	$724,941	$675,380	$624,857

Table 6-8. Low Case Scenario: 2009 – 2028 Residential Cumulative Annual Net Savings at Generator and Costs

APCO West Virginia - Residential - End-Use Market Potential (Energy & Winter Demand Impacts)

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	8,185	15,545	26,444	35,302	44,805	55,229	66,056	77,464	89,483	102,148	115,513	129,387	143,000	157,087	170,914	184,594	197,328	210,039	222,100	233,763
Total Appliances & Pool Pumps	296	1,378	2,637	4,451	6,312	8,222	10,181	12,079	13,918	15,701	17,428	19,103	20,726	22,299	23,823	25,301	26,733	28,122	29,467	30,772
Total Hot Water	896	1,936	3,276	4,875	6,560	8,353	10,221	12,049	13,845	15,614	17,371	19,114	20,792	22,467	24,110	25,738	27,301	28,868	30,400	31,920
Total HVAC & Shell	9,315	14,544	21,250	31,245	45,129	61,014	78,061	94,636	110,771	126,505	141,898	156,952	171,486	185,741	199,610	213,177	226,245	239,096	251,582	263,802
TOTAL	**18,692**	**33,403**	**53,607**	**75,873**	**102,806**	**132,818**	**164,519**	**196,229**	**228,017**	**259,967**	**292,211**	**324,556**	**356,004**	**387,594**	**418,456**	**448,811**	**477,607**	**506,125**	**533,549**	**560,256**
Total as % of Sector Loss-Adjusted Sales	0.30%	0.53%	0.85%	1.20%	1.62%	2.08%	2.57%	3.07%	3.56%	4.06%	4.53%	5.00%	5.47%	5.92%	6.36%	6.76%	7.19%	7.57%	7.93%	8.27%

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	736	1,435	2,424	3,220	4,072	5,009	5,978	6,999	8,074	9,208	10,405	11,644	12,852	14,102	15,315	16,505	17,594	18,679	19,700	20,685
Total Appliances & Pool Pumps	27	126	221	313	403	490	574	655	734	811	885	956	1,026	1,093	1,158	1,222	1,283	1,342	1,400	1,455
Total Hot Water	205	443	750	1,116	1,502	1,913	2,340	2,759	3,170	3,575	3,978	4,377	4,761	5,145	5,521	5,894	6,251	6,610	6,961	7,309
Total HVAC & Shell	6,569	10,089	14,329	20,015	28,679	39,155	50,444	61,418	72,086	82,460	92,554	102,380	111,933	121,232	130,281	139,092	147,658	155,999	164,116	172,020
TOTAL	**7,537**	**12,093**	**17,724**	**24,664**	**34,656**	**46,566**	**59,337**	**71,831**	**84,065**	**96,054**	**107,821**	**119,357**	**130,572**	**141,572**	**152,276**	**162,712**	**172,787**	**182,630**	**192,177**	**201,470**
Total as % of Sector Loss-Adjusted Sales	0.43%	0.70%	1.01%	1.40%	1.96%	2.61%	3.31%	4.00%	4.66%	5.29%	5.88%	6.47%	7.02%	7.55%	8.06%	8.55%	9.02%	9.47%	9.89%	10.37%

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	8,185	7,360	10,899	8,858	9,503	10,423	10,827	11,408	12,019	12,664	13,366	13,874	13,613	14,087	13,826	13,681	12,734	12,711	12,061	11,663
Total Appliances & Pool Pumps	296	1,082	1,259	1,814	1,861	1,910	1,959	1,898	1,839	1,782	1,728	1,675	1,623	1,573	1,525	1,478	1,432	1,388	1,346	1,304
Total Hot Water	896	1,041	1,340	1,599	1,685	1,793	1,868	1,829	1,795	1,769	1,757	1,742	1,678	1,675	1,642	1,629	1,562	1,567	1,532	1,520
Total HVAC & Shell	9,315	5,228	6,706	9,995	13,883	15,885	17,047	16,575	16,135	15,733	15,394	15,054	14,534	14,255	13,869	13,568	13,068	12,851	12,486	12,220
TOTAL	**18,692**	**14,711**	**20,204**	**22,266**	**26,933**	**30,012**	**31,701**	**31,710**	**31,789**	**31,950**	**32,244**	**32,345**	**31,448**	**31,590**	**30,862**	**30,355**	**28,796**	**28,517**	**27,424**	**26,707**
Total as % of Sector Loss-Adjusted Sales	0.30%	0.23%	0.32%	0.35%	0.42%	0.47%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.48%	0.48%	0.47%	0.46%	0.43%	0.43%	0.41%	0.39%

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	736	699	990	795	852	937	970	1,021	1,075	1,134	1,197	1,240	1,207	1,250	1,214	1,190	1,089	1,085	1,021	985
Total Appliances & Pool Pumps	27	98	95	92	90	87	84	81	79	76	74	72	69	67	65	63	61	59	58	56
Total Hot Water	205	238	307	366	386	411	428	419	411	405	402	399	384	384	376	373	358	359	351	348
Total HVAC & Shell	6,569	3,520	4,240	5,686	8,664	10,476	11,289	10,974	10,668	10,374	10,094	9,826	9,553	9,299	9,049	8,811	8,566	8,341	8,117	7,904
TOTAL	**7,537**	**4,556**	**5,631**	**6,940**	**9,992**	**11,910**	**12,770**	**12,495**	**12,234**	**11,989**	**11,767**	**11,536**	**11,215**	**11,000**	**10,704**	**10,437**	**10,075**	**9,843**	**9,546**	**9,293**
Total as % of Sector Loss-Adjusted Sales	0.43%	0.26%	0.32%	0.39%	0.56%	0.67%	0.71%	0.70%	0.68%	0.66%	0.64%	0.62%	0.60%	0.59%	0.57%	0.55%	0.53%	0.51%	0.49%	0.48%

Low Scenario - Winter - 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	$264,951	$169,165	$258,691	$308,803	$331,276	$364,085	$376,863	$396,632	$417,759	$440,469	$466,488	$486,452	$476,618	$495,626	$489,524	$488,797	$456,220	$459,161	$437,143	$424,690
Total Appliances & Pool Pumps	$13,392	$37,028	$52,610	$98,014	$103,188	$108,428	$113,642	$110,157	$106,777	$103,500	$100,331	$97,263	$94,272	$91,383	$88,578	$85,864	$83,215	$80,660	$78,177	$75,775
Total Hot Water	$69,033	$40,057	$59,576	$78,383	$85,065	$93,028	$99,093	$96,972	$95,199	$93,863	$93,324	$92,649	$89,089	$89,078	$87,323	$86,722	$82,995	$83,450	$81,547	$81,041
Total HVAC & Shell	$1,137,277	$464,516	$572,158	$799,107	$1,173,059	$1,391,844	$1,498,037	$1,456,634	$1,417,091	$1,379,714	$1,345,534	$1,312,276	$1,272,602	$1,242,514	$1,209,166	$1,179,584	$1,142,829	$1,117,139	$1,086,589	$1,060,267
TOTAL	$1,484,653	$710,767	$943,036	$1,284,307	$1,692,589	$1,957,385	$2,087,635	$2,060,396	$2,036,826	$2,017,546	$2,005,676	$1,988,639	$1,932,582	$1,918,601	$1,874,591	$1,840,967	$1,765,259	$1,740,410	$1,683,455	$1,641,773

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	$141,015	$102,589	$166,905	$198,273	$212,741	$233,321	$242,398	$255,410	$269,096	$283,546	$300,246	$313,977	$310,256	$322,613	$322,883	$326,265	$310,202	$313,275	$300,909	$293,102
Total Appliances & Pool Pumps	$57,413	$189,281	$191,692	$209,441	$207,001	$204,797	$202,674	$196,294	$190,117	$184,154	$178,434	$172,941	$167,528	$162,362	$157,348	$152,536	$147,769	$143,245	$138,842	$134,620
Total Hot Water	$49,070	$36,170	$51,419	$67,399	$72,682	$79,504	$83,709	$81,760	$80,258	$79,313	$79,385	$79,237	$75,285	$76,007	$74,398	$74,293	$70,069	$71,356	$69,500	$69,473
Total HVAC & Shell	$1,402,422	$871,666	$1,044,704	$1,388,581	$1,889,064	$2,189,937	$2,335,554	$2,271,001	$2,209,994	$2,153,169	$2,102,838	$2,053,482	$1,988,055	$1,944,953	$1,892,978	$1,849,196	$1,787,679	$1,752,126	$1,703,917	$1,665,151
TOTAL	$1,649,920	$1,199,707	$1,454,719	$1,863,694	$2,381,489	$2,707,560	$2,864,336	$2,804,466	$2,749,465	$2,700,181	$2,660,904	$2,619,637	$2,541,124	$2,505,935	$2,447,607	$2,402,290	$2,315,719	$2,280,002	$2,213,168	$2,162,346

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	$405,966	$271,754	$425,596	$507,076	$544,017	$597,405	$619,262	$652,043	$686,855	$724,015	$766,734	$800,428	$786,874	$818,239	$812,406	$815,062	$766,421	$772,435	$738,052	$717,792
Total Appliances & Pool Pumps	$70,805	$226,309	$244,302	$307,455	$310,190	$313,226	$316,316	$306,451	$296,893	$287,654	$278,765	$270,204	$261,800	$253,744	$245,926	$238,400	$230,985	$223,905	$217,018	$210,394
Total Hot Water	$118,103	$76,228	$110,995	$145,782	$157,748	$172,532	$182,802	$178,732	$175,457	$173,176	$172,709	$171,886	$164,374	$165,085	$161,721	$161,014	$153,063	$154,806	$151,047	$150,515
Total HVAC & Shell	$2,539,699	$1,336,183	$1,616,862	$2,187,687	$3,062,123	$3,581,781	$3,833,591	$3,727,636	$3,627,085	$3,532,883	$3,448,372	$3,365,759	$3,260,658	$3,187,467	$3,102,144	$3,028,780	$2,930,509	$2,869,265	$2,790,505	$2,725,418
TOTAL	$3,134,573	$1,910,473	$2,397,755	$3,148,001	$4,074,078	$4,664,944	$4,951,971	$4,864,862	$4,786,291	$4,717,727	$4,666,580	$4,608,277	$4,473,706	$4,424,536	$4,322,198	$4,243,257	$4,080,978	$4,020,411	$3,896,623	$3,804,119

APCO West Virginia - Residential - End-Use Market Potential (Energy & Winter Demand Impacts)

Cumulative Demand Potential (kW)

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	1,651	3,293	4,867	6,558	8,576	10,656	12,700	14,833	17,021	19,233	21,438	23,613	25,735	27,787	29,754	31,626	33,394	35,052	36,597	38,026
Water Heat LC	1,370	2,733	4,039	5,443	7,118	8,844	10,540	12,311	14,127	15,962	17,793	19,597	21,358	23,061	24,694	26,247	27,715	29,091	30,373	31,560
Total	3,022	6,026	8,906	12,001	15,694	19,500	23,240	27,144	31,148	35,195	39,231	43,210	47,093	50,848	54,448	57,873	61,108	64,143	66,970	69,586
Total as % of Loss-Adjusted Sales	0.17%	0.35%	0.51%	0.68%	0.89%	1.09%	1.30%	1.51%	1.73%	1.94%	2.14%	2.34%	2.53%	2.71%	2.88%	3.04%	3.19%	3.32%	3.45%	3.58%

Incremental Demand Potential (kW)

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	1,651	1,642	1,574	1,691	2,018	2,080	2,044	2,133	2,188	2,211	2,206	2,175	2,122	2,052	1,967	1,872	1,768	1,658	1,545	1,429
Water Heat LC	1,370	1,363	1,306	1,404	1,675	1,726	1,696	1,770	1,816	1,835	1,831	1,805	1,761	1,703	1,633	1,553	1,467	1,376	1,282	1,186
Total	3,022	3,004	2,880	3,095	3,693	3,806	3,740	3,903	4,004	4,047	4,036	3,979	3,883	3,755	3,600	3,425	3,235	3,035	2,827	2,616
Total as % of Loss-Adjusted Sales	0.17%	0.17%	0.16%	0.18%	0.21%	0.21%	0.21%	0.22%	0.22%	0.22%	0.22%	0.22%	0.21%	0.20%	0.19%	0.18%	0.17%	0.16%	0.15%	0.13%

Cumulative DLC Credits

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	$99,077	$296,665	$588,667	$982,140	$1,496,712	$2,136,086	$2,898,088	$3,788,075	$4,809,354	$5,963,317	$7,249,617	$8,666,390	$10,210,483	$11,877,679	$13,662,908	$15,560,439	$17,564,049	$19,667,165	$21,862,983	$24,144,570
Water Heat LC	$78,312	$234,490	$465,294	$776,302	$1,183,030	$1,688,403	$2,290,704	$2,994,167	$3,801,406	$4,713,520	$5,730,236	$6,850,081	$8,070,561	$9,388,345	$10,799,424	$12,299,269	$13,882,961	$15,545,304	$17,280,921	$19,084,331
Total	$177,390	$531,155	$1,053,961	$1,758,442	$2,679,742	$3,824,489	$5,188,793	$6,782,241	$8,610,760	$10,676,837	$12,979,853	$15,516,470	$18,281,044	$21,266,024	$24,462,332	$27,859,708	$31,447,010	$35,212,469	$39,143,904	$43,228,900

Incremental DLC Credits

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	$99,077	$197,588	$292,002	$393,473	$514,572	$639,373	$762,003	$889,987	$1,021,280	$1,153,963	$1,286,300	$1,416,773	$1,544,093	$1,667,196	$1,785,229	$1,897,531	$2,003,610	$2,103,116	$2,195,818	$2,281,587
Water Heat LC	$78,312	$156,177	$230,804	$311,008	$406,728	$505,373	$602,301	$703,462	$807,239	$912,114	$1,016,716	$1,119,845	$1,220,481	$1,317,784	$1,411,079	$1,499,845	$1,583,692	$1,662,343	$1,735,617	$1,803,410
Total	$177,390	$353,765	$522,807	$704,481	$921,300	$1,144,746	$1,364,304	$1,593,449	$1,828,519	$2,066,077	$2,303,016	$2,536,618	$2,764,574	$2,984,980	$3,196,308	$3,397,376	$3,587,302	$3,765,458	$3,931,435	$4,084,996

Cumulative Administrative Costs

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	$165,129	$329,313	$486,671	$655,788	$857,620	$1,065,622	$1,270,004	$1,483,311	$1,702,133	$1,923,271	$2,143,833	$2,361,289	$2,573,489	$2,778,660	$2,975,382	$3,162,552	$3,339,350	$3,505,193	$3,659,697	$3,802,644
Water Heat LC	$195,781	$390,443	$577,011	$777,521	$1,016,819	$1,263,433	$1,505,754	$1,758,656	$2,018,098	$2,280,285	$2,541,790	$2,799,612	$3,051,202	$3,294,459	$3,527,698	$3,749,613	$3,959,229	$4,155,857	$4,339,042	$4,508,524
Total	$360,910	$719,756	$1,063,681	$1,433,308	$1,874,440	$2,329,055	$2,775,758	$3,241,967	$3,720,230	$4,203,556	$4,685,623	$5,160,900	$5,624,691	$6,073,119	$6,503,080	$6,912,165	$7,298,579	$7,661,050	$7,998,740	$8,311,169

Incremental Administrative Costs

Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat LC	$165,129	$164,184	$157,358	$169,117	$201,833	$208,002	$204,382	$213,307	$218,822	$221,138	$220,562	$217,456	$212,200	$205,171	$196,722	$187,171	$176,798	$165,843	$154,505	$142,947
Water Heat LC	$195,781	$194,662	$186,568	$200,510	$239,299	$246,613	$242,321	$252,902	$259,442	$262,188	$261,505	$257,822	$251,591	$243,257	$233,239	$221,915	$209,617	$196,628	$183,185	$169,482
Total	$360,910	$358,846	$343,925	$369,627	$441,131	$454,615	$446,703	$466,209	$478,264	$483,326	$482,067	$475,277	$463,791	$448,428	$429,961	$409,085	$386,414	$362,470	$337,690	$312,429

6.3.1 Residential Energy Efficiency Results by End Use

Residential lighting measures, primarily CFLs in high-use and medium-use fixtures, along with HVAC and building envelope measures, account for the large majority of the total estimated residential energy conservation potential initially, shifting over time more to HVAC and building envelope emphasis. HVAC and building envelope demand impact predominate throughout the forecast period. See Figures 6-6 to 6-9.

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

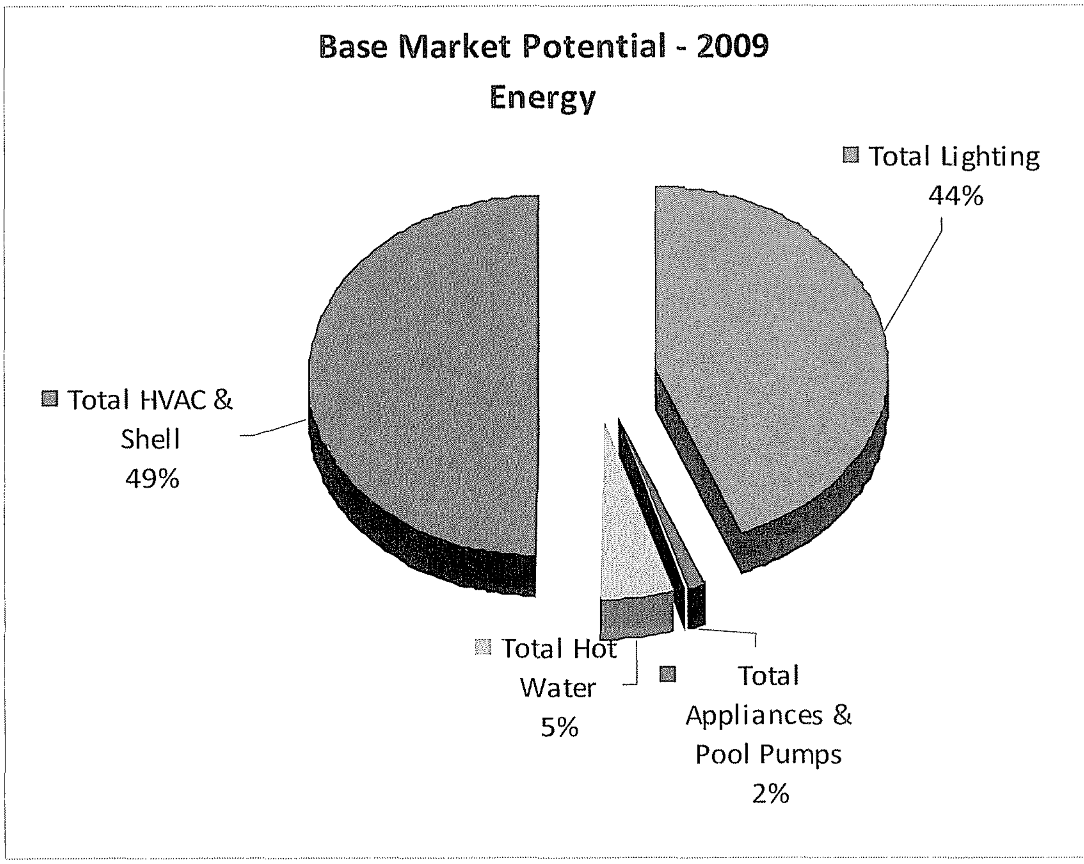


Figure 6-7. Residential Base Case Market Potential Incremental Annual Net Winter Peak Demand Savings at Generator – 2009 by End Use

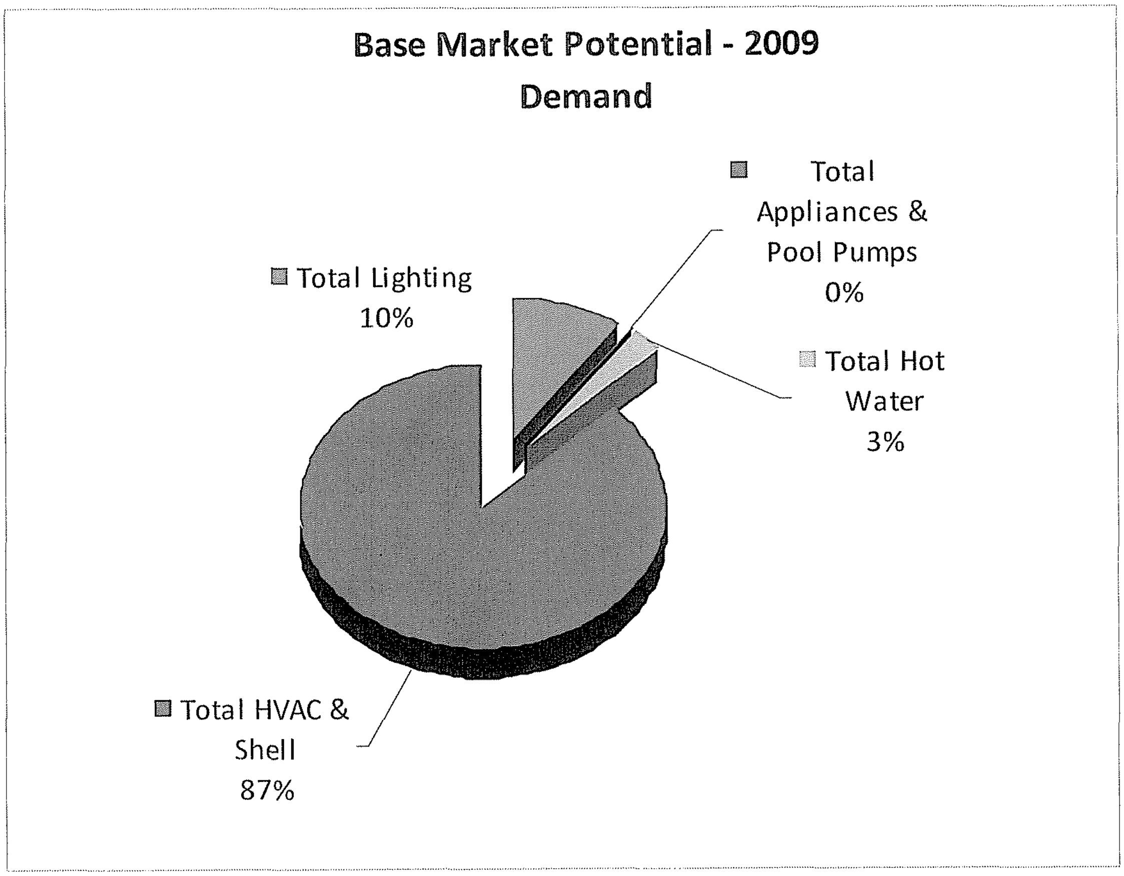


Figure 6-8. Residential Base Case Market Potential Incremental Annual Net Energy Savings at Generator – 2028 by End Use

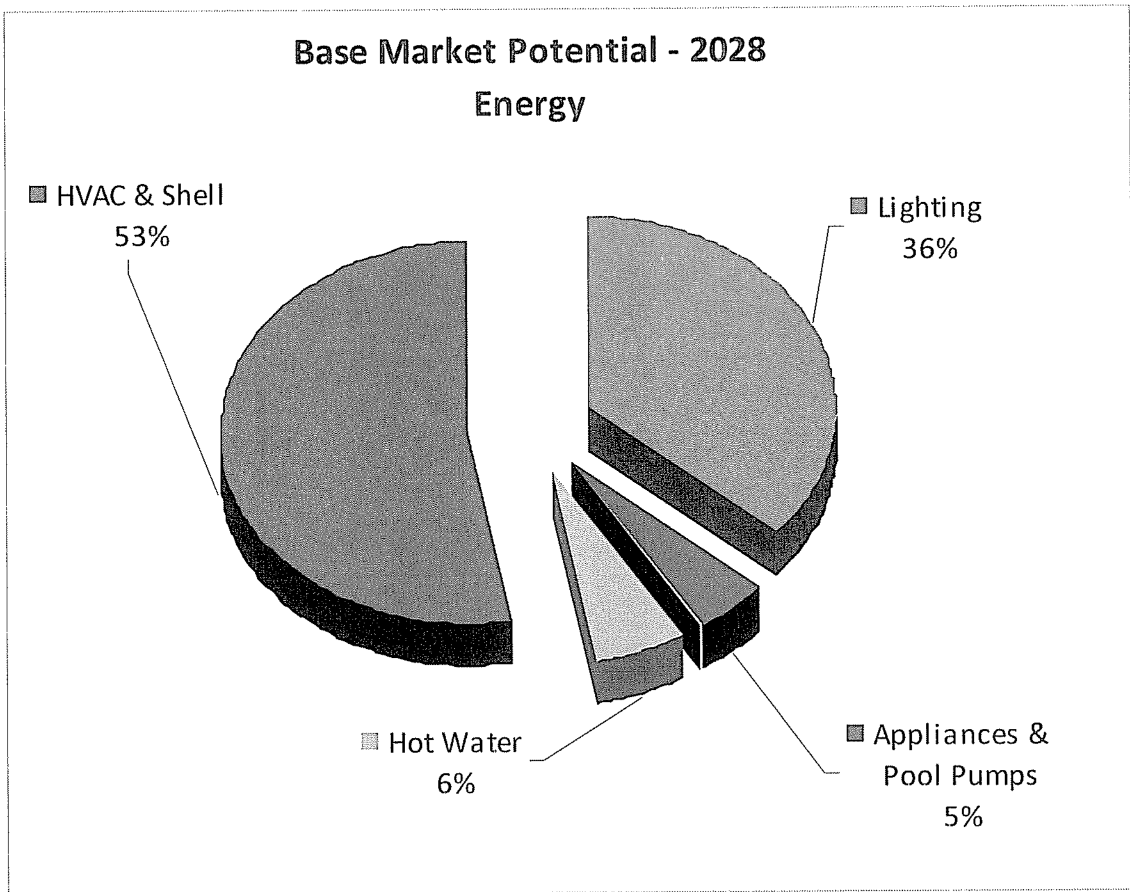


Figure 6-9. Residential Base Case Market Potential Incremental Annual Net Winter Peak Demand Savings at Generator – 2028 by End Use

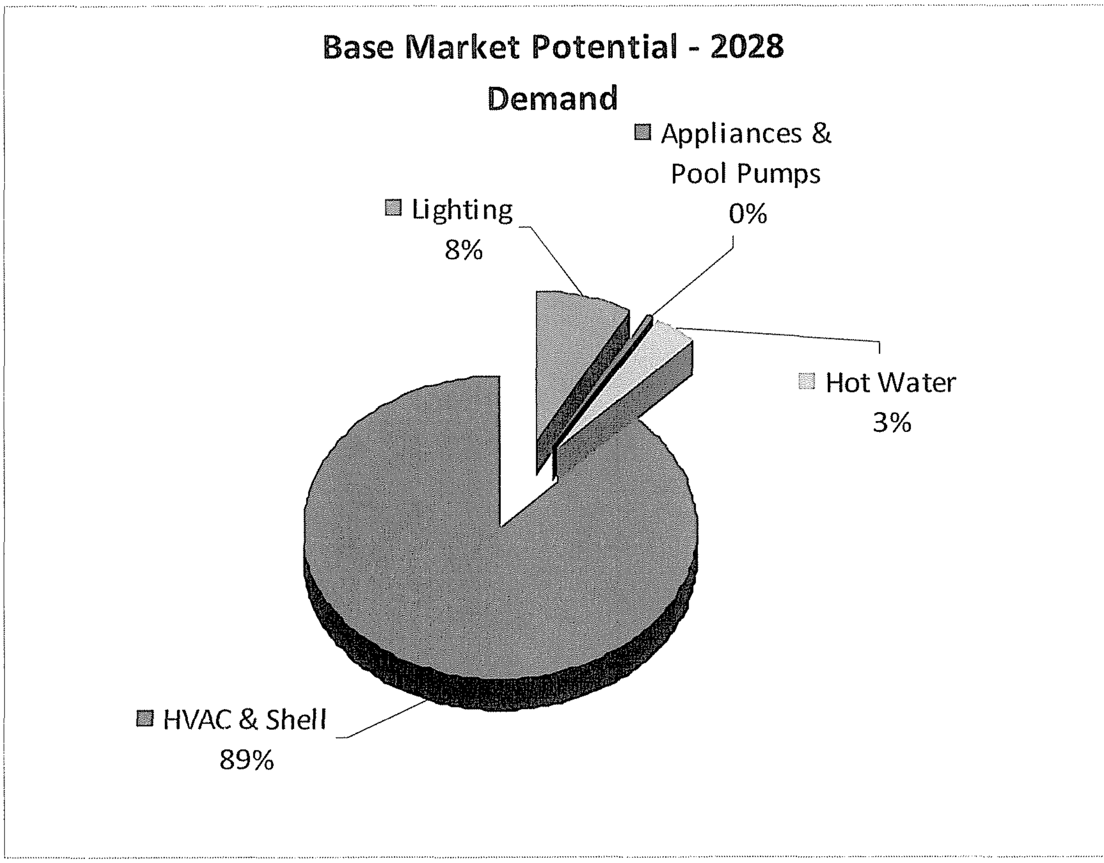


Figure 6-10 to Figure 6-15 present residential sector results for different scenarios through the year 2028.

Figure 6-10. Residential Base Case Market and Economic Potential Net Energy Savings at Generator – 2028 by End Use

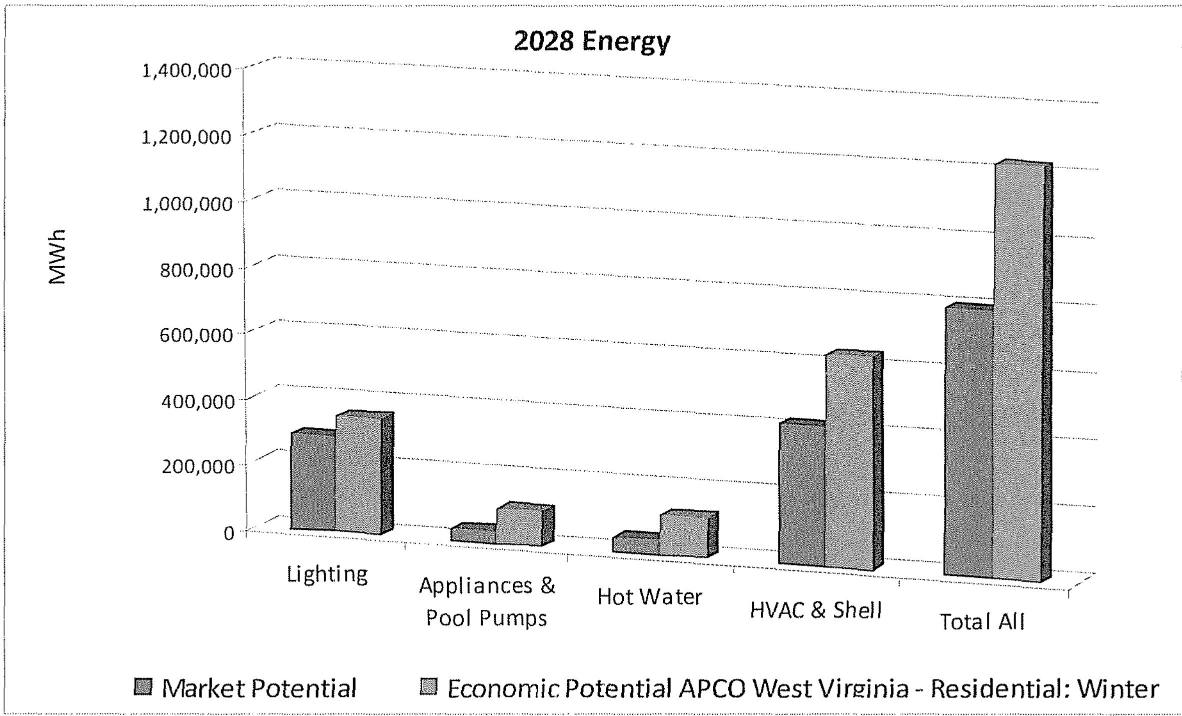


Figure 6-11. Residential Base Case Market and Economic Potential Net Winter Peak Demand Savings at Generator – 2028 by End Use

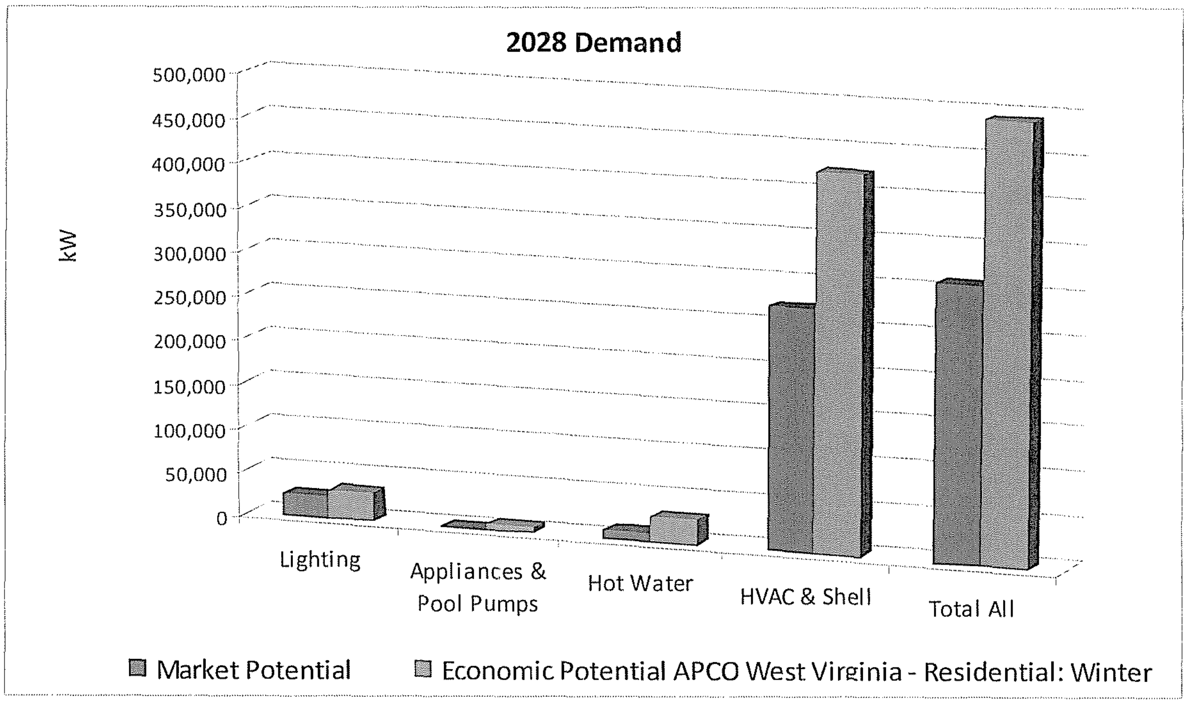


Figure 6-12. Residential Technical and Economic Potential Net Energy Savings at Generator – 2028 by End Use

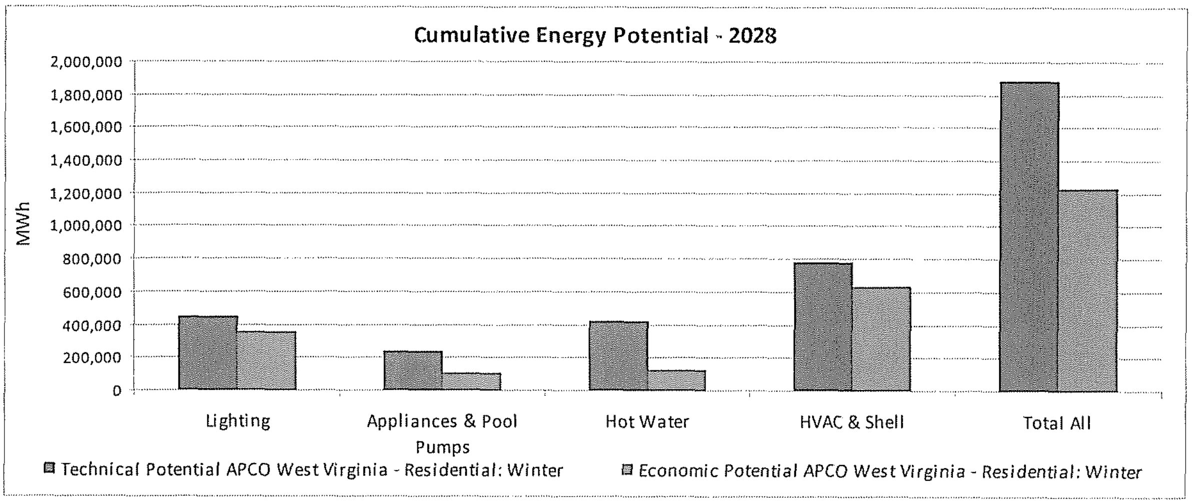


Figure 6-13. Residential Technical and Economic Potential Net Winter Peak Demand Savings at Generator – 2028 by End Use

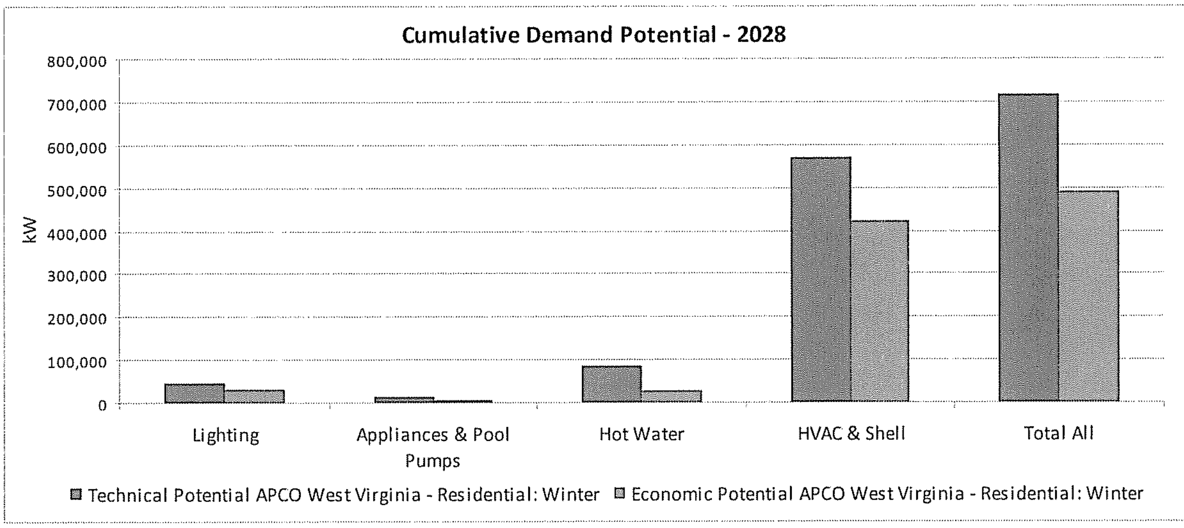


Figure 6-14. Residential Economic Potential Net Energy Savings at Generator – 2028 by End Use

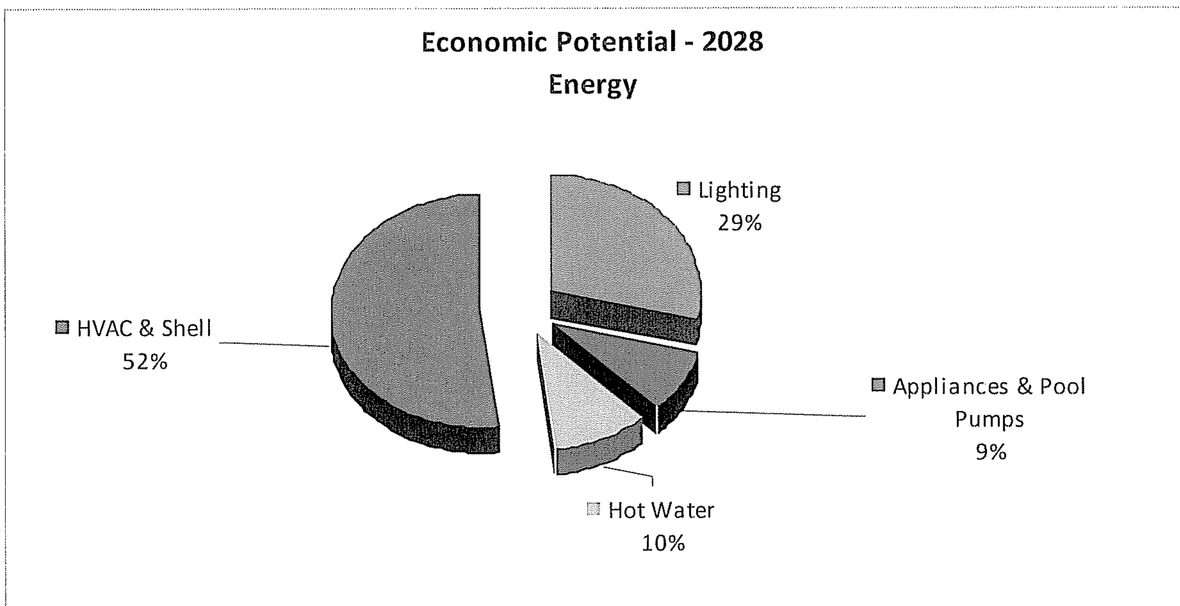
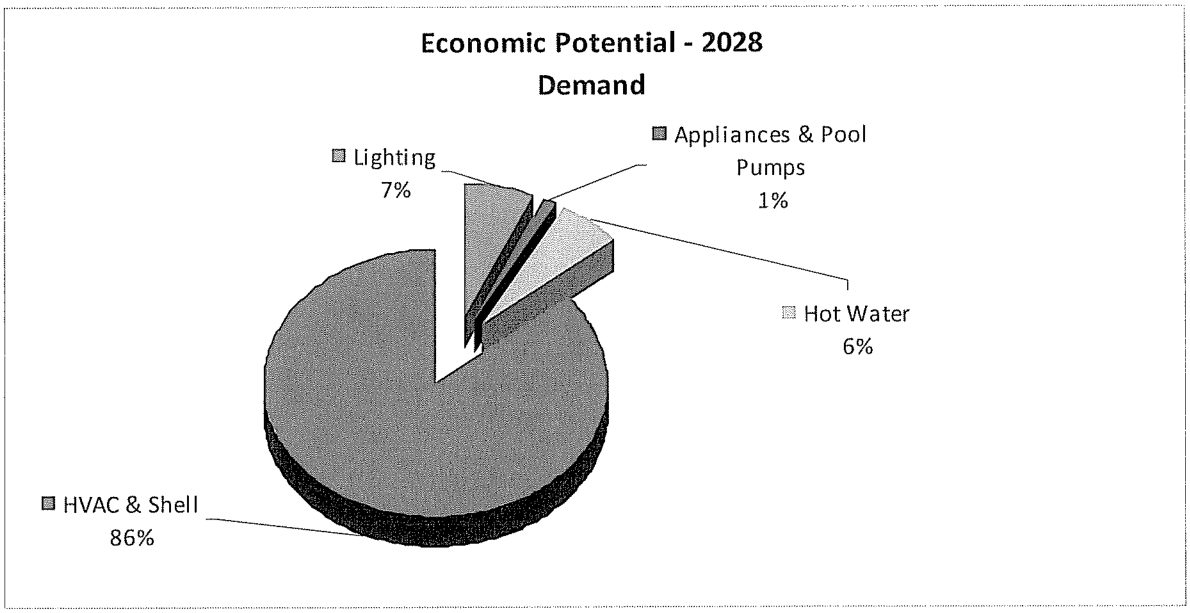


Figure 6-15. Residential Economic Potential Net Winter Peak Demand Savings at Generator – 2028 by End Use



6.4 Commercial and Industrial DSM Potential Results

This section provides the DSM potential results for the non-residential sector. The total and annual incremental non-residential achievable DSM potential results for the 20 years (2009 to 2028) are shown in Table 6-9 through Table 6-13. The energy values shown are for the DSM measures' first-year at meter energy savings, the incremental demand savings are the winter peak demand savings, and the program costs are the total estimated DSM program budgets for a given year, including rebate or other customer incentive costs, as well as administrative and implementation costs.

The total 20- year estimated non-residential base case market potential in 2028 is about 1,658 GWh in cumulative annual net savings at generator is about 177 MW of cumulative annual net winter peak demand. The annual incremental net energy savings at meter starts at 0.3% and peak out in 2014 at about 0.9% of APCo West Virginia's forecast annual non-residential energy sales (annual impacts begin to decline slowly thereafter as markets are saturated). 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. Cumulative demand response impacts total 197 MW in 2028, about 12 % of C&I winter peak demand.

Table 6-9. Base Case Scenario: 2009 – 2028 Commercial and Industrial Cumulative Annual Net Savings at Generator and Costs

APCO West Virginia - C & I - End-Use Market Potential (Energy & Winter Demand Impacts)

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	22,117	53,392	92,051	122,464	158,963	200,478	240,051	276,860	311,370	344,342	376,600	407,551	436,594	464,510	491,054	516,416	540,099	563,290	585,204	606,341
Total Motors & Other	9,845	22,096	38,075	61,530	93,558	143,876	191,815	237,581	281,394	323,438	363,872	402,767	440,177	476,215	510,934	544,403	576,654	607,793	637,830	666,832
Total HVAC & Shell	6,736	15,335	26,746	43,163	64,235	87,622	109,929	128,912	145,844	162,803	182,043	201,559	219,327	237,480	255,082	272,511	288,091	305,216	321,360	337,876
Total Refrigeration	425	1,415	3,371	5,942	8,514	11,086	13,658	16,230	18,802	21,374	23,946	26,518	29,089	31,661	34,233	36,805	39,377	41,949	44,521	47,093
TOTAL	39,122	92,239	160,243	233,099	325,270	443,063	555,453	659,583	757,409	851,957	946,461	1,038,394	1,125,189	1,209,866	1,291,303	1,370,135	1,444,221	1,518,248	1,588,914	1,658,141
Total as % of Loss-Adjusted Sales	0.29%	0.69%	1.20%	1.74%	2.42%	3.26%	4.06%	4.80%	5.49%	6.16%	6.78%	7.38%	7.94%	8.46%	8.96%	9.42%	9.87%	10.28%	10.67%	11.03%

Cumulative Demand Potential (kW)

Cumulative Annual Peak kW Saving	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	4,060	9,751	16,374	21,237	27,118	33,890	40,342	46,326	51,926	57,277	62,529	67,572	72,295	76,839	81,158	85,285	89,130	92,906	96,470	99,911
Total Motors & Other	1,018	2,274	3,893	6,247	9,507	14,521	19,257	23,746	28,029	32,137	36,096	39,909	43,575	47,112	50,522	53,813	56,982	60,051	63,011	65,874
Total HVAC & Shell	68	160	290	482	658	821	972	1,112	1,241	1,360	1,469	1,569	1,661	1,744	1,820	1,890	1,952	2,009	2,060	2,106
Total Refrigeration	84	280	665	1,155	1,645	2,135	2,626	3,116	3,606	4,097	4,587	5,077	5,567	6,058	6,548	7,038	7,528	8,019	8,509	8,999
TOTAL	5,231	12,465	21,222	29,121	38,928	51,367	63,196	74,300	84,802	94,871	104,681	114,127	123,098	131,753	140,048	148,026	155,593	162,984	170,050	176,890
Total as % of Loss-Adjusted Sales	0.36%	0.86%	1.46%	2.00%	2.66%	3.48%	4.25%	4.98%	5.67%	6.31%	6.92%	7.48%	8.01%	8.51%	8.97%	9.41%	9.82%	10.21%	10.58%	10.93%

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	22,117	31,276	38,659	30,413	36,499	41,515	39,573	36,809	34,510	32,972	32,258	30,951	29,043	27,916	26,544	25,362	23,683	23,191	21,913	21,137
Total Motors & Other	9,845	12,251	15,979	23,455	32,028	50,319	47,939	45,766	43,812	42,044	40,434	38,895	37,410	36,037	34,719	33,469	32,251	31,139	30,037	29,002
Total HVAC & Shell	6,736	8,600	11,411	16,417	21,072	23,387	22,306	18,983	16,932	16,959	19,240	19,516	17,769	18,152	17,602	17,429	15,581	17,124	16,144	16,516
Total Refrigeration	425	990	1,955	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572
TOTAL	39,122	53,117	68,004	72,856	92,171	117,793	112,390	104,130	97,826	94,547	94,504	91,934	86,794	84,677	81,437	78,832	74,086	74,027	70,666	69,227
Total as % of Loss-Adjusted Sales	0.29%	0.40%	0.51%	0.54%	0.68%	0.87%	0.82%	0.76%	0.71%	0.68%	0.68%	0.65%	0.61%	0.59%	0.56%	0.54%	0.51%	0.50%	0.47%	0.46%

Incremental Demand Potential (kW)

Incremental Annual Peak kW Savin	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	4,060	5,690	6,623	4,863	5,881	6,772	6,452	5,984	5,600	5,352	5,252	5,043	4,723	4,544	4,319	4,127	3,844	3,776	3,564	3,442
Total Motors & Other	1,018	1,256	1,619	2,354	3,260	5,014	4,736	4,490	4,283	4,108	3,959	3,813	3,666	3,537	3,410	3,291	3,169	3,068	2,960	2,863
Total HVAC & Shell	68	91	130	192	176	163	151	140	129	119	109	100	92	84	76	69	63	57	51	46
Total Refrigeration	84	196	384	490	490	490	490	490	490	490	490	490	490	490	490	490	490	490	490	490
TOTAL	5,231	7,234	8,757	7,899	9,807	12,439	11,829	11,104	10,502	10,069	9,811	9,446	8,971	8,655	8,296	7,978	7,566	7,391	7,065	6,840
Total as % of Loss-Adjusted Sales	0.36%	0.50%	0.60%	0.54%	0.67%	0.84%	0.80%	0.74%	0.70%	0.67%	0.65%	0.62%	0.58%	0.56%	0.53%	0.51%	0.48%	0.46%	0.44%	0.42%

APCO West Virginia - C & I - End-Use Market Potential (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	$1,444,994	$1,827,520	$2,089,632	$2,590,258	$3,742,255	$4,869,398	$4,661,570	$4,350,228	$4,078,628	$3,872,180	$3,735,696	$3,557,558	$3,336,854	$3,181,736	$3,011,554	$2,860,100	$2,673,204	$2,582,921	$2,434,087	$2,327,637
Total Motors & Other	$973,396	$1,165,303	$1,441,811	$2,004,841	$2,927,005	$4,814,362	$4,582,406	$4,373,915	$4,189,038	$4,023,635	$3,874,446	$3,731,898	$3,594,356	$3,467,726	$3,345,934	$3,230,535	$3,117,498	$3,014,990	$2,912,582	$2,816,543
Total HVAC & Shell	$453,979	$547,571	$686,128	$1,029,657	$1,471,720	$1,619,156	$1,542,637	$1,318,152	$1,178,185	$1,174,300	$1,317,490	$1,331,047	$1,213,615	$1,234,828	$1,195,648	$1,181,187	$1,058,140	$1,155,526	$1,089,195	$1,110,786
Total Refrigeration	$7,874	$16,017	$30,041	$41,762	$41,762	$41,762	$41,762	$41,762	$41,762	$41,762	$41,762	$41,762	$41,762	$41,762	$41,762	$41,762	$41,762	$41,762	$41,762	$41,762
TOTAL	$2,880,242	$3,556,412	$4,247,611	$5,666,519	$8,182,742	$11,344,678	$10,828,376	$10,084,057	$9,487,613	$9,111,877	$8,969,394	$8,662,265	$8,186,588	$7,926,052	$7,594,897	$7,313,583	$6,890,604	$6,795,199	$6,477,626	$6,296,727

Incremental Administrative Cost ($)

THESE VALUES DO NOT INCLUDE ANY PROGRAM START-UP COSTS. THESE COSTS ARE ADDED TO THE PROGRAM TOTALS TAB.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$973,266	$1,251,226	$1,546,351	$1,745,442	$2,101,154	$2,415,308	$2,300,604	$2,125,796	$1,985,500	$1,902,781	$1,882,745	$1,814,193	$1,696,619	$1,638,553	$1,559,704	$1,494,202	$1,388,192	$1,374,029	$1,296,830	$1,257,792
Total Motors & Other	$841,927	$953,172	$1,244,237	$1,826,273	$2,481,592	$3,933,432	$3,762,198	$3,599,205	$3,450,404	$3,315,030	$3,191,828	$3,072,446	$2,956,019	$2,848,951	$2,745,507	$2,647,477	$2,551,000	$2,464,367	$2,377,246	$2,295,977
Total HVAC & Shell	$436,016	$499,217	$653,516	$972,396	$1,355,733	$1,521,206	$1,465,529	$1,253,784	$1,121,976	$1,123,639	$1,270,862	$1,287,557	$1,172,717	$1,196,171	$1,158,997	$1,146,372	$1,025,031	$1,124,015	$1,059,190	$1,082,207
Total Refrigeration	$37,401	$79,230	$156,411	$205,751	$205,751	$205,751	$205,751	$205,751	$205,751	$205,751	$205,751	$205,751	$205,751	$205,751	$205,751	$205,751	$205,751	$205,751	$205,751	$205,751
TOTAL	$2,288,610	$2,782,845	$3,600,515	$4,749,862	$6,144,231	$8,075,697	$7,734,082	$7,184,536	$6,763,631	$6,547,201	$6,551,186	$6,379,948	$6,031,106	$5,889,427	$5,669,959	$5,493,801	$5,169,974	$5,168,162	$4,939,018	$4,841,726

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	$2,418,260	$3,078,746	$3,635,983	$4,335,700	$5,843,409	$7,284,705	$6,962,174	$6,476,024	$6,064,127	$5,774,960	$5,618,441	$5,371,751	$5,033,474	$4,820,290	$4,571,258	$4,354,301	$4,061,396	$3,956,950	$3,730,918	$3,585,428
Total Motors & Other	$1,815,323	$2,118,475	$2,686,048	$3,831,114	$5,408,597	$8,747,794	$8,344,604	$7,973,120	$7,639,441	$7,338,666	$7,066,274	$6,804,344	$6,550,375	$6,316,677	$6,091,441	$5,878,011	$5,668,498	$5,479,357	$5,289,829	$5,112,519
Total HVAC & Shell	$889,995	$1,046,788	$1,339,644	$2,002,053	$2,827,453	$3,140,362	$3,008,166	$2,571,936	$2,300,161	$2,297,939	$2,588,351	$2,618,604	$2,386,332	$2,431,000	$2,354,644	$2,327,558	$2,083,171	$2,279,540	$2,148,385	$2,192,993
Total Refrigeration	$45,275	$95,247	$186,451	$247,513	$247,513	$247,513	$247,513	$247,513	$247,513	$247,513	$247,513	$247,513	$247,513	$247,513	$247,513	$247,513	$247,513	$247,513	$247,513	$247,513
TOTAL	$5,168,853	$6,339,257	$7,848,126	$10,416,380	$14,326,973	$19,420,375	$18,562,458	$17,268,593	$16,251,244	$15,659,079	$15,520,580	$15,042,213	$14,217,693	$13,815,479	$13,264,857	$12,807,384	$12,060,578	$11,963,361	$11,416,644	$11,138,454

APCO West Virginia - C & I - End-Use Market Potential (Energy & Winter Demand Impacts)

Cumulative Demand Potential (kW)

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	7,899	15,769	23,327	31,464	41,189	51,230	61,117	71,454	82,077	92,833	103,583	114,204	124,591	134,659	144,337	153,570	162,318	170,549	178,245	185,393
Water Heat DLC	505	1,008	1,491	2,011	2,633	3,275	3,907	4,568	5,247	5,935	6,622	7,301	7,965	8,608	9,227	9,817	10,376	10,903	11,395	11,852
Total	8,404	16,777	24,818	33,476	43,822	54,505	65,024	76,022	87,324	98,768	110,205	121,504	132,556	143,267	153,564	163,387	172,694	181,452	189,640	197,244
Total as % of Loss-Adjusted Sales	0.58%	1.16%	1.71%	2.30%	2.99%	3.69%	4.38%	5.10%	5.83%	6.57%	7.28%	7.96%	8.62%	9.25%	9.84%	10.39%	10.90%	11.37%	11.80%	12.19%

Incremental Demand Potential (kW)

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	7,899	7,870	7,558	8,137	9,725	10,041	9,887	10,337	10,623	10,756	10,750	10,621	10,388	10,068	9,678	9,233	8,747	8,232	7,696	7,148
Water Heat DLC	505	503	483	520	622	642	632	661	679	688	687	679	664	644	619	590	559	526	492	457
Total	8,404	8,373	8,041	8,658	10,347	10,683	10,519	10,997	11,302	11,444	11,437	11,300	11,052	10,711	10,297	9,824	9,307	8,758	8,188	7,605
Total as % of Loss-Adjusted Sales	0.58%	0.58%	0.56%	0.59%	0.71%	0.72%	0.71%	0.74%	0.76%	0.76%	0.76%	0.74%	0.72%	0.69%	0.66%	0.62%	0.59%	0.55%	0.51%	0.47%

Cumulative DLC Credits

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	$1,136,162	$3,404,258	$6,759,487	$11,285,178	$17,209,671	$24,578,423	$33,369,261	$43,646,863	$55,452,451	$68,805,151	$83,704,048	$100,130,612	$118,051,291	$137,420,063	$158,180,853	$180,269,720	$203,616,779	$228,147,857	$253,785,875	$280,451,973
Water Heat DLC	$72,631	$217,624	$432,113	$721,427	$1,100,162	$1,571,223	$2,133,195	$2,790,210	$3,544,906	$4,398,503	$5,350,944	$6,401,044	$7,546,658	$8,784,844	$10,112,018	$11,524,092	$13,016,598	$14,584,795	$16,223,755	$17,928,437
Total	$1,208,793	$3,621,882	$7,191,601	$12,006,604	$18,309,832	$26,149,646	$35,502,456	$46,437,074	$58,997,356	$73,203,654	$89,054,992	$106,531,656	$125,597,949	$146,204,907	$168,292,871	$191,793,812	$216,633,376	$242,732,652	$270,009,630	$298,380,409

Incremental DLC Credits

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	$1,136,162	$2,268,096	$3,355,229	$4,525,690	$5,924,493	$7,368,752	$8,790,839	$10,277,602	$11,805,587	$13,352,701	$14,898,897	$16,426,564	$17,920,678	$19,368,772	$20,760,791	$22,088,866	$23,347,059	$24,531,079	$25,638,018	$26,666,098
Water Heat DLC	$72,631	$144,992	$214,490	$289,314	$378,735	$471,062	$561,971	$657,016	$754,695	$853,597	$952,441	$1,050,100	$1,145,614	$1,238,186	$1,327,174	$1,412,074	$1,492,506	$1,568,197	$1,638,960	$1,704,682
Total	$1,208,793	$2,413,088	$3,569,719	$4,815,004	$6,303,228	$7,839,814	$9,352,810	$10,934,618	$12,560,282	$14,206,298	$15,851,338	$17,476,664	$19,066,293	$20,606,959	$22,087,964	$23,500,940	$24,839,565	$26,099,275	$27,276,978	$28,370,780

Cumulative Administrative Costs

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	$1,379,625	$2,754,116	$4,074,207	$5,495,481	$7,194,027	$8,947,770	$10,674,590	$12,479,945	$14,335,356	$16,213,994	$18,091,517	$19,946,542	$21,760,824	$23,519,223	$25,209,531	$26,822,195	$28,350,000	$29,787,738	$31,131,879	$32,380,262
Water Heat DLC	$180,343	$360,015	$532,576	$718,364	$940,396	$1,169,643	$1,395,371	$1,631,365	$1,873,903	$2,119,476	$2,364,904	$2,607,391	$2,844,552	$3,074,408	$3,295,364	$3,506,169	$3,705,882	$3,893,822	$4,069,527	$4,232,714
Total	$1,559,969	$3,114,132	$4,606,783	$6,213,845	$8,134,423	$10,117,414	$12,069,961	$14,111,311	$16,209,259	$18,333,470	$20,456,422	$22,553,934	$24,605,376	$26,593,632	$28,504,895	$30,328,364	$32,055,882	$33,681,560	$35,201,405	$36,612,976

Incremental Administrative Costs

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	$1,379,625	$1,374,491	$1,320,091	$1,421,274	$1,698,546	$1,753,743	$1,726,819	$1,805,356	$1,855,410	$1,878,638	$1,877,524	$1,855,025	$1,814,281	$1,758,400	$1,690,308	$1,612,664	$1,527,805	$1,437,738	$1,344,140	$1,248,383
Water Heat DLC	$180,343	$179,672	$172,561	$185,787	$222,032	$229,247	$225,728	$235,994	$242,537	$245,574	$245,428	$242,487	$237,161	$229,856	$220,955	$210,806	$199,713	$187,940	$175,705	$163,187
Total	$1,559,969	$1,554,163	$1,492,651	$1,607,062	$1,920,578	$1,982,991	$1,952,547	$2,041,350	$2,097,948	$2,124,211	$2,122,952	$2,097,512	$2,051,442	$1,988,256	$1,911,263	$1,823,469	$1,727,518	$1,625,678	$1,519,845	$1,411,570

Table 6-10. Commercial & Industrial Technical Potential Scenario: 2009 – 2028 Net Savings at Generator

Technical Potential APCO West Virginia - C & I: Winter

Energy Potential (MWh)

C & I Sector	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	1,651,573	1,651,619	1,651,619	1,183,653	1,185,085	1,187,629	1,189,937	1,191,253	1,192,045	1,193,142	1,195,456	1,198,131	1,200,303	1,202,850	1,205,369	1,208,007	1,210,055	1,212,920	1,215,541	1,218,473
Total Motors & Other	1,785,457	1,785,461	1,785,461	1,785,551	1,785,698	1,785,957	1,786,193	1,786,327	1,786,408	1,786,520	1,786,756	1,787,029	1,787,251	1,787,511	1,787,768	1,788,038	1,788,247	1,788,539	1,788,807	1,789,106
Total HVAC & Shell	985,196	985,269	985,269	987,304	990,579	996,397	1,001,674	1,004,682	1,006,493	1,009,000	1,014,293	1,020,408	1,025,375	1,031,198	1,036,958	1,042,990	1,047,672	1,054,225	1,060,217	1,066,921
Total Refrigeration	166,438	166,438	166,438	166,438	166,438	166,438	166,438	166,438	166,438	166,438	166,438	166,438	166,438	166,438	166,438	166,438	166,438	166,438	166,438	166,438
Total All	4,588,664	4,588,786	4,588,786	4,122,946	4,127,800	4,136,421	4,144,242	4,148,699	4,151,384	4,155,100	4,162,943	4,172,005	4,179,366	4,187,996	4,196,532	4,205,472	4,212,411	4,222,122	4,231,002	4,240,938
Total as % of Loss-Adjusted Sales	34.36%	34.35%	34.37%	30.79%	30.67%	30.46%	30.27%	30.17%	30.11%	30.02%	29.84%	29.64%	29.48%	29.29%	29.11%	28.92%	28.78%	28.58%	28.40%	28.21%

Demand Potential (kW)

C & I Sector	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	241,842	241,849	241,849	174,924	175,129	175,494	175,825	176,013	176,127	176,284	176,616	176,999	177,311	177,676	178,037	178,415	178,709	179,119	179,495	179,915
Total Motors & Other	170,412	170,413	170,413	170,422	170,436	170,461	170,485	170,498	170,506	170,517	170,540	170,567	170,588	170,614	170,639	170,665	170,686	170,715	170,741	170,770
Total HVAC & Shell	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972	-3,972
Total Refrigeration	30,154	30,154	30,154	30,154	30,154	30,154	30,154	30,154	30,154	30,154	30,154	30,154	30,154	30,154	30,154	30,154	30,154	30,154	30,154	30,154
Total All	438,437	438,444	438,444	371,527	371,747	372,137	372,491	372,693	372,814	372,983	373,338	373,748	374,081	374,471	374,868	375,262	375,676	376,016	376,418	376,868
Total as % of Loss-Adjusted Sales	30.49%	30.30%	30.26%	25.50%	25.38%	25.21%	25.08%	24.99%	24.91%	24.82%	24.67%	24.49%	24.33%	24.18%	24.01%	23.86%	23.71%	23.57%	23.43%	23.29%

Table 6-11. Commercial & Industrial Economic Potential Scenario: 2009 – 2028 Net Savings at Generator

Economic Potential — APCO West Virginia - C & I: Winter

Energy Potential (MWh)

C & I Sector	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	1,291,194	1,291,228	1,291,228	906,494	907,569	909,477	911,209	912,196	912,790	913,613	915,350	917,356	918,986	920,897	922,786	924,766	926,302	928,452	930,418	932,618
Total Motors & Other	1,515,014	1,515,015	1,515,015	1,515,042	1,515,086	1,515,164	1,515,235	1,515,275	1,515,299	1,515,333	1,515,404	1,515,486	1,515,553	1,515,631	1,515,708	1,515,789	1,515,852	1,515,939	1,516,020	1,516,110
Total HVAC & Shell	574,069	574,129	574,129	575,802	578,493	583,274	587,612	590,083	591,572	593,633	597,982	603,008	607,090	611,875	616,609	621,567	625,415	630,800	635,724	641,234
Total Refrigeration	99,155	99,155	99,155	99,155	99,155	99,155	99,155	99,155	99,155	99,155	99,155	99,155	99,155	99,155	99,155	99,155	99,155	99,155	99,155	99,155
Total All	3,479,432	3,479,527	3,479,527	3,096,493	3,100,303	3,107,071	3,113,210	3,116,709	3,118,817	3,121,734	3,127,891	3,135,005	3,140,783	3,147,558	3,154,258	3,161,277	3,166,724	3,174,347	3,181,318	3,189,117
Total as % of Loss-Adjusted Sales	26.05%	26.05%	26.06%	23.12%	23.03%	22.88%	22.74%	22.66%	22.62%	22.56%	22.42%	22.27%	22.15%	22.01%	21.88%	21.74%	21.63%	21.49%	21.36%	21.21%

Demand Potential (kW)

C & I Sector	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	206,254	206,260	206,260	144,997	145,193	145,539	145,854	146,033	146,141	146,290	146,606	146,970	147,266	147,613	147,956	148,316	148,595	148,985	149,342	149,742
Total Motors & Other	149,087	149,087	149,087	149,096	149,109	149,133	149,154	149,166	149,173	149,184	149,205	149,230	149,250	149,274	149,297	149,322	149,340	149,367	149,391	149,419
Total HVAC & Shell	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164
Total Refrigeration	19,395	19,395	19,395	19,395	19,395	19,395	19,395	19,395	19,395	19,395	19,395	19,395	19,395	19,395	19,395	19,395	19,395	19,395	19,395	19,395
Total All	375,900	375,906	375,906	314,652	314,860	315,230	315,566	315,758	315,873	316,033	316,369	316,759	317,075	317,445	317,812	318,196	318,494	318,911	319,292	319,719
Total as % of Loss-Adjusted Sales	26.14%	25.98%	25.95%	21.60%	21.50%	21.35%	21.25%	21.18%	21.11%	21.03%	20.91%	20.76%	20.62%	20.49%	20.36%	20.23%	20.10%	19.99%	19.87%	19.76%

Table 6-12. High Case Scenario: 2009 – 2028 Commercial & Industrial Cumulative Annual Net Savings at Generator and Costs

APCO West Virginia - C & I - End-Use Market Potential (Energy & Winter Demand Impacts)

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	22,117	174,735	341,084	456,817	589,640	722,834	817,849	873,328	902,914	921,499	939,778	957,270	972,056	987,176	1,001,569	1,015,832	1,027,835	1,042,058	1,055,219	1,069,097
Total Motors & Other	9,845	46,844	92,310	153,533	229,011	337,064	432,299	518,540	597,001	668,725	734,601	795,128	850,709	901,933	949,139	992,700	1,032,821	1,069,994	1,104,308	1,136,076
Total HVAC & Shell	6,736	57,949	102,597	160,417	231,217	300,609	358,879	399,792	430,083	459,085	496,440	534,799	566,569	600,369	632,689	665,122	691,157	724,168	754,262	786,763
Total Refrigeration	425	2,976	7,202	13,244	19,287	25,330	31,373	37,416	43,458	49,501	55,544	61,587	67,630	73,672	79,715	85,758	91,801	97,844	103,886	109,929
TOTAL	39,122	282,505	543,193	784,012	1,069,155	1,385,836	1,640,400	1,829,076	1,973,457	2,098,810	2,226,363	2,348,784	2,456,964	2,563,150	2,663,112	2,759,412	2,843,614	2,934,063	3,017,676	3,101,866
Total as % of Loss-Adjusted Sales	0.29%	2.11%	4.07%	5.85%	7.94%	10.20%	11.98%	13.30%	14.31%	15.16%	15.96%	16.69%	17.33%	17.93%	18.47%	18.98%	19.43%	19.86%	20.26%	20.63%

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	4,060	33,533	63,345	82,026	103,734	125,889	141,810	151,095	155,959	158,967	161,983	164,895	167,335	169,851	172,246	174,627	176,605	178,994	181,197	183,538
Total Motors & Other	1,018	5,142	9,883	15,986	23,466	34,123	43,661	52,252	60,034	67,139	73,689	79,710	85,218	90,301	94,982	99,305	103,269	106,967	110,376	113,544
Total HVAC & Shell	68	720	1,431	2,117	2,448	2,573	2,580	2,522	2,432	2,330	2,227	2,128	2,036	1,953	1,880	1,815	1,758	1,708	1,665	1,627
Total Refrigeration	84	565	1,363	2,495	3,626	4,757	5,888	7,020	8,151	9,282	10,414	11,545	12,676	13,808	14,939	16,070	17,202	18,333	19,464	20,595
TOTAL	5,231	39,960	76,022	102,623	133,274	167,342	193,939	212,889	226,577	237,719	248,313	258,277	267,265	275,913	284,047	291,816	298,833	306,001	312,702	319,306
Total as % of Loss-Adjusted Sales	0.36%	2.76%	5.25%	7.04%	9.10%	11.33%	13.06%	14.28%	15.14%	15.82%	16.41%	16.93%	17.38%	17.81%	18.20%	18.55%	18.86%	19.18%	19.46%	19.73%

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	22,117	152,619	166,349	115,733	132,823	133,194	95,015	55,479	29,587	18,585	18,279	17,492	14,786	15,120	14,393	14,263	12,003	14,223	13,161	13,879
Total Motors & Other	9,845	37,000	45,466	61,223	75,478	108,053	95,236	86,241	78,461	71,724	65,876	60,527	55,581	51,224	47,206	43,561	40,121	37,172	34,315	31,768
Total HVAC & Shell	6,736	51,213	44,648	57,821	70,800	69,391	58,270	40,913	30,291	29,002	37,354	38,359	31,771	33,799	32,320	32,434	26,034	33,011	30,094	32,501
Total Refrigeration	425	2,551	4,225	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043
TOTAL	39,122	243,383	260,688	240,819	285,144	316,681	254,564	188,676	144,381	125,353	127,553	122,421	108,180	106,186	99,962	96,300	84,201	90,450	83,612	84,191
Total as % of Loss-Adjusted Sales	0.29%	1.82%	1.95%	1.80%	2.12%	2.33%	1.86%	1.37%	1.05%	0.91%	0.91%	0.87%	0.76%	0.74%	0.69%	0.66%	0.58%	0.61%	0.56%	0.56%

APCO West Virginia - C & I - End-Use Market Potential (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	$1,444,994	$18,252,650	$19,402,981	$20,605,268	$26,792,743	$29,790,389	$21,188,527	$11,486,222	$4,825,365	$1,904,841	$1,506,192	$1,365,390	$1,072,340	$1,140,045	$1,083,367	$1,096,343	$857,327	$1,144,375	$1,043,340	$1,150,534
Total Motors & Other	$973,396	$5,199,740	$5,949,059	$7,648,775	$10,419,703	$15,634,846	$13,813,266	$12,613,504	$11,550,874	$10,613,709	$9,788,524	$9,020,931	$8,301,397	$7,663,886	$7,071,290	$6,531,294	$6,018,626	$5,579,946	$5,152,368	$4,771,512
Total HVAC & Shell	$453,979	$5,551,094	$4,787,450	$6,292,600	$8,370,883	$7,937,321	$6,599,938	$4,697,215	$3,502,068	$3,252,339	$3,968,086	$3,987,699	$3,282,560	$3,428,156	$3,241,259	$3,216,778	$2,563,915	$3,218,841	$2,914,202	$3,131,590
Total Refrigeration	$7,874	$87,480	$137,598	$205,820	$205,820	$205,820	$205,820	$205,820	$205,820	$205,820	$205,820	$205,820	$205,820	$205,820	$205,820	$205,820	$205,820	$205,820	$205,820	$205,820
TOTAL	*$2,880,242*	*$29,090,965*	*$30,277,089*	*$34,752,463*	*$45,789,150*	*$53,568,376*	*$41,807,552*	*$29,002,761*	*$20,084,127*	*$15,976,708*	*$15,468,623*	*$14,579,840*	*$12,862,117*	*$12,437,907*	*$11,601,735*	*$11,050,234*	*$9,645,687*	*$10,148,981*	*$9,315,730*	*$9,259,456*

Incremental Administrative Cost ($)

THESE VALUES DO NOT INCLUDE ANY PROGRAM START-UP COSTS. THESE COSTS ARE ADDED TO THE PROGRAM TOTALS TAB.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$973,266	$6,105,596	$6,653,952	$6,643,043	$7,650,829	$7,780,073	$5,583,978	$3,258,277	$1,743,697	$1,135,408	$1,199,475	$1,178,589	$990,322	$1,034,491	$991,100	$991,647	$822,993	$1,004,601	$927,467	$989,366
Total Motors & Other	$841,927	$2,772,468	$3,467,014	$4,718,728	$5,823,721	$8,457,126	$7,486,897	$6,792,299	$6,190,371	$5,670,531	$5,221,819	$4,806,708	$4,418,118	$4,078,363	$3,762,647	$3,476,220	$3,202,470	$2,972,809	$2,745,647	$2,545,076
Total HVAC & Shell	$436,016	$3,127,098	$2,969,076	$3,894,857	$5,046,897	$4,829,398	$4,035,864	$2,842,444	$2,104,340	$1,984,532	$2,499,405	$2,543,313	$2,098,672	$2,216,892	$2,109,968	$2,108,461	$1,685,656	$2,132,723	$1,938,406	$2,090,690
Total Refrigeration	$37,401	$204,094	$338,034	$483,423	$483,423	$483,423	$483,423	$483,423	$483,423	$483,423	$483,423	$483,423	$483,423	$483,423	$483,423	$483,423	$483,423	$483,423	$483,423	$483,423
TOTAL	**$2,288,610**	**$12,209,256**	**$13,428,076**	**$15,740,051**	**$19,004,870**	**$21,550,020**	**$17,590,162**	**$13,376,444**	**$10,521,832**	**$9,273,895**	**$9,404,122**	**$9,012,033**	**$7,990,535**	**$7,813,169**	**$7,347,139**	**$7,059,750**	**$6,194,543**	**$6,593,556**	**$6,094,943**	**$6,108,556**

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	$2,418,260	$24,358,247	$26,056,933	$27,248,311	$34,443,573	$37,570,461	$26,772,505	$14,744,499	$6,569,062	$3,040,249	$2,705,668	$2,543,979	$2,062,661	$2,174,536	$2,074,467	$2,087,989	$1,680,320	$2,148,976	$1,970,807	$2,139,900
Total Motors & Other	$1,815,323	$7,972,209	$9,416,074	$12,367,503	$16,243,424	$24,091,972	$21,300,164	$19,405,804	$17,741,245	$16,284,239	$15,010,342	$13,827,639	$12,719,515	$11,742,248	$10,833,937	$10,007,514	$9,221,096	$8,552,755	$7,898,014	$7,316,588
Total HVAC & Shell	$889,995	$8,678,192	$7,756,526	$10,187,457	$13,417,780	$12,766,719	$10,635,802	$7,539,658	$5,606,409	$5,236,871	$6,467,491	$6,531,012	$5,381,232	$5,645,048	$5,351,227	$5,325,238	$4,249,571	$5,351,563	$4,852,608	$5,222,280
Total Refrigeration	$45,275	$291,574	$475,632	$689,243	$689,243	$689,243	$689,243	$689,243	$689,243	$689,243	$689,243	$689,243	$689,243	$689,243	$689,243	$689,243	$689,243	$689,243	$689,243	$689,243
TOTAL	**$5,168,853**	**$41,300,221**	**$43,705,165**	**$50,492,514**	**$64,794,020**	**$75,118,396**	**$59,397,715**	**$42,379,205**	**$30,605,959**	**$25,250,603**	**$24,872,745**	**$23,591,873**	**$20,852,652**	**$20,251,076**	**$18,948,874**	**$18,109,985**	**$15,840,230**	**$16,742,537**	**$15,410,673**	**$15,368,012**

APCO West Virginia - C & I - End-Use Market Potential (Energy & Winter Demand Impacts)

Cumulative Demand Potential (kW)

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	11,849	23,653	34,990	47,196	61,784	76,846	91,676	107,181	123,115	139,250	155,374	171,306	186,887	201,989	216,505	230,355	243,476	255,824	267,368	278,089
Water Heat DLC	757	1,512	2,237	3,017	3,950	4,913	5,861	6,852	7,870	8,902	9,933	10,951	11,947	12,913	13,841	14,726	15,565	16,354	17,092	17,777
Total	12,606	25,165	37,227	50,214	65,734	81,758	97,536	114,032	130,986	148,151	165,307	182,257	198,834	214,901	230,346	245,081	259,041	272,178	284,460	295,867
Total as % of Loss-Adjusted Sales	0.88%	1.74%	2.57%	3.45%	4.49%	5.54%	6.57%	7.65%	8.75%	9.86%	10.92%	11.94%	12.93%	13.87%	14.76%	15.58%	16.35%	17.06%	17.70%	18.28%

Incremental Demand Potential (kW)

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	11,849	11,804	11,337	12,206	14,588	15,062	14,830	15,505	15,935	16,134	16,125	15,931	15,581	15,102	14,517	13,850	13,121	12,348	11,544	10,721
Water Heat DLC	757	755	725	780	933	963	948	991	1,019	1,031	1,031	1,018	996	965	928	885	839	789	738	685
Total	12,606	12,559	12,062	12,987	15,520	16,024	15,778	16,496	16,953	17,166	17,155	16,950	16,578	16,067	15,445	14,735	13,960	13,137	12,282	11,407
Total as % of Loss-Adjusted Sales	0.88%	0.87%	0.83%	0.89%	1.06%	1.09%	1.06%	1.11%	1.13%	1.14%	1.13%	1.11%	1.08%	1.04%	0.99%	0.94%	0.88%	0.82%	0.76%	0.70%

Cumulative DLC Credits

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	$1,704,243	$5,106,387	$10,139,231	$16,927,766	$25,814,506	$36,867,634	$50,053,892	$65,470,295	$83,178,676	$103,207,727	$125,556,072	$150,195,918	$177,076,936	$206,130,094	$237,271,280	$270,404,580	$305,425,168	$342,221,786	$380,678,813	$420,677,959
Water Heat DLC	$108,947	$326,436	$648,170	$1,082,140	$1,650,242	$2,356,835	$3,199,792	$4,185,316	$5,317,358	$6,597,754	$8,026,416	$9,601,566	$11,319,987	$13,177,266	$15,168,027	$17,286,138	$19,524,897	$21,877,192	$24,335,632	$26,892,655
Total	$1,813,190	$5,432,823	$10,787,401	$18,009,907	$27,464,748	$39,224,469	$53,253,684	$69,655,611	$88,496,034	$109,805,481	$133,582,487	$159,797,484	$188,396,923	$219,307,361	$252,439,307	$287,690,717	$324,950,065	$364,098,978	$405,014,444	$447,570,614

Incremental DLC Credits

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	$1,704,243	$3,402,144	$5,032,844	$6,788,535	$8,886,740	$11,053,128	$13,186,258	$15,416,403	$17,708,381	$20,029,051	$22,348,345	$24,639,847	$26,881,018	$29,053,158	$31,141,186	$33,133,300	$35,020,588	$36,796,618	$38,457,027	$39,999,147
Water Heat DLC	$108,947	$217,489	$321,734	$433,970	$568,102	$706,593	$842,957	$985,523	$1,132,043	$1,280,396	$1,428,661	$1,575,150	$1,718,421	$1,857,280	$1,990,761	$2,118,110	$2,238,759	$2,352,295	$2,458,440	$2,557,023
Total	$1,813,190	$3,619,633	$5,354,578	$7,222,506	$9,454,842	$11,759,721	$14,029,215	$16,401,927	$18,840,423	$21,309,447	$23,777,006	$26,214,997	$28,599,439	$30,910,438	$33,131,947	$35,251,410	$37,259,347	$39,148,913	$40,915,467	$42,556,170

Cumulative Administrative Costs

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	$2,069,438	$4,131,175	$6,111,311	$8,243,222	$10,791,041	$13,421,656	$16,011,885	$18,719,918	$21,503,034	$24,320,991	$27,137,276	$29,919,814	$32,641,236	$35,278,835	$37,814,297	$40,233,292	$42,525,000	$44,681,607	$46,697,818	$48,570,392
Water Heat DLC	$270,515	$540,023	$798,864	$1,077,545	$1,410,594	$1,754,465	$2,093,057	$2,447,048	$2,810,854	$3,179,214	$3,547,356	$3,911,087	$4,266,828	$4,611,612	$4,943,045	$5,259,254	$5,558,824	$5,840,733	$6,104,290	$6,349,071
Total	$2,339,953	$4,671,198	$6,910,175	$9,320,767	$12,201,634	$15,176,120	$18,104,941	$21,166,966	$24,313,888	$27,500,205	$30,684,632	$33,830,900	$36,908,064	$39,890,448	$42,757,342	$45,492,546	$48,083,824	$50,522,340	$52,802,108	$54,919,463

Incremental Administrative Costs

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	$2,069,438	$2,061,737	$1,980,136	$2,131,911	$2,547,819	$2,630,615	$2,590,229	$2,708,034	$2,783,116	$2,817,957	$2,816,286	$2,782,538	$2,721,422	$2,637,599	$2,535,462	$2,418,995	$2,291,708	$2,156,607	$2,016,211	$1,872,574
Water Heat DLC	$270,515	$269,508	$258,841	$278,681	$333,048	$343,871	$338,592	$353,991	$363,806	$368,360	$368,142	$363,730	$355,741	$344,784	$331,433	$316,209	$299,570	$281,909	$263,557	$244,781
Total	$2,339,953	$2,331,245	$2,238,977	$2,410,592	$2,880,868	$2,974,486	$2,928,821	$3,062,025	$3,146,922	$3,186,317	$3,184,427	$3,146,268	$3,077,163	$2,982,384	$2,866,895	$2,735,204	$2,591,277	$2,438,517	$2,279,767	$2,117,355

Table 6-13. Low Case Scenario: 2009 – 2028 Commercial & Industrial Cumulative Annual Net Savings at Generator and Costs

APCO West Virginia - C & I - End-Use Market Potential (Energy & Winter Demand Impacts)

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	22,117	39,187	61,274	79,503	99,104	120,927	142,133	162,383	181,880	200,974	220,049	238,773	256,816	274,545	291,811	308,688	324,902	341,033	356,665	372,034
Total Motors & Other	9,845	17,109	26,523	40,277	59,645	91,335	122,248	152,380	181,768	210,457	238,490	265,873	292,611	318,741	344,274	369,231	393,613	417,464	440,779	463,581
Total HVAC & Shell	6,736	10,100	14,896	22,315	32,109	43,470	54,565	64,177	72,903	81,767	91,893	102,263	111,852	121,729	131,422	141,115	149,962	159,668	168,956	178,504
Total Refrigeration	425	800	1,619	2,798	3,977	5,156	6,335	7,514	8,693	9,871	11,050	12,229	13,408	14,587	15,766	16,945	18,124	19,303	20,482	21,661
TOTAL	39,122	67,196	104,312	144,892	194,834	260,888	325,281	386,453	445,243	503,070	561,482	619,139	674,687	729,603	783,274	835,979	886,601	937,468	986,882	1,035,781
Total as % of Loss-Adjusted Sales	0.29%	0.50%	0.78%	1.08%	1.45%	1.92%	2.38%	2.81%	3.23%	3.63%	4.03%	4.40%	4.76%	5.10%	5.43%	5.75%	6.06%	6.35%	6.62%	6.89%

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	4,060	6,976	10,578	13,551	16,642	20,130	23,518	26,746	29,850	32,893	35,945	38,945	41,833	44,674	47,443	50,150	52,748	55,340	57,851	60,324
Total Motors & Other	1,018	1,747	2,686	4,053	6,004	9,157	12,224	15,200	18,092	20,909	23,662	26,349	28,967	31,524	34,022	36,462	38,843	41,174	43,452	45,681
Total HVAC & Shell	68	102	153	232	307	381	452	521	588	654	717	779	838	896	952	1,007	1,059	1,110	1,159	1,207
Total Refrigeration	84	158	321	552	782	1,013	1,244	1,474	1,705	1,935	2,166	2,397	2,627	2,858	3,088	3,319	3,550	3,780	4,011	4,241
TOTAL	5,231	8,983	13,738	18,387	23,736	30,680	37,437	43,940	50,234	56,391	62,490	68,469	74,265	79,953	85,505	90,938	96,200	101,405	106,474	111,453
Total as % of Loss-Adjusted Sales	0.36%	0.62%	0.95%	1.26%	1.62%	2.08%	2.52%	2.95%	3.36%	3.75%	4.13%	4.49%	4.83%	5.16%	5.48%	5.78%	6.07%	6.36%	6.63%	6.89%

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	22,117	17,070	22,087	18,229	19,601	21,823	21,207	20,250	19,497	19,094	19,074	18,725	18,043	17,729	17,266	16,877	16,214	16,131	15,632	15,369
Total Motors & Other	9,845	7,264	9,414	13,754	19,367	31,691	30,913	30,131	29,388	28,689	28,033	27,383	26,738	26,130	25,533	24,956	24,382	23,851	23,314	22,803
Total HVAC & Shell	6,736	3,364	4,796	7,419	9,794	11,361	11,095	9,612	8,726	8,864	10,126	10,370	9,588	9,878	9,692	9,694	8,846	9,706	9,288	9,548
Total Refrigeration	425	375	818	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179
TOTAL	39,122	28,074	37,116	40,580	49,941	66,054	64,393	61,172	58,791	57,826	58,412	57,657	55,549	54,916	53,671	52,706	50,622	50,867	49,414	48,899
Total as % of Loss-Adjusted Sales	0.29%	0.21%	0.28%	0.30%	0.37%	0.49%	0.47%	0.44%	0.43%	0.42%	0.42%	0.41%	0.39%	0.38%	0.37%	0.36%	0.35%	0.34%	0.33%	0.33%

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	4,060	2,915	3,602	2,973	3,092	3,487	3,388	3,228	3,104	3,043	3,052	3,000	2,888	2,842	2,768	2,708	2,598	2,592	2,511	2,472
Total Motors & Other	1,018	728	939	1,367	1,951	3,153	3,067	2,976	2,892	2,818	2,753	2,686	2,618	2,558	2,497	2,440	2,381	2,331	2,278	2,229
Total HVAC & Shell	68	34	51	79	75	73	71	69	67	65	63	62	60	58	56	54	53	51	49	48
Total Refrigeration	84	74	163	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231
TOTAL	5,231	3,752	4,755	4,649	5,348	6,945	6,757	6,503	6,294	6,157	6,099	5,979	5,796	5,688	5,552	5,433	5,262	5,205	5,069	4,980
Total as % of Loss-Adjusted Sales	0.36%	0.26%	0.33%	0.32%	0.37%	0.47%	0.45%	0.44%	0.42%	0.41%	0.40%	0.39%	0.38%	0.37%	0.36%	0.35%	0.33%	0.33%	0.32%	0.31%

APCO West Virginia - C & I - End-Use Market Potential (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	$1,444,994	$539,868	$638,839	$867,891	$1,185,988	$1,557,192	$1,526,686	$1,470,616	$1,426,233	$1,402,174	$1,400,458	$1,379,116	$1,338,049	$1,318,401	$1,289,878	$1,265,470	$1,224,873	$1,218,226	$1,186,998	$1,169,532
Total Motors & Other	$973,396	$527,811	$659,999	$925,816	$1,362,708	$2,303,521	$2,245,696	$2,187,666	$2,132,779	$2,081,393	$2,033,431	$1,985,988	$1,938,905	$1,894,726	$1,851,370	$1,809,585	$1,767,966	$1,729,697	$1,690,911	$1,654,040
Total HVAC & Shell	$453,979	$156,651	$208,885	$337,268	$497,621	$575,740	$563,030	$489,233	$444,707	$450,239	$510,648	$521,586	$482,693	$496,038	$486,341	$485,800	$443,974	$485,322	$464,509	$476,725
Total Refrigeration	$7,874	$4,554	$9,290	$13,892	$13,892	$13,892	$13,892	$13,892	$13,892	$13,892	$13,892	$13,892	$13,892	$13,892	$13,892	$13,892	$13,892	$13,892	$13,892	$13,892
TOTAL	$2,880,242	$1,228,884	$1,517,014	$2,144,867	$3,060,208	$4,450,345	$4,349,303	$4,161,407	$4,017,611	$3,947,698	$3,958,430	$3,900,582	$3,773,539	$3,723,056	$3,641,482	$3,574,746	$3,450,705	$3,447,138	$3,356,310	$3,314,188

Incremental
Administrative Cost ($)

THESE VALUES DO NOT INCLUDE ANY PROGRAM START-UP COSTS. THESE COSTS ARE ADDED TO THE PROGRAM TOTALS TAB.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total Lighting	$973,266	$682,899	$883,494	$1,024,934	$1,126,813	$1,268,715	$1,231,639	$1,168,422	$1,120,936	$1,100,518	$1,109,848	$1,092,957	$1,049,707	$1,034,951	$1,008,291	$987,040	$944,122	$946,385	$915,781	$903,430
Total Motors & Other	$841,927	$570,933	$739,503	$1,079,004	$1,513,120	$2,489,309	$2,431,837	$2,372,454	$2,315,859	$2,262,729	$2,213,123	$2,163,306	$2,113,180	$2,066,234	$2,019,774	$1,974,864	$1,929,690	$1,888,546	$1,846,317	$1,806,281
Total HVAC & Shell	$436,016	$193,481	$269,457	$428,205	$609,523	$715,177	$705,081	$612,376	$557,745	$569,070	$652,915	$670,262	$620,726	$640,474	$629,198	$629,879	$575,307	$631,462	$604,593	$621,645
Total Refrigeration	$37,401	$30,037	$65,465	$94,316	$94,316	$94,316	$94,316	$94,316	$94,316	$94,316	$94,316	$94,316	$94,316	$94,316	$94,316	$94,316	$94,316	$94,316	$94,316	$94,316
TOTAL	$2,288,610	$1,477,350	$1,957,920	$2,626,458	$3,343,772	$4,567,518	$4,462,873	$4,247,568	$4,088,857	$4,026,633	$4,070,202	$4,020,841	$3,877,929	$3,835,975	$3,751,579	$3,686,099	$3,543,436	$3,560,710	$3,461,007	$3,425,673

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	$2,418,260	$1,222,767	$1,522,334	$1,892,825	$2,312,801	$2,825,907	$2,758,325	$2,639,038	$2,547,169	$2,502,692	$2,510,306	$2,472,073	$2,387,756	$2,353,351	$2,298,170	$2,252,509	$2,168,995	$2,164,611	$2,102,779	$2,072,962
Total Motors & Other	$1,815,323	$1,098,744	$1,399,502	$2,004,820	$2,875,828	$4,792,830	$4,677,533	$4,560,120	$4,448,637	$4,344,122	$4,246,554	$4,149,293	$4,052,085	$3,960,960	$3,871,144	$3,784,449	$3,697,656	$3,618,244	$3,537,227	$3,460,321
Total HVAC & Shell	$889,995	$350,132	$478,343	$765,472	$1,107,144	$1,290,917	$1,268,110	$1,101,609	$1,002,452	$1,019,309	$1,163,564	$1,191,848	$1,103,419	$1,136,512	$1,115,539	$1,115,679	$1,019,280	$1,116,785	$1,069,102	$1,098,370
Total Refrigeration	$45,275	$34,591	$74,755	$108,208	$108,208	$108,208	$108,208	$108,208	$108,208	$108,208	$108,208	$108,208	$108,208	$108,208	$108,208	$108,208	$108,208	$108,208	$108,208	$108,208
TOTAL	$5,168,853	$2,706,235	$3,474,934	$4,771,326	$6,403,981	$9,017,863	$8,812,176	$8,408,976	$8,106,467	$7,974,331	$8,028,632	$7,921,423	$7,651,467	$7,559,031	$7,393,061	$7,260,845	$6,994,140	$7,007,847	$6,817,316	$6,739,861

APCO West Virginia - C & I - End-Use Market Potential (Energy & Winter Demand Impacts)

Cumulative Demand Potential (kW)

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	5,924	11,827	17,495	23,598	30,892	38,423	45,838	53,590	61,558	69,625	77,687	85,653	93,444	100,994	108,253	115,178	121,738	127,912	133,684	139,045
Water Heat DLC	379	756	1,118	1,509	1,975	2,456	2,930	3,426	3,935	4,451	4,966	5,476	5,974	6,456	6,920	7,363	7,782	8,177	8,546	8,889
Total	6,303	12,583	18,614	25,107	32,867	40,879	48,768	57,016	65,493	74,076	82,653	91,128	99,417	107,451	115,173	122,541	129,521	136,089	142,230	147,933
Total as % of Loss-Adjusted Sales	0.44%	0.87%	1.28%	1.72%	2.24%	2.77%	3.28%	3.82%	4.38%	4.93%	5.46%	5.97%	6.47%	6.94%	7.38%	7.79%	8.18%	8.53%	8.85%	9.14%

Incremental Demand Potential (kW)

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	5,924	5,902	5,669	6,103	7,294	7,531	7,415	7,752	7,967	8,067	8,062	7,966	7,791	7,551	7,258	6,925	6,561	6,174	5,772	5,361
Water Heat DLC	379	377	362	390	466	481	474	496	509	516	515	509	498	483	464	443	419	395	369	343
Total	6,303	6,280	6,031	6,493	7,760	8,012	7,889	8,248	8,477	8,583	8,578	8,475	8,289	8,033	7,722	7,368	6,980	6,568	6,141	5,703
Total as % of Loss-Adjusted Sales	0.44%	0.43%	0.42%	0.45%	0.53%	0.54%	0.53%	0.55%	0.57%	0.57%	0.57%	0.56%	0.54%	0.52%	0.49%	0.47%	0.44%	0.41%	0.38%	0.35%

Cumulative DLC Credits

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	$852,122	$2,553,193	$5,069,615	$8,463,883	$12,907,253	$18,433,817	$25,026,946	$32,735,148	$41,589,338	$51,603,863	$62,778,036	$75,097,959	$88,538,468	$103,065,047	$118,635,640	$135,202,290	$152,712,584	$171,110,893	$190,339,406	$210,338,980
Water Heat DLC	$54,474	$163,218	$324,085	$541,070	$825,121	$1,178,418	$1,599,896	$2,092,658	$2,658,679	$3,298,877	$4,013,208	$4,800,783	$5,659,993	$6,588,633	$7,584,014	$8,643,069	$9,762,448	$10,938,596	$12,167,816	$13,446,327
Total	$906,595	$2,716,411	$5,393,700	$9,004,953	$13,732,374	$19,612,235	$26,626,842	$34,827,805	$44,248,017	$54,902,741	$66,791,244	$79,898,742	$94,198,461	$109,653,680	$126,219,654	$143,845,359	$162,475,032	$182,049,489	$202,507,222	$223,785,307

Incremental DLC Credits

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	$852,122	$1,701,072	$2,516,422	$3,394,268	$4,443,370	$5,526,564	$6,593,129	$7,708,202	$8,854,190	$10,014,526	$11,174,172	$12,319,923	$13,440,509	$14,526,579	$15,570,593	$16,566,650	$17,510,294	$18,398,309	$19,228,513	$19,999,573
Water Heat DLC	$54,474	$108,744	$160,867	$216,985	$284,051	$353,296	$421,479	$492,762	$566,021	$640,198	$714,331	$787,575	$859,211	$928,640	$995,380	$1,059,055	$1,119,380	$1,176,148	$1,229,220	$1,278,512
Total	$906,595	$1,809,816	$2,677,289	$3,611,253	$4,727,421	$5,879,860	$7,014,607	$8,200,963	$9,420,212	$10,654,723	$11,888,503	$13,107,498	$14,299,719	$15,455,219	$16,565,973	$17,625,705	$18,629,674	$19,574,457	$20,457,733	$21,278,085

Cumulative Administrative Costs

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	$1,034,719	$2,065,587	$3,055,655	$4,121,611	$5,395,520	$6,710,828	$8,005,942	$9,359,959	$10,751,517	$12,160,495	$13,568,638	$14,959,907	$16,320,618	$17,639,418	$18,907,149	$20,116,646	$21,262,500	$22,340,804	$23,348,909	$24,285,196
Water Heat DLC	$135,257	$270,011	$399,432	$538,773	$705,297	$877,232	$1,046,528	$1,223,524	$1,405,427	$1,589,607	$1,773,678	$1,955,543	$2,133,414	$2,305,806	$2,471,523	$2,629,627	$2,779,412	$2,920,366	$3,052,145	$3,174,535
Total	$1,169,976	$2,335,599	$3,455,087	$4,660,383	$6,100,817	$7,588,060	$9,052,471	$10,583,483	$12,156,944	$13,750,102	$15,342,316	$16,915,450	$18,454,032	$19,945,224	$21,378,671	$22,746,273	$24,041,912	$25,261,170	$26,401,054	$27,459,732

Incremental Administrative Costs

Winter Demand Response	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Space Heat DLC	$1,034,719	$1,030,868	$990,068	$1,065,956	$1,273,910	$1,315,307	$1,295,114	$1,354,017	$1,391,558	$1,408,978	$1,408,143	$1,391,269	$1,360,711	$1,318,800	$1,267,731	$1,209,498	$1,145,854	$1,078,304	$1,008,105	$936,287
Water Heat DLC	$135,257	$134,754	$129,421	$139,341	$166,524	$171,936	$169,296	$176,996	$181,903	$184,180	$184,071	$181,865	$177,871	$172,392	$165,716	$158,104	$149,785	$140,955	$131,778	$122,390
Total	$1,169,976	$1,165,622	$1,119,489	$1,205,296	$1,440,434	$1,487,243	$1,464,410	$1,531,012	$1,573,461	$1,593,159	$1,592,214	$1,573,134	$1,538,582	$1,491,192	$1,433,447	$1,367,602	$1,295,639	$1,219,258	$1,139,884	$1,058,678

6.4.1 Commercial and Industrial Energy Efficiency Results by End Use

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 impact predominate throughout the forecast period. See Figures 6-16 to 6-19.

Figure 6-16. Commercial and Industrial Market Potential Incremental Annual Net Generator Energy Savings by End Use 2009

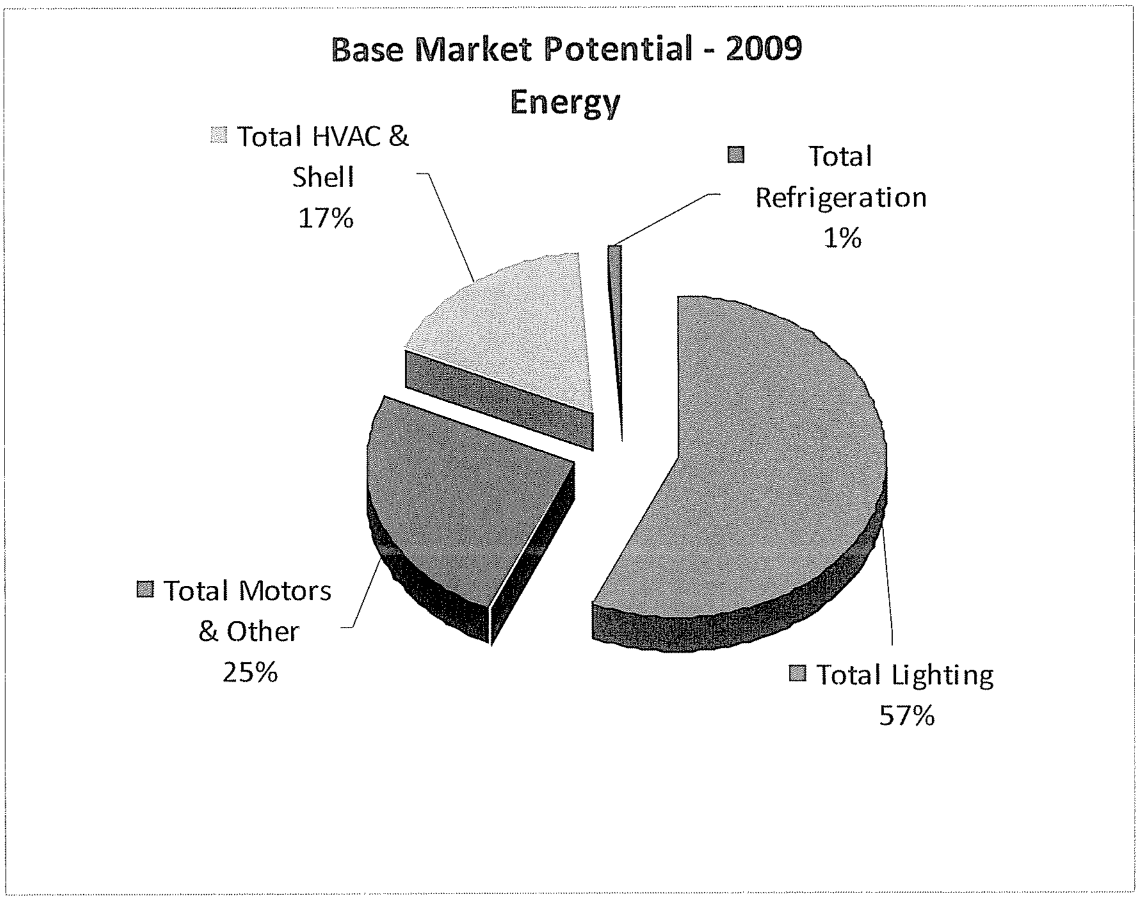


Figure 6-17. Commercial and Industrial Market Potential Incremental Annual Net Winter Peak Demand Generator Savings by End Use 2009

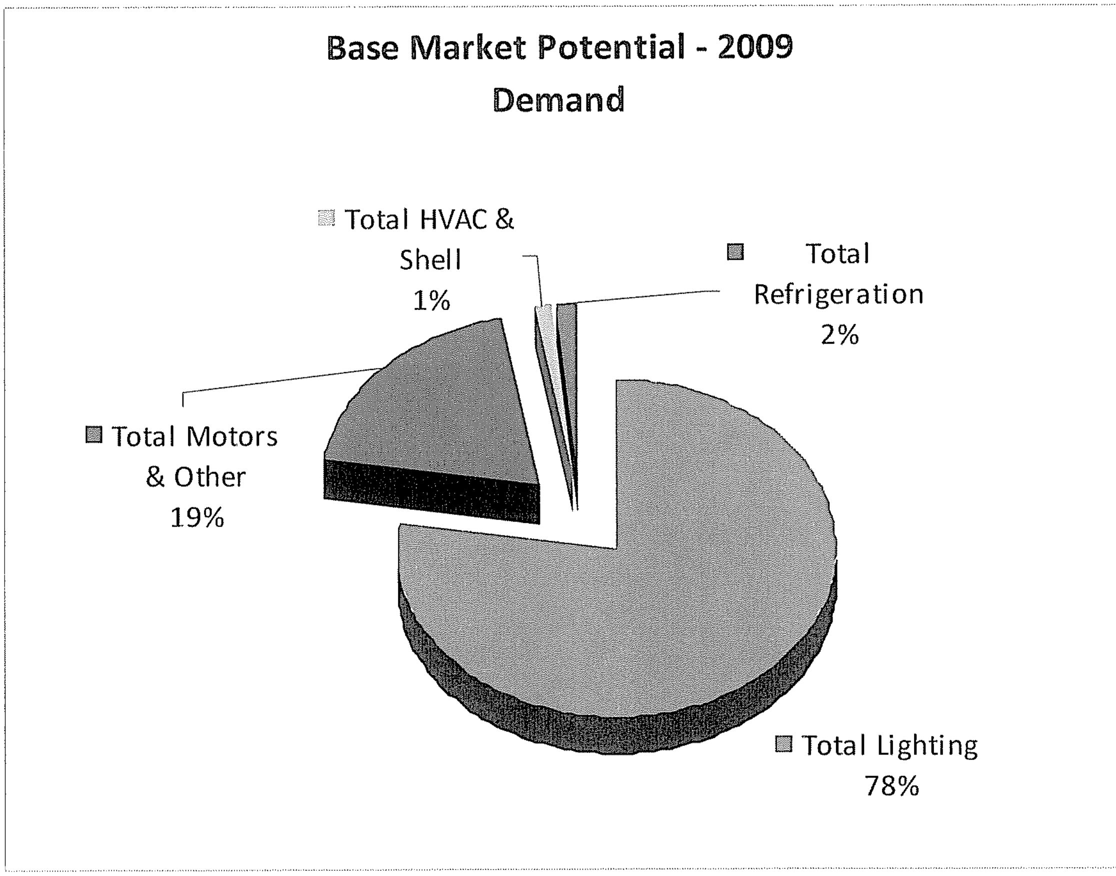


Figure 6-18. Commercial and Industrial Market Potential Incremental Annual Net Energy Savings at Generator by End Use 2028

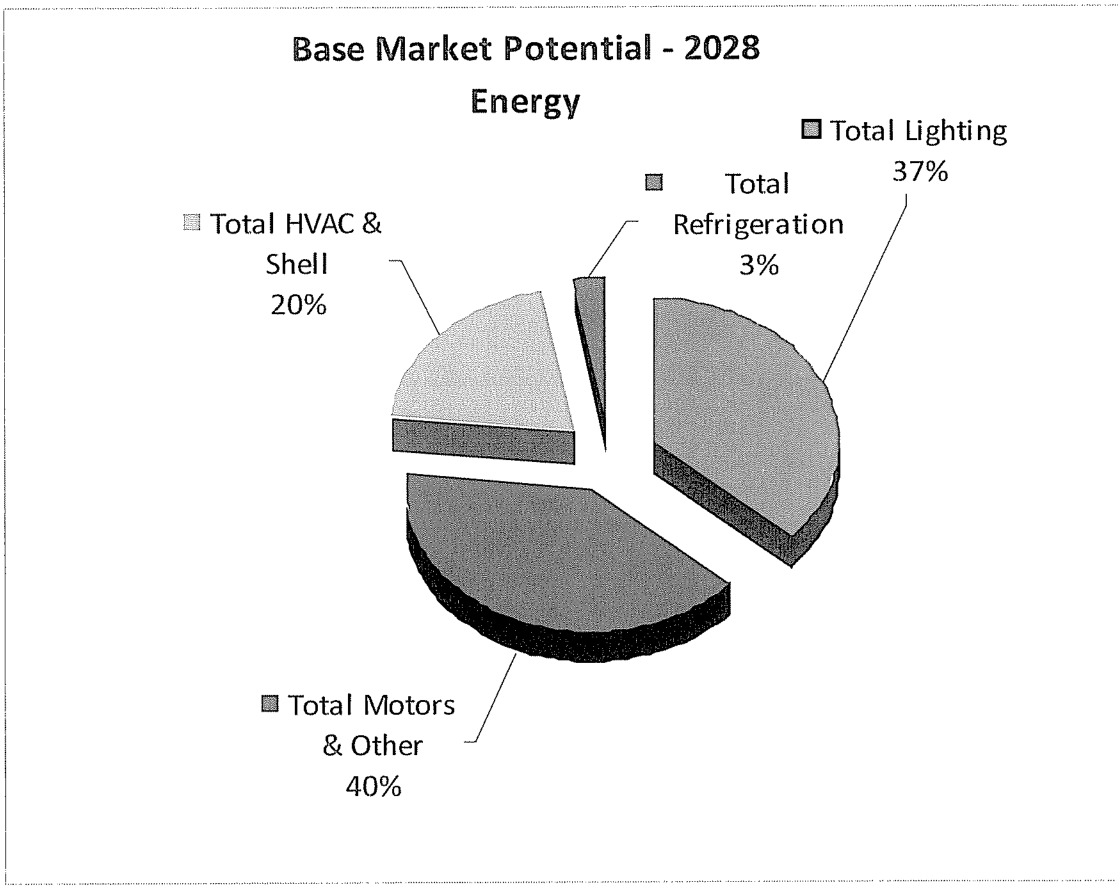
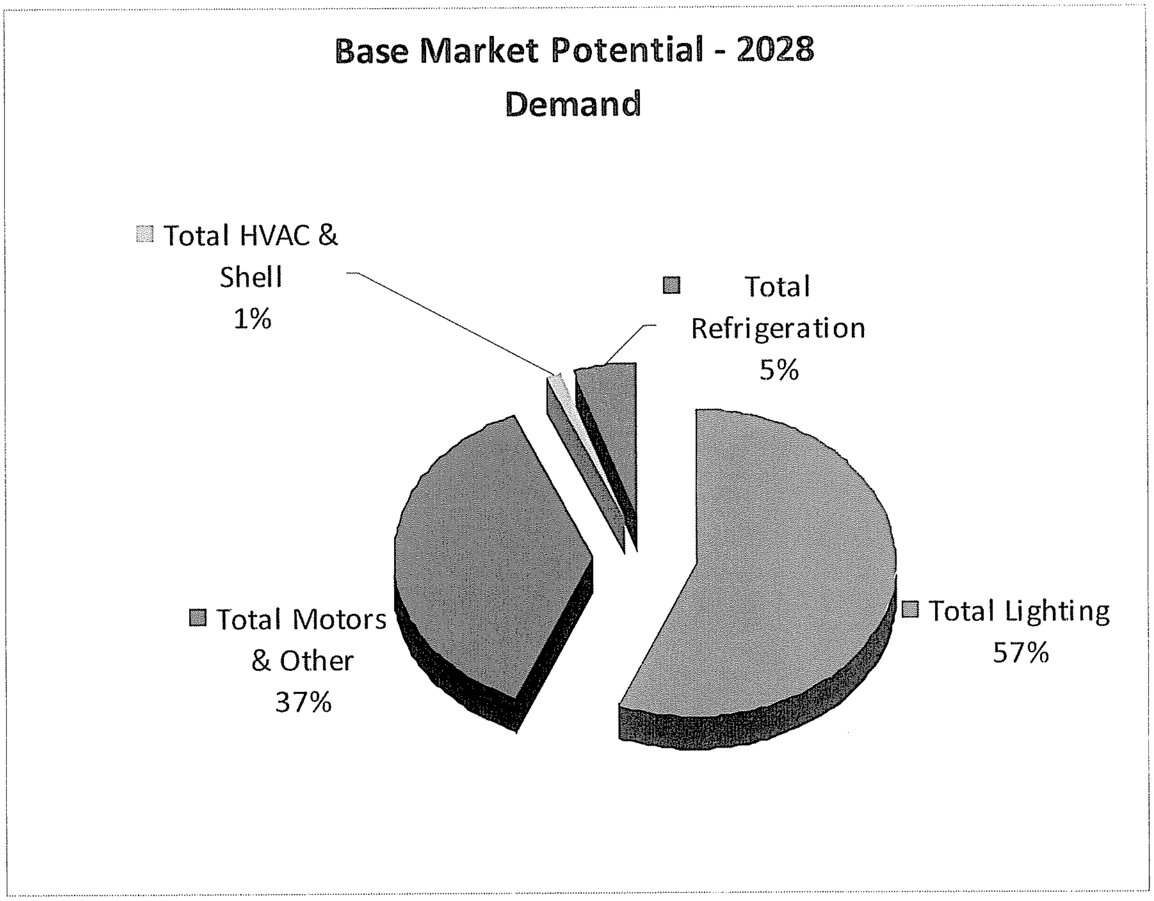


Figure 6-19. Commercial and Industrial Market Potential Incremental Annual Net Winter Peak Demand Savings at Generator by End Use 2028



Figures 6-20 to Figure 6-25 present C&I sector results for different scenarios through and in year 2028.

Figure 6-20. Commercial and Industrial Base Case Market and Economic Potential Net Energy Savings at Generator – 2028 by End Use

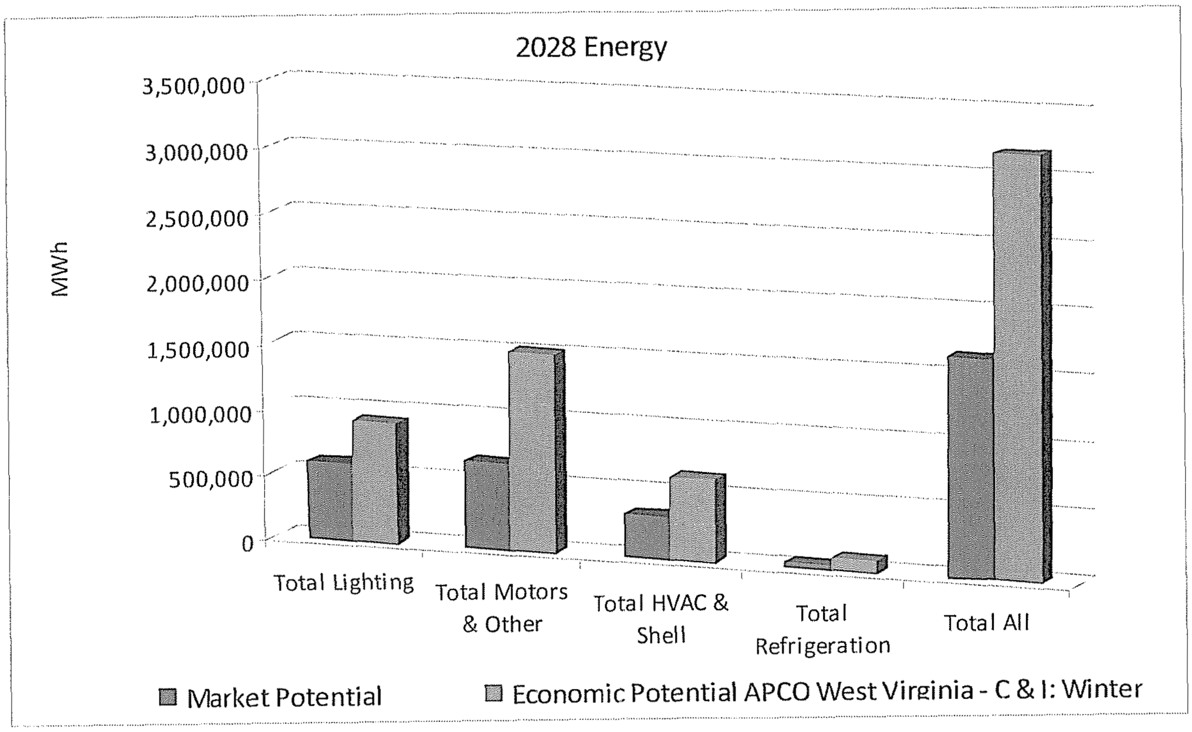


Figure 6-21. Commercial and Industrial Base Case Market and Economic Potential Net Winter Peak Demand Savings at Generator – 2028 by End Use

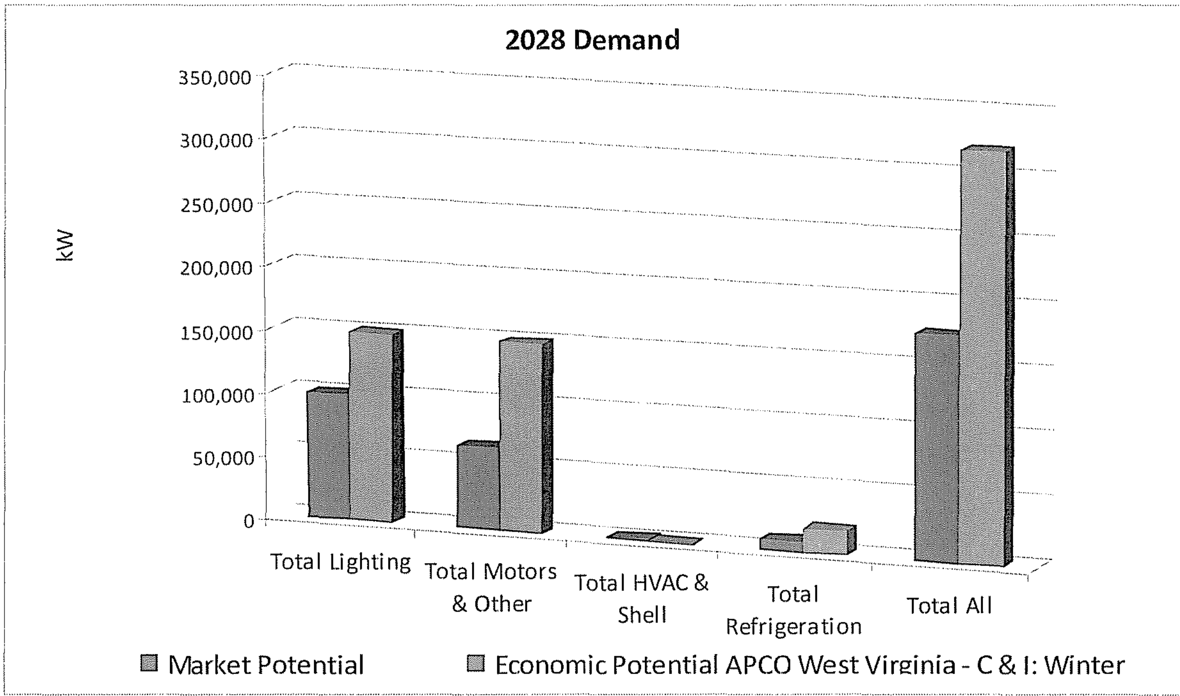


Figure 6-22. Commercial and Industrial Technical and Economic Potential Net Energy Savings at Generator – 2028 by End Use

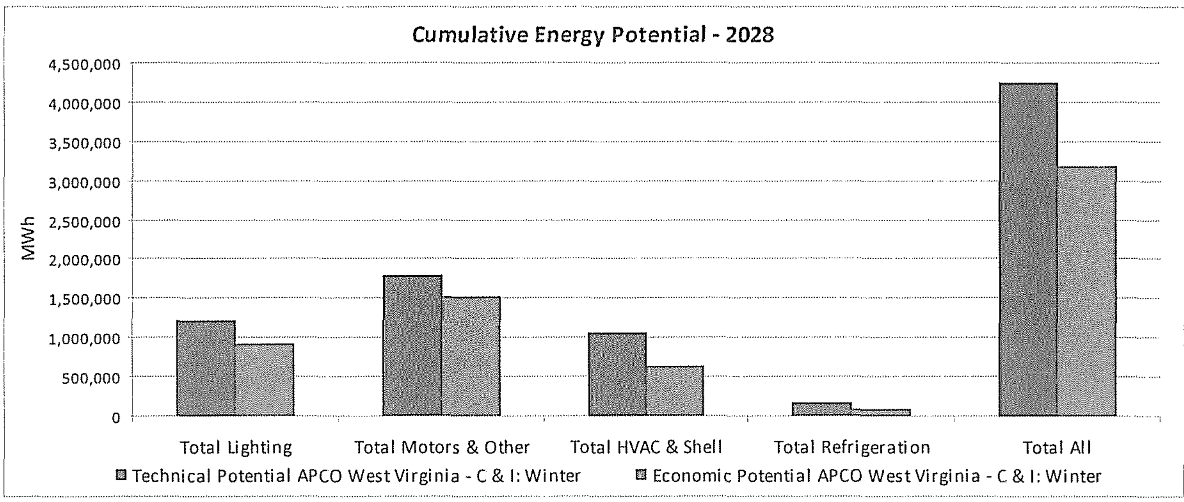
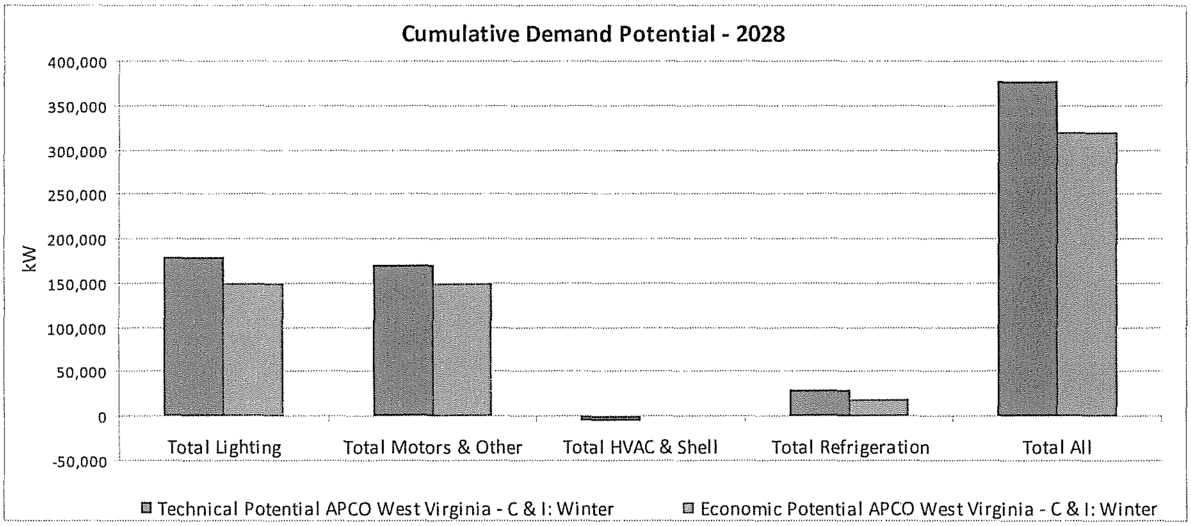


Figure 6-23. Commercial and Industrial Technical and Economic Potential Net Winter Peak Demand Savings at Generator – 2028 by End Use[42]



[42] HVAC/Shell technical and economic potentials are slightly negative due to programmable thermostats offsetting other impacts. Such measures did not pass the economic screening, so they are not included in the program potentials.

Figure 6-24. Commercial and Industrial Economic Potential Incremental Annual Net Energy Savings at Generator by End Use 2028

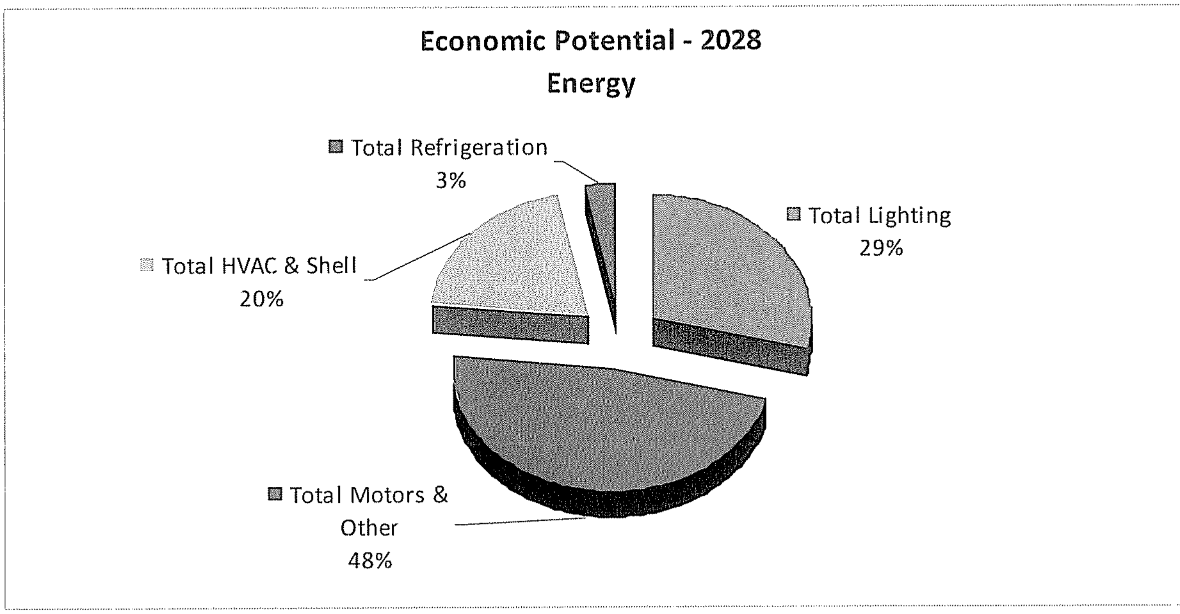
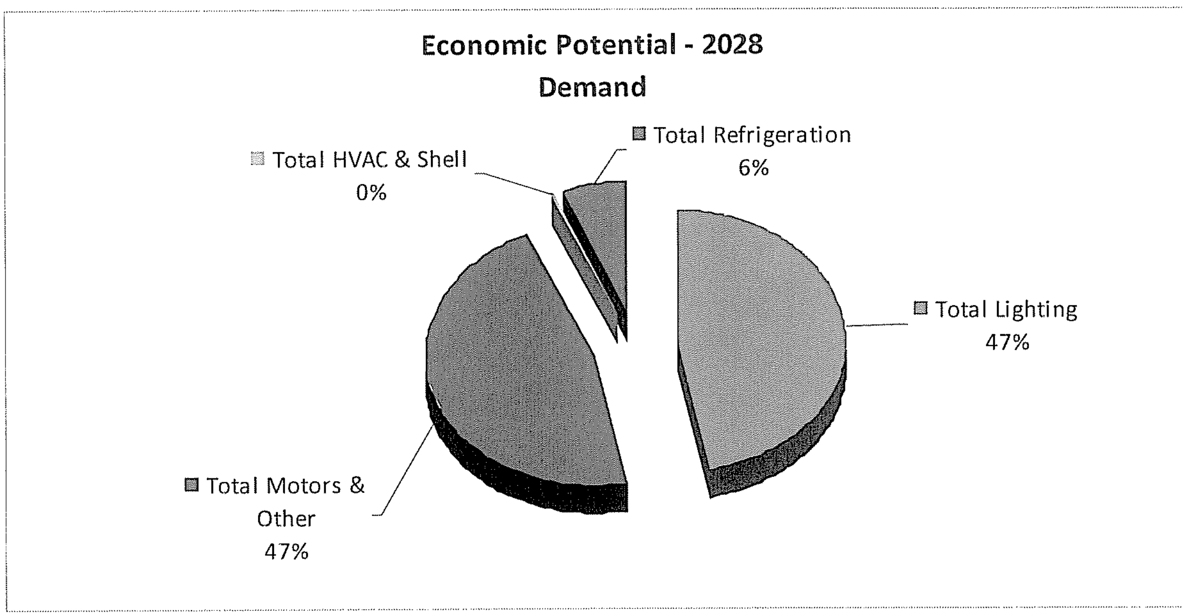


Figure 6-25. Commercial and Industrial Economic Potential Incremental Annual Net Winter Peak Demand Savings at Generator by End Use 2028



7 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. It 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 DSM 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 3:

Appalachian Power Co – West Virginia

DSM Action Plan and Potential Study Appendices

Submitted To:

Appalachian Power Co

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APPENDIX A:
DSM BENCHMARKING RESULTS BY REGION

Figure A-1. 2007 Electricity DSM Results of IOUs & Agencies by Region

Appendix: 2007 DSM Results of IOUs & Agencies by Region

		Incremental DSM Results			2007 Retail				Cost of	Spending	Energy	Demand	Cost of Savings	
Customer						Annual		Revenue	Energy	as % of	Savings	Savings		
Sector	Utility/Agency	GWh	MW	Costs $M	Customers	GWh	Peak MW	$M	$/kWh	Revenue	as % of	as % of	$/kWh	$/kW
Residential	**Median**	**33.6**	**7.2**	**$7.3**	**617,523**	**4,936**	**1,091**	**$597**	**$0.10**	**1.5%**	**0.7%**	**0.75%**	**$0.23**	**$933**
Midwest	Interstate P&L (IA)	34.1	14.0	$11.0	408,094	3,870	792	$419	$0.11	2.6%	0.9%	1.8%	$0.32	$787
	Interstate P&L (MN)	0.8	0.6	$0.3	36,223	323	66	$31	$0.10	0.9%	0.2%	0.8%	$0.35	$481
	MidAmerican (IA)	30.1	12.9	$8.9	540,810	5,458	1,715	$465	$0.09	1.9%	0.6%	0.8%	$0.30	$691
	MN Power	9.5	1.7	$1.6	118,870	1,051	508	$81	$0.08	2.0%	0.9%	0.3%	$0.17	$970
	Otter Tail	2.7	0.5	$0.8	47,195	548	181	$41	$0.07	1.9%	0.5%	0.3%	$0.28	$1,404
	Xcel Energy (MN)	13.8	31.2	$12.4	1,071,319	9,125	2,485	$898	$0.10	1.4%	0.2%	1.3%	$0.89	$398
	Wisconsin Focus on Energ	69.0	5.8	$6.2	2,572,557	22,374	5,590	$2,431	$0.11	0.3%	0.3%	0.1%	$0.09	$1,057
Northeast	Efficiency ME	48.7	n/a	$5.0	694,235	4,413	781	$729	$0.17	0.7%	1.1%	-	$0.10	-
	Efficiency VT	54.3	7.2	$6.7	289,118	2,079	368	$294	$0.14	2.3%	2.6%	2.0%	$0.12	$933
	National Grid (MA)	151.7	11.8	$28.5	1,100,080	8,658	1,845	$1,313	$0.15	2.2%	1.8%	0.6%	$0.19	$2,419
	NSTAR (MA)	77.6	5.9	$17.4	973,656	6,607	1,390	$1,093	$0.17	1.6%	1.2%	0.4%	$0.22	$2,945
West	Arizona Public Service	179.2	33.9	$10.0	979,138	13,771	3,519	$1,418	$0.10	0.7%	1.3%	1.0%	$0.06	$296
	SWEPCO (TX)	1.8	0.5	$0.7	142,473	2,124	614	$162	$0.08	0.4%	0.1%	0.1%	$0.39	$1,408
	Xcel Energy (CO)	33.1	25.0	$7.9	1,120,333	8,904	2,224	$801	$0.09	1.0%	0.4%	1.1%	$0.24	$314
C&I	**Median**	**83.5**	**13.2**	**$10.0**	**88,667**	**12,279**	**2,585**	**$817**	**$0.07**	**1.5%**	**0.7%**	**0.56%**	**$0.13**	**$676**
Midwest	Interstate P&L (IA)	86.1	18.8	$11.4	75,169	11,215	2,293	$691	$0.06	1.6%	0.8%	0.8%	$0.13	$605
	Interstate P&L (MN)	16.2	2.7	$2.2	7,364	516	105	$39	$0.08	5.7%	3.1%	2.6%	$0.14	$823
	MidAmerican (IA)	133.6	22.5	$12.9	86,948	13,343	4,191	$658	$0.05	2.0%	1.0%	0.5%	$0.10	$572
	MN Power	34.7	3.1	$2.2	21,854	2,288	1,106	$151	$0.07	1.5%	1.5%	0.3%	$0.06	$694
	Otter Tail	8.9	2.5	$1.1	11,976	1,583	524	$97	$0.06	1.1%	0.6%	0.5%	$0.12	$446
	Xcel Energy (MN)	245.4	72.5	$32.9	129,304	22,110	6,020	$1,569	$0.07	2.1%	1.1%	1.2%	$0.13	$454
	Wisconsin Focus on Energ	109.4	22.3	$14.7	336,955	48,927	12,224	$3,614	$0.07	0.4%	0.2%	0.2%	$0.13	$658
Northeast	Efficiency ME	43.2	8.0	$7.4	90,385	7,447	1,318	$1,002	$0.13	0.7%	0.6%	0.6%	$0.17	$928
	Efficiency VT	45.2	6.8	$10.6	45,630	3,420	605	$365	$0.11	2.9%	1.3%	1.1%	$0.24	$1,561
	National Grid (MA)	90.6	16.8	$27.9	152,561	13,505	2,877	$943	$0.07	3.0%	0.7%	0.6%	$0.31	$1,659
	NSTAR (MA)	120.5	19.2	$32.2	164,704	15,048	3,164	$1,320	$0.09	2.4%	0.8%	0.6%	$0.27	$1,683
West	Arizona Public Service	80.9	9.6	$9.4	122,299	15,400	3,935	$1,355	$0.09	0.7%	0.5%	0.2%	$0.12	$981
	SWEPCO (TX)	3.7	1.1	$0.5	33,350	5,235	1,512	$296	$0.06	0.2%	0.1%	0.1%	$0.14	$474
	Xcel Energy (CO)	94.0	17.3	$7.6	208,594	19,138	4,780	$1,306	$0.07	0.6%	0.5%	0.4%	$0.08	$443
Overall	**Median**	**123.6**	**26.6**	**$18.4**	**706,189**	**16,943**	**3,820**	**$1,427**	**$0.08**	**1.8%**	**0.9%**	**0.59%**	**$0.15**	**$754**
Midwest	Interstate P&L (IA)	120.2	32.8	$22.4	483,263	15,086	3,085	$1,110	$0.07	2.0%	0.8%	1.1%	$0.19	$683
	Interstate P&L (MN)	17.0	3.3	$2.5	43,587	839	172	$70	$0.08	3.6%	2.0%	1.9%	$0.15	$774
	MidAmerican (IA)	163.7	35.5	$21.8	627,758	18,801	5,906	$1,123	$0.06	1.9%	0.9%	0.6%	$0.13	$616
	MN Power	44.2	4.8	$3.8	140,724	3,340	1,614	$232	$0.07	1.7%	1.3%	0.3%	$0.09	$791
	Otter Tail	11.6	3.0	$1.9	59,171	2,131	705	$138	$0.06	1.4%	0.5%	0.4%	$0.16	$617
	Xcel Energy (MN)	259.2	103.6	$47.4	1,200,623	31,235	8,505	$2,468	$0.08	1.9%	0.8%	1.2%	$0.18	$457
	Wisconsin Focus on Energ	178.4	28.1	$20.8	2,909,512	71,301	17,814	$6,045	$0.08	0.3%	0.3%	0.2%	$0.12	$741
Northeast	Efficiency ME	91.9	8.0	$12.6	784,620	11,860	2,099	$1,731	$0.15	0.7%	0.8%	0.4%	$0.14	$1,588
	Efficiency VT	99.5	14.0	$17.4	334,748	5,499	973	$660	$0.12	2.6%	1.8%	1.4%	$0.17	$1,238
	National Grid (MA)	242.3	28.6	$56.4	1,252,641	22,162	4,722	$2,256	$0.10	2.5%	1.1%	0.6%	$0.23	$1,972
	NSTAR (MA)	198.1	25.1	$49.7	1,138,360	21,655	4,554	$2,413	$0.11	2.1%	0.9%	0.6%	$0.25	$1,982
West	Arizona Public Service	260.1	43.4	$19.4	1,101,437	29,171	7,454	$2,773	$0.10	0.7%	0.9%	0.6%	$0.07	$447
	SWEPCO (TX)	5.5	1.6	$1.2	175,823	7,358	2,126	$458	$0.06	0.3%	0.1%	0.1%	$0.22	$767
	Xcel Energy (CO)	127.0	42.3	$15.5	1,328,927	28,042	7,004	$2,107	$0.08	0.7%	0.5%	0.6%	$0.12	$367

Figure A-2. Estimated Program Costs and Benchmarked Program Costs – C&I

C&I	AEP APCo WV						Best Practice				Others					
	2009	2010	2011	2012	2013	2009-2013 Total	Interstate P&L (IA)	Interstate P&L (MN)	MidAmerican (IA)	Xcel Energy (MN)	National Grid (MA)	NSTAR (MA)	Efficiency ME	Efficiency VT	Otter Tail	Xcel Energy (CO)
Total Program Costs per kWh																
Prescriptive	$0.11	$0.10	$0.09	$0.13	$0.15	$0.12	$0.13		$0.03	$0.10			$0.17	$0.22	$0.10	$0.06
Custom	$0.18	$0.17	$0.16	$0.16	$0.17	$0.17	$0.10	$0.13	$0.11	$0.08					$0.11	$0.18
New Construction	$0.13	$0.12		$0.14	$0.14	$0.14	$0.27		$0.14	$0.09	$0.48	$0.30	$0.70	$0.27	$0.05	$0.27
Demand Response																
Total	$0.20	$0.19	$0.19	$0.23	$0.24	$0.22	$0.13	$0.14	$0.10	$0.13	$0.30	$0.26	$0.19	$0.22		
Incentive Costs per kWh																
Prescriptive	$0.06	$0.06	$0.05	$0.08	$0.09	$0.07	$0.12		$0.03	$0.07			$0.08	$0.07	$0.05	NA
Custom	$0.09	$0.09	$0.08	$0.08	$0.09	$0.08	$0.07	$0.10	$0.08	$0.03					$0.09	NA
New Construction	$0.06	$0.06		$0.07	$0.07	$0.07	$0.24		$0.12	$0.05	NA	NA	$0.63	$0.10	$0.03	NA
Demand Response																
Total	$0.10	$0.11	$0.11	$0.14	$0.16	$0.13										
Administrative Costs per kWh																
Prescriptive	$0.04	$0.04	$0.04	$0.05	$0.05	$0.05	$0.02		$0.01	$0.03			$0.10	$0.16	$0.05	NA
Custom	$0.09	$0.08	$0.08	$0.08	$0.08	$0.08	$0.03	$0.04	$0.04	$0.05					$0.01	NA
New Construction	$0.07	$0.06		$0.07	$0.07	$0.07	$0.03		$0.02	$0.04	NA	NA	$0.08	$0.17	$0.01	NA
Demand Response																
Total	$0.10	$0.08	$0.07	$0.09	$0.09	$0.09										

Figure A-3. Estimated Program Costs and Benchmarked Program Costs – Residential

Residential	AEP APCo WV						Best Practice						Others				
Total Program Costs per kWh	2009	2010	2011	2012	2013	2009-2013 Total	Arizona Public Service	Efficiency ME	Efficiency VT	MN Power	National Grid (MA)	NSTAR (MA)	Interstate P&L (IA)	MidAmerican (IA)	Otter Tail	Interstate P&L (MN)	MN Power
Retrofit	$0.26	$0.23	$0.23	$0.22	$0.23	$0.23			$0.69		$0.85	$0.86		$0.10			
Products	$0.08	$0.07	$0.08	$0.11	$0.11	$0.09	$0.04	$0.06	$0.05	$0.11	$0.04	$0.08					
Recycling	$0.25	$0.23	$0.23	$0.23	$0.23	$0.23							$0.11				
Low Income	$0.45	$0.38	$0.36	$0.39	$0.42	$0.40	$1.78	$0.54		$0.24	$1.13	$1.39	$0.29	$0.31	$0.55	$1.69	$0.24
New Construction	$0.08	$0.08	$0.07	$0.10	$0.11	$0.10	$0.27		$0.81		$0.85	$1.42					
Winter-Demand Response																	
Total	$0.26	$0.21	$0.19	$0.23	$0.26	$0.23	$0.06	$0.10	$0.12	$0.17	$0.19	$0.22					
Incentive Costs per kWh																	
Retrofit	$0.12	$0.12	$0.11	$0.11	$0.12	$0.11			$0.27		NA	NA		$0.08			
Products	$0.04	$0.03	$0.04	$0.06	$0.06	$0.05	NA	$0.02	$0.03	$0.07	NA	NA					
Recycling	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04							$0.10				
Low Income	$0.21	$0.19	$0.18	$0.19	$0.21	$0.20	NA	$0.50		$0.18	NA	NA	$0.15	$0.24	$0.02	$1.36	$0.18
New Construction	$0.04	$0.04	$0.04	$0.05	$0.05	$0.05	NA		$0.21		NA	NA					
Winter-Demand Response																	
Total	$0.12	$0.10	$0.10	$0.12	$0.13	$0.11											
Administrative Costs per kWh																	
Retrofit	$0.14	$0.12	$0.11	$0.11	$0.12	$0.12			$0.42		NA	NA		$0.03			
Products	$0.04	$0.04	$0.04	$0.05	$0.05	$0.05	NA	$0.04	$0.03	$0.05	NA	NA					
Recycling	$0.21	$0.19	$0.19	$0.19	$0.19	$0.19							$0.005				
Low Income	$0.23	$0.19	$0.18	$0.19	$0.21	$0.20	NA	$0.04		$0.07	NA	NA	$0.14	$0.07	$0.53	$0.34	$0.07
New Construction	$0.04	$0.04	$0.04	$0.05	$0.05	$0.05	NA		$0.60		NA	NA					
Winter-Demand Response																	
Total	$0.14	$0.11	$0.10	$0.11	$0.12	$0.11											

Appendix B:
Best Practice C&I Programs

This section reviews best practices by program of the organizations that achieved significant C&I impacts.

The following tables show the distribution of DSM spending and energy savings for the C&I customer sector by program and end-use.

Table B-1. IOU & Agency Distribution of C&I Electricity DSM Spending by Program[1],[2]

C&I	Interstate P&L (IA)	Interstate P&L (MN)	MidAmerican (IA)	MN Power	Xcel Energy (MN)
Program/Measures					
Lighting	*	4%	20%		43%
Cooling/Heating/Roofing	*	*			8%
Refrigeration	*				
Motors	*				8%
Compressed Air					
Combination	14%	2%			1%
Custom Rebates	55%	85%	11%	79%	10%
Energy Audit			18%		
New Construction	15%		38%		18%
Agriculture	5%	10%			
Indirect Impact			<1%	5%	1%
C&I Interruptible Rates	1%		8%		2%
C&I Direct Load Control					5%
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

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

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

Table B-2. IOU & Agency Distribution of C&I Electricity DSM Energy Savings by Program

C&I	Interstate P&L (IA)	Interstate P&L (MN)	MidAmerican (IA)	MN Power	Xcel Energy (MN)
Program/Measures					
Lighting	10%	2%	56%		37%
Cooling/Heating/Roofing	1%	<1%			9%
Refrigeration	<1%				
Motors	2%				17%
Compressed Air					
Combination					
Custom Rebates	73%	88%	10%	100%	10%
Energy Audit			9%		
New Construction	7%		25%		26%
Agriculture	6%	10%			
C&I Interruptible Rates			1%		1%
C&I Direct Load Control					<1%
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%

B.1 C&I Custom Type Incentive Programs

Custom type incentive programs (custom programs) offer incentives for energy efficiency projects that are not covered by other programs or prescriptive incentives. A custom program may also include:

- A partially or fully subsidized energy audit or study,
- Low interest financing for the project, and
- Third party consultant or vendor sponsor.

The incentive is usually based on estimated installed savings. Projects may come from a program-sponsored audit/study, a trade ally, or from the customer.

Custom programs are key to a high impact C&I electricity DSM portfolio: every organization reviewed in this study with a C&I energy savings rate above the median and has a custom program responsible for at least 10% of the organization's total C&I energy savings.

The custom programs reviewed here are those of the top performers in C&I energy savings. Top performers in C&I energy savings are identified as those that achieved above median energy savings at or below median costs: Interstate P&L (IA), Interstate P&L (MN), MidAmerican (IA), MN Power, and Xcel Energy (MN).

Interstate P&L (IA) offered two custom programs, the traditional Custom Rebate program and the Performance Contracting program.

Custom Rebate, available to all nonresidential customers, offered incentives for energy/peak demand saving equipment that did not qualify for Interstate P&L (IA)'s Prescriptive Rebates program or its Nonresidential Commercial New Construction program. Projects required review and pre-approval. Interstate P&L (IA) promoted the program principally via account managers whose efforts were supported with seminars, workshops, and direct mailings to customers, vendors, and trade allies.

Through the Performance Contracting program, customers paid for energy efficiency projects with no up-front costs, but with guaranteed energy savings. Incentives, in the form of risk premiums, were offered to project developers/contractors to defray risks of marketing, proposal development, customer default, and energy savings and financing underperformance. The risk premium was based on actual savings as verified by an independent third party, kW Engineering. The program was promoted directly to project developers and was administered by Franklin Energy Services, which had been selected from a formal RFP process.

In 2007, Interstate P&L (IA) approved 210 projects for the Custom Rebate program and 34 projects for the Performance Contracting program. Together, the two projects provided 73% of Interstate P&L (IA)'s total C&I energy savings with just 55% of Interstate P&L (IA)'s total C&I

spending, the Custom Rebate program providing 64% of the total C&I savings at just 46% of the total C&I spending.

Interstate P&L (MN) principally targeted its custom program, Commercial Industrial and Agricultural Shared Savings, at customers with annual electric revenue greater than $50,000. The program provided a custom package of energy efficiency measures on the basis of the program's detailed energy audit and offered low-interest financing for the installation of the custom package. IPL (MN) promoted Shared Savings via personal contacts, account managers, website, direct mail, bill inserts, newsletters, and newspaper advertising.

IPL technical engineers worked with C&I customers to determine best-suited efficiency technologies and estimate potential savings. For small business customers, IPL (MN) contracted an energy engineering firm to deliver the program via subsidized energy audits. If the $75 (normally $400) audit identified potential efficiency improvements, then a Shared Savings project was offered. Submitted projects were required to pass a benefit/cost screening. After a project installation was complete, IPL (MN) retained an independent engineering consultant to review the project and estimate energy and peak demand savings, project costs, and any operating cost savings.

In 2007, Shared Savings provided 88% of Interstate P&L (MN)'s total C&I energy savings with just 15 C&I participants. This profile of C&I market and custom program impacts is unique to Interstate P&L (MN) of the organizations reviewed here.

MidAmerican (IA) offered two custom type incentive programs: 1) Nonresidential Custom Systems for new and existing buildings and manufacturing processes, and 2) Efficiency Bid for large industrial customers with peak demands of 3MW and greater.

Nonresidential Custom Systems offered custom incentives and/or low-interest financing on projects which were generally identified by customers but also by energy consultants and trade allies. MidAmerican (IA) promoted the program to its large customers through its in-house account managers/energy consultants and through local trade allies: engineering firms, mechanical contractors, electrical contractors, and control contractors. MidAmerican met individually with and offered training workshops to its trade allies and had its account managers/energy consultants personally deliver program material to large customers.

Efficiency Bid offered incentives through a competitive bidding process in which customers submitted customer-designed energy efficiency projects. MidAmerican (IA) encouraged a systems approach to efficiency and the use of energy use indices to quantify and control energy input per production unit.

MidAmerican (IA) in-house account managers/energy consultants personally promoted Efficiency Bid to eligible customers. Interested customers then worked with a MidAmerican (IA) product manager or a program contractor who would perform facility assessments as needed to identify potential projects. MidAmerican also contracted EnVinta to offer One-2-Five Energy diagnostics to potential program participants.

In 2007, MidAmerican (IA) approved six projects and completed ten projects from prior bid cycles for Efficiency Bid and completed 131 Nonresidential Custom projects (71 of which had been approved before 2007). The resulting 2007 total custom programs energy savings constituted 10% of MidAmerican (IA)'s C&I total electricity DSM energy savings, in line with the custom percentage of its total C&I spending, about 11%.

MN Power offered custom incentives through its PowerGrant Grants program to all commercial, industrial, and agricultural customers. Approved projects qualified for $200/kW incentive with a maximum annual grant based on the customer's demand (0 to 100 kW--$10,000, 101-300kW, $25,000, and over 300kW--$50,000). Projects included new technologies, improved manufacturing processes, renewable electric energy projects, and project design assistance. Customer contribution was required to meet or exceed the estimated annual electric savings, and customers could submit multiple grant proposals, but at most one would be approved in the year.

Each month, MN Power reviewed the proposals received in the month, ranked them by cost per kW or cost per kWh, and awarded the grants; customers had twelve months to complete the projects after the award.

In 2007, MN Power offered the Grants program as part of its PowerGrant program, which also included prescriptive incentives, and MN Power reported the expenditures and impacts of prescriptive incentives and custom projects in aggregate. However, it is estimated that the Grants constituted about a quarter of total PowerGrant activity.

Xcel Energy (MN), in 2007, offered its main custom program, Custom Efficiency, and launched two new custom programs to target C&I customer segments: Industrial Efficiency and Segment Efficiency.

Custom Efficiency offered rebates for pre-approved efficiency projects of $200 per kW saved, up to 50% of incremental costs. Xcel Energy also provided engineering assistance and funding for engineering studies, up to 50% of the study cost, with a maximum of $15,000 per study. Account managers promoted the program and provided assistance in the application process. Applications were required to: 1) be submitted before equipment purchase and installation, 2) be reviewed by a professional engineer with an emphasis on deemed savings and interactive energy effects of the system, 3) pass the Societal and Participant Tests, and 4) have a payback between one and 15 years. Pre-approved and installed projects that failed the payback period requirement (and, thus, earned no rebate), but would have passed review otherwise, may have qualified as "Influenced Savings" which Xcel Energy could claim in its 2007 conservation results (other requirements applied[3]).

Industrial Efficiency consisted of two components: Process Efficiency and Efficiency Proposal. Process Efficiency targeted systematic solutions for manufacturing processes and included an evaluation, identification of best opportunities, development of long term energy management plan, and incentives and bonus dollars for efficiencies exceeding 2GWh. Efficiency Proposal offered up to $300 per kW saved for bids of custom-type measures with savings of at least 1GWh.

[3] The following requirements applied to Influenced Savings: pre-approval prior to purchase and installation; passing the Participant and Societal Tests, separate review by the Department of Commerce for projects of 2GWh and greater; savings claims capped at 4% of Xcel Energy's annual CIP achievements; and documentation demonstrating that Xcel Energy's involvement was important in effecting the project.

Segment Efficiency targeted office buildings by combining technical and financial studies with existing incentive offerings into a segment-specific incentive package. This package, for businesses of at least 50,000 square feet, included: 1) a 50% incentive for a $3,500 study of the building's energy consumption, conservation opportunities, projected savings, costs, and incentives for each efficiency measure; 2) a 50% incentive, up to $20,000, of NOIBuilder analysis and detailed engineering calculations for measures; and 3) bonus incentives up to 30% for all measures identified as having less than a three-year payback.

In 2007, Xcel Energy (MN)'s custom program offerings achieved 10% of the utility's total C&I energy savings at 10% of total C&I electricity DSM costs. Almost all of the savings of the three programs were achieved by Custom Efficiency. Industrial Efficiency and Segment Efficiency were launched in 2007, which explains their composing half of all custom costs but little impacts (custom projects often take more than a year to complete, thus savings for 2007 efforts may not be realized until 2008 and 2009).

For these four IOUs, energy savings achieved by custom programs as a percentage of total C&I energy savings ranged from 10% to 100% with the median at about 42%. Similarly, costs of custom programs, as a percentage of total C&I electricity DSM costs, also ranged widely from 10% to 85% with the median at about 33%. For most of these organizations, about 70% of custom program costs were for incentives.

Clearly, as in Interstate P&L (MN)'s case, large industrial customers present the greatest potential for savings at low program costs. Interstate P&L (IA) and MidAmerican (IA), which have mature custom programs and mature DSM markets, achieved significant energy savings at low costs.

Table B-3. IOU & Agency Spending Distribution and $/kWh per Cost Component for Custom Programs

C&I Custom Rebates Utility/Agency	Program Name		Incentives Costs as % of Total	Incentives $/kWh	Admin & Other Costs as % of Total	Admin & Other $/kWh	Program Total $/kWh
Interstate P&L (IA)	Custom Rebates		77%	$0.07	23%	$0.02	$0.09
Interstate P&L (IA)	Performance Contracting		49%	$0.07	51%	$0.07	$0.14
		Total	**72%**	**$0.07**	**28%**	**$0.03**	**$0.10**
Interstate P&L (MN)	C/I Shared Savings Project		**73%**	**$0.10**	**27%**	**$0.04**	**$0.13**
MidAmerican (IA)	Efficiency Bid		61%	$0.09	39%	$0.06	$0.15
MidAmerican (IA)	Nonresidential Custom Program		71%	$0.07	29%	$0.03	$0.10
		Total	**68%**	**$0.08**	**32%**	**$0.04**	**$0.11**
MN Power	PowerGrant		**70%**	**$0.07**	**30%**	**$0.02**	**$0.05**
Xcel Energy (MN)	Industrial Efficiency		4%	$0.05	96%	$1.25	$1.29
Xcel Energy (MN)	Segment Efficiency		15%	$0.36	85%	$2.00	$2.36
Xcel Energy (MN)	Custom Efficiency		40%	$0.03	60%	$0.05	$0.08
		Total	**28%**	**$0.04**	**72%**	**$0.10**	**$0.13**

Table B-4. IOU & Agency Custom Program Costs and Energy Savings as a % of Total C&I Electricity DSM

C&I Custom Rebates Utility/Agency	Program Name		Program's Costs ($M)	% of Total C&I DSM Spending	Program's Energy Savings	% of Total C&I Energy
Interstate P&L (IA)	Custom Rebates		$5.2	46%	54.9	64%
Interstate P&L (IA)	Performance Contracting		$1.1	10%	8.1	9%
		Total	**$6.3**	**55%**	**62.9**	**73%**
Interstate P&L (MN)	C/I Shared Savings Project		**$1.9**	**85%**	**14.2**	**88%**
MidAmerican (IA)	Efficiency Bid		$0.4	3%	2.9	2%
MidAmerican (IA)	Nonresidential Custom Program		$1.0	8%	10.1	8%
		Total	**$1.5**	**11%**	**12.9**	**10%**
MN Power	PowerGrant		**$1.7**	**79%**	**34.7**	**100%**
Xcel Energy (MN)	Industrial Efficiency		$0.8	2%	0.6	0%
Xcel Energy (MN)	Segment Efficiency		$0.5	2%	0.2	0%
Xcel Energy (MN)	Custom Efficiency		$2.0	6%	24.3	10%
		Total	**$3.3**	**10%**	**25.2**	**10%**

B.2 C&I Prescriptive Incentive Programs

Prescriptive incentive programs offer pre-determined incentives for specific types of high-efficiency equipment. Typical prescriptive incentive programs offer incentives for high efficiency lighting, HVAC equipment, motors, and variable speed drives. Incentives are measure-specific and usually increase with equipment efficiency.

Prescriptive incentive programs are key to a high impact C&I electricity DSM portfolio: every organization reviewed in this study with a C&I energy savings rate above the median has prescriptive incentive programs that are responsible for at least 14% of the organization's total C&I energy savings (except Interstate P&L (MN), which has a unique profile of C&I market and custom program impacts). Costs for prescriptive programs range from 14% to 27% of total C&I electricity DSM costs.

The prescriptive incentive programs reviewed here are those of the top performers in C&I energy savings that achieved significant savings by prescriptive incentive programs: Interstate P&L (IA), MidAmerican (IA), MN Power, and Xcel Energy (MN).

Interstate P&L (IA) offered cash rebates for high efficiency equipment for a variety of end-uses through its Nonresidential Prescriptive Rebates program. The program offered cash incentives to customers and sales and installation incentives to dealers and builders for a variety of energy efficiency measures, including heating, cooling, lighting, replacement windows, water heaters, occupancy sensors, and programmable thermostats. Interstate P&L (IA) promoted the program to residential customers via its website, direct mail, bill inserts, newsletters, and trainings.

In 2007, energy savings of Prescriptive Rebates accounted for 14% of Interstate P&L (IA)'s total C&I energy savings at about 14% of Interstate P&L (IA)'s total C&I electricity DSM costs at $0.13/kWh. Incentives composed 87% of costs for the prescriptive rebate program.

MidAmerican (IA)'s Nonresidential Equipment program offered incentives for lighting, HVAC, motor, and variable-speed drive measures, focusing on replacement and first-time purchase markets for all measures and primarily the retrofit market for lighting. Participation was driven by dealers in the up-sell of energy efficient equipment to customers. Thus, MidAmerican focused on supporting relationships with trade allies by providing new program brochures, contacting and meeting with trade allies directly, and promoting the program at trade shows and conferences. MidAmerican also recognized those trade allies that achieved the highest energy savings through the Nonresidential Equipment program with awards at eight trade ally meetings. MidAmerican continued program development by reviewing and researching equipment, qualifying levels, incentive structures, and incentive levels of other organizations.

Most of the 2007 program activity and impacts were from lighting measures, which accounted for over 26% of the program's total energy savings and 34% of the program's total incentives. Variable speed drives accounted for 67% of the program's total energy savings at only 32% of the program's total incentives.

In 2007, Nonresidential Equipment achieved 56% of MidAmerican's C&I energy savings at only 20% of MidAmerican's C&I electricity DSM costs. As with Interstate P&L (IA), the administrative costs for the Nonresidential Equipment program were low, about $0.01/kWh, and 83% of this program's costs were for incentives. Overall, MidAmerican's costs per kWh for this prescriptive incentive program are the lowest of the organizations reviewed here, about $0.03/kWh.

MN Power offered prescriptive incentives through its PowerGrant Rebates program to all commercial, industrial, and agricultural customers who were not using a large power rate. Incentives were based on kW or kWh saved over measure life (for measures having minimum life of ten years) up to a maximum annual grant based on the customer's demand (0 to 100 kW--$10,000, 101-300kW, $25,000, and over 300kW--$50,000). Projects included lighting, motors/pumps, air conditioning, and refrigeration. Customer contribution was required to meet or exceed the estimated annual electric savings, and customers could submit multiple incentive requests.

MN Power reviewed incentive requests within seven working days, and awarded incentives after inspecting approved projects that were installed within twelve months after approval.

In 2007, MN Power offered the Rebates program as part of its PowerGrant program, which also included incentives for custom projects, and MN Power reported the expenditures and impacts of prescriptive incentives and custom projects in aggregate. However, it is estimated that the Rebates constituted about a quarter of total PowerGrant activity.

Xcel Energy (MN) offered several channel-specific prescriptive incentive programs: Lighting Efficiency, Cooling Efficiency, and Motor Efficiency; eligibility criteria and incentive structure and level were specified for each measure.

Xcel Energy (MN)'s Lighting Efficiency program offered incentives for high-efficiency lighting measures for new construction and greater incentives for retrofits in existing buildings. The program also included a lighting redesign study to determine proper light levels in commonly over-lit spaces. While the program had one of the largest impacts in Xcel Energy (MN)'s C&I electricity DSM portfolio, continued market saturation and increasing baseline efficiency standards have reduced the impact in recent years. This trend was reversed in 2007 with bonus incentive promotions that included additional 40% incentive on most lighting measures and 50% bonus incentive for low-wattage T8 installations; bonus incentives were limited to 75% of project costs. Xcel Energy (MN) also offered a bonus incentive up to 75% (at most $15,000) for Lighting Redesign Studies. Additional lighting measures were added to the prescriptive incentive schedule on the basis of their high frequency in custom efficiency applications: ceramic metal halides and 6-lamp T5 high bay fixtures. In 2007, Xcel Energy (MN) began counting all savings effected by lighting measures implemented as a result of a Lighting Redesign Study; these savings were now counted as program impacts (as "study-driven credit"), even if the measures did not merit a incentive.

In 2007, Lighting Efficiency achieved 22% of Xcel Energy (MN)'s total C&I energy savings at about 16% of total C&I electricity DSM costs, being one of Xcel Energy (MN)'s least expensive prescriptive incentive programs.

The Cooling Efficiency program offered incentives for a variety of cooling equipment: PTAC units, water source heat pumps, rooftop units, rooftop economizers, hotel room controllers, split systems, condensing units, air cooled chillers, oversized cooling towers, and centrifugal chillers. Incentives were structured to increasingly reward higher efficiencies: in addition to the base incentive, a specified dollar amount per ton, there was an incremental incentive based on a dollar per ton per 0.1 EER above the base efficiency level. The program also included funding for cooling system replacement Engineering Assistance Studies, up to 50% of study cost with a maximum benefit at $15,000. Xcel Energy (MN) promoted the program primarily through trade allies, supporting them with seminars, site visits, and special promotions. Xcel Energy (MN) also developed and distributed a cooling guidebook for its business customers. In 2007, the program achieved 4% of Xcel Energy (MN)'s total C&I energy savings at about 6% of total C&I electricity DSM costs.

Xcel Energy (MN)'s Motor Efficiency program offered incentives for NEMA Premium efficiency motors and variable frequency drives from 1 hp to 200 hp according to the following structure: for a new application (a new installation or burnout) for a qualifying NEMA Premium motor--$4/hp, to upgrade an existing operating motor to a NEMA Premium motor--$16.50/hp, for a variable frequency drive--$30/hp. As with the Cooling Efficiency program, Xcel Energy (MN) relied on key trade allies to promote the program. In 2007, the program achieved about 10% of Xcel Energy (MN)'s total C&I energy savings at about 5% of total C&I electricity DSM costs.

Combined, Xcel Energy (MN)'s prescriptive incentive programs achieved about 36% of its total C&I energy savings at about 27% of its total C&I electricity DSM costs, the bulk of those savings earned from lighting and motors.

For these four IOUs, prescriptive incentive programs achieved 14-56% of a utility's total C&I energy savings at 14-27% of the utility's total C&I electricity DSM costs. Incentives composed 75-87% of total prescriptive incentive programs costs.

In recent years, increased market saturation of energy efficient measures and higher efficiency baseline standards that obviate incentives have reduced impacts of prescriptive incentive programs. However, counting all effected energy savings ("study-driven credit") and leveraging efficient administration while expanding incentive offerings, Xcel Energy (MN) was able to exceed savings goals at low costs.

Table B-5. IOU & Agency Spending Distribution and $/kWh per Cost Component for Prescriptive Incentive Programs

C&I Lighting Cooling/Heating/Roof Motors Utility/Agency	Program Name	Incentives Costs as % of Total	Incentives $/kWh	Admin & Other Costs as % of Total	Admin & Other $/kWh	Program Total $/kWh
Interstate P&L (IA)	Prescriptive Rebates	**87%**	**$0.12**	**13%**	**$0.02**	**$0.13**
MidAmerican (IA)	Nonresidential Equipment Program	**83%**	**$0.03**	**17%**	**$0.01**	**$0.03**
Xcel Energy (MN)	Lighting Efficiency	79%	$0.08	21%	$0.02	$0.10
Xcel Energy (MN)	Cooling Efficiency	74%	$0.14	26%	$0.05	$0.19
Xcel Energy (MN)	Motor Efficiency	61%	$0.04	39%	$0.03	$0.07
	Total	**75%**	**$0.07**	**25%**	**$0.03**	**$0.10**

Table B-6. IOU & Agency Prescriptive Incentive Program Costs and Energy Savings as a % of Total C&I Electricity DSM

C&I Lighting Cooling/Heating/Roof Motors Utility/Agency	Program Name	Program's Costs ($M)	% of Total C&I DSM Spending	Program's Energy Savings (GWh)	% of Total C&I Energy Savings
Interstate P&L (IA)	Prescriptive Rebates	**$1.6**	**14%**	**11.7**	**14%**
MidAmerican (IA)	Nonresidential Equipment Program	**$2.6**	**20%**	**74.3**	**56%**
Xcel Energy (MN)	Lighting Efficiency	$5.3	16%	53.1	22%
Xcel Energy (MN)	Cooling Efficiency	$1.9	6%	10.2	4%
Xcel Energy (MN)	Motor Efficiency	$1.6	5%	24.0	10%
	Total	**$8.7**	**27%**	**87.3**	**36%**

B.3 C&I New Construction Programs

New construction programs offer incentives for energy efficient new construction, renovation, and room addition projects. The program typically includes:

- Professional energy efficiency design assistance, and
- Incentives for installed measures that increase with savings beyond minimum code.

Eligibility for incentives is usually based on a minimum percentage of energy savings beyond that required by state building energy code.

New construction programs are key to a high impact C&I electricity DSM portfolio: every organization reviewed in this study with a C&I energy savings rate above the median has a new construction program responsible for at least 7% of the organization's total C&I energy savings (except Interstate P&L (MN), which has a unique C&I market and custom program impacts profile). New construction programs are also key because they ensure that the most cost-effective energy efficiencies in a new building are: 1) implemented when it is most cost-effective to do so—before the building is built, and 2) realized from its first day of operation.

The new construction programs reviewed here are of the top performers in C&I energy savings that achieved significant savings by new construction programs: MidAmerican (IA) and Xcel Energy (MN).

MidAmerican (IA)'s Commercial New Construction program offered energy efficient design assistance through a third party contractor, The Weidt Group, to design teams and offer construction incentives ranging from \$0.05 to \$0.14 per kWh to the building owner for achieving cost effective energy savings beyond that required by current state building energy code. MidAmerican promoted the program through architectural, engineering, and building contractor firms, trade ally meetings and events, and MidAmerican awarded firms for high efficiency design projects. Account managers personally delivered materials to customers and attended project design assistance meetings. In addition to providing energy design assistance, The Weidt Group also provided project management and project completion verification. Despite the new program criteria based on the new, more stringent State of Iowa Energy Code, participation was the same as in 2006.

In 2007, the Commercial New Construction program achieved about 25% of MidAmerican's total C&I energy savings at about 38% of total C&I electricity DSM costs, and about 84% of program costs were for incentives.

Xcel Energy (MN)'s Energy Design Assistance provided professional energy consulting and incentives ranging from \$170 to \$275 per peak kW saved on installed measures. Design assistance was offered in two tiers by market: Custom Consulting and Plan Review.

Custom Consulting targeted buildings larger than 50,000 square feet that were early in the design stage. The program provided the design team with a selection of energy efficient design solutions as indicated by hourly, whole-building, energy use simulations on the basis of building-specific data. Building design professionals were compensated for their time spent in meetings and additional design review.

Plan Review targeted buildings of 15,000 – 50,000 square feet that were in early to mid stages of design, and Plan Review provided streamlined reviews of preliminary designs with recommendations for efficient upgrades within two weeks to better fit the small commercial new construction market's needs. Verification of installation was a requirement for incentives and ensured proper installation and operation.

In 2007, Energy Design Assistance achieved 26% of Xcel Energy (MN)'s total C&I energy savings at about 18% of total C&I electricity DSM costs, and incentives were only 56% of total program costs.

For all organizations, over recent years, rising state building energy codes and equipment standards have reduced potential savings each year and required new incentive rates and structures and the inclusion of new technologies in the programs.

Table B-7. IOU & Agency Spending Distribution and $/kWh per Cost Component for New Construction Programs

C&I New Construction Utility/Agency	Program Name	Incentives Costs as % of Total	Incentives $/kWh	Admin & Other Costs as % of Total	Admin & Other $/kWh	Program Total $/kWh
Interstate P&L (IA)	New Construction	89%	$0.24	11%	$0.03	$0.27
MidAmerican (IA)	Commercial New Construction	84%	$0.12	16%	$0.02	$0.14
Xcel Energy (MN)	Energy Design Assistance	56%	$0.05	44%	$0.04	$0.09

Table B-8. IOU & Agency New Construction Program Costs and Energy Savings as a % of Total C&I Electricity DSM

C&I New Construction Utility/Agency	Program Name	Program's Costs ($M)	% of Total C&I DSM Spending	Program's Energy Savings	% of Total C&I Energy
Interstate P&L (IA)	New Construction	$1.7	15%	6.2	7%
MidAmerican (IA)	Commercial New Construction	$4.9	38%	33.9	25%
Xcel Energy (MN)	Energy Design Assistance	$6.0	18%	64.2	26%

B.4 C&I Peak Demand Response Programs

Demand response (DR) programs offer incentives for reducing peak demand. Demand response programs may include:

- Interruptible rate– reduced rates for customers who agree to curtail load on peak demand upon request, and
- Direct load control– incentives for customers who allow the utility to directly control equipment (such as central air conditioners) during periods of peak demand.

Eligibility for interruptible rate programs is usually based on a minimum kW load that the customer is able to shed on peak demand.

Demand response programs can provide significant reductions in peak demand at very low costs per kW. Best practice C&I DR programs that demonstrate this are those of Xcel Energy (MN) and Interstate P&L (IA).

Interstate P&L (IA) offered its Interruptible Program to large commercial and industrial customers who agreed to curtail a contractual firm load amount (200kW minimum) within a specified response time. Participants earned bill credits in return for reducing load and were subject to financial penalties if they failed to meet their contractual demand level. In 2007, IPL (IA) called 12 curtailment events.

In 2007, Interstate P&L (IA)'s Interruptible Program achieved 17% of the utility's total C&I peak demand savings at about 1% of the utility's total C&I DSM costs, only $33/kW.

Xcel Energy (MN) offered two demand response programs to its small business, commercial, and industrial customers: 1) Electric Rate Saving (ERS, also marketed as Peak Controlled Rates and Energy Controlled Rates), an interruptible rate program, and 2) Saver's Switch (SS), a direct load control program.

ERS offered monthly discounts up to 60% of peak demand charges to customers who agreed to reduce a minimum of 50kW on short notice and to pay penalties for non-compliance. Since 1997, ERS has controlled 24-41 hours per year, about seven to eight events per year.

ERS included several interruptible rates and riders, such as the Peak Controlled Tiered Service rate, initiated in November of 2007. Peak Controlled Tiered customers having a 15 minute measured demand equal to or greater than 1,000 kW for at least four of the last 12 consecutive months were placed on the Peak Controlled Tiered Time of Day Service and remained on this rate schedule until their demand fell below 1,000kW for 12 consecutive months.

Saver's Switch gave monthly discounts to customers who allowed Xcel Energy to directly control their rooftop AC units, by way of 900 MHz paging, during periods of peak demand; discounts were applied during months with curtailments.

For both programs, participants agreed to curtailments at any time of year, although they typically occurred during summer months; other terms applied. Customers could participate in one of the two DR programs; small and medium businesses typically chose SS while large businesses chose ERS. Xcel Energy (MN) promoted its demand response programs directly through account managers.

In 2007, Electric Rate Saving and Saver's Switch achieved over 30% of Xcel Energy (MN)'s total C&I peak demand savings at about $130/kW ($34/kW for ERS and $239/kW for SS), only 7% of Xcel Energy (MN)'s total C&I DSM costs.

APPENDIX C:
BEST PRACTICE RESIDENTIAL PROGRAMS

This section reviews best practices by program of IOUs and agencies that achieved significant residential impacts.

The tables below show the distribution of DSM spending and energy savings for the residential customer sector by program and end-use.

Table C-1. IOU & Agency Distribution of Residential Electricity DSM Costs by Program [4, 5, 6]

Residential	Arizona Public Service	Efficiency ME	Efficiency VT	MN Power	National Grid (MA)	NSTAR (MA)
Program/Measures						
Lighting	41%	58%	*	*	13%	17%
Cooling/Heating/Roofing	20%		*	*	3%	7%
Building Envelope						
Refrigerator/Freezer Removal						
ES Appliances			*	*	5%	6%
Water Heating			*			
Energy Audit					34%	28%
Combination			39%*	55%*		
Low Income	14%	42%		22%	30%	23%
New Construction	16%		39%		5%	7%
Indirect Impact				7%	11%	11%
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

[4] 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).

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

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

Table C-2. IOU & Agency Distribution of Residential Electricity DSM Energy Savings by Program

Residential	Arizona Public Service	Efficiency ME	Efficiency VT	MN Power	National Grid (MA)	NSTAR (MA)
Program/Measures						
Lighting	89%	92%	91%	44%	86%	87%
Cooling/Heating/Roofing	7%		1%	8%	<1%	1%
Building Envelope						
Refrigerator/Freezer Removal						
ES Appliances			3%	5%	<1%	<1%
Water Heating			<1%			
Energy Audit					7%	7%
Combination			<1%	28%		
Low Income	<1%	8%		16%	5%	4%
New Construction	4%		6%		1%	1%
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 Resider	1.30%	1.10%	2.61%	0.90%	1.75%	1.17%

C.1 Residential Prescriptive Incentive Programs

Prescriptive incentive programs offer pre-determined incentives for specific types of high-efficiency equipment. Typical prescriptive incentive programs offer incentives for high efficiency lighting, heating and cooling systems, and appliances. Incentives may be in the form of point of sale coupon, mail-in incentive, or retailer/distributor buy down. In the residential sector, prescriptive incentive programs may be administered and reported by specific channel (e.g., lighting or appliances) or many channels may be bundled into one program.

Prescriptive incentive programs form the basis of any residential electricity DSM portfolio and account for most (85-90%) of the energy savings for residential electricity DSM portfolios of top performing organizations reviewed in this study. Costs for prescriptive incentive programs are relatively low and range from 20-60% of total residential electricity DSM costs.

The prescriptive incentive programs reviewed here are those of top performers in residential energy savings that achieved above median energy savings rates at or below median costs with prescriptive incentive programs: Efficiency ME, Efficiency VT, MN Power, National Grid, and NSTAR.

Efficiency ME offered prescriptive incentives for lighting through its Residential Lighting program. Residential Lighting offered incentives for qualifying CFLs ($1.50 each) and energy efficient light fixtures via instant in-store coupons. Efficiency ME recruited independent retailers and large retail chains to participate, supporting them with training on use and benefits of efficient lighting and with point-of purchase materials, including coupons, stickers, and banners. Efficiency ME also worked with electrical wholesalers to encourage contractors to install CFLs. Under direction of Maine's legislature, Efficiency ME and Maine's Department of Environmental Protection developed an in-store CFL recycling program and recruited retail partners to participate.

In 2007, energy savings of Residential Lighting accounted for 92% of Efficiency ME's total residential energy savings at about 58% of Efficiency ME's total residential DSM costs; costs for the program, at $0.06/kWh, are very low. Incentives composed only 33% of total costs for the program; this is a considerably smaller percentage than typical and may be explained by its recent decrease in incentive for CFLs.

Efficiency VT offered prescriptive incentive programs through its Efficient Products program. Efficient Products offered incentives for Energy Star lighting, appliances, and dehumidifiers.

Incentives for lighting products were delivered via instant coupons and retailer and manufacturer buy-downs/markdowns, i.e., negotiated cooperative promotions (NCPs). Efficiency VT entered into 18 NCPs with independent retailers and large retail chains wherein the retailer agreed to sell a set number of CFLs over a set period at a set price (equivalent to the price after an instant coupon). Efficiency VT reported that NCPs offered many benefits over instant coupons: 1) for Efficiency VT, lower administrative costs and ability to specify bulb and ensure variety of bulb types; 2) for manufacturer and retailer, support for a fixed volume of bulbs and simpler process than coupon-implementation; and 3) for customer, increased product availability and no form to fill out. Consequently, CFL program participation increased 140% over 2006, and NCPs accounted for 74% of CFL program sales. Over 90% of energy savings for the Efficient Products program was earned by lighting.

Efficiency VT also offered incentives for Energy Star appliances and dehumidifiers and, in a pilot program with the US EPA, offered increased incentives for Energy Star refrigerators and room air conditioners of a higher tier of efficiency, "Save More with Energy Star"; appliances with the higher efficiency were identified with a "Save More" label.

Efficiency VT also offered prescriptive incentives to market-rate multifamily owners for qualifying equipment upon proof of purchase. However, expenditures and impacts for this program were reported elsewhere under Efficiency VT's Existing Homes program, described in the following section of energy audit and retrofit programs.

In 2007, energy savings of Efficient Products accounted for 91% of Efficiency VT's total residential energy savings at about 39% of Efficiency VT's total residential DSM costs; costs for the program, at $0.05/kWh, are very low. Incentives composed only about 50% of total costs for Efficient Products.

MN Power offered prescriptive incentives bundled within its Triple E Plus program. Triple E Plus was MN Power's brand for a comprehensive program, which included prescriptive incentives for efficient HVAC systems, geothermal heat pumps, ES lighting, ES appliances, and new construction projects. MN Power promoted the Energy Star products program with training and incentives for retailers, education and incentives for customers, and by leveraging regional and national energy efficiency promotions. The HVAC program offered mail-in incentives for customers through HVAC contractors. Thus, MN Power worked closely with HVAC distributors and contractors and trained them on energy efficient technologies and on the incentive program; MN Power also offered seasonal promotions.

In 2007, Triple E Plus achieved 84% of MN Power's total residential energy savings at about 55% of the utility's total residential electricity DSM costs; at $0.11/kWh, Triple E Plus' cost of energy savings is very reasonable. Incentives composed about 60% of program costs.

National Grid and NSTAR offered prescriptive incentives through their joint Energy Star (ES) Appliances, ES Lighting, and COOL SMART programs.

The ES Appliances and ES Lighting programs offered incentives to customers purchasing ES lighting products, clothes washers, and room air conditioners. Both programs were administered and promoted by Massachusetts' Program Administrators (PA), which included, in addition to NSTAR and National Grid, Fitchburg Gas and Electric, Western Massachusetts Electric, and the Cape Light Compact. PA promoted ES Lighting through mail order and website catalogs and through buy-downs. PA promoted both ES programs by leveraging manufacturer, retailer, and national ES promotional campaigns.

COOL SMART, administered jointly in 2007 by NSTAR and National Grid, offered incentives to customers, certified technicians, and contractors for ES central air conditioning units: 1) customers were offered mail-in incentives for purchasing qualifying equipment (ASHP minimum SEER 14.0, EER 11.5, and HSPF 8.2), 2) North American Technical Excellence-certified technicians were offered reimbursements for installing qualifying equipment, and 3) contractors were offered $175 incentives for performing Quality Installation Verifications on new installations of air conditioners and heat pumps. COOL SMART coordinated with NSTAR's new construction and MassSave/Residential Conservation Services program and with other utilities' COOL SMART programs.

In 2007, for both National Grid and NSTAR, prescriptive incentive programs achieved energy savings that accounted for about 87% of each utility's total residential energy savings at a smaller percentage of the utility's total residential electricity DSM costs, for National Grid—20%, for NSTAR—31%. While the lighting program accounted for almost all of each utility's prescriptive incentives program energy savings, lighting composed only about 60% of each utility's prescriptive incentives program costs. At costs around $0.03/kWh for both utilities, lighting achieved significant savings at very low costs. Cost component detail was not available for National Grid or NSTAR.

Table C-3. IOU & Agency Costs Distribution and $/kWh per Cost Component for Prescriptive Incentive Programs

Residential Prescriptive Rebates Utility/Agency	Program Name	Incentives Costs as % of Total	Incentives $/kWh	Admin & Other Costs as % of Total	Admin & Other $/kWh	Program Total $/kWh
Efficiency ME	Energy Star Lighting	**33%**	**$0.02**	**67%**	**$0.04**	**$0.06**
Efficiency VT	Efficient Products	**49%**	**$0.03**	**51%**	**$0.03**	**$0.05**
MN Power	Triple E Plus	**58%**	**$0.07**	**42%**	**$0.05**	**$0.11**
National Grid (MA)	Residential HVAC	NA	NA	NA	NA	$1.48
National Grid (MA)	Residential Lighting	NA	NA	NA	NA	$0.03
National Grid (MA)	Residential Appliances	NA	NA	NA	NA	$4.08
	National Grid (MA) Total	**NA**	**NA**	**NA**	**NA**	**$0.04**
NSTAR (MA)	Residential HVAC	NA	NA	NA	NA	$2.47
NSTAR (MA)	Residential Lighting	NA	NA	NA	NA	$0.04
NSTAR (MA)	Residential Appliances	NA	NA	NA	NA	$3.27
	NSTAR (MA) Total	***NA***	***NA***	***NA***	***NA***	***$0.08***

Table C-4. IOU & Agency Prescriptive Incentive Program Costs and Energy Savings as a % of Total Residential Electricity DSM

Residential Prescriptive Rebates Utility/Agency	Program Name	Program's Costs ($M)	% of Total Res DSM Costs	Program's Energy Savings	% of Total Res Energy
Efficiency ME	Energy Star Lighting	**$2.9**	**58%**	**44.7**	**92%**
Efficiency VT	Efficient Products	**$2.6**	**39%**	**49.5**	**91%**
MN Power	Triple E Plus	**$0.9**	**55%**	**8.0**	**84%**
National Grid (MA)	Residential HVAC	$0.8	3%	0.6	<1%
National Grid (MA)	Residential Lighting	$3.6	13%	130.4	86%
National Grid (MA)	Residential Appliances	$1.4	5%	0.3	<1%
	National Grid (MA) Total	**$5.8**	**20%**	**131.3**	**86%**
NSTAR (MA)	Residential HVAC	$1.3	7%	0.5	1%
NSTAR (MA)	Residential Lighting	$3.0	17%	67.3	87%
NSTAR (MA)	Residential Appliances	$1.1	6%	0.3	<1%
	NSTAR (MA) Total	**$5.4**	**31%**	**68.2**	**87%**

C.2 Residential Energy Audit and Retrofit Programs

Residential energy audit and retrofit programs typically provide an on-site energy audit and incentives for retrofit measures for existing housing. The program typically includes:

- Free direct installation of low-cost measures, and
- Incentives in the form of rebates or low interest financing for retrofit measures.

Residential audit and retrofit programs can provide significant savings, but only three of the organizations with top performing residential portfolios reviewed here had audit and retrofit programs with impacts.

Efficiency VT's Existing Homes program included a variety of retrofit efforts to market-rate households and multi-family housing.

Efficiency VT promoted energy audits with direct install (principally CFLs) and whole house retrofits by offering training and marketing to private Home Performance with Energy Star contractors. Training support included free advanced training sessions to certified contractors; mentoring to achieve certifications of Building Analyst, Envelope Specialist, and Heat Specialist; and quality assurance processes. Marketing support included statewide radio and print ads for Home Performance with Energy Star.

Efficiency VT also provided technical support and incentives for energy efficient measures to customers with high electric bill who called Efficiency VT for assistance.

Existing Homes included programs for low-income customers, single family and multifamily; however, the expenditures and impacts for low-income and market-rate activity are reported in aggregate.

In 2007, energy savings of Existing Homes accounted for 3% of Efficiency VT's total residential energy savings at about 16% of Efficiency VT's total residential electricity DSM costs. Incentives for Existing Homes composed only 40% of total costs for the program.

National Grid and NSTAR offered an audit/retrofit program to any residential customer, Residential Conservation Services (RCS)/MassSAVE, and each utility offered its own audit/retrofit program to multifamily customers.

RCS/Mass SAVE, a state mandated, fuel-blind program under the oversight of the MA Department of Energy Resources, was implemented by each utility for their respective customers. The program offered two tiers of services. Tier One offered low cost education and tools for energy efficiency, including technical information, self-audit tools, online resources, and phone support. Tier One participants were screened to determine need for Tier Two services. Tier Two offered a Home Energy Assessment (HEA), which included: 1) an audit of HVAC, water heating, building envelope, appliances, lighting, and refrigeration; 2) recommendations of energy efficiency measures; and 3) incentives to implement them, including financing. Customers who had an HEA and installed qualified recommended measures were eligible to apply for the statewide HEAT Loan Program. This provided qualifying customers with no-interest or low-interest loans (up to 3%) for the installation of eligible energy efficient improvements. Loans up to $15,000 with terms up to seven years were available.

National Grid offered its multifamily retrofit program, EnergyWise, to all customers with electric heat and to customers with non-electric heat who had high electricity consumption.

EnergyWise offered the installation of lighting measures primarily and other measures as deemed appropriate: customers with electric water heaters received hot water measures, and customers with electric space heat received insulation, thermostats, and air sealing. EnergyWise also replaced, with a co-payment according to size, refrigerators and freezers that exceeded a minimum usage level when monitored during the audit.

NSTAR's multifamily retrofit program, Residential Multi Family Assessment, offered non-low income customers an energy assessment and education and recommendation of energy efficiency measures. The Residential Multi-Family Assessment also offered free direct installation of low cost measures and incentives to install major measures.

In 2007, for both National Grid and NSTAR, the energy savings of each utility's two energy audit/retrofit programs accounted for about 7% of each utility's total residential energy savings at $0.85/kWh, about 30% of each utility's total residential electricity DSM costs. Cost component detail was not available for National Grid or NSTAR.

Table C-5. Costs Distribution and $/kWh per Cost Component for Energy Audit and Retrofit Programs[7]

Residential Audit and Retrofit Utility/Agency	Program Name	Incentives Costs as % of Total	Incentives $/kWh	Admin & Other Costs as % of Total	Admin & Other $/kWh	Program Total $/kWh
Efficiency VT	Existing Homes	**40%**	**$0.27**	**60%**	**$0.42**	**$0.69**
National Grid (MA)	Residential Retrofit 1-4	NA	NA	NA	NA	$1.03
National Grid (MA)	Residential Retrofit Multifamily	NA	NA	NA	NA	$0.72
	National Grid (MA) Total	**NA**	**NA**	**NA**	**NA**	**$0.85**
NSTAR (MA)	Residential Retrofit 1-4	NA	NA	NA	NA	$1.02
NSTAR (MA)	Residential Retrofit Multifamily	NA	NA	NA	NA	$0.61
	NSTAR (MA) Total	**NA**	**NA**	**NA**	**NA**	**$0.86**

Table C-6. Energy Audit and Retrofit Costs and Energy Savings as a % of Total Residential Electricity DSM

Residential Audit and Retrofit Utility/Agency	Program Name	Program's Costs ($M)	% of Total Res DSM Costs	Program's Energy Savings	% of Total Res Energy
Efficiency VT	Existing Homes	**$1.1**	**16%**	**1.6**	**3%**
National Grid (MA)	Residential Retrofit 1-4	$5.1	18%	4.9	3%
National Grid (MA)	Residential Retrofit Multifamily	$4.6	16%	6.4	4%
	National Grid (MA) Total	**$9.7**	**34%**	**11.4**	**7%**
NSTAR (MA)	Residential Retrofit 1-4	$3.6	21%	3.5	5%
NSTAR (MA)	Residential Retrofit Multifamily	$1.3	8%	2.1	3%
	NSTAR (MA) Total	**$4.9**	**28%**	**5.7**	**7%**

[7] Expenditures and impacts for Efficiency VT's Existing Homes include low-income program expenditures and costs.

C.3 New Construction Programs

New construction programs can provide significant savings to a residential electricity DSM portfolio: for organizations reviewed here with top performing residential electricity DSM portfolios, savings from new construction programs ranged widely from 1-10% of total residential energy savings. New construction programs are key to any residential portfolio, because they realize the most cost-effective energy efficiencies in a building at the most cost-effective time to do so, as it is planned and built.

The new construction programs reviewed here are of the top performers in residential energy savings: Efficiency VT, National Grid, and NSTAR.[8]

Efficiency VT offered a new construction program with Vermont Gas, Vermont Energy Star Homes (VESH). Through VESH, Efficiency VT offered Energy Star certification for qualified homes, energy code support, plan reviews, technical assistance, site inspections, energy ratings, and performance testing. Efficiency VT promoted VESH through direct mailings to builders, articles in local builder publications, workshops at trade conferences, and by providing information on applicable federal tax credits and current energy code via its website.

In 2007, VESH accounted for 6% of Efficiency VT's total residential energy savings at 39% of total residential electricity DSM costs; incentives composed only 26% of program costs.

National Grid and NSTAR sponsored the Energy Star Homes new construction program. ES Homes provided incentives to home buyers and to builders for the design and construction of energy efficient single-family and multi-family homes, independent of heating fuel. Incentives covered HVAC, water heating, appliances, and lighting. ES Homes also provided technical assistance and quality assurance inspections. ES Homes offered two participation paths: the Energy Star path lead to ES home certification, and the Code Plus path offered a way to receive incentives for some efficiency measures without requiring ES home certification.

In 2007, for both National Grid and NSTAR, ES Homes accounted for 1% of each utility's total residential energy savings at about 6% of each utility's total residential electricity DSM costs. ES Homes costs were $0.85/kWh for National Grid and $1.42/kWh for NSTAR. Cost component detail was not available for National Grid or NSTAR.

[8] MN Power's Triple E Plus program included a new construction component, an Energy Star builder option program, but data on this component were not available.

Table C-7. Costs Distribution and $/kWh per Cost Component for New Construction Programs

Residential New Construction Utility/Agency	Program Name	Incentives Costs as % of Total	Incentives $/kWh	Admin & Other Costs as % of Total	Admin & Other $/kWh	Program Total $/kWh
Efficiency VT	New Construction	26%	$0.21	74%	$0.60	$0.81
National Grid (MA)	Residential Lost Opportunity	NA	NA	NA	NA	$0.85
NSTAR (MA)	Residential Lost Opportunity	NA	NA	NA	NA	$1.42

Table C-8. New Construction Program Costs and Energy Savings as a % of Total Residential Electricity DSM

Residential New Construction Utility/Agency	Program Name	Program's Costs ($M)	% of Total Res DSM Costs	Program's Energy Savings	% of Total Res Energy
Efficiency VT	New Construction	$2.6	39%	3.3	6%
National Grid (MA)	Residential Lost Opportunity	$1.3	5%	1.5	1%
NSTAR (MA)	Residential Lost Opportunity	$1.2	7%	0.9	1%

C.4 Low Income Programs

Low income programs can provide significant savings to a residential electricity DSM portfolio: for organizations reviewed here with top performing residential electricity DSM portfolios, savings from low income programs ranged from about 4-16% of total residential energy savings. Low income programs are typically promoted and delivered by community organizations and jointly funded with federal, state, and/or other utilities. Low income programs are key because, with proper incentives, they can realize efficiencies that otherwise would remain untapped due to owner/tenant split incentives.

The low income programs reviewed here are of the top performers in residential energy savings: Efficiency ME, MN Power, National Grid (MA), and NSTAR (MA).

Efficiency ME offered several low income programs to households with income levels at or below 150% of the poverty line: Low Income CFL, Low Income Appliance Replacement, and Operation Keep Me Warm. The Low Income CFL program, implemented by Maine's local housing and service agencies, Residential Initiative for Maine, distributed or directly installed CFLs into rental facilities where the tenants paid the utilities.

Low Income Appliance Replacement leveraged the infrastructure of the existing federally funded weatherization programming, implemented by MaineHousing and Maine's Community Action Programs (CAPs), to replace refrigerators and freezers identified by certified auditors at low administrative costs. This program also involved direct installation of CFLs in high use applications.

Efficiency ME also provided CFLs to homes that participated in a weatherization event, implemented with the State Planning Office, Maine Office of Energy Independence and Security, and MaineHousing, in which volunteers directly installed low-cost efficiency measures to qualifying homes.

In 2007, Efficiency ME's low income programs accounted for about 8% of Efficiency ME's total residential energy savings at 42% of the utility's total residential electricity DSM costs; costs for the program, at $0.54/kWh, are reasonable. Efficiency ME's partnerships afforded very low administrative costs, $0.04/kWh, and incentives composed 93% of total program costs.

MN Power's low income program, Energy Partners, offered energy audits and installation of efficiency measures to qualifying households (low income status, single-family home or in two- to four-unit dwelling, and responsible for bills) at little or no cost to participants. MN Power promoted the program through several community-wide energy expos, Community Action Agencies, and other community organizations and encouraged participation from households that traditionally have not participated in low income programs (working poor and those unaware of the program). Services included: 1) in-home audits with blower door analysis, caulking, and weather stripping; 2) installation of low-cost measures, such as low-flow showerheads, faucet aerators, pipe wrap, and water heater blankets; and 3) replacement of qualifying water heaters and refrigerators.

MN Power's low income programming also included site-specific efficiency events for multi-family dwellings where MN Power offered energy efficiency ENERGY STAR lamps and CFLs, funding for common area lighting upgrades, and replacement of qualifying refrigerators.

In 2007, MN Power's Energy Partners program accounted for about 16% of MN Power's total residential energy savings at 22% of the utility's total residential electricity DSM costs; costs for the program, at $0.24/kWh, are very reasonable. Incentives composed 73% of total program costs.

National Grid offered three low income programs: Low Income ES Homes, Appliance Management Program, and Low Income EnergyWise. Programs served customers having 60% or less of the median income or were eligible for LIHEAP.

Low Income ES Homes was managed under the non-low income new construction program with 10% of total new construction program budget targeted to low income. Programming for Low Income ES Homes was essentially the same as the non-low income program, but included additional incentives for low-income developers and marketing that coordinated with community agencies.

Appliance Management served low income qualifying customers who had baseload consumption levels over 10 kWh/day. The program offered education on appliance efficiency; appliance audits; and direct installation of measures including weatherization, heating system replacements, and water heating measures.

Low Income EnergyWise was similar to the non-low income EnergyWise program, except it offered qualifying refrigerator and freezer replacements with no co-payments. The program also included direct installation of weatherization and water heating measures.

In 2007, National Grid's three low income programs accounted for about 5% of NSTAR's total residential energy savings at about 30% of the utility's total residential electricity DSM costs. Costs for the program, at $1.13/kWh, are high among the best practice low income programs. Cost component detail was not available.

NSTAR also offered three low income programs: Low Income New Construction, Low Income Single-Family, and Low Income Multi-Family.

Low Income New Construction program was for new buildings and major renovations of buildings with at least 50% low income residents (i.e., residents having 60% or less of the median income) and for single-family homes for low income customers (as with Habitat for Humanity). The program coordinated with NSTAR's standard residential new construction program, ES Homes, and covered building envelope, insulation, windows, HVAC, appliances, water heating, lighting and best practice construction techniques to minimize leakage, infiltration, and heat loss.

Low Income Single-Family and Low Income Multi-Family delivered energy efficient products and measures directly into homes, including weatherization measures, lighting, and appliances. The programs also included non-energy benefits like improved comfort. The Single-Family program was for low income customers living in one to four unit dwellings. The Multi-Family program was for customers in buildings with at least 50% low income residents.

In 2007, NSTAR's three low income programs accounted for about 4% of NSTAR's total residential energy savings at about 23% of the utility's total residential electricity DSM costs. Costs for the program, at $1.39/kWh, are the highest among the best practice low income programs. Cost component detail was not available.

Table C-9. IOU & Agency Costs Distribution and $/kWh per Cost Component for Low Income Programs

Residential Low Income Utility/Agency	Program Name	Incentives Costs as % of Total	Incentives $/kWh	Admin & Other Costs as % of Total	Admin & Other $/kWh	Program Total $/kWh
Efficiency ME	Low Income	**93%**	**$0.50**	**7%**	**$0.04**	**$0.54**
MN Power	Energy Partners	**73%**	**$0.18**	**27%**	**$0.07**	**$0.24**
National Grid (MA)	Lost Opportunity, Low-Income	NA	NA	NA	NA	$1.25
National Grid (MA)	Low Income Retrofit 1-4	NA	NA	NA	NA	$1.47
National Grid (MA)	Low-Income Retrofit Multifamily	NA	NA	NA	NA	$0.84
	National Grid (MA) Total	**NA**	**NA**	**NA**	**NA**	**$1.13**
NSTAR (MA)	Lost Opportunity, Low-Income	NA	NA	NA	NA	$5.02
NSTAR (MA)	Low Income Retrofit 1-4	NA	NA	NA	NA	$1.49
NSTAR (MA)	Low-Income Retrofit Multifamily	NA	NA	NA	NA	$0.88
NSTAR (MA)	***NSTAR (MA) Total***	**NA**	**NA**	**NA**	**NA**	**$1.39**

Table C-10. IOU & Agency Low Income Program Costs and Energy Savings as a % of Total Residential Electricity DSM

Residential Low Income Utility/Agency	Program Name	Program's Costs ($M)	% of Total Res DSM Costs	Program's Energy Savings	% of Total Res Energy
Efficiency ME	Low Income	**$2.1**	**42%**	**4.0**	**8%**
MN Power	Energy Partners	**$0.4**	**22%**	**1.5**	**16%**
National Grid (MA)	Lost Opportunity, Low-Income	$0.2	1%	0.1	<1%
National Grid (MA)	Low Income Retrofit 1-4	$4.9	17%	3.3	2%
National Grid (MA)	Low-Income Retrofit Multifamily	$3.4	12%	4.1	3%
	National Grid (MA) Total	**$8.5**	**30%**	**7.5**	**5%**
NSTAR (MA)	Lost Opportunity, Low-Income	$0.4	2%	0.1	<1%
NSTAR (MA)	Low Income Retrofit 1-4	$2.8	16%	1.9	2%
NSTAR (MA)	Low-Income Retrofit Multifamily	$0.8	5%	0.9	1%
NSTAR (MA)	**NSTAR (MA) Total**	**$4.0**	**23%**	**2.9**	**4%**

C.5 Residential Demand Response Programs for Summer Peaking Territories[9]

Residential demand response (DR) programs are typically comprised of incentives for direct load control of central air conditioning systems, but DR programs may also include direct load control of other appliances including water heaters and pool pumps.

DR programs in the residential sector can provide significant peak demand savings at very low costs. A best practice residential DR program that demonstrates this is Xcel Energy (MN)'s, which achieved 77% of Xcel Energy's total residential electricity DSM peak demand savings at $298/kW, 58% of its total residential electricity DSM costs.

The demand response programs reviewed here are those of top performers in residential electricity DSM that had DR programs: Interstate P&L (IA), Xcel Energy (CO), and Xcel Energy (MN).[10]

Interstate P&L (IA)'s demand response program, Appliance Cycling program, offered incentives for direct load control of customers' air conditioner compressor and/or water heater. Participants agreed to the direct cycling off of their appliance every other 15-minute period from 1 p.m. to 7 p.m. on days when weather.com forecasted temperatures exceeding each regional zone's threshold temperature (e.g., 94F for the Southern zone). Switches were controlled over FM radio, but in 2006, Interstate P&L began converting the control technology to Canon paging. Interstate P&L (IA) promoted the program via bill inserts and direct mail.

In 2007, IPL (IA)'s Appliance Cycling program's incremental savings, 1.0 MW, composed about 7% of Interstate P&L (IA)'s total residential electricity DSM peak demand savings at $477/kW, about 4% of the utility's total residential electricity DSM costs.

MidAmerican (IA)'s offered owner-occupiers of single-family homes incentives for direct load control of their central air conditioner or air source heat pump. The switch, controlled by FM radio or pager (for all new installs), cycled off only the system's compressor and not the fan. Participants received $40 bill credits their first year and $30 thereafter. MidAmerican (IA) promoted SummerSaver by direct mailing a brochure with a postage paid response card in January and February; MidAmerican (IA) minimized attrition by transience by following up with participating customers that moved into a non-controlled home and enrolling by default any new owner of a controlled home.

In 2007, SummerSaver cycled four days with a total peak demand savings capacity of 52 MW. Incremental peak demand savings for SummerSaver in 2007, 2.2 MW, composed 8% of MidAmerican (IA)'s total residential peak demand savings at $645/kW, 16% of the utility's total residential electricity DSM costs.

Xcel Energy (CO)'s Saver's Switch program offered customers a $25 annual credit for direct load control of their air conditioners. A control signal interrupted the air conditioning load during peak periods, typically between 2 p.m. and 7 p.m. In 2004, the program began deploying switches with varying load control strategies that used an adaptive algorithm to learn the air conditioner's operation pattern in order to achieve a 50% reduction in load.

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[9] This section is included even though APCo West Virginia is winter peaking, because there is still a significant summer peak and APCo West Virginia may wish to consider summer demand response programs, as well as winter programs.

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

In 2007, Xcel Energy (CO)'s Saver's Switch program's incremental savings, 16.5 MW, composed 66% of the utility's total residential electricity DSM peak demand savings at only $378/kW, accounting for about 80% of Xcel Energy (CO)'s total residential electricity DSM costs.

Xcel Energy (MN)'s Saver's Switch program offered customers incentives for direct load control of their central air conditioner and water heater. Central air conditioners were cycled off when pre-determined thresholds were met; water heaters were cycled off for up to five hours. Participants received 15% monthly bill credit June to September for AC control and an additional 2% monthly bill credit year-round for water heater control. From Saver's Switch's inception in 1990 to 2007, the number of cycling days averaged 10-15 days per summer. Xcel Energy's survey indicated a high level of customer satisfaction and no difference in comfort between control periods and non-control periods. Xcel Energy (MN) promoted Saver's Switch via direct mail, bill inserts, newsletters, call campaigns, and website.

In 2007, Saver's Switch's incremental peak demand savings, 24 MW, composed 77% of Xcel Energy (MN)'s total residential electricity DSM peak demand savings at only $298/kW, accounting for about 60% of the utility's total residential electricity DSM costs.

C.6 Residential Demand Response Programs for Winter and Twin Peaking Territories

Winter direct load control (DLC) programs can provide significant reduction to winter peak demand (for territories with winter or twin peak demand). However, winter residential demand response programs are relatively rare, and none of the top performers in residential DSM reviewed here offered winter DLC programs (all were summer peaking in 2007). But information of winter DLC programs of other organizations was available.[11]

Hawaiian Electric Company (HECO), with twin peak demand, offered the Energy Scout program which paged water heater switches on and off. The switch also automatically shut off the water heater when it detected frequency reduction. HECO found high customer satisfaction and a low dropout rate, less than 1% annually. In 2006, their *cumulative* installations totaled 13,000, reducing 9 MW of peak (.76% of their overall 2006 winter peak, 1,192 MW); their first cost was $250/participant, averaging 0.7kW/participant at the cost of $360/kW.

Otter Tail (MN), with winter peak demand, offered a program that radio-controlled multiple end-uses through one switch: space heating, water heating, and clothes dryers. Participants paid for switch and installation, $500-800, at once or through a lease, and saved about $300/year. In recent years, Otter Tail (MN) controlled 300-400 hours per year which has been a source of dissatisfaction for long-time participants who were on the program when Otter Tail (MN) controlled only about 20 hours/year. In 2006, their *cumulative* installations totaled 7,000, reducing 12 MW of peak (1.8% of their overall 2006 peak, 680MW); their first cost was $655/participant, averaging 1.7kW/participant at the cost of $385/kW.

[11] Komor (2006).

Appendix D:
DSM Measure Descriptions and Characterizations – Winter Peak Basis

This Appendix describes the DSM measures analyzed for this study and the methods used to estimate savings. Residential and Non-Residential measures were analyzed along parallel tracks with similar methods and outputs. This section contains common elements of the analysis and subsequent sections discuss the non-residential and residential measures and analysis methods in more detail.

The measure characterizations for all sectors include the following parameters:

- ***Measure Description*** – Provides a brief description of the efficiency measure being characterized.
- ***Baseline Description*** – Provides a description of the assumed baseline technology for the measure characterization.
- ***DSM Measure Description*** – Provides a description of the assumed efficient technology implemented in place of the baseline technology.
- ***Normalization Unit*** – Defines how savings and cost values are reported on a per unit basis.
- ***Effective Useful Life*** – Defines the number of years the efficient technology is expected to last, based on average residential usage. Values primarily sourced from DEER 2008 updates.
- ***Energy Savings (kWh)*** – Provides the energy savings for each measure in units of kilowatt-hours per year. For the residential sector results are for the heating types (Gas Furnace, Electric Resistance, Heat Pump) and for the building types (Single Family New, Single Family Existing, Multi Family, Mobile Home) in spreadsheet tabs. For the commercial and industrial sectors results are presented for gas and electric heating (heat pump assumed) and by segment on a single tab. All savings estimates are "generator" savings including loss factors provided by APCo.
- ***Demand Savings (kW)*** – Provides the coincident demand savings for each measure in units of kilowatts per year. For the residential sector results are for the heating types (Gas Furnace, Electric Resistance, Heat Pump) and for the building types (Single Family New, Single Family Existing, Multi Family, Mobile Home) in spreadsheet tabs. For the commercial and industrial sectors results are presented for gas and electric heating (heat pump assumed) and by segment on a single tab. All savings estimates are "generator" savings including loss factors provided by APCo. It is assumed that system peak across all regions/utilities is 7:00-8:00 a.m. on a winter weekday.
- ***Incremental Cost Data*** – Summit Blue researched material and labor costs for each measure and calculated incremental costs for the following applications:
    - ***New/ROB*** – The incremental costs for new construction and replace on burnout (ROB) applications only account for material costs. This assumes that the labor costs for the baseline and measure technology are equivalent.
    - ***Retrofit*** – The incremental costs for retrofit applications accounts for the incremental material cost as well as the labor cost for the efficient technology.

  The costs for each measure are adjusted for regional cost differences. Adjustments were made using multipliers for material and labor sourced from DEER 2008 and RS Means Cost Works 2008.

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 and are widespread in their potential application, thus garnering a large portion of the conservation potential.

[Spreadsheet workbooks for APCo-West Virginia accompany this documentation. C&I measures are available specifically for APCo-West Virginia. Residential measures for all five AEP retail companies including APCo-West Virginia are aggregated in one spreadsheet workbook with a separate tab specific to each residential segment and a retail company selection function on the {Data Tables – MASTER} tab. Selected data in these spreadsheets are also integrated in the text below in retail company specific reports.]

D.1 Residential DSM Measure Characterizations

Residential measure analysis for each service territory was modeled for four housing types: new and existing single family homes, multi-family homes, and mobile homes. Savings for each housing type were evaluated for three HVAC systems: gas furnace/AC, electric resistance/AC, and air source heat pump. As in the commercial measure analysis, a combination of DOE2 simulations, engineering calculations, and secondary resources were used to estimate measure savings.

Weather Dependent Measures

In order to calculate savings for weather-dependent measures (grouped as "HVAC and Shell" and "Energy Star Homes" in the reporting document), building energy simulation models were created using eQuest. Within each utility, Summit Blue created four aggregate calibrated buildings, each with three heating types. These homes were created based on the Building America Benchmark (BABM), plus Summit Blue engineering judgment. The homes were then calibrated to annual end use consumption data for each of three building types generated using the same methodology as the Market Profiles, which combines RASS data, monthly consumption data, and BABM assumptions to estimate annual end uses.

Non-Weather Dependent Measures

Lighting, appliances, hot water, and "other" measures are evaluated using engineering calculations and secondary research. In addition, the eQuest simulations for weather-dependent measures are used to calculate HVAC interaction factors for lighting and appliances. Lighting estimates are primarily based on differences in installed lamp wattage and residential usage patterns combined with previously mentioned HVAC interactive effects. Savings for appliances are based on secondary sources, such as Energy Star calculators and commercial product reports. Domestic hot water usage is estimated with BABM equations based on the number of bedrooms for a given home. Savings for each service territory vary based on water main's temperatures estimated from ASHRAE climate data.

D.1.1 Lighting Measures – Residential

The following lighting measures are often part of utilities' prescriptive residential lighting energy efficiency programs. Measure costs and measure lives are based on the California DEER database. Costs are adjusted to the APCo Retail company area by regional cost factors from *RS Means Cost Data.* Table D-1 presents the measures for the example of existing single family homes. Similar information is provided for new construction single family, multi-family, and mobile home segments in an electronic appendix.

Compact Fluorescent Lamp – Screw-In and Hard-Wired Fixtures

Compact fluorescent lamps (CFLs) are the most common alternatives to standard incandescent lamps. CFLs are generally about four times as efficient as incandescent lamps and last about ten times as long. CFLs can either be screw-in replacements for incandescent lamps or plug-in lamps in fixtures specifically designed around CFL technology. Savings are determined by subtracting the input CFL Wattage from the lamp or fixture Wattage of the incandescent lamps they are replacing. The measure life for a indoor CFL is based on standard residential usage and estimated at six years. Usage is slightly less for outdoor applications, with an estimated lifetime of eight years.

Daylight Sensors

Lighting systems are designed assuming no contribution from ambient daylight. In apartment common areas where daylight is available, artificial light maybe unnecessary and possibly detrimental to occupant comfort. Daylight sensors measure the contribution of ambient daylight and either turn-off or dim the lamps of the artificial lighting system. Savings are sourced from previous analysis conducted by Summit Blue.

Occupancy Sensors

Occupancy sensors automatically turn off the lights in a room or an area when the area is unoccupied. Occupancy sensors are an alternative to standard wall mounted on/off lighting switches. Savings are sourced from previous analysis conducted by Summit Blue.

LED Exit Signs

LED exit signs are among the most efficient types of exit signs on the market. A single lamp generally draws about two to three watts of power, compared to 20 Watts or more for CFLs, or 25 Watts or more for incandescent exit signs. The analysis assumes conservative savings based on a two-lamp CFL exit sign retrofitted with a two lamp LED exit sign.

LED Night Lights

LED night lights are highly efficient, often consuming less that 1 Watt of power. This analysis retrofits a 7W incandescent bulb with a 1W LED night light and assumes eight hours of operation per day.

LED Holiday Lights

LED holiday lights have a number of advantages over standard incandescent lights. An LED C7 bulb consumes 0.08W compared to 0.48W for a comparable incandescent. In addition, the lifetime of an LED bulb is rated at 100,000 hours for indoor use, and 50,000 hours for outdoor use. This analysis assumes a string of 300 lights, operated for five hours per day for 30 days annually.

Table D-1. Residential Lighting Measure Characteristics for New Single Family Dwellings (generator savings)

Measure Description	Baseline Description	DSM Measure Description	Units	Effective Useful Life (Years)	Energy Savings - Annual kWh			Demand Savings - Winter kW			Incremental Costs (nominal)	
					Gas Heating kWh/unit	Electric Heating kWh/unit	Heat Pump Heating kWh/unit	Gas Heating kW/unit	Electric Heating kW/unit	Heat Pump Heating kW/unit	New/ROB $/unit	Retrofit $/unit
9-16W Screw-in CFL	40W incandescent	13 Watt Screw-in CFL <=800 lumens	Lamp	6	25	14	20	0.0033	0.0003	0.0013	$1.92	$2.53
9-16W Screw-in CFL	60W incandescent	13 Watt Screw-in CFL > 800 lumens	Lamp	6	43	25	35	0.0058	0.0005	0.0023	$1.88	$2.53
17-24W Screw-in CFL	75W Incandescent	20 Watt Screw-in CFL	Lamp	6	50	29	41	0.0057	0.0006	0.0027	$1.96	$2.62
25-34W Screw-in CFL	100W Incandescent	30 Watt Screw-in CFL	Lamp	6	64	37	52	0.0086	0.0007	0.0035	$3.31	$3.96
Over 34W Screw-in CFL	120W Incandescent	40 Watt Screw-in CFL	Lamp	6	73	42	60	0.0098	0.0008	0.0040	$5.77	$8.13
9-16W Pin Based CFL	40W incandescent	13 Watt Pin Based CFL <=800 lumens	Lamp	6	25	14	20	0.0033	0.0003	0.0013	$12.16	$46.00
9-16W Pin Based CFL	60W incandescent	13 Watt Pin Based CFL >800 lumens	Lamp	6	43	25	35	0.0058	0.0005	0.0023	$11.21	$46.00
17-24W Pin Based CFL	75W Incandescent	20 Watt Pin Based CFL	Lamp	6	50	29	41	0.0067	0.0006	0.0027	$13.45	$49.65
25-34W Pin Based CFL	100W Incandescent	30 Watt Pin Based CFL	Lamp	6	64	37	52	0.0086	0.0007	0.0035	$16.53	$56.05
35-44W Pin Based CFL	120W Incandescent	40 Watt Pin Based CFL	Lamp	6	73	42	60	0.0098	0.0008	0.0040	$27.28	$69.16
45-54W Pin Based CFL	200W Incandescent	55 Watt Pin Based CFL	Lamp	6	132	76	108	0.0178	0.0015	0.0072	$31.82	$76.34
Over 54W Pin Based CFL	250W Incandescent	65 Watt Pin Based CFL	Lamp	6	123	70	101	0.0166	0.0014	0.0067	$35.71	$87.18
9-16W Screw-in CFL - Outdoor	40W incandescent	13 Watt Screw-in CFL - Outdoor <=800 lumens	Lamp	8	32	32	32	0.0045	0.0045	0.0045	$3.28	$3.89
9-16W Screw-in CFL - Outdoor	60W incandescent	13 Watt Screw-in CFL - Outdoor > 800 lumens	Lamp	8	56	56	56	0.0079	0.0079	0.0079	$3.24	$3.89
17-24W Screw-in CFL - Outdoor	75W Incandescent	20 Watt Screw-in CFL - Outdoor	Lamp	8	66	66	66	0.0092	0.0092	0.0092	$3.32	$3.98
25-34W Screw-in CFL - Outdoor	100W Incandescent	30 Watt Screw-in CFL - Outdoor	Lamp	8	84	84	84	0.0117	0.0117	0.0117	$5.36	$6.01
Over 34W Screw-in CFL - Outdoor	120W Incandescent	40 Watt Screw-in CFL - Outdoor	Lamp	8	132	132	132	0.0184	0.0184	0.0184	$10.00	$17.36
9-16W Pin Based CFL - Outdoor	40W incandescent	13 Watt Pin Based CFL - Outdoor <=800 lumens	Lamp	8	32	32	32	0.0045	0.0045	0.0045	$1.92	$35.76
9-16W Pin Based CFL - Outdoor	60W incandescent	13 Watt Pin Based CFL - Outdoor >800 lumens	Lamp	8	56	56	56	0.0079	0.0079	0.0079	$0.97	$35.76
17-24W Pin Based CFL - Outdoor	75W Incandescent	20 Watt Pin Based CFL - Outdoor	Lamp	8	66	66	66	0.0092	0.0092	0.0092	$2.17	$38.38
25-34W Pin Based CFL - Outdoor	100W Incandescent	30 Watt Pin Based CFL - Outdoor	Lamp	8	84	84	84	0.0117	0.0117	0.0117	$3.08	$42.59
35-44W Pin Based CFL - Outdoor	120W Incandescent	40 Watt Pin Based CFL - Outdoor	Lamp	8	96	96	96	0.0134	0.0134	0.0134	$9.33	$51.21
45-54W Pin Based CFL - Outdoor	200W Incandescent	55 Watt Pin Based CFL - Outdoor	Lamp	8	174	174	174	0.0242	0.0242	0.0242	$11.42	$55.94
Over 54W Pin Based CFL - Outdoor	250W Incandescent	65 Watt Pin Based CFL - Outdoor	Lamp	8	222	222	222	0.0309	0.0309	0.0309	$11.60	$63.07
Indoor Torchieres	200 W Inc	55 W CFL	Lamp	8	159	91	130	0.0214	0.0122	0.0175	$4.79	$62.58
Indoor Torchieres	300 W Inc (halogen)	55 W CFL	Lamp	8	268	154	220	0.0361	0.0207	0.0296	$1.31	$59.11
Pin based CFL table Lamp	75 W Inc	20 W CFL	Lamp	8	50	29	41	0.0067	0.0006	0.0027	-$4.67	$54.00
Pin based CFL table Lamp	100 W Inc	25 W CFL	Lamp	8	68	39	56	0.0092	0.0008	0.0037	$12.22	$64.25
Pin based CFL table Lamp	120 W Inc	30 W CFL	Lamp	8	82	47	67	0.0110	0.0009	0.0044	$4.93	$66.23
Pin based CFL table Lamp	200 W inc	55 W CFL	Lamp	8	132	76	108	0.0178	0.0015	0.0072	$9.67	$123.48
Occupancy Sensor for Common Area	Occupancy Sesor for Common Area	No sensor	Sensor	8	235	134	192	0.0317	0.0045	0.0156	$45.17	$86.04
Lighting Photocell controls for Common Area	Lighting Photocell controls for Common Area	No sensor	Sensor	8	519	297	426	0.0000	0.0000	0.0000	$132.34	$173.57
LED Exit Signs for Multi-family	LED Exit Signs for Multi-family	Incandescent Exit Sign	Sign	16	346	198	284	0.0375	0.0053	0.0184	$21.73	$103.45
LED night light	7W Incandescent Light	1 W LED light	Light	16	19	11	16	0.0003	0.0000	0.0002	$3.00	$3.00
LED holiday lights	300 x 0.48 W Incandescent Lights	300 x 0.08 W LED Lights	300 bulb string	16	19	19	19	0.0065	0.0065	0.0065	$10.00	$10.00

D.1.2 Residential Water Heating Measures

Hot water savings can occur through reducing the amount of hot water consumed or by improving the efficiency of the water heating/storage/distribution process. Total hot water energy use is based on Baseline Market Profiles described in the prior section of this report. Table D-2 presents the measures for the example of existing single family homes. Similar information is provided for new construction single family, multi-family, and mobile home segments in an electronic appendix.

Efficient Water Heaters

Traditional electric water heaters have an overall efficiency of about 90% including standby and distribution losses. High efficiency units achieve 95% efficiency with improved insulation and heat traps that minimize convection into under insulated distribution pipes. The savings estimate for the high-efficiency unit is calculated from the total hot water energy use and the unit efficiencies. Base case gas and electric energy factors/efficiencies are assumed to be 0.6 and 0.86 respectively, with efficient cases of 0.63 and 0.93.

Low Flow Showerheads

Low flow showerheads use an orifice plate inside the fixture to restrict the water flow to a maximum 2.5 gallons per minute versus a 3.5 gallon per minute permitted with standard new showerheads. Water flow from older showerheads typically exceeds 5.0 gallons per minute. Engineering methods were used to estimate savings between the 1.5 and 2.5 gpm showerheads assuming baseline consumption sourced from BABM.

Faucet Aerators

Faucet aerators introduce air into the water as it leaves the faucet. The result is perceived full flow at a much reduced actual flow rate. We estimated that a faucet aerator reduces flow from four gallons per minute to 1.5 gallon per minute using baseline consumption sourced from BABM.

Hot Water Pipe Insulation

Pre-formed segments of foam insulation are placed around hot water distribution pipes to minimize heat loss. While useful for the entire length of hot water piping, it is most cost-effective in the first five to ten feet of pipe extending from the hot water heater. Engineering estimates of steady state heat loss from the pipes to conditioned indoor air were used to estimate savings.

Hot Water Tank Insulation

The addition of a hot water heater blanket minimizes standby tank losses by insulating the tank. Estimates are based on a 50 gallon tank retrofitted with an R-13 blanket. Baseline water consumption is based on the BABM.

Drain Water Heat Recovery

These systems recover some of the heat from drain pipe hot water. Savings were based on US Department of Energy information and manufacturer case studies. Engineering calculations based on the effectiveness of an average of six commercially-available drain water heat recovery systems were used to estimate savings. Water consumptions is based on residential usage for showers and sinks sourced from the BABM.

Energy Star Clothes Washers

Energy Star clothes washers must exceed the minimum energy efficiency standards by at least 37% and, since January 1, 2007, meet water efficiency criteria. The federal standard sets the minimum Modified Energy Factor (MEF) at 1.26, Energy Star sets the minimum MEF at 1.72 with a maximum water factor of 8.0. Savings is not climate dependent and is based on DEER estimates. Estimates were calculated for Tier 1, 2, and 3 clothes washers with MEF ratings of 1.8,2.0, and 2.2, respectively. Baseline consumption is based on BABM.

Energy Star Dishwashers

Energy Star dishwashers must exceed minimum energy efficiency standards by at least 41%. Energy Star, since January 1, 2007, requires a minimum Energy Factor (EF) of .65 for standard models and .88 for compact models. Savings is not climate dependent and is based on Energy Star estimates.

Table D-2. Residential Hot Water Measure Characteristics for New Single Family Dwellings (generator savings)

Measure Description	Baseline Description	DSM Measure Description	Units	Effective Useful Life (Years)	Energy Savings - Annual kWh			Demand Savings - Winter kW			Incremental Costs (nominal)	
					Gas Heating	Electric Heating	Heat Pump Heating	Gas Heating	Electric Heating	Heat Pump Heating	New/ROB	Retrofit
					kWh/unit	kWh/unit	kWh/unit	kW/unit	kW/unit	kW/unit	$/unit	$/unit
High Efficiency Water Heating Tank	Standard Efficiency WH Tank	High Efficiency Water Heating Tank	Tank	13	315	315	315	0.0722	0.0722	0.0722	$48.83	$494.63
Low flow showerhead	2.5gpm	1gpm	Home	10	144	144	144	0.0331	0.0331	0.0331	$14.90	$42.42
Faucent Aerators	normal aerator (4gpm)	low flow aerator (1.5gpm)	Home	10	87	87	87	0.0200	0.0200	0.0200	$2.79	$11.82
Clothes Washer - Tier 1	Standard Clothes Washer	Clothes Washer - Tier 1	Unit	11	533	517	526	0.0720	0.0699	0.0711	$363.73	$815.61
Gas Dryer	Electric Dryer	Gas Dryer	Unit	11	881	504	723	0.0726	0.0104	0.0357	$226.96	$649.47
Dishwasher - Energy Star	Standard Dishwasher	Dishwasher - Energy Star	Unit	11	106	76	94	0.0000	0.0000	0.0000	$284.54	$606.89
Drain Water Heat Recovery	No heat recovery	DWHR with GFX 60	Home	20	599	599	599	0.1372	0.1372	0.1372	$622.00	$717.55
Clothes Washer - Tier 2	Standard Clothes Washer	Clothes Washer - Tier 2	Unit	11	624	604	616	0.0842	0.0817	0.0832	$492.16	$944.03
Clothes Washer - Tier 3	Standard Clothes Washer	Clothes Washer - Tier 3	Unit	11	713	690	704	0.0963	0.0933	0.0951	$620.58	$1,072.46
tank insulation	No Insulation	R-13 Blanket	Tank	7	538	538	538	0.1232	0.1232	0.1232	$25.42	$68.39
pipe insulation	No Insulation	R-2.5 Pipe Wrap	Tank	12	168	168	168	0.0384	0.0384	0.0384	$1.06	$4.52

D.1.3. Residential HVAC & Shell Measures

HVAC savings can occur through reducing the amount of heating/cooling required by improving the building shell and setting back thermostat settings or by improving the efficiency of the equipment and/or distribution process.

Since HVAC savings are climate dependent, most of the savings for the following measures were determined by modifying the baseline simulation model first to reflect the less efficient option then to reflect the improved efficiency measure. Savings are calculated as the difference between the two. Incremental costs are mostly based on the DEER database adjusted with "location factors" to reflect APCo service area labor and/or equipment costs.[12] Where measures can be purchased from national retailers, such as room air conditioners, the retailer prices are the basis of incremental costs. Table D-3 presents the measures for the example of existing single family homes. Similar information is provided for new construction single family, multi-family, and mobile home segments in an electronic appendix.

Energy Star Residential Room Air Conditioners

Energy Star room air conditioners must be at least 10% more efficient than standard U.S. models which are defined as units with a minimum EER rating of 9.4-10.8 depending upon the size and type of the unit.[13] Minimum efficiency standards for room air conditioners range from 8.5 EER to 9.8 EER depending on the unit size and type. Savings is determined by simulation models improving equipment from 9.5 to 10.7 EER.

Energy Star Residential Air Source Heat Pumps

Energy Star air source heat pumps are units with minimum ratings of 14 SEER, EER ratings of 11.0-11.5, and heating system performance factors of 8.0-8.2 or higher.[14] Since 2006, minimum efficiency standards for heat pumps are 13 SEER and 7.7 HSPF. Savings is determined by modeling.

High Efficiency Central Air Conditioning

Since 2006, the minimum efficiency standard for central air conditioners is 13 SEER. More efficient models are available in the market. Savings is determined by modeling SEER 14 equipment versus the minimum efficiency.

HVAC Diagnostic Repair, Testing, and Maintenance

Many residential and commercial HVAC systems are not operating as efficiently as possible due to inadequate maintenance. This package of services includes ensuring proper refrigerant charge, lubrication, cleanliness, and fan operation. The savings estimate assumes that the tune-up improves efficiency by 10% which is consistent with refrigerant over-charge and undercharge savings.

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

[13] See US DoE Energy Star web site: http://www.energystar.gov/index.cfm?c=roomac.pr_room_ac.

[14] *Ibid.*

HVAC Duct Sealing, Operations, and Maintenance

Many HVAC ducts are not sealed well and leak conditioned air into conditioned and unconditioned spaces such as basements and attics failing to properly deliver heating and cooling to the occupied areas of the home. Duct sealing reduces such heat loss and reduces fan power. Savings estimates are determined by modeling well sealed ductwork vs. systems with typical leakage, about 5%.

Ceiling Insulation

Ceiling insulation includes both insulating uninsulated and under-insulated roof areas. Savings are calculated from simulations replacing R-19 with R-38.

Wall Insulation

Wall insulation is most cost-effective when insulating un-insulated wall areas. Savings are determined from simulations replacing R-4 insulation with R-11.

Efficient Windows

Efficient windows are generally considered to be either triple paned windows, windows with a radiant barrier to reflect heat back into the conditioned space, or windows with low "shading coefficients." Reducing the shading coefficients of glass will reduce the amount of solar heat gain into the building. This reduced solar gain will decrease the cooling load for the building but may increase the heating load.[15] On the other hand, these windows usually have a higher R-value than the windows they replace, thus heating energy can decrease. Savings are determined from modeling the replacement of baseline windows with a U-Value of 0.65 and Solar Heat Gain Coefficient (SHGC) of 0.62 with windows with a U-Value of 0.35 and a SHGC of 0.55.

Comprehensive Shell Air Sealing

This measure includes caulking, weather stripping, and sealing other visible cracks and penetrations in the building shell. Practically speaking, a house should be able to breathe to purge contaminants, so a lower limit of 0.35 air-changes per hour (ACH) is advised without the addition of mechanical ventilation. Savings is determined for two levels of sealing by modeling a base case of 0.6ACH and efficient cases of 0.5 ACH versus 0.35 ACH.

Ground Source Heat Pumps

Ground source heat pumps use the ground instead of the air as their thermal source and sink. Ground temperatures are much more even over the course of the year, so ground source heat pumps can operate much more efficiently than air source heat pumps during the hottest and coldest parts of the year. Savings are determined by simulating a 4.6 COP ground source heat pump against a standard SEER 13 air source heat pump.

[15] Itron: 2005, *op.cit.*, p. 7-17.

Table D-3. Residential Electric Space Heating and Cooling Measure Characteristics for New Single Family Dwellings (generator savings)

Measure Description	Baseline Description	DSM Measure Description	Units	Effective Useful Life (Years)	Energy Savings - Annual kWh			Demand Savings - Winter kW			Incremental Costs (nominal)	
					Gas Heating kWh/unit	Electric Heating kWh/unit	Heat Pump Heating kWh/unit	Gas Heating kW/unit	Electric Heating kW/unit	Heat Pump Heating kW/unit	New/ROB $/unit	Retrofit $/unit
Room A/C - Energy Star	Standard Room A/C	Room A/C - Energy Star	Unit	9	56	56	56	0.0000	0.0000	0.0000	$30.00	$300.00
Central A/C - SEER 14 w/TXV	Central A/C - SEER 13	Central A/C - SEER 14 w/TXV	Ton	15	34	34	177	0.0000	0.0000	0.0000	$119.21	$1,118.34
Geothermal Heat Pump - Energy Star	13 SEER Air Source Heat Pump	Geothermal Heat Pump - Energy Star	Ton	15	N/A	N/A	396	N/A	N/A	1.5614	$2,704.00	$4,797.55
Window Upgrade	U-0.65 SHGC 0.62	U-0.35 SHGC 0.55	per sqft	20	1	6	4	0.0002	0.0046	0.0046	$2.87	$19.14
Improved Ceiling Insulation	R-19	R-38	per sqft	20	0	1	0	0.0000	0.0003	0.0003	$0.60	$1.55
Improved Wall Insulation	R-4	R-11 added to walls	per sqft	20	0	3	2	0.0001	0.0020	0.0020	$0.40	$0.80
Reduce Infiltration	0.8 ACH	0.5 ACH	per 1000 sqft	11	34	391	230	0.0133	0.3308	0.3306	$25.00	$115.00
Reduce Infiltration	0.8 ACH	0.35 ACH	per 1000 sqft	11	50	555	340	0.0199	0.4951	0.4947	$50.00	$230.00
HVAC testing and Maintanence	no maintenance	refrigerant charge and air flow corrected	Ton	10	71	700	415	0.0060	0.0060	0.0574	$15.74	$47.59
Duct Repair	no maintenance	Ducts sealed	per home	18	165	1630	967	0.0507	1.0725	1.4359	$55.75	$437.98
Energy Star Air Source Heat Pump	78 AFUE Gas Furnace w/13 SEER A/C	14 SEER ASHP	Ton	15	-1373	N/A	N/A	-2.0354	N/A	N/A	$217.49	$1,320.54
Energy Star Air Source Heat Pump	Electric Furnace w/13 SEER A/C	14 SEER ASHP	Ton	15	N/A	2326	N/A	N/A	0.0288	N/A	$217.49	$1,320.54
Energy Star Air Source Heat Pump	13 SEER HP	14 SEER ASHP	Ton	15	N/A	N/A	177	N/A	N/A	0.0286	$137.00	$1,320.54

Table D-4. Residential Refrigeration and Appliances Measure Characteristics for New Single Family Dwellings (generator savings)

Measure Description	Baseline Description	DSM Measure Description	Units	Effective Useful Life (Years)	Energy Savings - Annual kWh			Demand Savings - Winter kW			Incremental Costs (nominal)	
					Gas Heating kWh/unit	Electric Heating kWh/unit	Heat Pump Heating kWh/unit	Gas Heating kW/unit	Electric Heating kW/unit	Heat Pump Heating kW/unit	New/ROB $/unit	Retrofit $/unit
Refrigerator, replace with Energy Star	Standard Refrigerator	Refrigerator - Energy Star	Unit	11	103	59	84	0.0106	0.0015	0.0052	$122.23	$1,407.98
Freezer Energy Star	Standard Freezer	Freezer Energy Star	Unit	11	71	40	58	0.0073	0.0010	0.0036	$35.00	$630.02
Refrigerator, retire old	2 units in use	1 unit in use	Unit	5	1219	698	1000	0.1261	0.0180	0.0620	$0.00	$0.00
Freezer retire old	1 unit in use	0 unit in use	Unit	4	1090	624	894	0.1128	0.0161	0.0554	$0.00	$0.00
Variable Speed Drive Pool Pumps	Standard Pool Pump	Variable Speed Drive Pool Pumps	Pump	10	2058	2058	2058	0.0007	0.0007	0.0007	$434.41	$707.73
occ sensor power bars	No Sensor	Occupancy Sensor - Plug Loads	Sensor	8	92	53	76	0.0105	0.0015	0.0052	$85.00	$85.00

D.1.4 Residential Appliance and Additional Measures

Minimum refrigerator and freezer efficiency has progressed substantially in the past 20 years, with older units consuming at least twice as much energy as a comparable new machine. Table D-4 presents the measures for the example of existing single family homes. Similar information is provided for new construction single family, multi-family and mobile home segments in an electronic appendix.

Energy Star Refrigerators and Freezers

Energy Star refrigerators must exceed current federal energy efficiency standards by at least 15% for full-size units, and 20% for compact size units.[16] Energy Star freezers must exceed minimum energy efficiency standards by at least 10% for full-sized units and 20% for compact units.

Remove Secondary Refrigerators and Freezers

Second refrigerators and freezers that customers own are often older and less efficient appliances. For example, the most common refrigerator sold in 1990 used between 60-70 kWh per cubic foot, compared to 2003, when the most common refrigerator sold used less than 30 kWh per cubic foot.[17] According to the appliance saturation survey, 39% of households in the Nebraska Public Power District territory region have more than one refrigerator.

Power Strips with Occupancy Sensors

Power strips with occupancy sensors have several inputs that are controlled by an associated occupancy sensor and some that are not controlled. In an office environment, a computer could be plugged into an uncontrolled input and a monitor and task lamp could be plugged into the sensor controlled inputs.

Variable Speed Drive Pool Pumps

This replaces a standard efficiency (84.7%) single speed pool pump and motor with a new high efficiency (90%) variable speed pump and motor. Savings are sourced using the the Pentair Pool Pump Energy Savings Calculator.[18] This assumes operation for 3.6 hours and ten hours, with load factors of one and 0.36 for the base and efficient cases respectively.

D.1.5 ENERGY STAR Homes

As part of the analysis, eQuest simulations were used to determine energy and demand savings for ENERGY STAR homes. Baseline models constructed for weather-dependent measures were modified to estimate savings on two tiers. The first tier consists of 40% reduction of lighting power density, infiltration reduction to 0.35 ACH, R38 roof insulation, window upgrades, and R19 wall insulation. Tier 2 homes employ the previous measures as well as a higher efficiency HVAC system. Costs were sourced from DEER 2008 data.

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[16] See Energy Star web site: http://www.energystar.gov/index.cfm?c=refrig.pr_refrigerators.

[17] Natural Resources Canada, "Energy Consumption of Major Household Appliances Shipped in Canada, Trends for 1990-2003 ," (NRCAN, Gatineau, QC, December 2005) p.8. U.S. and Canadian efficiency standards and availability very similar; therefore, we conclude that the old equipment stock that would be removed is similar as well.

[18] http://www.pentairpool.com/pool_pump_calc/index.htm

D.1.6 Direct Load Control[19]

Demand response in the residential sector is typically in the form of direct load control (DLC) where the utility has direct communication with a controller at the customer's site. The controller might be an on/off switch or a thermostat. Through the controller the utility can cause equipment to cycle or change setpoints in a manner to reduce system peak loads. Different degrees of control are possible with trade-offs between aggressive control to maximize kW savings and customer satisfaction and acceptance. For this analysis, Summit Blue assumed fairly conservative 50% cycling with equipment changing state every 15 minutes and no energy savings. Since APCo-West Virginia might want to limit demand during the winter with its system peak or during the summer with its generation pool peak, both heating and cooling loads are considered. Morning winter system peak has large components of space heat, as residences warm after night setbacks, and water heating as domestic hot water systems recover from heavy morning usage for showers. Summer peak is mostly driven by space cooling loads.

Savings and costs were sourced from other utility DLC programs evaluated by Summit Blue.

Water Heater Control

In an electric water heater, there are frequently two heating elements. Generally the bottom element does most of the heating as the convective flows inside the tank and the tank inlet concentrates cooler water at the bottom of the tank. The upper element is energized during peak hot water demand so that cold water is not delivered to the load as the tank reservoir is used. Hot Water DLC controls the bottom element so that the tank does not recover from usage during peak hours, but permits the upper element to operate as needed so the customer retains hot water service, if needed.

Air-Conditioning Control

During summer peaks, AC-DLC controls the compressor/condenser sections of the air-conditioning system. The indoor fan is permitted to run during the control period to maintain airflow and to extract residual cooling energy from the coils. Control can be accomplished with a thermostat and supervisory changes to the thermostat settings or via cycling controls of the equipment.

Space Heat Control

During winter peaks, the controls affect the electric resistance heating elements inside electric furnaces and/or heat-pumps. Since winter control events are expected to occur at cold outdoor temperatures when the heat pump refrigerant cycle is not effective, furnaces and heat pumps are treated equivalently. The indoor fan is permitted to run during the control period to maintain airflow and to extract residual heating energy from the coils. Control can be accomplished with a thermostat and supervisory changes to the thermostat settings or via cycling controls of the equipment.

[19] Both summer- and winter-based measures are noted here given that APCo West Virginia has significant peaks in both seasons.

Table D-5. Residential Energy Star Homes Measure Savings for New Single Family Dwellings (generator savings)

Measure Description	Baseline Description	DSM Measure Description	Units	Effective Useful Life (Years)	Energy Savings - Annual kWh			Demand Savings - Winter kW			Incremental Costs (nominal)	
					Gas Heating	Electric Heating	Heat Pump Heating	Gas Heating	Electric Heating	Heat Pump Heating	New/ROB	Retrofit
					kWh/unit	kWh/unit	kWh/unit	kW/unit	kW/unit	kW/unit	$/unit	$/unit
Energy Star Homes - Tier 1	Single Family New Construction	Lighting and Shell Measures	per home	0	N/A	N/A	1793	N/A	N/A	1.3770	$1,440.31	N/A
Energy Star Homes - Tier 2	Single Family New Construction	Lighting, Shell and HVAC Measures	per home	0	N/A	N/A	2882	N/A	N/A	1.3773	$1,851.31	N/A

Table D-6. Residential Direct Load Control Measure Savings (generator savings – Winter Basis)

Measure Description	Baseline Description	Units	Effective Useful Life (Years)	Energy Savings - By Space Heat Type			Demand Savings - by Space Heat Type			Incremental Costs (nominal)	
				Gas	Electric	Heat Pump	Gas	Electric	Heat Pump	New/ROB	Retrofit
				kWh / unit	kWh / unit	kWh / unit	kW / unit	kW / unit	kW / unit	$ / unit	$ / unit
Domestic Hot Water Control - **Summer & Winter**	No control	Home	15	0	0	0	0.70	0.70	0.70	$230.00	$230.00
AC control - **Summer** control ONLY	No control	Home	15	0	0	0	1.60	1.60	1.60	$450.00	$450.00
Space Heat Control - Resistance and Heat Pump **Winter** Control ONLY	No control	Home	15	0	0	0	NA	1.00	1.00	$420.00	$420.00

D.2 Non-Residential DSM Measure Characterizations

D.2.1 Sources used for the analysis

- eQUEST (DOE-2.2 engine) simulations based on the market profiles described in the previous section. http://www.doe2.com/equest/.
- Advance Transformer 1 catalog http://www.advancetransformer.com/resources/literature.jsp, 2008.
- California Database for Energy Efficient Resources (DEER), 2004-2005 version 2.01. http://www.energy.ca.gov/deer/ cost and savings estimates.
- California Database for Energy Efficient Resources (DEER), 2008 update. Unpublished data. Cost and savings estimates.
- Minnesota Deemed Savings Database, unpublished data.
- Michigan Deemed Savings Database, unpublished data.
- RS Means *Mechanical Cost Data*, 2005.
- 2007 ASHRAE Fundamentals Handbook, *HVAC applications*.
- Xcel Energy – MN, *Conservation Improvement Plan 2007-2009*, July 2006.

This section describes the non-residential energy efficiency measures analyzed for this study and the methods used to estimate savings. The section is organized by major end-uses such as lighting, heating, ventilation and air-conditioning (HVAC), and refrigeration. This section focuses on prescriptive measures, which are generally straight-forward measures that have largely uniform energy and peak demand savings on a per unit basis from application to application. However, even prescriptive measures' savings will have some variability, depending on the specific application and baseline equipment replaced.

Summit Blue chose to represent the commercial sector with three segments: office buildings, retail, and restaurants. These three segments include a significant portion of the commercial floor area and consumption (see Market Profile) and diverse energy end-uses.

Savings estimates are based on secondary resources, such as evaluations and deemed savings estimates from other jurisdictions (CA, MN, and MI) and engineering calculations for climate *independent* measures. For measures that are climate *dependent,* Summit Blue used hourly simulations executed with DOE2-2 simulation software. For indoor lighting measures, a combination of the techniques is used. Engineering calculations estimate direct energy savings from lighting measures and simulations are used to estimate the indirect savings from interaction with HVAC equipment. Each service territory was modeled with appropriate weather sites and the baseline models were calibrated against the Market Profiles developed earlier in the project.

In the industrial sector, the measure focus is on lighting, compressed air, drivepower, and HVAC measures. All other measures are aggregated into the custom line item. There are no HVAC interactive effects assumed for industrial indoor lighting. Custom Measures have more variable energy and peak demand savings on a per unit basis from application to application and might involve any qualifying technology. *Ex Post* results from a large Midwestern utility company's Custom Program calibrate the custom measure savings estimates. Custom measures might include process or control improvements and holistic renovations of systems.

Cost estimates are largely based on the CA-Database of Energy Efficient Resources (DEER) with costs adjusted with RS Means Mechanical Cost Data factors for APCo company service areas. Measures can either be installed as retrofits or replace on burn-out (ROB). In the former the cost includes labor and material costs. In the latter, the measure costs generally exclude labor costs since those would still be incurred in the event of replacement with non-qualifying equipment. Some measures are strictly ROB applications.

D.2.2 Lighting Measures – Non-Residential

The following lighting measures are often part of utilities' prescriptive non-residential lighting energy efficiency programs. The major inputs for the impact estimates are the same for both baseline and efficient technologies: equipment connected Watts, hours of operation, and interaction with HVAC equipment for commercial applications.

Measure costs and measure lives are based on the California DEER database. Costs are adjusted to the APCo Retail company area by regional cost factors from *RS Means Cost Data*.

Compact Fluorescent Lamp – Screw-In and Hard-Wired Fixtures

Compact fluorescent lamps (CFLs) are the most common alternatives to standard incandescent lamps. CFLs are generally about four times as efficient as incandescent lamps and last about ten times as long. CFLs can either be screw-in replacements for incandescent lamps or plug-in lamps in fixtures specifically designed around CFL technology. The measure life for a screw-in CFL is the life of the bulb or two to three years depending on the application. Plug-in lamps in CFL fixtures are assumed to last the life of the fixture because failed lamps must be replaced with comparable CFLs.

T8 Lamps and Electronic Ballasts- Premium

Premium T8 lamps and electronic ballasts have the same market as regular T8 systems. They gain efficiency over regular T8 systems by the co-development of lamps and ballasts that optimize the efficiency of both when used together. Premium T8 technology is compared versus both a T12 and standard T8 baseline. This measure qualifies under the general lighting category, and indirect heating and cooling impacts are included and are estimated by eQuest simulations.

T5 Lamps and Electronic Ballasts

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

Daylight Sensors

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

Occupancy Sensors

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

Delamping

The definition of delamping used for this project is replacing a removing one lamp in a three-lamp, four-foot fluorescent lighting fixture, and re-aligning the lamps in the fixture. This measure is intended for areas that are currently over-lit. Lighting reflectors are often used as part of delamping projects. The measure life for this measure is shorter because the fixture is assumed to have been in place for a period of time already. Savings from Commercial HVAC interactions were determined by eQuest simulation.

LED Exit Signs

LED exit signs are among the most efficient types of exit signs on the market. They generally only draw about two to three watts of power, compared to 15 Watts or more for CFLs, or 25 Watts or more for incandescent exit signs. Weighting of the baseline technologies was based on primary data collected for this project. Savings from Commercial HVAC interactions were determined by eQuest simulation.

High-Bay Fluorescent Lights

High-bay lighting is used in industrial settings for general ambient light. T5 and T8 fluorescent lamps can be used in place of more traditional high-intensity discharge (HID) lamps in specially designed fixtures. The advantages include higher efficacy (lumens/Watt), greater lumen maintenance over the lamp life and better controllability. Savings are determined with engineering calculations, no HVAC interactive effects and 20% fewer operating hours due to control benefits.

Pulse-Start HIDs

Metal Halide pulse-start technology is a slightly more efficient type of HID lighting compared to traditional metal halide and high-pressure sodium HIDs. Special lamps and ballasts generate equivalent illumination in the same light fixture at lower power requirements. Savings are determined with engineering calculations and no HVAC interactive effects.

Table D-7. Commercial Lighting Measure Characteristics (generator savings – Winter Basis)

Measure Description	Base	Units	Office						Retail						Restaurant						EUL	Adjusted	
			Gas Heat			Elec Heat			Gas Heat			Elec Heat			Gas Heat			Elec Heat				Incremental RET	Incremental - NEW/ROB
Lighting			Sum_kW	Wint_kW	kWh	Sum_kW	Wint_kW	kWh	Sum_kW	Wint_kW	kWh	Sum_kW	Wint_kW	kWh	Sum_kW	Wint_kW	kWh	Sum_kW	Wint_kW	kWh	Years		
CFL - Screw-in	Incandescent weighted Watts	lamp	0.094	0.065	311	0.09	0.01	273	0.11	0.08	390	0.11	0.02	297	0.090	0.068	452	0.09	0.01	376	3	$4.00	$3.34
CFL - Hard-wired	Incandescent weighted Watts	lamp	0.11	0.07	349	0.11	0.01	306	0.10	0.07	361	0.10	0.02	275	0.10	0.08	507	0.10	0.01	421	12	$14.14	$6.53
Electronic Ballast - Dimming	T8 Normal Ballast	fixture	0.06	0.01	190	0.06	0.00	167	0.06	0.01	209	0.06	0.00	160	0.06	0.04	294	0.06	0.01	244	8	$145.35	$101.34
LED Exit	Incandescent Exit Sign	fixture	0.03	0.00	224	0.03	0.00	197	0.03	0.02	219	0.03	0.00	167	0.03	0.02	220	0.03	0.00	183	16	$78.43	$21.79
T5 w/Electronic Ballast	T8 with electronic Ballast	fixture	0.04	0.03	130	0.04	0.00	114	0.04	0.03	135	0.04	0.01	103	0.04	0.03	190	0.04	0.00	157	15	$54.32	$2.07
Super T8 -- T12 baseline	T12	fixture	0.07	0.05	221	0.07	0.01	193	0.06	0.05	228	0.06	0.01	174	0.06	0.05	321	0.07	0.01	267	15	$48.24	$5.01
Super T8 -- T8 baseline	T8	fixture	0.01	0.01	42	0.01	0.00	36	0.01	0.01	43	0.01	0.00	33	0.01	0.01	60	0.01	0.00	50	15	$48.24	$1.21
Delamping w/Reflectors (2 lamp)	3 lamp Fixture	fixture	0.07	0.04	216	0.07	0.01	189	0.06	0.04	223	0.06	0.01	170	0.06	0.05	313	0.06	0.01	260	15	$47.92	N/A
Occupancy Sensor Motion Det.	No sensor	sensor	0.23	0.16	609	0.23	0.03	533	0.16	0.11	423	0.16	0.03	323	0.12	0.09	424	0.12	0.01	352	8	$84.71	$84.71
50W MH HID	150W Incandescent	fixture- indoor	0.13	0.09	432	0.13	0.02	378	0.13	0.09	446	0.13	0.02	340	0.13	0.09	627	0.13	0.02	521	15	$139.29	$120.93
75W MH HID	100W Mercury Vapor	fixture- indoor	0.04	0.03	137	0.04	0.00	120	0.04	0.03	142	0.04	0.01	108	0.04	0.03	196	0.04	0.00	163	15	$139.29	$100.85
100W MH HID	170W Mercury Vapor	fixture- indoor	0.11	0.08	376	0.11	0.01	329	0.11	0.08	388	0.11	0.02	296	0.11	0.08	541	0.11	0.01	449	15	$144.28	$67.89
175W PS MH HID	500W Incandescent	fixture- indoor	0.46	0.32	1518	0.46	0.06	1330	0.44	0.32	1570	0.44	0.07	1198	0.44	0.33	2207	0.45	0.05	1833	15	$161.57	$62.16
250W PS MH HID	400W Mercury Vapor	fixture- indoor	0.26	0.18	895	0.26	0.03	784	0.25	0.18	924	0.25	0.04	705	0.25	0.19	1288	0.26	0.03	1070	15	$174.15	$66.26
50W MH HID	150W Incandescent	fixture- outdoor	0.05	0.05	313	0.05	0.05	313	0.05	0.05	313	0.05	0.05	313	0.05	0.05	313	0.05	0.05	313	15	$139.29	$120.93
75W MH HID	100W Mercury Vapor	fixture- outdoor	0.01	0.01	100	0.01	0.01	100	0.01	0.01	100	0.01	0.01	100	0.01	0.01	100	0.01	0.01	100	15	$139.29	$100.85
100W MH HID	170W Mercury Vapor	fixture- outdoor	0.04	0.04	273	0.04	0.04	273	0.04	0.04	273	0.04	0.04	273	0.04	0.04	273	0.04	0.04	273	15	$144.28	$67.89
175W PS MH HID	500W Incandescent	fixture- outdoor	0.16	0.16	1101	0.16	0.16	1101	0.16	0.16	1101	0.16	0.16	1101	0.16	0.16	1101	0.16	0.16	1101	15	$161.57	$62.16
250W PS MH HID	400W Mercury Vapor	fixture- outdoor	0.09	0.09	651	0.09	0.09	651	0.09	0.09	651	0.09	0.09	651	0.09	0.09	651	0.09	0.09	651	15	$174.15	$66.26
Outdoor Lighting Controls	No controls	sensor	0.00	0.00	238	0.00	0.00	238	0.00	0.00	238	0.00	0.00	238	0.00	0.00	238	0.00	0.00	238	8	$98.11	$98.11
T5 Interior High Bay Fl. Fixt.	400W Mercury Vapor	fixture	0.33	0.23	1254	0.33	0.04	1099	0.32	0.23	1295	0.32	0.05	988	0.32	0.24	1821	0.32	0.04	1512	15	$263.39	$122.14
T8 Interior High Bay Fl. Fixt.	400W Mercury Vapor	fixture	0.25	0.17	992	0.25	0.03	869	0.24	0.17	1024	0.24	0.04	782	0.24	0.18	1440	0.24	0.03	1196	15	$243.44	$102.19
LED Streetlights	250W HPS or 250W MH	fixture	0.00	0.00	669	0.00	0.00	669	0.00	0.00	827	0.00	0.00	827	0.19	0.00	775	0.19	0.00	775	10	$722.88	$401.86
LED Traffic Lights	Incandescent Traffic Light	Traffic Signal	0.10	0.10	412	0.10	0.10	412	0.10	0.10	412	0.10	0.10	412	0.10	0.10	412	0.10	0.10	412	5	$209.64	$35.31

Table D-8. Industrial Lighting Measure Characteristics (generator savings – Winter Basis)

Measure Description	Base	Units	Industrial			EUL	Incremental Costs - Adjusted	
			Sum_kW	Wint_kW	kWh	Years	Incremental RET	Incremental - NEW/ROB
Lighting								
LED Exit	Incandescent Exit Sign	fixture	0.02	0.02	177	16	$80.19	$22.50
T8/T5 w/Electronic Ballast	T12	fixture	0.02	0.02	93	15	$54.42	$2.14
50W MH HID	150W Incandescent	fixture- indoor	0.09	0.09	442	15	$143.04	$124.88
75W MH HID	100W Mercury Vapor	fixture- indoor	0.03	0.03	139	15	$143.04	$104.15
100W MH HID	170W Mercury Vapor	fixture- indoor	0.08	0.08	382	15	$148.20	$70.11
175W PS MH HID	500W Incandescent	fixture- indoor	0.32	0.32	1554	15	$165.32	$64.19
250W PS MH HID	400W Mercury Vapor	fixture- indoor	0.18	0.18	910	15	$178.31	$68.43
50W MH HID	150W Incandescent	fixture- outdoor	0.05	0.05	157	15	$143.04	$124.88
75W MH HID	100W Mercury Vapor	fixture- outdoor	0.01	0.01	50	15	$143.04	$104.15
100W MH HID	170W Mercury Vapor	fixture- outdoor	0.04	0.04	137	15	$148.20	$70.11
175W PS MH HID	500W Incandescent	fixture- outdoor	0.16	0.16	551	15	$165.32	$64.19
250W PS MH HID	400W Mercury Vapor	fixture- outdoor	0.09	0.09	325	15	$178.31	$68.43
Outdoor Lighting Controls	No controls	sensor	0.00	0.00	121	8	$100.57	$100.57
T5 Interior High Bay Flourescent Fixt.	400W Mercury Vapor	fixture	0.24	0.24	1196	15	$268.79	$126.13
T5 Interior High Bay Flourescent Fixt.	400W MH or HPS	fixture	0.12	0.12	600	15	$318.29	$175.63

D.2.3 Non-Residential Motors & Other

The following measures are common and cut across end-use categories, or they are specialized but generally found to be cost effective.

Motor Efficiency

Motor efficiency improvements can be achieved effectively during system specification and installation when new motors are purchased. Premium efficiency motors can be installed in place of motors that only meet minimum federal efficiency standards detailed in the Energy Policy Act. Since many larger motors (greater than 30 HP) are rewound after failure rather than replaced, an additional opportunity exists by ensuring rewinds are performed to maintain motor efficiency. Steps like close control of baking temperatures, careful winding removal, and use of high-quality materials will help ensure that efficiency will not diminish during rewinds. Premium motors typically exceed mandated EPACT efficiencies by 1-3% depending on the motor size. Motor cost data are based on surveys of motor manufacturers (Baldor, Lesson, Marathon, GE, US Motors, Dayton) prepared for the 2008 update to the California DEER.

VFDs for HVAC Application

VFDs for HVAC applications are listed separately because they take advantage of the fluid affinity laws that show a cube relationship between speed and power. These applications also have a more predictable use pattern than VFDs in industrial processes and conveyance applications. The latter examples would be included with custom measures. The baseline technologies for HVAC VFDs is flow throttling for liquid systems and vortex dampers for air applications.

Compressed Air Controls

Frequently called the fourth utility (after electricity, gas, and water), compressed air systems have many savings opportunities, including: leak repair, efficient motors and compressors and staging, pressure optimization, and receiver installation. These measures could be legitimately included in "Custom" due to the site specific nature of savings. We have estimated savings for Compressed air with benchmarks from the Compressed Air Challenge program run by the U.S. Department of Energy, and on a Midwestern utility custom compressed air program results and conservation plan.[20] Savings are listed per system horsepower.

Convection Ovens

These ovens circulate air inside the oven to enhance heat transfer to the food. As a result, cooking times are shorter and lower temperatures are needed to cook food.

Spray Nozzles

Pre-wash nozzles remove excess food debris from plates and reduce the use of hot water inside the dish washer.

[20] Xcel Energy – Minnesota Conservation Improvement Plan 2007-2009.

Hot Water Circulation Pump Control

Small pumps will circulate domestic hot water throughout a facility continuously so that hot water is almost immediately available at the tap. Controls, which turn off the pump at night, save pumping energy and reduce stand by losses in the water distribution system.

D.2.4 Non-Residential HVAC Measures

In the APCo Commercial and Industrial sectors, space heating is split between natural gas and electric heat – primarily heat pumps. Summit Blue analyzed savings with both heating types for the market segments. HVAC Savings can occur through reducing the amount of heating/cooling required with insulation and setting back thermostat settings or by improving the efficiency of the equipment and/or distribution process.

Since HVAC savings are climate dependent, all of the savings for the following measures were determined with eQuest computer energy simulations. The measure baselines are derived from the calibrated models derived with the Market Profile. Savings are the difference between the simulation with the efficient technology and the simulation with the standard or code-compliant technology. Incremental costs are mostly based on the DEER database adjusted with *RS Means Mechanical Cost Data* "location factors" to reflect APCo labor and/or equipment costs.[21]

Measure life for these items are base on the American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE) depreciation lives and the California DEER database.

VFDs for HVAC Application

VFDs for HVAC applications are listed separately because they take advantage of the fluid affinity laws that show a cube relationship between speed and power. These applications also have a more predictable use pattern than VFDs in industrial processes and conveyance applications. The latter examples would be included with custom measures. The baseline technologies for HVAC VFDs are flow throttling for liquid systems and vortex dampers for air applications.

Efficient Packaged Commercial Air Conditioning Systems

Standard efficiency units are specified as units with EER ratings of 10.1. Efficient units are specified as units with EER ratings of 10.4-13.0 depending on the equipment size. Summit Blue characterized a high efficiency unit with an EER of 12.2.

Energy Management Systems (EMS)

EMSs can effectively reduce energy consumption by optimizing equipment operation and/or scheduling equipment use by the time of day and/or time of year. Savings vary based on controlled equipment and the comprehensiveness of the EMS hardware and programming

Economizers

Economizers use outside air for cooling instead of operating the air conditioning compressors on mild days, particularly during the spring and early fall seasons. The analysis assumed an

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

integrated economizer where 100% outdoor air is used up to 65°F ambient temperature. During peak summer conditions economizers produce no peak demand savings.

Programmable Thermostats

Programmable thermostats allow temperatures to be automatically set warmer or colder during unoccupied periods to reduce heating and cooling energy use when facilities are unoccupied. We analyzed 5°F setbacks (set-ups in the summer). Since the impact of set-backs is typically off-peak, these thermostats have minimal peak benefits.

Window Film

Polymer films are applied to the interior of glazing to enhance the glazing attributes. Films will have any combination of the following effects: reduced visibility and radiant energy from the sun (solar heat gain and shading) or lower glazing U-factor and lower emissivity to keep heat in the building in the winter

Cool Roof

Light-colored or white roofs have a lower solar absorptance, thereby reducing the energy gains through the roof. This behavior reduces summer cooling loads, but can increase winter heating requirements.

Efficient Water Chillers

Minimum efficiency standards for water chillers are established by state codes. Primarily through the use of variable speed drives and over-sized heat exchangers, standard equipment can be made more efficient for energy savings.

D.2.5 Refrigeration & Custom Non-Residential Measures

Refrigeration Measures improve the efficiency of the cooling plant and/or reduce the cooling loads that the system must satisfy. Measures that do not fit in the categories listed above are that have savings that are highly project-specific we group in this category. Custom measures is a catch-all category that might include special lighting systems, building controls, exceptional HVAC equipment or process improvements at a factory, for a few examples. Experience of other utilities informs this measure category.

Motor cost data for Custom measures are based on surveys of motor manufacturers (Baldor, Lesson, Marathon, GE, US Motors, Dayton) prepared for the 2008 update to the California DEER.

ECM Motors

Electronically commutated motors are DC motors that are more efficient than the permanent split capacitor motors they replace. Since they are used inside refrigeration cases they have the indirect effect of reducing refrigeration loads.

Multi-Line Compressors

Instead of one compressor per refrigeration unit, a multi-line system has several compressors that stage optimally to serve many pieces of equipment on the retail floor.

Oversized Condensers

Oversized condensers more efficiently reject heat from the refrigeration system and reduce the compressor loads.

High Efficiency Compressors

HE compressors provide gains over standard machines, primarily through the use of VFDs to modulate compressors to match loads.

Evaporator Fan Controllers

Most walk-in cooler evaporator fan motors run continuously. Controllers allow the fans to cycle based on cooling demand.

Strip Curtains, Night Covers, and Glass Doors

Strip curtains, night covers and glass doors are used to reduce losses from the refrigerated zones and products to the rest of the retail zones. They are particularly deployed at night when they do not inhibit access to refrigerated products.

Anti-Sweat Controls

To keep glass clear of condensation so the merchandise is visible, anti-sweat heaters typically run continuously. Controls cycle heaters based on humidity sensors and or on a timed basis.

Floating Head Pressure Controls

When outdoor temperatures are mild, condensed refrigerant can be cooled below default settings to reduce the loads on compressors.

Custom Efficiency

"Custom" is a generic name for consumer-specific conservation projects. The magnitude of estimated potential savings is scaled to kW saved and is based on Midwestern utility custom program results and conservation plan.[22] Costs and measure lives are based on the same source.

D.2.6 Non-Residential Direct Load Control

Demand response in the small-commercial and industrial sector is typically in the form of direct load control (DLC), where the utility has direct communication with a controller at the customer's site. The controller might be an on/off switch or a thermostat. Through the controller, the utility can cause equipment to cycle or change setpoints in a manner to reduce system peak loads. Different degrees of control are possible with trade-offs between aggressive control to maximize kW savings and customer satisfaction and acceptance. For this analysis, Summit Blue assumed fairly conservative 50% cycling with equipment changing state every 15 minutes and no energy savings. Since APCo-West Virginia might want to limit demand during the winter with its system peak or during the summer with its generation pool peak, both heating and cooling loads are considered. Morning winter system peak has large components of space heat, as businesses turn up heat after night setbacks, and a smaller component for

[22] Xcel Energy – Minnesota Conservation Improvement Plan 2007-2009.

water heating since commercial hot water loads are typically less coincident with the peak winter hours. Summer peak is mostly driven by space cooling loads.

Savings and costs were sourced from other utility DLC programs evaluated by Summit Blue.

Water Heater Control

In an electric water heater, there are frequently two heating elements. Generally, the bottom element does most of the heating as the convective flows inside the tank and the tank inlet concentrates cooler water at the bottom of the tank. The upper element is energized during peak hot water demand so that cold water is not delivered to the load as the tank reservoir is used. Hot Water DLC controls the bottom element so that the tank does not recover from usage during peak hours, but permits the upper element to operate as needed so the customer retains hot water service if needed.

Air-Conditioning Control

During summer peaks AC-DLC controls the compressor/condenser sections of the air-conditioning system. The indoor fan is permitted to run during the control period to maintain airflow and to extract residual cooling energy from the coils. Control can be accomplished with a thermostat and supervisory changes to the thermostat settings or via cycling controls of the equipment.

Space Heat Control

During winter peaks, the controls affect the electric resistance heating elements inside electric furnaces and/or heat-pumps. Since winter control events are expected to occur at cold outdoor temperatures when the heat pump refrigerant cycle is not effective, furnaces and heat pumps are treated equivalently. The indoor fan is permitted to run during the control period to maintain airflow and to extract residual heating energy from the coils. Control can be accomplished with a thermostat and supervisory changes to the thermostat settings or via cycling controls of the equipment.

Table D-9. Commercial Non-Lighting Measure Characteristics (Generator Savings – Winter Basis)

Measure Description	Base	Units	Office Gas Heat Sum_kW	Office Gas Heat Wint_kW	Office Gas Heat kWh	Office Elec Heat Sum_kW	Office Elec Heat Wint_kW	Office Elec Heat kWh	Retail Gas Heat Sum_kW	Retail Gas Heat Wint_kW	Retail Gas Heat kWh	Retail Elec Heat Sum_kW	Retail Elec Heat Wint_kW	Retail Elec Heat kWh
Motors & Other														
Prem Motor < =10 HP	EPACT <= 10 HP	motor (per HP)	0.02	0.02	76	0.02	0.02	76	0.02	0.02	76	0.02	0.02	76
Prem Motor > 10HP	EPACT > 10 HP	motor (per HP)	0.01	0.01	34	0.01	0.01	34	0.01	0.01	34	0.01	0.01	34
Adjustable Speed Drives for Fans & Pumps	No ASD	motor (per HP)	0.00	0.27	908	0.00	0.27	908	0.00	0.28	935	0.00	0.28	935
Compressed Air Controls	No control	per HP	0.00	0.00	219	0.00	0.00	219	0.00	0.00	219	0.00	0.00	219
Convection Oven	Standard Oven	oven	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Spray Nozzles for Food Service	No spray nozzle	sink	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hot Water Circulation Pump Time Clock	No time clock	tank	0.00	0.00	983	0.00	0.00	983	0.00	0.00	1139	0.00	0.00	1139
Retrocommissioning	No retrocommissioning	building sq.ft (1,000s)	0.11	0.11	1348	0.14	0.14	1992	0.10	0.10	1174	0.10	0.10	1935
HVAC & Shell														
Packaged Rooftop A/C 12 EER	Packaged A/C 10.1 EER	tons	0.17	0.00	205	0.17	0.00	207	0.16	0.00	152	0.17	0.00	154
EMS System	No EMS	controlled sq.ft (1,000s	0.00	0.00	2017	0.00	0.00	2792	0.00	0.00	928	0.00	0.00	2654
Programable Thermostat	Standard Thermostat	Thermostat	-0.08	0.00	1048	-0.08	-0.56	1815	0.00	0.00	512	0.00	0.77	2233
Economizer	No Economizer	tons of cooling	0.00	0.00	583	0.00	0.00	585	0.00	0.00	159	0.00	0.00	162
Reflective Window Film	No Film	100 sqft window area	0.27	0.03	692	0.27	0.01	592	0.11	0.00	257	0.11	-0.04	38
Cool Roof	Standard Roof	100 sqft roof area	0.04	0.00	104	0.04	-0.05	130	0.00	0.00	10	0.00	-0.14	4
Efficient Centrifugal Chiller	ASHRAE01Chiller - 0.59 kW/tor	tons	0.12	0.00	162	0.12	0.00	162	0.12	0.00	113	0.12	0.00	113
Efficient Screw Chiller	ASHRAE01Chiller - 0.63 kW/tor	tons	0.10	0.00	142	0.10	0.00	142	0.10	0.00	99	0.10	0.00	99
Efficient AirCooled Chiller	ASHRAE01Chiller - 1.15 kW/tor	tons	0.19	0.00	261	0.19	0.00	261	0.19	0.00	182	0.19	0.00	182
Tune-up/Advanced Diagnostics	None	tons	0.05	0.00	87	0.06	0.00	87	0.06	0.00	60	0.06	0.00	60
Refrigeration														
Motor Upgrade for Fans & Compressors	Shaded pole motors	motor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Single Line to Multiplex Compressor	Single line compresser	per ton	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Multiplex system with oversized condenser	Multiplex system with standard	per ton	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
High efficiency, low temperature compresser	Low temperature compresser w	per ton	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Evap Fan Controller for Med. Temp Walk-in	No controller for cycling	Med Temp Walk-ins	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Strip Curtains	No strip curtains	per sq ft of curtain	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Night Covers	No night covers	per linear feet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Anti-sweat Heater Controls	No controls	control	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Floating Head Pressure Controls	No controls	per ton	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Glass Doors on Low and Med. Temp Displays	No doors	linear feet of display	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Measure Description	Restaurant Gas Heat Sum_kW	Restaurant Gas Heat Wint_kW	Restaurant Gas Heat kWh	Restaurant Elec Heat Sum_kW	Restaurant Elec Heat Wint_kW	Restaurant Elec Heat kWh	EUL Years	Adjusted Incremental RET	Adjusted Incremental - NEW/ROB
Motors & Other									
Prem Motor < =10 HP	0.02	0.02	76	0.02	0.02	76	15	$201.37	$39.29
Prem Motor > 10HP	0.01	0.01	34	0.01	0.01	34	15	$64.39	$10.58
Adjustable Speed Drives for Fans & Pumps	0.00	0.28	937	0.00	0.28	937	15	$215.10	$205.54
Compressed Air Controls	0.00	0.00	219	0.00	0.00	219	15	$1,005.00	$216.00
Convection Oven	0.40	0.40	1797	0.40	0.40	1797	10	$4,804.00	$554.50
Spray Nozzles for Food Service	0.31	0.31	3673	0.31	0.31	3673	5	$147.54	$147.54
Hot Water Circulation Pump Time Clock	0.00	0.00	1094	0.00	0.00	1094	15	$299.57	$299.57
Retrocommissioning	0.10	0.10	1819	0.10	0.10	2084	10	$1,500.00	$1,500.00
HVAC & Shell									
Packaged Rooftop A/C 12 EER	0.15	0.00	203	0.15	0.00	203	15	$1,310.77	$207.21
EMS System	0.00	0.00	971	0.00	0.00	1180	15	$448.77	$448.77
Programable Thermostat	-0.06	0.00	520	-0.06	-0.20	1538	11	$144.50	$82.00
Economizer	0.00	0.00	245	0.00	0.00	256	10	$140.60	$140.60
Reflective Window Film	0.01	0.00	26	0.02	0.00	1	10	$14.86	$14.86
Cool Roof	0.01	0.00	13	0.01	-0.07	15	15	$3.22	$0.85
Efficient Centrifugal Chiller	NA	0.00	NA	NA	0.00	NA	20	$657.35	$169.21
Efficient Screw Chiller	NA	0.00	NA	NA	0.00	NA	20	$657.35	$169.21
Efficient AirCooled Chiller	NA	0.00	NA	NA	0.00	NA	20	$657.35	$169.21
Tune-up/Advanced Diagnostics	0.06	0.00	74	0.06	0.00	74	7	$136.75	$136.75
Refrigeration									
Motor Upgrade for Fans & Compressors	0.35	0.35	1552	0.35	0.35	1552	15	N/A	$35.50
Single Line to Multiplex Compressor	0.03	0.03	556	0.03	0.03	556	12	N/A	$2,768.15
Multiplex system with oversized condenser	0.01	0.01	67	0.01	0.01	67	12	$404.90	N/A
High efficiency, low temperature compresser	0.18	0.18	1091	0.18	0.18	1091	12	N/A	$846.33
Evap Fan Controller for Med. Temp Walk-in	0.45	0.45	2454	0.45	0.45	2454	16	$138.54	N/A
Strip Curtains	0.03	0.03	267	0.03	0.03	267	4	$7.43	N/A
Night Covers	0.07	0.07	14	0.07	0.07	14	5	$37.29	N/A
Anti-sweat Heater Controls	0.02	0.02	142	0.02	0.02	142	12	$672.51	N/A
Floating Head Pressure Controls	0.00	0.05	1371	0.00	0.05	1371	12	$36.79	N/A
Glass Doors on Low and Med. Temp Displays	0.02	0.02	159	0.02	0.02	159	12	$819.82	N/A

Table D-10. Industrial Non-Lighting Measure Characteristics (Generator Savings – Winter Basis)

Measure Description	Base	Units	Industrial Sum_kW	Industrial Wint_kW	Industrial kWh	EUL Years	Incremental Costs - Adjusted: Incremental RET	Incremental Costs - Adjusted: Incremental - NEW/ROB
Motors & Other								
Prem Motor < =10 HP	EPACT <= 10 HP	motor (per HP)	0.02	0.02	93	15	$203.18	$39.57
Prem Motor > 10HP	EPACT > 10 HP	motor (per HP)	0.01	0.01	43	15	$64.91	$10.65
Adjustable Speed Drives for Fans & Pumps	No ASD	motor (per HP)	0.18	0.18	906	15	$213.05	$203.87
Compressed Air Optiization	status quo	per HP	0.04	0.04	358	15	$197.14	$197.14
Custom								
Custom Measure	Old technology	Application	39.00	39.00	405286	15	$253,000.00	$253,000.00
HVAC & Shell								
Hi Efficiency Roof Top Units (Cooling Only)	9.7-10.1 EER	tons	0.21	0.00	292	15	$1,302.40	$206.59

Table D-11. Small Commercial and Industrial Direct Load Control Measure Characteristics (Generator Savings – Winter Basis)

Measure Description	Baseline	Units	Summer kW	Winter kW	EUL	Incremental Costs
Water Heat DLC	No control	tank	0.18	0.18	15	$250
Central Heat DLC	No control	tons	0.00	1.46	15	$140
Central AC DLC	No control	tons	0.53	0.00	15	$150

APPENDIX E: PROGRAM RESULTS SUMMARY

Table E-1. APCo West Virginia Commercial & Industrial Base Case Scenario – A

Energy Efficiency Measure	Average Annual No. of Measures	Unit of Measure	Average Life of Measure	Annual Penetration Rate for Measure	Net to Gross Ratio % (Free Rider % less Spillover %)	Incremental Cost per Measure	Incentive per Measure
Lighting							
CFL - Screw-in weighted Watts	12,976	lamp	3	1.5%	100%	$3.40	$1.70
CFL - Hard-wired weighted Watts	17,233	lamp	8	1.8%	100%	$14.17	$7.08
T8 Electronic Ballast - Dimming	0	fixture	8	0.0%	100%	$147.48	$73.74
LED Exit	1,430	fixture	16	1.0%	100%	$79.18	$39.59
T8/T5 w/Electronic Ballast	28,902	fixture	15	0.7%	100%	$53.89	$26.94
Delamping w/Reflectors (2 lamp)	11,216	fixture	15	0.9%	100%	$47.43	$23.72
Occupancy Sensor Motion Detector	9,056	sensor	8	1.6%	100%	$84.59	$42.29
50W MH HID	0	fixture- indoor	15	0.0%	100%	$141.16	$70.58
75W MH HID	0	fixture- indoor	15	0.0%	100%	$141.16	$70.58
100W MH HID	0	fixture- indoor	15	0.0%	100%	$146.25	$73.13
175W PS MH HID	3,156	fixture- indoor	15	15.4%	100%	$63.30	$31.65
250W PS MH HID	283	fixture- indoor	15	7.1%	100%	$67.48	$33.74
50W MH HID	484	fixture- outdoor	15	0.4%	100%	$141.16	$70.58
75W MH HID	0	fixture- outdoor	15	0.0%	100%	$141.16	$70.58
100W MH HID	0	fixture- outdoor	15	0.0%	100%	$146.25	$73.13
175W PS MH HID	0	fixture- outdoor	15	0.0%	100%	$63.30	$31.65
250W PS MH HID	592	fixture- outdoor	15	22.2%	100%	$67.48	$33.74
Outdoor Lighting Controls	0	sensor	8	0.0%	100%	$99.27	$49.64
T5 Interior High Bay Fluorescent Fixture - four lamp	293	fixture	15	22.0%	100%	$265.49	$132.74
T8 Interior High Bay Fluorescent Fixture - six lamp	0	fixture	15	0.0%	100%	$245.17	$122.58

Table E-2. APCo West Virginia Commercial & Industrial Base Case Scenario – B

Energy Efficiency Measure	Average Annual No. of Measures	Unit of Measure	Average Life of Measure	Annual Penetration Rate for Measure	Net to Gross Ratio % (Free Rider % less Spillover %)	Incremental Cost per Measure	Incentive per Measure
Motors & Other							
Prem Motor < =10 HP	636	motor (per HP)	15	0.9%	100%	$39.65	$19.83
Prem Motor > 10HP	1,067	motor (per HP)	15	2.0%	100%	$10.67	$5.34
Adjustable Speed Drives for Fans & Pumps	1,062	motor (per HP)	15	2.4%	100%	$218.14	$109.07
Compressed Air Controls	0	per HP	15	0.0%	100%	$1,005.00	$502.50
Convection Oven	0	oven	10	0.0%	100%	$4,804.00	$2,402.00
Spray Nozzles for Food Service	583	sink	5	2.8%	100%	$147.54	$73.77
Hot Water Circulation Pump Time Clock	411	tank	15	1.9%	100%	$296.20	$148.10
Retrocommissioning	0	building sqft (1,000s)	10	0.0%	100%	$1,500.00	$750.00
HVAC & Shell							
Packaged Rooftop A/C 12 EER	0	tons	15	0.0%	100%	$207.00	$103.50
EMS System - Lighting & HVAC	1,986	controlled sqft (1,000s)	15	0.7%	100%	$468.41	$234.21
Programmable Thermostat	1,881	controlled sqft (1,000s)	11	3.4%	100%	$144.50	$72.25
Economizer	0	tons of cooling	10	0.0%	100%	$145.49	$72.74
Reflective Window Film	9,570	100 sqft window area	10	1.9%	100%	$15.29	$7.64
Cool Roof	18,957	100 sqft roof area	15	1.4%	100%	$3.22	$1.61
Efficient Centrifugal Chiller - 0.51 kW/ton	0	tons	20	0.0%	100%	$169.04	$84.52
Efficient Screw Chiller - 0.55 kW/ton	0	tons	20	0.0%	100%	$662.29	$331.15
Efficient Air-Cooled Chiller - 1.01 kW/ton	0	tons	20	0.0%	100%	$662.29	$331.15
Tune-up/Advanced Diagnostics	0	tons	7	0.0%	100%	$136.75	$68.38
Refrigeration							
Motor Upgrade for Fans & Compressors - ECM & PSC motors	400	motor	15	0.9%	100%	$37.23	$18.62
Single Line to Multiplex Compressor	0	per ton	12	0.0%	100%	$2,762.81	$1,381.41
Multiplex system with oversized condenser	0	per ton	12	0.0%	100%	$406.38	$203.19
High efficiency, low temperature compressor with EER of 5.2	0	per ton	12	0.0%	100%	$848.53	$424.26
Evap Fan Controller for Med. Temp Walk-in	121	Med Temp Walk-ins	16	1.2%	100%	$136.75	$68.38
Strip Curtains	143	per sq ft of curtain	4	1.0%	100%	$7.50	$3.75
Night Covers	0	per linear feet	5	0.0%	100%	$37.63	$18.82
Anti-sweat Heater Controls	0	control	12	0.0%	100%	$868.24	$434.12
Floating Head Pressure Controls	29	per ton	12	0.1%	100%	$36.15	$18.08
Glass Doors on Low and Med. Temperature Displays	0	linear feet of display	12	0.0%	100%	$816.29	$408.15

Table E-3. APCo West Virginia Residential Base Case Scenario – A

Energy Efficiency Measure	Average Annual No. of Measures	Unit of Measure	Average Life of Measure	Annual Penetration Rate for Measure	Net to Gross Ratio % (Free Rider % less Spillover %)	Incremental Cost per Measure	Incentive per Measure	Payback Period (Incremental Cost less Incentive) / Annual kWh Savings	Incentive % of Incremental Cost
Lighting									
9-16W Screw-in CFL	126,849	per lamp	6.6	3.5%	100%	$1.95	$0.97	0.63	50.0%
9-16W Screw-in CFL	253,208	per lamp	6.6	3.6%	100%	$1.91	$0.95	0.35	50.0%
17-24W Screw-in CFL	75,378	per lamp	6.6	3.4%	100%	$2.00	$1.00	0.32	50.0%
25-34W Screw-in CFL	39,640	per lamp	6.6	3.7%	100%	$3.36	$1.68	0.42	50.0%
Over 34W Screw-in CFL	27,553	per lamp	6.6	3.4%	100%	$5.86	$2.93	0.64	50.0%
9-16W Pin Based CFL	0	per lamp	16	0.0%	100%	$38.21	$19.10	12.33	50.0%
9-16W Pin Based CFL	321	per lamp	16	15.3%	100%	$38.21	$19.10	7.09	50.0%
17-24W Pin Based CFL	95	per lamp	16	15.3%	100%	$41.92	$20.96	6.64	50.0%
25-34W Pin Based CFL	62	per lamp	16	15.3%	100%	$48.42	$24.21	6.03	50.0%
35-44W Pin Based CFL	0	per lamp	16	0.0%	100%	$61.75	$30.88	6.73	50.0%
45-54W Pin Based CFL	55	per lamp	16	15.5%	100%	$69.05	$34.53	4.15	50.0%
Over 54W Pin Based CFL	9	per lamp	16	15.2%	100%	$80.08	$40.04	5.17	50.0%
9-16W Screw-in CFL - Outdoor	4,939	per lamp	8.8	3.4%	100%	$3.33	$1.67	0.50	50.0%
9-16W Screw-in CFL - Outdoor	13,336	per lamp	8.8	3.7%	100%	$3.29	$1.65	0.29	50.0%
17-24W Screw-in CFL - Outdoor	2,268	per lamp	8.8	3.7%	100%	$3.38	$1.69	0.25	50.0%
25-34W Screw-in CFL - Outdoor	5,580	per lamp	8.8	3.6%	100%	$5.45	$2.73	0.32	50.0%
Over 34W Screw-in CFL - Outdoor	394	per lamp	8.8	3.5%	100%	$10.16	$5.08	0.38	50.0%
9-16W Pin Based CFL - Outdoor	34	per lamp	16	17.6%	100%	$27.79	$13.90	4.20	50.0%
9-16W Pin Based CFL - Outdoor	37	per lamp	16	15.1%	100%	$27.79	$13.90	2.42	50.0%
17-24W Pin Based CFL - Outdoor	21	per lamp	16	15.1%	100%	$30.46	$15.23	2.26	50.0%
25-34W Pin Based CFL - Outdoor	295	per lamp	16	15.1%	100%	$34.74	$17.37	2.03	50.0%
35-44W Pin Based CFL - Outdoor	24	per lamp	16	16.9%	100%	$43.51	$21.75	2.22	50.0%
45-54W Pin Based CFL - Outdoor	0	per lamp	16	0.0%	100%	$48.31	$24.16	1.36	50.0%
Over 54W Pin Based CFL - Outdoor	0	per lamp	16	0.0%	100%	$55.56	$27.78	1.23	50.0%
Indoor Torchieres	0	per lamp	8.8	0.0%	100%	$60.71	$30.36	3.04	50.0%
Indoor Torchieres	1,738	per lamp	8.8	3.0%	100%	$57.18	$28.59	1.69	50.0%
Occupancy Sensor for Common Area	0	Sensor	8.8	0.0%	100%	$66.54	$33.27	2.02	50.0%
Lighting Photocell controls for Common Area	0	Sensor	8.8	0.0%	100%	$155.35	$77.67	2.13	50.0%
LED Exit Signs for Multi-family	0	Sign	16	0.0%	100%	$84.06	$42.03	1.73	50.0%
LED night light	2,021	Light	16	3.3%	100%	$3.00	$1.50	1.24	50.0%
LED holiday lights	0	300 bulb string	16	0.0%	100%	$10.00	$5.00	2.57	50.0%

Table E-4. APCo West Virginia Residential Base Case Scenario – B

Energy Efficiency Measure	Average Annual No. of Measures	Unit of Measure	Average Life of Measure	Annual Penetration Rate for Measure	Net to Gross Ratio % (Free Rider % less Spillover %)	Incremental Cost per Measure	Incentive per Measure	Payback Period (Incremental Cost less Incentive) / Annual kWh Savings	Incentive % of Incremental Cost
Appliances & Pool Pumps									
Refrigerator, replace with Energy Star	0	Unit	11	0.0%	100%	$122.23	$61.12	9.46	50.0%
Freezer Energy Star	0	Unit	11	0.0%	100%	$35.00	$17.50	3.94	50.0%
Refrigerator, retire old	783	Unit	5	0.6%	53%	$0.00	$25.00	-0.20	na
Freezer retire old	0	Unit	4	0.0%	57%	$0.00	$25.00	-0.22	na
Variable Speed Drive Pool Pumps	267	Pump	10	1.1%	100%	$434.41	$217.21	1.03	50.0%
occ sensor power bars	0	Sensor	8	0.0%	100%	$85.00	$42.50	7.34	50.0%
Hot Water									
High Efficiency Water Heating Tank	4,804	Tank	13	1.8%	100%	$48.83	$24.42	0.87	50.0%
Low flow showerhead	1,808	Home	10	1.9%	100%	$38.05	$19.02	1.24	50.0%
Faucet Aerators	1,915	Home	10	2.0%	100%	$10.07	$5.04	0.60	50.0%
Dishwasher - Energy Star	0	Unit	11	0.0%	100%	$284.54	$142.27	19.11	50.0%
Drain Water Heat Recovery	0	Home	20	0.0%	100%	$703.87	$351.93	6.64	50.0%
Clothes Washer - Tier 3	0	Unit	11	0.0%	100%	$620.58	$310.29	4.87	50.0%
tank insulation	258	Tank	7	1.6%	100%	$56.47	$28.24	0.70	50.0%
pipe insulation	3,790	Tank	12	1.4%	100%	$3.53	$1.77	0.12	50.0%
HVAC & Shell									
Room A/C - Energy Star	0	Unit	9	0.0%	100%	$30.00	$15.00	2.51	50.0%
Central A/C - SEER 14 w/TXV	0	Ton	15	0.0%	100%	$119.21	$59.61	19.28	50.0%
Window Upgrade	0	per sqft of window	20	0.0%	100%	$16.76	$8.38	17.10	50.0%
Improved Ceiling Insulation	0	per sqft of ceiling	20	0.0%	100%	$1.42	$0.71	13.98	50.0%
Improved Wall Insulation	1,877,392	per sqft of wall	20	1.8%	100%	$0.60	$0.30	1.07	50.0%
Reduce Infiltration	7,910	per 1000 sqft	11	2.6%	100%	$230.00	$115.00	1.60	50.0%
HVAC testing and Maintenance	8,608	Ton	10	2.1%	100%	$36.79	$18.39	0.41	50.0%
Duct Repair	2,990	per home	18	1.8%	100%	$308.31	$154.16	1.16	50.0%
Energy Star Air Source Heat Pump	1,257	Ton	15	2.2%	100%	$217.49	$108.75	0.75	50.0%

APPENDIX F:
SB-RAM INPUT SUMMARY & MEASURE TRACKING SUMMARY

F.1 Input Summary Table

The following table shows the SB-RAM Inputs needed for potential savings calculations. The numbers used are examples from the APCo Virginia model. The same calculation procedures apply to West Virginia.

Input	Value	Source
Time Parameters		
Building Stock Base Year	2008	Utility provided. Work plan.
DSM Analysis Base Year	2009	Utility provided. Work plan.
# of Forecast Years	20	Utility provided. Work plan.
Financial Inputs		
Electricity Energy Rate	$0.078 (2008)	Utility provided. Customer billing.
Electricity Demand Rate	$0.000 (2008)	Utility provided. Customer billing.
Avoided Costs – Energy	$0.036 (2008)	Utility provided. Avoided cost data sheet.
Avoided Costs – Demand	$38.40 (2008)	Utility provided. Avoided cost data sheet.
Forecast Data Energy & Demand Inputs		
Total Energy Use – RES	16,035 GWh (2008)	Utility provided. Energy/Demand forecast data.
Total Demand Use – RES	7,862 MW (2008)	Utility provided. Energy/Demand forecast data.
Total Energy Use – C&I	GWh (2008)	Utility provided. Energy/Demand forecast data.
Total Demand Use – C&I	MW (2008)	Utility provided. Energy/Demand forecast data.
Forecast Data Building Stock Inputs		
Sector Stock – RES	451,750 (Ttl. Res)	Utility provided. Customer forecast data. Or EIA data.
Sector Stock – C&I	(Ttl/1000 sq.ft.)	Floor space based on EIA data.
Decay Rate	0.10%	Professional judgment.
Line Loss Assumptions		
Transmission	4.51%	Utility provided.
Distribution	5.43%	Utility provided.
Miscellaneous Program Inputs		
% of Low Income	18.0%	National Low Income database.
Escalation rate	3.1%	Utility provided.
Discount rate	8.1%	Utility provided.
Measure Technology Specific Inputs		
Base Tech Density		Based on other Utility surveys
Efficient Tech Density		Based on other Utility surveys
Total Maximum Density		Based on other Utility surveys
Willingness/Awareness		Based on other Utility surveys
Energy Impact		eQuest data.
Winter Demand Impact		eQuest data.
Measure Life		eQuest data.
Net to Gross Factor		EM&V Research
Technology Cost		DEER database.
Incentive Cost		DEER database.
Administrative Cost		DEER database.
Applicability		Building Characteristics & Professional judgment.
Program Specific Inputs		
Program Type	ROB/RET	Utility Input & Professional judgment
New Standards		Federal and State Regulations
Decision Maker data		
Coefficients		Based on customer payback values

F.2 Measure Tracking Summary

This appendix provides a high-level overview of how a measure moves through the Resource Assessment Model; including initial input energy and demand impact numbers, density in the marketplace, technical and economic potential, and finally achievable savings results.

As an example, the measure "17-24W Screw-in CFLs" installed in single-family existing homes, with electric space heat and the measure "25-34W Screw-in CFLs" installed in single family existing homes with non-electric space heat, are provided.

Step 1: Measure Inputs

Each measure requires a number of specific inputs for use in RAM calculations. For a complete list of Model Inputs, see Appendix E.

Measure	Energy Impact	Demand Impact	Base Technology Density	Installation Applicability	Space Heat Saturation
17-24 W Screw-in CFL – El Space Heat	31.3 kWh/lamp	0.45 watts/lamp	5.51 lamps/home	90%	61.9% Electric
25-34 W Screw-in CFL – Non-Electric Space Heat	65.7 kWh/lamp	8.72 watts/lamp	2.524 lamps/home	90%	38.1% Non-Electric

Step 2: Technical Potential and Economic Potential - 2009

Technical potential is the total conservation potential if the base technology is converted to the efficient technology in all homes at one time. Economic potential is the same as Technical Potential if the measure passes the TRC test. The technical potential is calculated by taking the number of homes and multiplying by the impact, density, applicability, and space heat saturation.

In 2009, there were 398,851 homes.

Measure	Energy Potential	Demand Potential	Pass TRC Test?
17-24 W Screw-in CFL – El Space Heat	38,307 MWh	555 kW	Yes (2.04)
25-34 W Screw-in CFL – Non-Electric Space Heat	22,317 MWh	3,008 kW	Yes (2.87)

Step 3: Maximum First Year Market Potential

This step is used to help in the calibration of the model. Calibration targets are generally at the end-use, not measure level, and these values are used to distribute the end-use calibration targets into measure specific targets. The values are the same as economic potential, except that they also have the Willingness and Awareness values applied to them.

Measure	% Aware of Measure	% Willing to Purchase	Maximum First Year Market Potential
17-24 W Screw-in CFL – El Space Heat	85%	70%	22,792 MWh
25-34 W Screw-in CFL – Non-Electric Space Heat	85%	70%	13,279 MWh

Step 4: Decision Maker Calibration and Market Penetration Variables

The decision making function includes measure payback, fixed adoption model Beta value that influences how quickly or slowly a measure enters the market place, and a diffusion formula based on consumer Willingness and Awareness and changes to these variables over time. After establishing initial values based on these aforementioned variables and fixed values, the calibration targets by measure are used to calculate the measure market factor. Changes in payback and measure Willingness and Awareness over time modify year-to-year implementation rates. Different Market Potential scenarios are generally based on modifying one of these inputs. The most common is to modify the incentive level, which changes the payback value.

Measure	Initial Payback	Beta Value	Calibrated Market Factor	Diffusion Curve Deflection Point
17-24 W Screw-in CFL – El Space Heat	0.4 years	8.06	0.6904	2.8 years
25-34 W Screw-in CFL – Non-Electric Space Heat	0.32 years	9.9	0.6904	2.8 years

Step 5: Calculate Annual Measure Participation (before space heat saturation, measure applicability, or net-to-gross adjustments)

In this step, the number of individual measures that participate in the program are calculated. This is not the number of participants, but rather the number of units installed, for this example, the number of CFL lamps installed. This is also a stock accounting step. All measures that are implemented are removed from the pool of base technology applications.

The basic calculation is to have the Base Technology Density multiplied by the Calibrated Market Factor multiplied by a function that includes Measure Payback and the Beta Value multiplied by the Willingness and Awareness function.

Measure	2009Unadjusted Participant Measures	2010 Unadjusted Participant Measures
17-24 W Screw-in CFL – El Space Heat	36,799	72,594
25-34 W Screw-in CFL – Non-Electric Space Heat	16,858	36,685

Step 6: Calculate Cumulative Energy and Demand Potential

Within this step, the per unit energy and demand savings per measure are multiplied by the results of Step 5, as well as multiplied by the appropriate space heat saturation, measure applicability, and the net-to-gross value. Below are the calculations for Energy Market Potential for 2009.

Measure	Unadjusted Participant Measure Units - 2009	Energy Savings/Unit	Net-to-Gross Factor	Measure Applicability	Space Heat Saturation	2009 Market Potential
17-24 W Screw-in CFL – El Space Heat	36,799	31.3 kWh/lamp	1.0	90%	61.9% Electric	641 MWh
25-34 W Screw-in CFL – Non-Electric Space Heat	16,858	65.6 kWh/lamp	1.0	90%	38.1% Non-Electric	379 MWh

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Kentucky Power Company

REQUEST

Refer to Tab 1, Section 10 of the application, titled "Expected Savings/Benefits." Provide an explanation of how energy savings per year are calculated for all the proposed programs.

RESPONSE

The energy savings per year for all the proposed efficient products were calculated by taking the wattage difference between the replacement of the incandescent bulb with a energy efficient lamp (such as a compact fluorescent lamp or LED bulb) multiplied by the estimated hours of use per year. For example, if a 100 watt incandescent bulb that was used for 840 hours per year was replaced with a 26 watt compact fluorescent lamp, the annual energy savings would be 62 kWh *[(100 watt - 26 watt)/1000 watts per kilowatt x 840 hours/year]*.

WITNESS: Errol K Wagner

Kentucky Power Company

REQUEST

Provide any calculations involved with the cost/benefit analysis results provided for each proposed program.

RESPONSE

In the previous Question No. 4, "proposed programs" refers to the "proposed efficient products" of the Residential Efficient Products Program. Therefore, the calculations provided are those involved with the cost/benefit analysis results for the efficient products of the Residential Efficient Products Program, which are attached on Page 2 of this response.

WITNESS: Errol K Wagner

Calculations Involved with the Cost/Benefit Analysis For the Efficient Products Program

Program	Res Eff Products (CFL)
Utility	KPC
Jurisdiction	KY
Market Segment	Residential
Area	East
	Program Benefits

Test	NPV	Benefit/Cost Ratio	PV Benefits	PV Costs
Total Resource	$ 1,050,803	1.48	3,242,161	2,191,358
Participant	$ 2,217,392	2.08	4,275,199	2,057,807
RIM	$ (2,426,901)	0.47	2,195,521	4,622,422
Utility	$ 2,888,816	9.18	3,242,161	353,345

Kentucky Power Company

REQUEST

Refer to Tab 2, Commercial High Efficiency Heat Pump/Air Conditioner Program. Section 6A mentions promoting the program by other "expeditious means."

a. Provide examples of other "expeditious means" of promoting the program.

b. Identify what procedures are in place to ensure fair and equitable distribution of the program's funding to customers, dealers, and vendors.

RESPONSE

a. Other "expeditious means" that the Company will try to obtain a listing of licensed HVAC dealers from the Commonwealth of Kentucky. KPCo will compare the listing of dealers with it's list of HVAC dealers and send letters to the respective dealers informing them of the program.

b. The program will be promoted to licensed HVAC dealers operating within our twenty county service area. An incentive will be paid to each customer who installs new equipment that meets or exceeds program guidelines. Each participating HVAC dealer will receive an incentivefor each unit that they sell that meets or exceeds program guidelines. Participating HVAC dealers sell various brands of equipment and they purchase this equipment from various distributors. KPCo does not promote one brand of equipment over another brand of equipment nor does the company promote specific HVAC dealers.

WITNESS: Errol K Wagner

Kentucky Power Company

REQUEST

The commercial efficiency heat pump program does not contain a cost/benefit analysis.

a. Explain why no cost/benefit analysis is provided for this program.

b. If available, please provide a cost/benefit analysis for this program with supporting documentation.

RESPONSE

When the Company was re-producing the February 26, 2010 filing, the page containing the cost/benefit analysis was omitted for the Commercial High Efficiency Heat Pump / Air Conditioner Program. The Company apologies for this oversight.

Attached please find a copy of the Commercial High Efficiency Heat Pump/Air Conditioner Program wherein Page 6 of 6, paragraph 10 contains the Cost/Benefit Analysis.

WITNESS: Errol K Wagner

Commercial
High Efficiency Heat Pump / Air Conditioner Program

1. DESCRIPTION

Kentucky Power Company (KPCo) will offer a financial incentive to small commercial customers (< 100 kW demand) who purchase a new qualifying central air conditioner or heat pump up to a 5-ton unit with a Consortium for Energy Efficiency (CEE)$_{SM}$ rating and who comply with pertinent eligibility requirements of the program.

2. RATIONALE FOR PROGRAM

The commercial high-efficiency heat pump / air conditioner program is designed to encourage the purchase of energy efficient central air conditioners and heat pumps identified by the U. S. Department of Energy (DOE), the U. S. Environmental Protection Agency (EPA) and/or the Consortium for Energy Efficiency (CEE) as being influential in energy efficiency. This program targets the existing retrofit market only.

This program is beneficial, as it helps lower electric bills for all commercial customers and allows KPCo to utilize its existing generating capacity more efficiently, thereby deferring or delaying the need for new generation as well as conserving our country's valuable natural resources.

3. PARTICIPATION GOALS

	Air Conditioner Replacement	Heat Pump Replacement
Jan. 2010 thru Dec. 2010	50	10
Jan. 2011 thru Dec. 2011	100	20
Jan. 2012 thru Dec. 2012	100	20

4. ELIGIBLE CUSTOMERS

Eligible existing retail small commercial customers must:

- Have unit installed at a location receiving electric service from KPCo;
- Have a maximum peak demand less than 100 kW over the previous 12 months;
- Install a central air conditioner or heat pump that meets the (CEE)$_{SM}$ guidelines as indicated by listing in the CEE/ARI Verified Directory.

Licensed HVAC dealers installing qualifying equipment will also be eligible to receive an incentive.

5. INCENTIVES

KPCo will provide monetary incentives as inducements for customers to purchase higher efficiency eligible central air conditioners and heat pumps meeting the specifications at the CEE Tier 1 level instead of baseline efficiency (i.e., standard) air conditioners and heat pumps. The incentive is designed to offset a portion of the additional cost involved with the qualified purchase of the higher efficiency central air conditioner or heat pump. KPCo will pay incentives for each central air conditioner or heat pump replaced based on the following tables:

Unitary Central Air Conditioner for Units Meeting CEE Specifications

Equipment Type	Size Category	Sub Category	CEE Tier 1
Air Cooled Cooling Mode	<65,000 Btu/h	Split System	14 SEER 12.0 EER
Air Cooled Cooling Mode	<65,000 Btu/h	Single Package	14 SEER 11.6 EER

KPCo will pay a $250 incentive for each central air conditioner equal to or less than 36,000 Btu/h. A $400 incentive will be paid for each central air conditioner greater than 36,000 Btu/h and less than 65,000 Btu/h. A $50 incentive will be paid to participating HVAC dealers for each air conditioner installed.

Unitary Heat Pump for Units Meeting CEE Specifications*

Equipment Type	Size Category	Sub Category	CEE Tier 1
Air Cooled Cooling Mode	<65,000 Btu/h	Split System	14 SEER 12.0 EER
Air Cooled Cooling Mode	<65,000 Btu/h	Single Package	14 SEER 11.6 EER
Air Cooled Heating Mode	<65,000 Btu/h	Split System	8.5 HSPF
Air Cooled Heating Mode	<65,000 Btu/h	Single Package	8.0 HSPF

KPCo will pay a $300 incentive for each heat pump equal to or less than 36,000 Btu/h. A $450 incentive will be paid for each heat pump greater than 36,000 Btu/h and less than 65,000 Btu/h. A $50 incentive will be paid to participating HVAC dealers for each heat pump installed.

*Eligibility for Central Heat Pump incentive is limited to customers whose primary heating source is electricity.

6. IMPLEMENTATION PLAN

A. Promotion

KPCo will promote the program to its small commercial customers by written information in monthly electric bills, media promotion of eligible central air conditioners and heat pumps, direct contact, or other expeditious means.

KPCo will contact HVAC dealers in its service area to explain the program, encourage their participation, and provide educational outreach materials and incentive rebate forms.

B. Delivery

KPCo representatives will work in conjunction with trade allies to promote high efficiency air conditioners / heat pumps in place of less efficient electric heating and cooling systems.

C. Quality Assurance

The program will be regularly reviewed by KPCo staff responsible for the program as well as the Company's DSM Collaborative. The Company will maintain communication with trade allies as well as respond to any customer inquiries. A selected sample of installations will be inspected to verify quality of installation.

D. Evaluation

KPCo will perform an evaluation relating to the program's impact and processes, including program objectives, data collection procedures, quality assurance methodologies, reporting timelines, costs, and the program's cost/benefit analyses.

The program evaluation objectives will be to:

1. Assess participant satisfaction with the program;
2. Gain insight into the market potential, including the participant characteristics, participation rate, and customer awareness of energy efficiency;
3. Determine the program impacts, including energy savings (KWh) and demand reduction (kW), and program value to customers;
4. Assess the program's cost-effectiveness based on various economic tests;
5. Assess the effectiveness of program delivery mechanisms.

7. TIMELINE

Action	Start	End
Program Approval	02/10	06/10
Implementation	06/10	12/12
Evaluation	01/12	06/12*

*Evaluation Report will be provided on 08/15/12

8. ANNUAL BUDGET

	Year 1	Year 2	Year 3
Customer Incentives	$ 24,500	$ 49,000	$ 49,000
Equipment/Vendor	$ 3,000	$ 6,000	$ 6,000
Promotion	$ 5,700	$ 12,000	$ 12,000
Evaluation	$ 2,000	$ 2,000	$ 6,000
TOTAL COSTS	$ 35,200	$ 69,000	$ 73,000

9. EXPECTED SAVINGS / BENEFITS

a. Anticipated load Impact Per Participant: (Based on 5 Ton Units)

Upgrading Heat Pump Customers:

Energy Savings Per Year	=	1,240	kWh
Demand Reduction	=	0.350	kW
	(@ system winter peak)		
	=	0.164	kW
	(@ system summer peak)		

b. Upgrading Air Conditioning Customers: (Based on 5 Ton Units)

Energy Savings Per Year	=	313	kWh
Demand Reduction	=	0.000	kW
	(@ system winter peak)		
	=	0.164	kW
	(@ system summer peak)		

c. Annual Expected Program Savings/Benefits (including T&D losses) @ 120 units in one year:

Winter Demand Reduction	Summer Demand Reduction	Annual Energy Savings
6.8 kW	19.6 kW	55 MWh

Projected energy savings and demand reductions are estimated based on the anticipated number of installations. The estimated effects of freeriders are included.

d. Projected Program MWh Savings and kW Reduction Assuming Participation (Including T&D losses):

Goal of 300 units is achieved (all customers in three years)

Energy Savings	=	137 MWh
Demand Reduction	=	17.4 kW
	(@ system winter peak)	
	=	49.1 kW
	(@ system summer peak)	

10. COST / BENEFIT ANALYSIS

Benefit / cost ratios based on Summer Peak and the information available at the time of program design.

a.	Total Resource Cost	=	1.24
b.	Ratepayer Impact Measure	=	0.39
c.	Participant	=	1.68
d.	Utility Cost	=	1.02

Kentucky Power Company

REQUEST

Refer to Tab 3, Section 6 of the application, titled "Implementation Plan," Section A. Explain the process for selecting those HVAC dealers with whom relationships are to be developed.

RESPONSE

The Company will partner with licensed HVAC dealers operating within our service area to promote the program. KPCo will send a letter to the HVAC dealers explaining the program and copies of the HVAC tune-up installation form. KPCo will meet with HVAC dealer as necessary, an upon request, to discuss questions and details of the program. New dealers can be added to the program upon request.

WITNESS: Errol K Wagner