May 15, 2012

Docketing Division
Public Utilities Commission of Ohio
180 East Broad Street
Columbus, Ohio 43215-3793

Re: Case No. 12-1420-EL-POR
Case No. 11-4627-EL-WVR

Dear Docketing:

By way of Entry dated December 14, 2011 in *In the Matter of the Joint Application of Columbus Southern Power Company, Ohio Power Company, The Dayton Power and Light Company, and Duke Energy Ohio, Inc., for a Waiver with Regard to Rule 4901:1-39-05(C), Ohio Administrative Code*, Case No. 11-4627-EL-WVR, the Commission directed that each electric utility file a cover letter with its portfolio status report referencing the waiver of Rule 4901:1-39-05(C), which permits the utility to file its Annual Portfolio Status Report on or before May 15, 2012.

Pursuant to the entry granting the waiver request, DP&L hereby requests that Docketing Division designate Case No.11-4627-EL-WVR as a related case to *In the Matter of The Dayton Power and Light Company's Portfolio Status Report*, Case No. 12-1420-EL-POR. Thank you.

Very truly yours,

Emily Rabb

Emily Rabb

BEFORE
THE PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of The Dayton Power and Light Company's Portfolio Status Report	))	Case No. 12-1420-EL-POR Case No. 11-4627-EL-WVR

THE DAYTON POWER AND LIGHT COMPANY'S COMBINED NOTICE OF FILING PORTFOLIO STATUS REPORT AND APPLICATION TO ADJUST BASELINES

The Dayton Power and Light Company ("DP&L" or "the Company") hereby submits its annual Portfolio Status Report pursuant to section 4901:1-39-05(C) of the Ohio Administrative Code ("O.A.C"), addressing the performance of all of DP&L's approved energy efficiency and peak demand reduction programs over calendar year 2011. As shown in the attached Portfolio Status Report, DP&L has met its statutory benchmarks for energy efficiency and peak demand reduction.

DP&L also makes application pursuant to section 4928.66(A)(2)(c) of the Ohio Revised Code ("O.R.C.") and O.A.C. §4901:1-39-05(B) to adjust its sales and demand baselines to normalize for weather and changes in numbers of customers and sales. As described in the 2011 Benchmark Report, included within the Portfolio Status Report as Appendix B, the changes requiring adjustments to the baselines were outside of DP&L's reasonable control. Appendix B contains all assumptions, rationales, and calculations, and proposes methodologies and practices to be used in the proposed adjustments or normalizations to support DP&L's application to adjust baselines, as required by O.A.C. §4901:1-39-05(B).

1. DP&L is a public utility and electric light company as defined by sections 4905.02 and 4905.03(A)(3) of the Ohio Revised Code respectively, and an electric distribution utility as defined by O.R.C. §4928.01(A)(6).

2. Pursuant to O.R.C §4928.66(A)(1)(a), DP&L is required to "implement energy efficiency programs that achieve energy savings equivalent to at least three-tenths of one per cent of the total, annual average, and normalized kilowatt-hour sales of the electric distribution utility during the preceding three calendar years to customers in this state. The savings requirement, using such a three-year average, shall increase to an additional five-tenths of one per cent in 2010, seven-tenths of one per cent in 2011."

3. O.R.C. §4928.66(A)(1)(b) requires that DP&L "implement peak demand reduction programs designed to achieve a one per cent reduction in peak demand in 2009 and an additional seventy-five hundredths of one per cent reduction each year through 2018."

4. O.R.C. §4928.66(A)(2)(a) provides: "The baseline for energy savings under division (A)(1)(a) of this section shall be the average of the total kilowatt hours the electric distribution utility sold in the preceding three calendar years, and the baseline for a peak demand reduction under division (A)(1)(b) of this section shall be the average peak demand on the utility in the preceding three calendar years, except that the commission may reduce either baseline to adjust for new economic growth in the utility's certified territory."

5. On March 15, 2011, DP&L filed its 2010 Portfolio Status Report pursuant to O.A.C. §4901:1-39-05(C) and Application to Adjust Baselines pursuant to O.A.C.

§4901:1-39-05(B) in Case No.11-1276-EL-POR, *In the matter of the Dayton Power and Light Company's Portfolio Status Report.*

6. As more fully described, and supported in DP&L's 2011 Benchmark Report attached hereto, DP&L applies to make adjustments to its baselines to normalize for weather changes, and to reflect changes to DP&L's customer base and corresponding load, which fall outside of the realm of what would be expected in the ordinary course of natural business growth and contraction cycles. Specifically, DP&L seeks to make adjustments to account for both customer load growth and loss of at least 2 MW. This level of change would represent a greater loss or growth than would be counterbalanced under typical business conditions.

7. As more fully explained in the 2011 Benchmark Report, and supported by Schedule 1 and the corresponding Workpapers A, C, D and E, DP&L's 2011 normalized energy efficiency baseline is 14,099,979 MWh and DP&L's 2011 incremental normalized energy efficiency reduction benchmark is 98,700 MWh. DP&L's cumulative energy efficiency reduction benchmark is 214,336 MWh.

8. DP&L's 2011 normalized peak demand reduction baseline, as fully explained in its 2011 Benchmark Report, and supported by Schedule 2 and the corresponding Workpapers B, C, D and E is 2,824 MW and DP&L's 2011 normalized peak demand reduction benchmark is 70.6 MW.

9. DP&L's energy efficiency and demand reduction programs, designed to achieve the required energy savings and demand reductions, were filed as part of a comprehensive energy efficiency and peak-demand reduction program portfolio approved in Case No. 08-1094-EL-SSO, *In the Matter of the Application of The Dayton Power and*

Light Company for Approval of Its Electric Security Plan ("ESP filing") and supplemented and again approved by the Stipulation and Recommendation filed and approved without modification by Commission Order dated April 27, 2011 in *In the matter of the Application of the Dayton Power and Light Company for a finding that DP&L has Satisfied Program Portfolio Filing Requirements*, Case No. 09-1986-EL-POR.

10. O.A.C. §4901:1-39-05(C) provides: "by March fifteenth of each year, each electric utility shall file a portfolio status report addressing the performance of all approved energy efficiency and peak-demand reduction programs in its program portfolio plan over the previous calendar year. . ." DP&L sought, and was granted a waiver of O.A.C. § 4901:1-39-05(C) to permit DP&L to file its Annual Portfolio Status Report on or before May 15, 2012.[1]

11. DP&L timely submits the attached Portfolio Status Report ("Report") which includes the following components:

(1) A Compliance Demonstration which includes: (a) an update to DP&L's initial benchmark report (Report, Section 2); (b) a comparison of the applicable benchmarks to the actual energy savings and peak demand reductions achieved (Report, Section 2); and (c) an affidavit regarding compliance with the statutory benchmarks (Exhibit 2).

(2) A Program Performance Assessment, including: (a) a description of each approved energy efficiency or peak-demand reduction program implemented in the previous calendar year (Report, Sections 3-5); (b) an evaluation, measurement, and verification report by The Cadmus Group, Inc. ("Cadmus Report," Exhibit 1);

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[1] Entry dated December 14, 2011 in *In the Matter of the Joint Application of Columbus Southern Power Company, Ohio Power Company, The Dayton Power and Light Company, and Duke Energy Ohio, Inc., for a Waiver with Regard to Rule 4901:1-39-05(C), Ohio Administrative Code*, Case No. 11-4627-EL-WVR,

and (c) a recommendation with respect to continuation, modification or elimination of each program (Report, Section 6).

12. As described in the Report, and as attested to in the attached Affidavit of the Vice President of Service Operations, DP&L has met its 2011 statutory benchmarks for energy efficiency and peak demand reduction.

WHEREFORE, DP&L respectfully requests that the Commission issue an order finding that DP&L has complied with its 2011 statutory energy efficiency and peak demand reduction benchmark requirements and acknowledging DP&L compliance with the Program Portfolio Status Report requirements found in O.A.C. § 4901:1-39-05(C).

Respectfully submitted,

Judi L. Sobecki (0067186)
Randall V. Griffin (0080499)
The Dayton Power and Light Company
1065 Woodman Drive
Dayton, OH 45432
Telephone: (937) 259-7171
Facsimile: (937) 259-7178
Email: judi.sobecki@dplinc.com
randall.griffin@dplinc.com

Attorneys for The Dayton Power and Light Company

THE DAYTON POWER AND LIGHT COMPANY

2011 ENERGY EFFICIENCY AND DEMAND REDUCTION/RESPONSE PORTFOLIO STATUS REPORT

MAY 15, 2012

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EXECUTIVE SUMMARY

OVERVIEW

On October 10, 2008, The Dayton Power and Light Company (DP&L) filed its energy efficiency and peak demand reduction plan in Book Two of its Electric Security Plan in Case No. 08-1094-EL-SSO. DP&L's plan, as modified by the Stipulation filed on February 24, 2009, was approved by the Commission on June 24, 2009. DP&L supplemented the portfolio plan by its Notice of Filing Supplement to Application filed on July 15, 2010 and July 16, 2010 in Case No. 09-1986-EL-POR. DP&L's supplemented plan, as modified by the Stipulation filed March 22, 2011, was approved by the Commission on April 27, 2011.

Since 2009, DP&L has focused on implementing its approved plan. DP&L has successfully put in place a portfolio of business and residential programs that provide customers with a variety of energy efficiency choices. Specifically, DP&L is offering customers five residential programs, two business programs, and an educational effort that includes a school program and a consumer awareness campaign. Through the process, DP&L has kept the energy efficiency collaborative informed of its progress and is working directly with several collaborative members to either implement programs or market them to various customer groups. DP&L filed a supplement to its energy efficiency and peak demand reduction program portfolio in Case No. 11-610-EL-POR on December 20, 2011, for approval to count the results of its 4 kV to 12 kV conversion project ("conversion project") toward its energy efficiency and peak demand reduction benchmarks. Since the case is still pending Commission approval, no savings from this conversion project have been counted in 2011.

It should be noted that the 2009 actual energy and demand savings were reported in DP&L's 2009 Energy Efficiency and Demand Reduction/Response Portfolio Status Report filed on March 12, 2010, in Case No. 10-0303-EL-POR. Further, the 2010 actual energy and demand savings were reported in DP&L's 2010 Energy Efficiency and Demand Reduction/Response Portfolio Status Report filed on March 15, 2011, in Case No. 11-1276-EL-POR.

SAVINGS CALCULATIONS

The energy and demand savings calculations were based mainly on the draft State of Ohio Energy Efficiency Technical Reference Manual (TRM), filed August 6, 2010 under Case No. 09-0512-GE-UNC. However, there were exceptions for measures not included in the TRM or where evaluations resulted in a valid alternate calculation. A discussion of calculation methodology is included in the Cadmus EM&V report, attached as Exhibit 1.

COMPLIANCE SUMMARY

In 2009, DP&L reported energy savings of 115,279 MWh. In 2010, DP&L reported energy efficiency program savings of 174,249 MWh and mercantile program savings of 4,957 MWh. In 2011, DP&L energy efficiency programs generated savings of 164,039 MWh and mercantile programs generated savings of 15,547 MWh. Therefore, cumulative annualized energy savings for 2009 through 2011 are 474,071 MWh.

In 2009, DP&L reported 16.5 MW of demand savings. In 2010, DP&L reported 24.7 MW of demand savings from energy efficiency programs and 1.5 MW from energy efficiency mercantile commitments. In 2011, DP&L's energy efficiency programs generated 24.2 MW of demand savings. In addition, mercantile customers committed 51.4 MW of PJM Demand Response and 3.5 MW of energy efficiency demand for integration with DP&L's program portfolio. Therefore, total 2011 cumulative demand savings are 121.8 MW.

Based on this performance, DP&L surpassed its 2011 cumulative benchmark targets of 214,336 MWh and 70.6 MW. A more detailed analysis is provided in Section 2, Compliance Demonstration.

	MWh	MW
2009 Actuals	115,279	16.5
2010 Energy Efficiency Actuals	174,249	24.7
2010 Mercantile Commitments (EE only)*	4,957	1.5
2011 Energy Efficiency Actuals	164,039	24.2
2011 Mercantile Commitments	15,547	54.9
Cumulative 2009/10/11 Total Savings	474,071	121.8
Cumulative 2011 Benchmarks	214,336	70.6

*Mercantile commitments for PJM Demand Response do not carry over from year to year. Therefore, 2010 PJM Demand Response commitments have been removed from the cumulative total.

2011 PROGRAM SUMMARY

2011 Annualized Program Results

Program	2011 Energy (MWh)	2011 Demand (MW)
Residential Lighting (CFL)	92,842	11.10
Residential HVAC Rebates	8,016	2.56
Residential HVAC Diagnostic & Tune Up	39	0.01
Residential Appliance Recycling	5,961	0.95
Residential Appliance Rebates[1]	0	0.00
Residential Low Income Affordability	1,001	0.10
Non-Residential Prescriptive Rebates	34,495	6.15
Non-Residential Custom Rebates	20,514	3.22
Education, School Programs[2]	1,171	0.14
Mercantile Customer Commitments[3]	15,547	54.87
Total	179,586	79.10

[1] With the approval of PUCO Staff and notification of DP&L's energy efficiency collaborative, DP&L transferred the 2011 appliance rebate budget to the appliance recycling program.

[2] 2011 savings are savings from the 2010/2011 school year.

[3] Mercantile Customer Commitments include 51.42 MW of PJM Demand Response committed to DP&L.

BANKED ENERGY SAVINGS

DP&L plans to bank the excess energy savings achieved cumulatively through 2011 and apply the excess toward future benchmarks. The total amount of banked energy savings is 259,735 MWh and is calculated as follows:

2011 Actual Cumulative Energy Savings – 2011 Cumulative Benchmark = Banked Energy Savings

474,071 MWh – 214,336 MWh = 259,735 MWh

PRO-RATED VERSUS ANNUALIZED SAVINGS

Appendix A includes the energy savings and demand calculations on a pro-rated basis for 2011. The 2011 incremental energy savings on a pro-rated basis totals 99,308 MWh and the 2011 incremental demand savings on a pro-rated basis totals 71.1 MW.

Regardless of whether calculated on a pro-rated basis or an annualized basis, DP&L achieved both its energy and demand 2011 cumulative benchmarks.

The compliance calculations on a pro-rated basis are as follows:

	MWh	MW
2009 Actuals	115,279	16.5
2010 Actuals	174,249	24.7
2010 Mercantile Commitments*	4,957	1.5
2011 Pro-Rated Actuals	83,761	16.2
2011 Mercantile Commitments	15,547	54.9
Cumulative 2009/10/11 Total Savings	393,793	113.8
Cumulative 2011 Benchmarks	214,336	70.6

*Mercantile commitments for PJM Demand Response do not carry over from year to year. Therefore, 2010 PJM Demand Response commitments have been removed from the cumulative total.

EVALUATION, COST EFFECTIVENESS

Attached to this report, as Exhibit 1, is the 2011 evaluation, measurement, and verification report produced by The Cadmus Group (Cadmus).

In addition, Cadmus performed cost effectiveness tests for each of the programs and for the portfolio as a whole. These are the Total Resource Cost Test (TRC), the Utility Cost Test (UCT), the Participant Cost Test (PCT), the Ratepayer Impact Measure (RIM), and the Societal Test (SCT). DP&L's portfolio was cost effective as measured by the TRC. A detailed review of the cost effectiveness tests and program-specific results can be found in the cost effectiveness section of the EM&V report, included as Exhibit 1.

	Primary	Secondary		
	Total Resource Cost Test	Utility Cost Test	Ratepayer Impact Measure Test	Participant Cost Test
DP&L Portfolio	1.71	4.92	0.39	4.70

2011 PROGRAM COST SUMMARY

Program	Original Filing, 2011	Actual, 2011
Residential Lighting (CFL)[1]		
Incentive Costs	$1,724,260	$2,574,159
Marketing & Admin	$1,138,012	$581,378
Program Total	$2,862,272	$3,155,537
Residential HVAC Rebates[1]		
Incentive Costs	$968,939	$1,812,800
Marketing & Admin	$678,257	$405,559
Program Total	$1,647,196	$2,218,359
Residential HVAC Tune Up[1]		
Incentive Costs	$804,479	$33,240
Marketing & Admin	$402,240	$182,195
Program Total	$1,206,719	$215,435
Residential Appliance Recycling[1]		
Incentive Costs	$118,435	$185,625
Marketing & Admin	$260,557	$548,108
Program Total	$378,992	$733,733
Residential Appliance Rebates[1]		
Incentive Costs	$131,770	$0
Marketing & Admin	$79,062	$0
Program Total	$210,832	$0
Residential Low Income Affordability		
Incentive Costs	$841,143	$802,582
Marketing & Admin	$224,151	$187,110
Program Total	$1,065,294	$989,692
Non-Residential Prescriptive Rebates		
Incentive Costs	$1,897,646	$1,808,730
Marketing & Admin	$834,964	$353,672
Program Total	$2,732,610	$2,162,402
Non-Residential Custom Rebates		
Incentive Costs	$1,412,458	$1,381,728
Marketing & Admin	$776,852	$332,706
Program Total	$2,189,310	$1,714,434
Non-Residential Mercantile Program		
Incentive Costs	$0	$1,099,890
Marketing & Admin	$0	$121,229
Program Total	$0	$1,221,119
Education[1][2]		
School Program, Ohio Energy Project		$211,621
General Energy Efficiency Education		$685,718
Program Total	$1,619,625	$897,339
Evaluations, Measurement & Verification[3]	$784,066	$671,997
Total Program Costs	**$14,696,916**	**$13,980,047**

(1) With the approval of PUCO Staff and notification of DP&L's energy efficiency collaborative, DP&L reallocated budgets within the residential portfolio as described below. The original filed budgets are listed in this table.

(2) For Education, Awareness Building, and Market Transformation Activities, the filed portfolio plan did not separate budgets for individual activities.

(3) EM&V costs include charges from Vermont Energy Improvement Corporation (VEIC), EcoNorthwest and Cadmus.

With the approval of PUCO Staff and notification of DP&L's energy efficiency collaborative, DP&L reallocated budgeted dollars within the residential program portfolio. The following table summarizes that reallocation.

Approved Budget Reallocations

Program	Filed 2011 Budget	Change	Revised 2011 Budget
Residential Lighting (CFL)	$2,862,272	+$600,000	$3,462,272
HVAC Rebates	$1,647,196	+$850,000	$2,497,196
HVAC Tune Up	$1,206,719	($850,000)	$356,719
Appliance Recycling	$378,992	$210,832	$589,824
Appliance Rebates	$210,832	($210,832)	--
Low Income Affordability	$1,065,294	--	$1,065,294
Education, Awareness, Mkt Transformation	$1,619,625	($600,000)	$1,019,625
Total	$8,990,930	$0	$8,990,930

The next table provides a total budget summary compared to actuals, taking into account the approved budget reallocation.

Reallocated 2011 Program Budgets

Program	**2011 Budget**	**Actual, 2011**
Residential Lighting (CFL)	$3,462,272	$3,155,537
Residential HVAC Rebates	$2,497,196	$2,218,359
Residential HVAC Tune Up	$356,719	$215,435
Residential Appliance Recycling	$589,824	$733,733
Residential Appliance Rebates	$0	$0
Residential Low Income Affordability	$1,065,294	$989,692
Non-Residential Prescriptive Rebates	$2,732,610	$2,162,402
Non-Residential Custom Rebates	$2,189,310	$1,714,434
Mercantile	$0	$1,221,119
Education	$1,019,625	$897,339
Evaluations, Measurement & Verification	$784,066	$671,997
Total Program Costs	**$14,696,916**	**$13,980,047**

COMPLIANCE DEMONSTRATION

BENCHMARK REPORT UPDATE

In accordance with section 4901:1-39-05(C)(1)(a) of the Ohio Administrative Code, DP&L is filing its 2011 Benchmark Report, included in this filing as Appendix B.

DP&L's 2011 cumulative energy and peak demand reduction benchmark targets are as follows:

Normalized Energy Reduction Benchmark (MWh)	214,336
Normalized Peak Demand Reduction Benchmark (MW)	70.6

For informational purposes, included below are Schedules 1 and 2 from DP&L's 2011 Benchmark Report.

Schedule 1

THE DAYTON POWER & LIGHT COMPANY

2011 Benchmark Report

Energy Efficiency Baseline and Benchmark Calculation

		2008	2009	2010	2011
1	**Baseline Calculation Components**				
2	Retail MWh Sales [1]	14,795,127	13,727,277	14,282,324	
3					
4	**Normalizing Adjustments**				
5	Significantly Reduced Customer Sales [2]	(365,767)	(116,092)	(35,022)	
6	Significantly Expanded Customer Sales [3]	67,362	60,245	44,978	
7	Total Customer Sales Adjustment (5)+(6)	(298,405)	(55,847)	9,956	
8	Mercantile Customer Adjustment [4]	11,705	15,822	16,818	
9	Total Adjusted Retail Sales (2)+(7)+(8)	14,508,427	13,687,252	14,309,098	
10	Weather Normalization Factor [5]	1.00089	1.01859	0.96700	
11	Normalized Retail Energy Sales (9)*(10)	14,521,340	13,941,698	13,836,898	
12					
13	**2011 Normalized Energy Efficiency Baseline**				
14	3 Year Normalized Average (MWh)				14,099,979
15					
16	**Calculation of 2011 Energy Efficiency Reduction Benchmark**				
17	Normalized Preceding 3 Year Average Sales (14)				14,099,979
18	2011 Incremental Energy Efficiency Reduction Benchmark % [6]				0.70%
19	2011 Incremental Energy Efficiency Reduction Benchmark (17)*(18)				98,700
20	2009-2010 Energy Efficiency Reduction Benchmark [7]				115,636
21	**2011 Cumulative Energy Efficiency Reduction Benchmark (19)+(20)**				**214,336**

[1] Retail sales for the period 2008-2010 are reported in PUCO Form FE-D1 (Case No. 11-2505-EL-FOR). See Workpaper A, Column (6).

[2] Significantly reduced customer sales include those who ceased or reduced their operations during the period. See Workpaper C for details on load reductions.

[3] Significantly expanded customer sales include those who started or expanded their operations during the period. See Workpaper C for details on load expansions.

[4] See Workpaper D for calculation of Mercantile Customer Adjustment.

[5] See Workpaper E for calculation of the weather normalization factor.

[6] Energy Efficiency benchmark as established in O.R.C. §4928.66(A)(1)(a).

[7] 2009-2010 Energy Efficiency Reduction Benchmark as established in Case No. 11-1276-EL-POR, Schedule 1, line 21.

Schedule 2

THE DAYTON POWER & LIGHT COMPANY

2011 Benchmark Report

Peak Demand Baseline and Benchmark Calculation

		2008	2009	2010	2011
1	**Baseline Calculation Components**				
2	Peak MW Demand [1]	3,027	2,909	2,924	
3					
4	**Normalizing Adjustments**				
5	Significantly Reduced Customer Load [2]	(60)	(12)	(3)	
6	Significantly Expanded Customer Load [3]	14	13	9	
7	Total Customer Load Adjustment (5)+(6)	(46)	1	6	
8	Mercantile Customer Adjustment [4]	3	4	4	
9	Total Adjusted Peak Demand (2)+(7)+(8)	2,984	2,914	2,934	
10	Weather Normalization Factor [5]	0.98612	0.97525	0.91621	
11	Normalized Peak Demand (9)*(10)	2,943	2,842	2,688	
12					
13	**2011 Normalized Peak Demand Reduction Baseline**				
14	3 Year Normalized Average (MW)				2,824
15					
16	**Calculation of Normalized 2011 Peak Demand Reduction Benchmark**				
17	Normalized Preceding 3 Year Average Peak Demand (14)				2,824
18	2011 Peak Demand Reduction Benchmark % [6]				2.50%
19	**2011 Peak Demand Reduction Benchmark (17)*(18)**				**70.6**

[1] Peak demand for the period 2008-2010 is reported in PUCO Form FE-D3. See Workpaper B.

[2] Significantly reduced customer load include those who ceased or reduced their operations during the period. See Workpaper C for a complete list of customers.

[3] Significantly expanded customer load include those customers who started or expanded operations during the period. See Workpaper C for a complete list of customers.

[4] See Workpaper D for calculation of Mercantile Customer Adjustment.

[5] See Workpaper E for calculation of weather normalization factor.

[6] Peak Demand Reduction benchmark as established in O.R.C § 4928.66(A)(1)(b).

2011 FILED VERSUS ACTUAL ENERGY SAVINGS

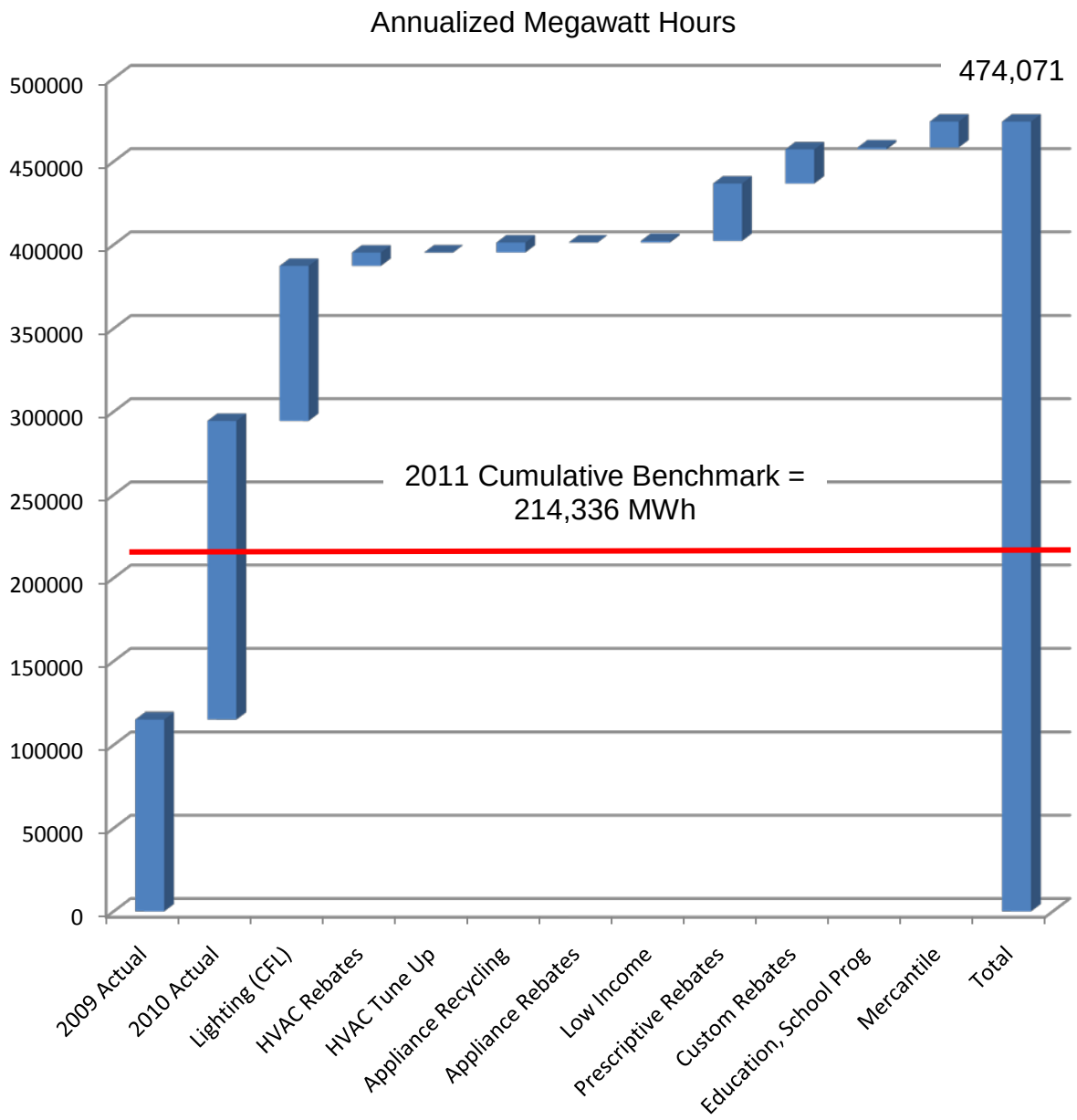
Below, in tabular and graph form, are the programs' energy and demand savings as filed, as well as the corresponding energy and demand forecasts compared to 2011 actual program performance. The actual performance is then compared to the 2011 energy and peak demand reduction benchmarks to demonstrate DP&L's compliance.

Program	Filed, 2011 (MWh)	Annualized Actual, 2011 (MWh)	Variance (MWh)
Residential Lighting (CFL)	28,505	92,842	64,337
Residential HVAC Rebates	1,685	8,016	6,331
Residential HVAC Diagnostic & Tune Up	2,973	39	-2,934
Residential Appliance Recycling	3,952	5,961	2,009
Residential Appliance Rebates[(1)]	958	0	-958
Residential Low Income Affordability	1,705	1,001	-704
Non-Residential Prescriptive Rebates	28,224	34,495	6,271
Non-Residential Custom Rebates	14,721	20,514	5,793
Education, School Programs	0	1,171	1,171
Mercantile Customer Commitments[(2)]	0	15,547	15,547
Total	**82,723**	**179,586**	**96,863**

[(1)] With the approval of PUCO Staff and notification of DP&L's energy efficiency collaborative, DP&L transferred the appliance rebate budget to the appliance recycling program.

[(2)] Mercantile Customer Commitments for energy represent those mercantile applications filed in 2011 and approved by the PUCO prior to the filing of this report.

2011 ENERGY ACTUALS COMPARED TO CUMULATIVE BENCHMARKS



	MWh
2009 Actuals	115,279
2010 Energy Efficiency Actuals	174,249
2010 Mercantile Commitments	4,957
2011 Energy Efficiency Actuals	164,039
2011 Mercantile Commitments	15,547
Cumulative 2009-2011 Total Savings	474,071
Cumulative 2011 Benchmark	214,336

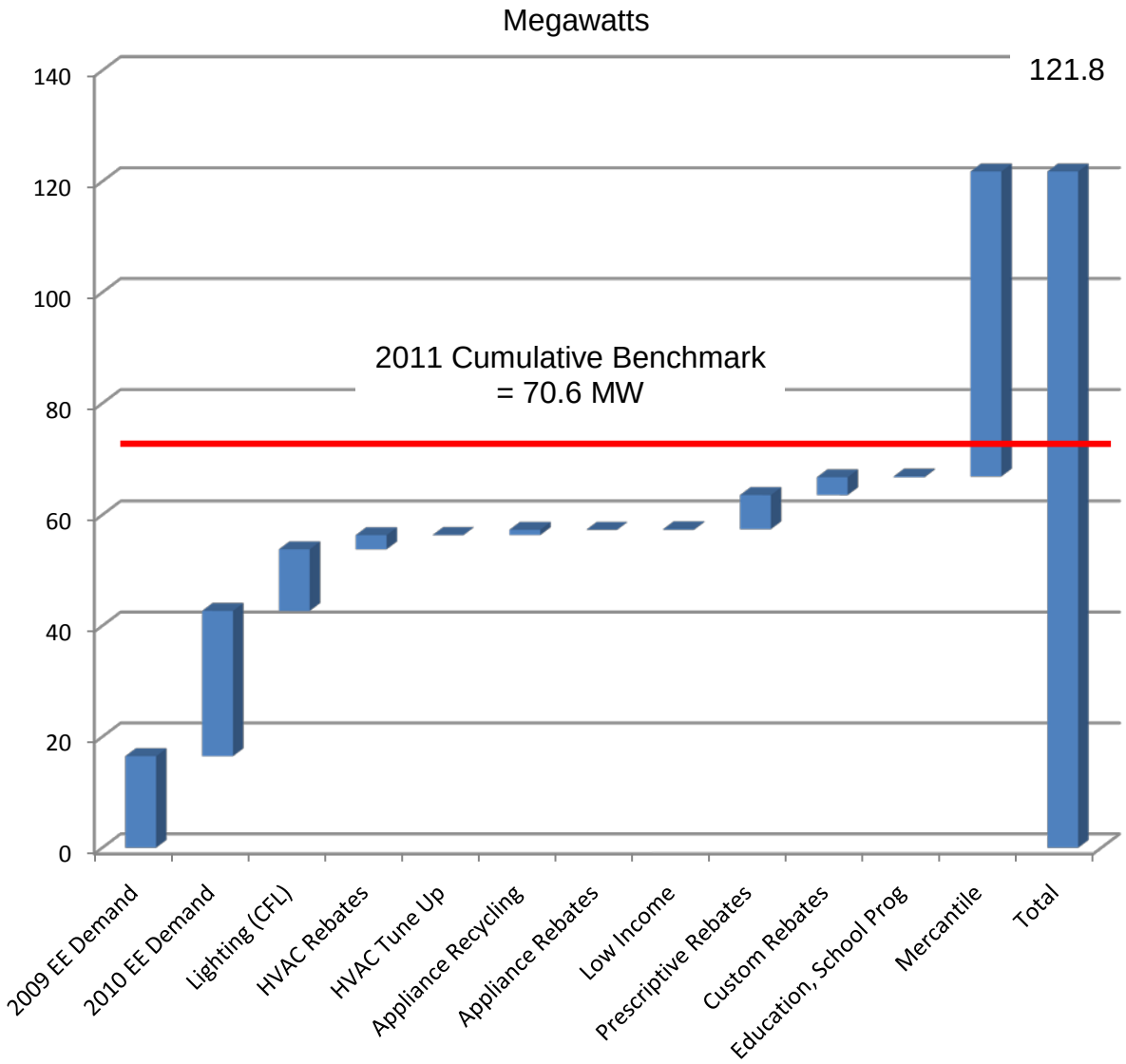
2011 FILED VERSUS ACTUAL DEMAND SAVINGS

Program	Filed, 2011 (MW)	Annualized Actual, 2011 (MW)	Variance (MW)
Residential Lighting (CFL)	2.43	11.10	8.67
Residential HVAC Rebates	1.50	2.56	1.06
Residential HVAC Diagnostic & Tune Up	2.64	0.01	-2.63
Residential Appliance Recycling	0.62	0.95	0.33
Residential Appliance Rebates[(1)]	0.12	0.00	-0.12
Residential Low Income Affordability	0.13	0.10	-0.03
Non-Residential Prescriptive Rebates	7.64	6.15	-1.49
Non-Residential Custom Rebates	2.74	3.22	0.48
Education, School Programs	0.00	0.14	0.14
Mercantile Customer Commitments[(2)]	0.00	54.87	54.87
Total	**17.82**	**79.10**	**61.28**

[(1)] With the approval of PUCO Staff and notification of DP&L's energy efficiency collaborative, DP&L transferred the appliance rebate budget to the appliance recycling program.

[(2)] Mercantile Customer Commitments includes 51.42 MW of PJM Demand Response committed to DP&L by mercantile customers.

2011 DEMAND ACTUALS COMPARED TO CUMULATIVE BENCHMARKS



	MW
2009 Actuals	16.5
2010 Energy Efficiency Actuals	24.7
2010 Mercantile Commitments*	1.5
2011 Energy Efficiency Actuals	24.2
2011 Mercantile Commitments	54.9
Cumulative 2009-2011 Total Savings	121.8
Cumulative 2011 Benchmark	70.6

*Mercantile commitments for PJM Demand Response do not carry over from year to year. Therefore, 2010 PJM Demand Response commitments have been removed from the cumulative total.

RESIDENTIAL PROGRAMS

RESIDENTIAL LIGHTING

PROGRAM DESCRIPTION

The residential lighting program is an upstream, manufacturer buy-down of compact fluorescent light bulbs (CFL) sold at the retail level. No coupon or rebate form is required; the customer receives the discount at the register at the time of purchase.

The objective of the program is to increase the number of long-life, Energy Star qualified CFLs sold to DP&L customers by providing incentives to decrease consumer costs. The program increases consumer awareness and acceptance of energy-efficient lighting technology and also has an educational component to promote use, and proper disposal of, CFL bulbs.

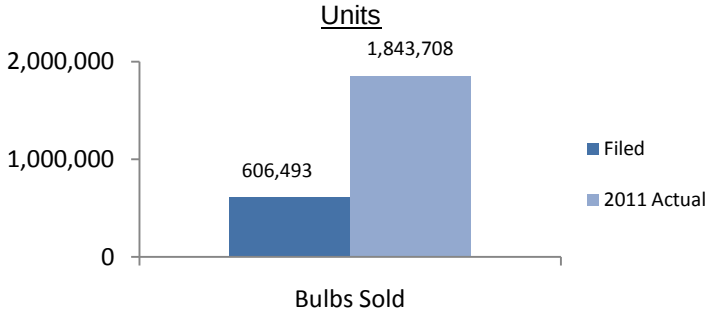
The Residential Lighting Program is designed for all DP&L residential customers who purchase bulbs through retail channels. All customers taking delivery service from DP&L are eligible for this program regardless of their choice of generation supplier.

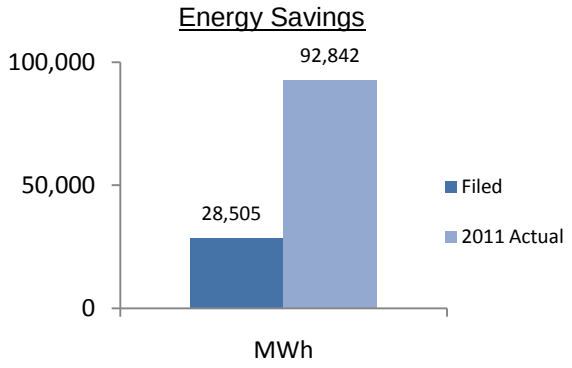
This program started in February 2009 and continues in 2012.

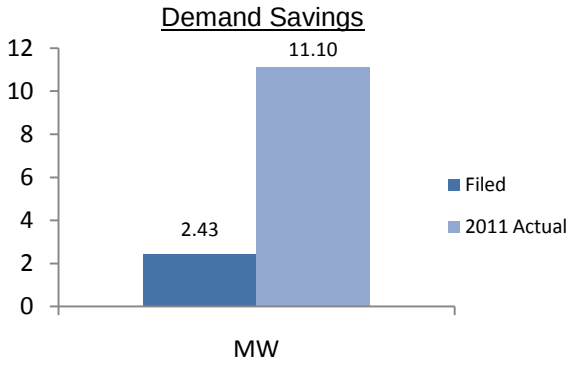
PERFORMANCE SUMMARY

During 2011, a total of 1,843,708 bulbs were sold throughout the DP&L service territory, resulting in gross annualized energy savings of 92,842 MWh and peak demand savings of 11.10 MW. Keys to the program's success include offering customers a wide variety of CFL choices with attractive discounts as well as a broad, and convenient, retail distribution network.

2011 Performance

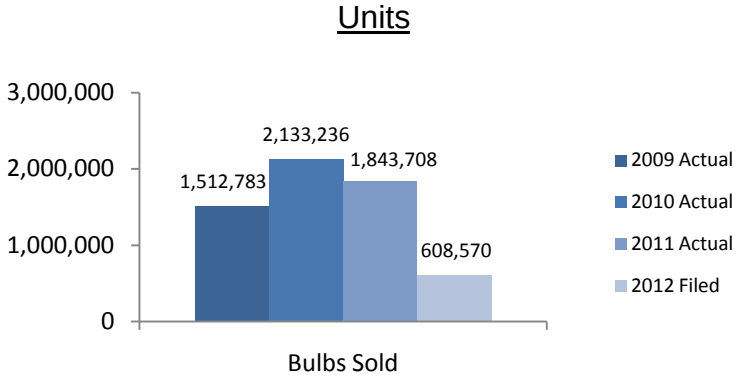


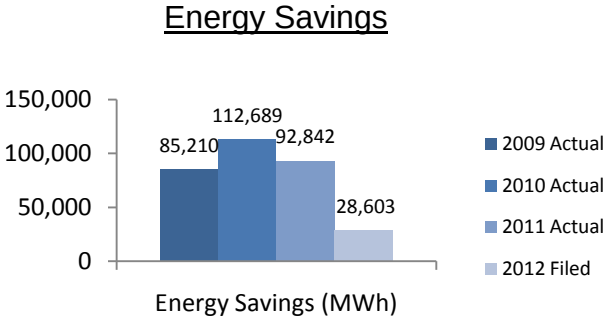


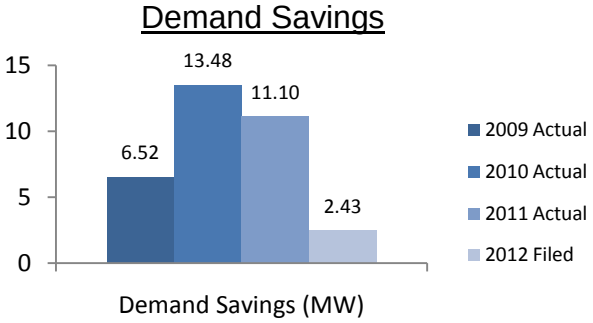


All "filed" numbers are taken from DP&L's program portfolio filing; Case No. 08-1094-EL-SSO.

Four-Year Trend Analysis







*Budget, Cost Summary**

Budget Category	Filed, 2011	Actual, 2011	Filed, 2012
Incentive Costs	$1,724,260	$2,574,159	$1,786,762
Marketing & Admin	$1,138,012	$581,378	$1,179,263
Total Costs	$2,862,272	$3,155,537	$2,966,025

*With the approval of PUCO Staff and notification of DP&L's energy efficiency collaborative, DP&L reallocated 2011 budgets within the residential program portfolio. The reallocation is summarized on page 1-7. Shown above is the original filed budget for 2011.

IMPLEMENTATION REVIEW

Implementation Strategy

With a CFL program, a third party implementation vendor offers significant value due to its experience running similar programs as well as existing lighting manufacturer and retailer relationships. As such, DP&L determined that program implementation would be most effectively managed by a third-party implementation partner. In 2008, DP&L researched potential implementation vendors and issued a request for proposal (RFP) to qualified vendors.

Based on the responses to the RFP, Ecova (formerly Ecos IQ), based in Portland, Oregon, was selected as the implementation partner. In its proposal, Ecova demonstrated a sound process for quickly and effectively implementing programs based on its ten year track record of successfully implementing similar programs. Specifically, Ecova had experience implementing CFL programs for Arizona Public Service, the California Public Utilities Commission, Sierra Pacific Power, Puget Sound Energy, Nevada Power, and the Texas Statewide CFL Program.

Targeted Products, Locations

DP&L's CFL program was designed to provide customers with an extensive choice of products, so customers can select the types of bulbs that best meet their needs. In total, DP&L's program offers customers a choice of 75 different types of products. The most popular is the 13W twist bulb. Overall, DP&L offers soft white, bright white and daylight colored bulbs, 3-way, dimmable, globe, A-line, and flood bulbs, ranging from 7 to 55 watts. The average discount was $1.39 per bulb with discounts ranging from $.30 to $2.50, depending on the type of bulb.

Products Types Offered

Product Name	Units
13w BW twist	11,260
100W 3-Way	189
100w BW twist	7,286
100w daylight twist	784
100W Dim	153
100W Dim Twist	11,110
100W PAR 26	373
100W PAR 30	17
100w T2 twist	1,862
100W Twist	369,313
120W PAR 38	899
120W R20	338
125W Twist	92
150W 3-Way	5,011
240W Twist	301
3-Way Twist	80
30W A-line	0
40W A-Line	1,076
40w BW décor	117
40W Candela	170
40W Ceiling Fan	1,619
40W Chandelier	60
40w daylight twist	21
40W Décor	1,068
40W Dim R30	62
40W G25	234
40W Globe	3,702
40W R20	828
40W Twist	59,820
45w R20	113
50w BW R20	261
60W A-Line	41,816
60W BR30	0
60w BW T2 twist	1,042
60w BW twist	19
60W Can	948
60W Candle Base	2,612
60w daylight twist	1,482

Product Name	Units
60W Dim	545
60W Dust to Dawn	279
60W Globe	6,133
60W Mini Twist	14,416
60W Post	267
60W R30	2,076
60W T2 twist	12,838
60W Twist	1,099,985
65W A-Line	506
65w BW R30	833
65w daylight R30	188
65W Dim R30	305
65W PAR Flood	82
65W R30	16,063
65W R30 Dim	423
65W Twist	1,146
75W A-line	2,354
75w BW R40	301
75w BW twist	1,483
75w daylight R40	51
75w daylight twist	417
75W Dim R30	12
75w Mini Twist	9,306
75w T2 twist	850
75W Twist	98,363
90W PAR 38	1,393
90W Par28	40
90W Twist	5,011
PAR38	4,188
R20	26
R20 2pack	830
R30	22,497
R30 6pack	11,940
R30 Dim	1,699
R40	317
R40 2pack	320
R40 Dim	87
Total	**1,843,708**

Targeted Retailers, Locations

To make the program convenient and accessible for all customers, DP&L's program enlisted the participation of the traditional "big box" retailers as well as independent hardware and specialty locations. The big box retailers were the first selected to participate given their previous experience with implementing similar buy down programs in other regions and their ability to get the programs up and running quickly. Further, big box retailers sell significant volume, allowing the program to reach the largest number of DP&L customers as quickly as possible.

The first participating retail outlets selected were concentrated in the Dayton metropolitan area to match the location of the highest volume of DP&L residential customers. DP&L then expanded the program to outlying areas, giving all residential customers the opportunity to participate. In addition, an online retailer was added to the program in 2009 to provide an additional convenient option for customers.

Retail locations were carefully selected to minimize the potential for participation from non-DP&L customers. The highest concentration of retailer locations coincides with geographic areas that have the highest concentration of DP&L customers. Retailer locations outside or on the edge of the DP&L service territory were excluded. In communities served by municipal utilities, store locations were minimized, so DP&L customers in the area still had an option to participate.

Participating Retailers

Retailer	# of Locations		
Ace	17	Kroger	29
Batteries Plus	3	Lowes	12
Bed Bath and Beyond	3	Meijer	6
Dickman Supply	3	Menards	2
Do It Best	1	Online	1
Dollar Tree	15	Sam's	3
Goodwill	17	True Value	3
Home Depot	8	Walmart	19
		Total	**142**

Staffing

Two Ecova staff members manage the program locally and serve as DP&L's direct point-of-contact. The local field staff is responsible for visiting participating retail outlets to ensure that discounted products are stocked on the shelves, priced and labeled correctly, so that customers are receiving the discounts at the register. The local field staff is also responsible for promoting the program at a number of community events. This staff is supported by the experienced managers and support team located at the Ecova main office.

Marketing

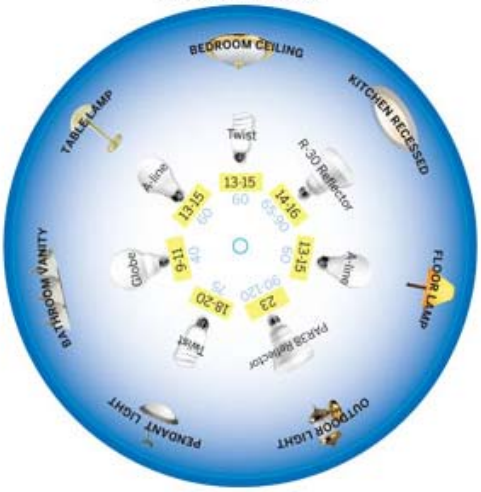
In order to promote CFLs and the lighting program discounts to its customers, DP&L employed a breadth of marketing methods. Starting with the assumption that approximately 70 percent of purchasing decisions are made in the store at the time of purchase, the core of the marketing efforts focuses on point-of-purchase (POP) materials. For instance, DP&L created a special sticker which is placed next to the standard price sticker to alert customers to program discounts. A "shelf wobbler" protrudes into the aisle and calls attention to the available discounts and the benefits of CFLs. A "bulb wheel" hangs off the shelf to help customers pick the right bulb for their fixture and convert the incandescent wattage to the CFL wattage. And, Ecova works with store managers to position the discounted CFLs in highly visible areas whenever possible.

Point-of-Purchase Material Samples:

Shelf Wobbler

Shelf Sticker

Bulb Wheel

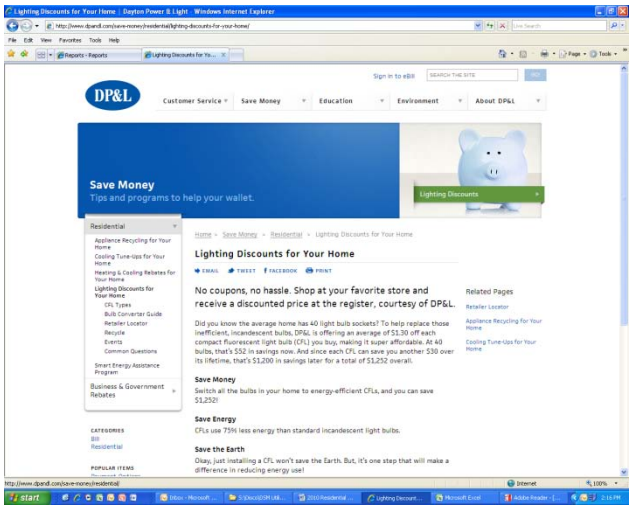


Beyond the POP materials, DP&L also promotes the residential lighting program to customers via a web site, bill inserts, presence at special events, and mass media advertising.

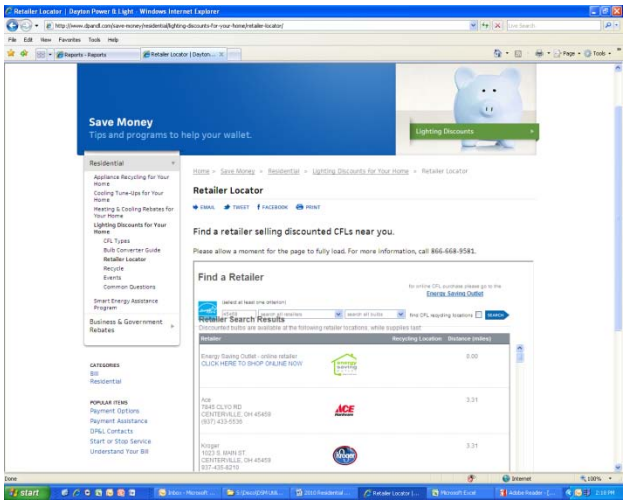
The CFL program web pages on the DP&L company web site provide a description of CFL bulb types and their applications, conversions of wattages from incandescent to CFL, calendar of upcoming events, and answers to frequently asked questions. A page of the web site is devoted to CFL recycling, educating customers about the small

amount of mercury in CFLs, and how to properly dispose of a CFL (if broken), and where to recycle (if unbroken).

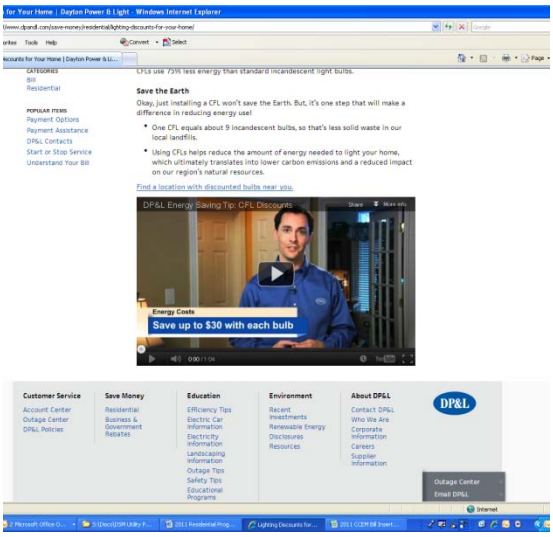
The web site also contains a retailer locator which allows customers to search for participating retailers by their home zip code. The results are shown in terms of the store location's distance from the customer's zip code. Customers can see which bulb types are discounted at each store. Customers can access the Energy Saving Outlet, the online retailer, via the retailer locator to place an order. The Energy Saving Outlet offers discounts on traditional and specialty bulbs.



Web Site
The CFL program landing page gives a description of the residential lighting program and allows customers to navigate to other pages for more information.



Web Site Retailer Locator
The retailer locator allows customers to search for participating retailers by their home zip code or by desired bulb type.



YouTube Video
The YouTube video, produced in 2011 and posted on the CFL program landing page, educates customers about the benefits of switching to CFLs.

Bill Insert
Bill inserts were mailed to 450,000 residential customers in August and September.

Community Outreach Events
The Ecova local field staff attended 19 local community events to discuss the residential lighting program, CFLs, and their benefits.

Education, General Awareness
DP&L conducted a mass media education and general awareness campaign promoting the value of energy efficiency and the available residential programs, including the CFL discounts. A complete discussion of this campaign can be found in Section 5.

Community Partnerships
DP&L was able to utilize promotional benefits provided via existing corporate sponsorships of local organizations, like the minor league Dayton Dragons baseball team.

Customer Service

In all programs, customer service is a critical element of program success. As such, DP&L designed a number of customer service elements into its program, some of which have been previously discussed.

The program web pages (discussed in the Residential Lighting Program Marketing section) allow DP&L to provide a breadth of information for all customers with internet access. The web pages not only educate about CFLs, but also help customers to locate available discounts near their home.

For those without internet access, or who want to speak to a person, DP&L set up a program hotline number staffed by Ecova employees. The staff has been trained to answer detailed questions about the residential lighting program and help customers locate available discounts. The hotline received 15 calls in 2011. While few customers utilized this service, having a telephone option available when needed is an important customer service element.

DP&L maintains its own customer service center, accepting calls regarding all functions of DP&L. DP&L residential lighting program management staff conducted trainings for customer service center staff regarding program details. This was completed to ensure that DP&L phone representatives have a basic understanding of the program, can assist customers in finding a retail location, if needed, and point the customer to the information listed on the CFL section of the web site.

DP&L employees in other areas of the company have also been educated about CFLs and the available discounts so they can answer questions from customers. A series of internal email announcements were sent and our CFL educational display was set up in the lunch room of our corporate headquarters and service operations buildings. In addition, the program management staff attended meetings to inform and educate management and union leaders, as well as meter readers, who often have direct contact with customers.

The Ecova local field staff continues to be a large component of DP&L's customer service, ensuring the accuracy of prices and products in stores, which helps to meet customers' expectations. In a retail environment, it is possible for point-of-purchase materials to be inadvertently removed or placed next to products that may or may not be discounted as restocking occurs. Regular, in-person store visits are an essential element of the program. In addition, the local field staff was in direct contact with customers at 19 local community events in 2011, answering questions and helping to educate customers about the program.

RESIDENTIAL HVAC REBATES

PROGRAM DESCRIPTION

The Residential HVAC Rebates program offers rebates for the installation of new or replacement, high efficiency central air conditioning and heat pump systems. The customer receives an instant discount as a line item on the invoice from a participating HVAC contractor.

The objective of the program is to reduce energy consumption and peak demand savings by incentivizing customers to purchase efficient HVAC equipment that goes above and beyond the current minimum standard for efficiency.

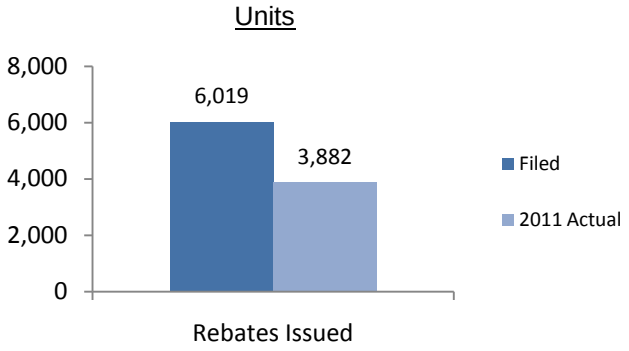
This program is designed for any homeowner or landlord purchasing a new or replacement HVAC unit that will be installed at a residence within the DP&L service territory. All customers taking delivery service from DP&L are eligible for this program regardless of their choice of generation supplier.

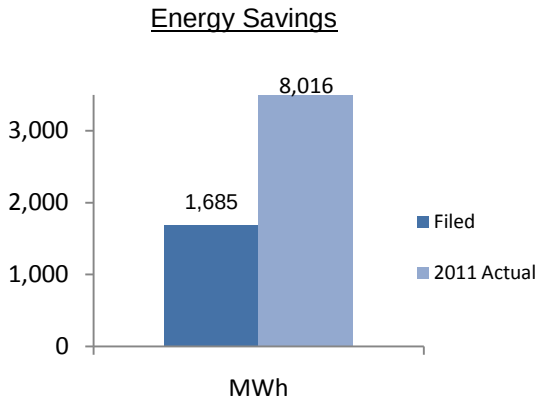
The program started in June 2009 with a core group of 23 participating contractors, and continued in 2010. New contractors continually joined the program, increasing to 212 participating contractors by the end of 2011.

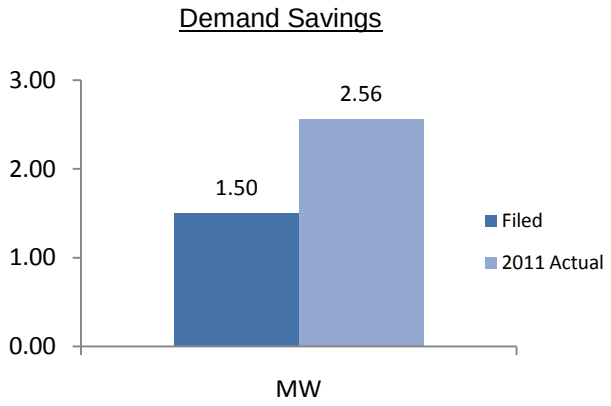
PERFORMANCE SUMMARY

During 2011, a total of 3,882 HVAC rebates were issued throughout the DP&L service territory, resulting in gross annualized energy savings of 8,016 MWh and peak demand savings of 2.56 MW. This performance exceeded the anticipated energy savings of 1,685 MWh with fewer rebates. The combination of federal, manufacturer, and DP&L incentives for new, high-efficiency equipment installations increased the number of customers DP&L expected to elect to replace their system prior to the end of its life (early retirement), yielding a greater energy savings. In addition, the savings estimates did not include heat pump winter usage savings. The addition of these savings coupled with a stronger than expected heat pump volume also had a significant effect on the energy savings results.

2011 Performance

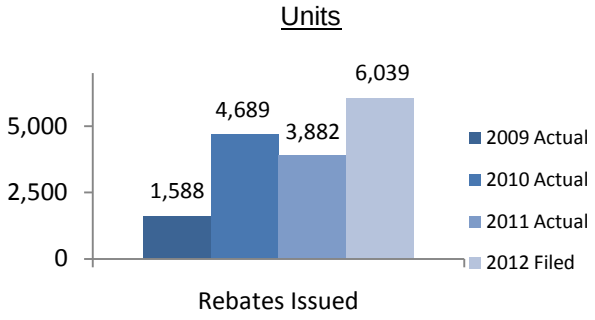


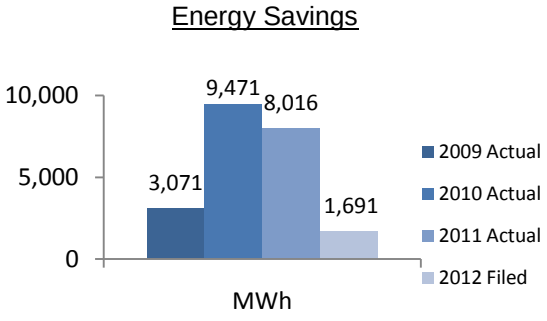


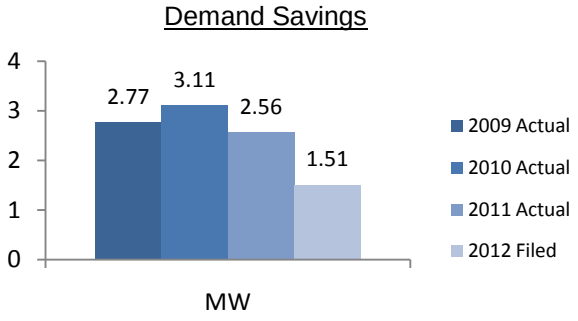


All "filed" numbers are taken from DP&L's program portfolio filing; Case No. 08-1094-EL-SSO.

Four-Year Trend Analysis







*Budget, Cost Summary**

Budget Category	Filed, 2011	Actual, 2011	Filed, 2012
Incentive Costs	$968,939	$1,812,800	$1,003,742
Marketing & Admin	$678,257	$405,559	$702,619
Total Costs	$1,647,196	$2,218,359	$1,706,361

*With the approval of PUCO Staff and notification of DP&L's energy efficiency collaborative, DP&L reallocated 2011 budgets within the residential program portfolio. The reallocation is summarized on page 1-7. Shown above is the original filed budget for 2011.

IMPLEMENTATION REVIEW

Implementation Strategy

With a residential HVAC rebate program, it is of great value to have a third party implementation vendor that has experience running similar programs that require building a network of HVAC contractors. Therefore, DP&L determined that program implementation would be most effectively managed by a third-party implementation partner. In 2008, DP&L researched potential implementation vendors and issued a request for proposal (RFP) to qualified vendors.

Based on the responses to the RFP, Conservation Services Group (CSG) was chosen as DP&L's implementation partner. CSG, based in Westborough, Massachusetts is a non-profit organization with a 25-year history of delivering energy efficiency programs. CSG's track record includes running successful programs for utilities such as Southern California Edison, San Diego Gas and Electric, NSTAR, Columbia Gas of Ohio, and National Grid. In addition, since the Residential HVAC Rebates program is a logical extension of the HVAC Diagnostic and Tune-Ups program, the most cost-effective approach is to utilize the same vendor to implement both programs.

Targeted Products

DP&L offered rebates in three categories: New Construction; Replacement; and Early Retirement, with tiers for higher efficiency levels. DP&L customers can select the system manufacturer and model of their choice, but are only eligible to receive a rebate if the system meets the Seasonal Energy Efficiency Rating (SEER) requirements, or the Energy Efficiency Ratio (EER) requirements for ground source heat pumps. In 2011, the most popular rebate was for early retirement air conditioners at SEER 14/15, followed by early retirement air conditioners at SEER 16+.

Rebates Offered

For Central Air Conditioning, Air-Source Heat Pumps, and Ductless Mini-Splits*

SEER Efficiency Rating	New Construction	Replacement	Early Retirement
14-15	$200	$200	$400
16+	$300	$300	$600

*Mini-splits are not eligible for early retirement rebates.

For Ground-Source Heat Pumps

EER Efficiency Ratio	New Construction	Replacement	Early Retirement
13-15	$200	$200	$400
16+	$300	$300	$600

New Construction – High-efficiency, new equipment installed in new homes in a home or a home addition where there is no previously existing central air conditioning or heat pump system.
Replacement – High-efficiency, new equipment installed as a replacement for existing equipment not meeting early retirement eligibility requirements.
Early Retirement – High-efficiency, new equipment installed as a replacement for existing equipment that meets the following requirements:

Existing equipment is in working order, regardless of age OR
Existing equipment is less than or equal to 20 years old and is repairable for less than $1000.

Rebates Issued

Product	Rebates Issued 2011
Replacement or New Construction Air Conditioner SEER 14/15:	139
Replacement or New Construction Air Conditioner SEER 16+:	65
Replacement or New Construction Heat Pump SEER 14/15:	83
Replacement or New Construction Air Source Heat Pump SEER 16+:	41
Replacement or New Construction Ductless Mini-Split SEER 14/15:	2
Replacement or New Construction Ductless Mini-Split SEER 16+:	52

Replacement or New Construction Ground Source Heat Pump EER 13-15:	3
Replacement or New Construction Ground Source Heat Pump EER 16+:	54
Early Retirement Air Conditioner SEER 14/15:	1,342
Early Retirement Air Conditioner SEER 16+:	883
Early Retirement Air Source Heat Pump SEER 14/15:	625
Early Retirement Air Source Heat Pump SEER 16+:	416
Early Retirement Ground Source Heat Pump EER 13-15:	6
Early Retirement Ground Source Heat Pump EER 16+:	171

Targeted Contractors

CSG recruited a network of contractors to market, recommend, and install eligible HVAC equipment. Contractors must be certified by DP&L to participate in the program and must sign a partnership agreement. Certification qualifications include: a valid HVAC license; minimum levels of insurance; Environmental Protection Agency-certified technicians; and a Better Business Bureau rating higher than B-. Large contractors were targeted first, which allowed the program to reach the greatest number of DP&L customers as quickly as possible. Continually, smaller, independent contractors were recruited, so that by the end of 2011, the program had 212 participating contractors located throughout the DP&L service territory.

To make the program convenient and accessible for all customers, customers may purchase an eligible HVAC system from any certified contractor, dealer or distributor of their choice. If a customer's existing contractor is not already a certified contractor, CSG will work to recruit the contractor into the program so that the customer does not have to switch contractors.

When purchasing qualifying equipment, DP&L customers receive the rebate via an instant discount on the invoice total from the certified contractor. Participating contractors are then reimbursed for the total of the rebates issued, with proper support documentation. This approach allows customers to have a lower upfront out-of-pocket expense when making their purchase. Also, it is the most cost-effective method, as establishing a rebate processing service for individual customers (which CSG had not included in their implementation plan) can be a significant, added expense.

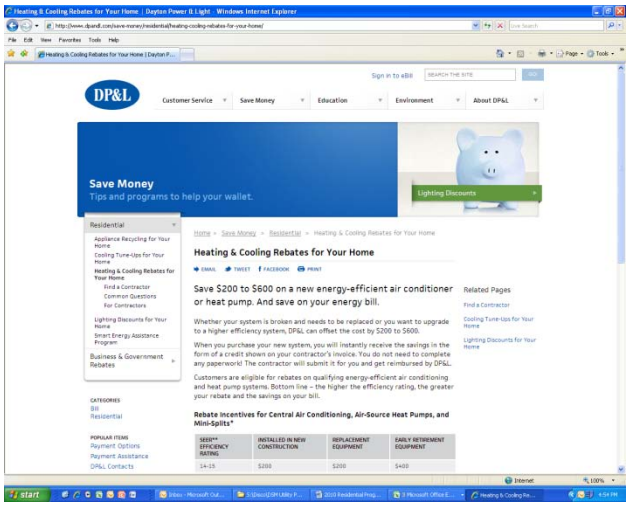
Staffing
CSG's local staff members manage the program and serve as DP&L's direct point-of-contact. (This staff also manages the HVAC Tune-Up program.) The local field staff, consisting of a program manager, account manager, administrative coordinator, and part-time quality control auditor, is responsible for maintaining relationships with HVAC contractors to ensure that the program is mutually beneficial and successful. For contractors to be most successful in the program, they need to have a thorough understanding of program guidelines and buy-in to the DP&L program design and processes. CSG maintains regular contact with contractors to discuss program issues, potential solutions, and opportunities for improvement.

CSG closely monitors rebate applications for accuracy of rebate values and eligibility of equipment. CSG also performs quality control checks on a portion of all system installations and accompanying paperwork to ensure that contractors adhere to the program guidelines. Contractors who exhibit a track record of poor quality work or customer complaints are removed from the program. The local staff is supported by the experienced managers and support team located in the CSG main office.

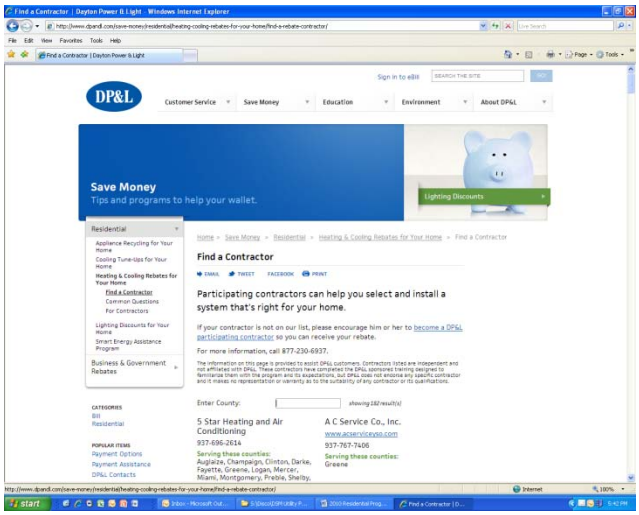
Marketing
The program is designed to be marketed largely through participating HVAC contractors. Since contractors work directly with DP&L customers, they are able to offer rebates at the point-of-sale. Participating contractors are motivated to offer the rebates as a sales tool, providing a discount that a non-participating contractor cannot. To support contractors and help advertise the program, DP&L created a series of marketing pieces including web pages, fliers, and bill inserts.

The HVAC rebate program web pages on the DP&L company web site provide an overview of the program, a list of eligible equipment, and answers to frequently asked questions. One page is dedicated to helping customers find a participating contractor. Customers can search by their home county and see a list of all contractors serving that area. This page also mentions the ability to recruit the customer's present contractor.

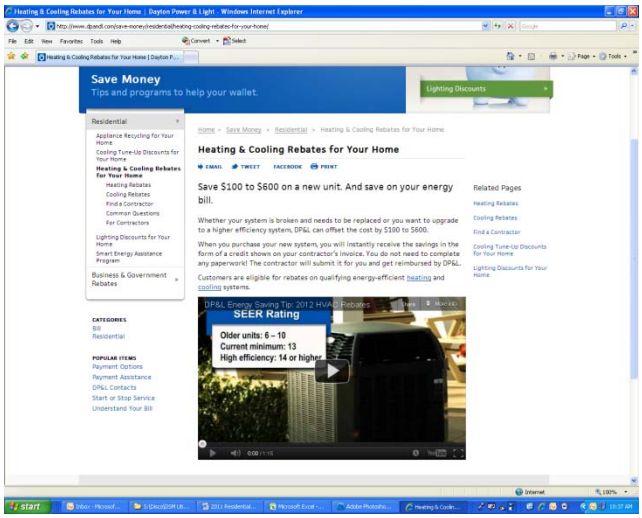
The web portal contains a special log-in section for participating contractors. The portal displays program news, answers to frequently asked questions, and the ability to order customizable, branded program marketing materials.



Customer Web Pages
The HVAC program landing page gives a description of the residential HVAC rebates program and allows customers to navigate to other pages for more information.



Web Site Contractor Locator
The contractor locator allows customers to search for participating contractors by their home county.



YouTube Video
The YouTube video, produced in 2011 and posted on the HVAC rebates program landing page, educates customers about the benefits of upgrading to a high efficiency HVAC system.

Bill Insert
Bill inserts were mailed to 450,000 customers in May, July, and August.

Flyer
Program fliers were distributed to customers at community outreach events attended by the residential lighting program field staff, creating promotional efficiencies among programs.

Education, General Awareness
DP&L conducted a mass media education and general awareness campaign promoting the value of energy efficiency and the available residential programs, including HVAC rebates. A complete discussion of this campaign can be found in Section 5.

Customer Service
In all programs, customer service is a critical element of program success. As such, DP&L designed a number of customer service elements into its program, some of which have been previously discussed.

The web pages and contractor locator (discussed in the Residential HVAC Rebates Marketing section) allow DP&L to provide a breadth of information for all customers with internet access. The contractor locator allows customers to conveniently access a way to participate in the program.

For those without internet access, or who want to speak to a person, DP&L set up a program hotline number staffed by CSG employees. The staff has been trained to answer detailed questions about the residential HVAC Rebates program and help customers locate participating contractors in their area. The hotline received approximately 3,893 calls in 2011 for both the HVAC Rebates and Tune-Up programs (CSG tracks calls for both programs together).

DP&L maintains its own customer service center, accepting calls regarding all functions of DP&L. DP&L program management staff conducted trainings for customer service center staff regarding program details. This was completed to ensure that DP&L phone representatives have a basic understanding of the program, can assist customers in finding participating contractors if need be, and direct customers to the information listed on the HVAC rebates section of the web site.

DP&L employees in other areas of the company have also been educated about HVAC rebates so they can answer questions from customers. The program management staff attended meetings to inform and educate management and union leaders, as well as meter readers, who often have direct contact with customers.

The large number of participating contractors is an important component of DP&L's customer service. The contractors were located throughout DP&L's service territory, making the rebates accessible to all customers. In addition, the ability to recruit a customer's current contractor is a large source of satisfaction for both the customer and the contractor.

The CSG local staff is another significant element of DP&L's customer service, serving both the contractors and the customers. For contractors to be most successful in the program, they need to have a thorough understanding of program guidelines and buy-in to the program design and processes. CSG maintains regular contact with contractors to discuss program issues, potential solutions, and opportunities for improvement.

In addition, CSG's quality control of contractors' work allows DP&L customers to receive their rebates, as promised. CSG performs quality control checks on five percent of all system installations and five percent of pre-installations for early retirement systems. Equipment is reviewed along with the accompanying paperwork to ensure that

contractors adhere to the program guidelines. CSG's oversight ensures that the program's integrity is maintained and that customers are treated properly and fairly. Contractors who exhibit a track record of poor quality work or customer complaints are removed from the program.

Participating Contractors

5 Star Heating and Air Conditioning	Hudson Heating
A C Service Co., Inc.	Humble Heating and Air Conditioning
AAA Professional Heating & Cooling	Integrity Comfort Systems
A-Abel Heating & Air Conditioning Inc.	J & M Heating & Cooling
Accurate Heating & Cooling	John Boyd Heating & Cooling
Advanced Mechanical Services	John P. Timmerman Co., LLC
Aero Mechanical Systems	Johnson Mechanical, Inc.
Air Comfort Heating and Cooling	Joseph's Heating & A/C, Inc.
Air Conditioning & Refrigeration Ser. Co. Inc.	K C Services, LLC
Air Systems Div. PRD Corp. Inc.	Kenny Adams Heating & Cooling LLC
Aireawide Heating & Air Inc.	Kettering Heating and Air
Airtron Heating & Air Conditioning	Kirkwood Heating & Cooling
AJ Mechanical Services, Inc.	Kogge Plumbing, Heating & A/C, Inc.
Allied Services, Inc.	Kool-Ease, Inc.
Al's Complete Heating & Cooling Inc.	Korrect Plumbing Co.
Alternative Heating and Cooling	Lake Contracting Company
American Residential Systems	Lefeld Plbg. & Htg. Inc.
Anderson Mechanical Associates, LLC	Livingston HVAC
Apex Mechanical Systems	Lochard Inc.
Applied Mechanical Systems	Logan Master Appliance
Area Energy & Electric	Logan Services
Area Heating & Air Conditioning, LLC	Lowe's HVACR
Arrow Mechanical Services	Lowman Metal Shop
Ayers Service Group DBA CW Service	M. Bruns Plbg. HVAC & Elect

B & B Plumbing and Heating Co.	Mark Sweitzer Htg. Clg. & Ref. Inc.
B & K Heating & A/C Inc.	Masters Heating & Cooling Inc.
Babb Sheet Metal	MC Heating & Cooling
Bach Heating & Air, LLC	Mike Logan Refrigeration/Appliance
Barga Heating, A/C & Refrig., Inc.	Minkner Services Corp
Barker Heating and Air Conditioning Co.	Morland Heating & Air Conditioning
Barnard HVAC, LLC	Morris Heating & Cooling
Beck Heating & Air Conditioning, LLC	Morris Heating Cooling and Electrical Services Inc.
Bill Ahrens Plumbing & Heating, Inc.	National Heating & A/C Co.
Blair Heating & Air Conditioning	Nelson Comfort
Bluestone Solar Engineering	New Comfort Heating & Cooling
Bolyard Heating & Cooling Inc.	New Knoxville Supply Co.
Bowling Contracting Services Ltd.	Noll-Fisher Inc.
Brockman Furnace Co.	North Star Plbg. Htg. & Clg.
Brookville Htg & AC LLC	Northtowne Heating
Bunsold Plumbing & Heating Inc.	Osterfeld Champion Service
Burkett's Heating & Cooling, Inc.	Outstanding Heating & Air, LLC
Buschur's Refrigeration Inc.	Peck Heating Air Conditioning
Butler Heating and Air Conditioning Co.	Perry's Heating & Air Conditioning
Central Htg & A/C	Peters Heating & Clg. Co.
Childers H.V.A.C. Systems Inc.	Peters Heating Service Co.
ChillTex, LLC	Peterson Electric & Heating Inc.
CHW Mechanical Services, LLC	Pinnacle Heating & Cooling
CJ Zimmer & Sons, Inc.	Premier Restoration & Mechanical Services
CJS Heating & Air	Quality Heating & Cooling Inc.
Clark's Air Conditioning and Heating	Quality Mechanical Services
Climate Control Specialist	Quality Plumbing & Heating
Climate Control Systems, Inc.	R & R Service Plumbing
Climate Dragon LLC	R & W Heating, Inc.

Climate Zone Heating & Air LLC	R J Brothers Heating & Cooling
Comfort Control Heating & Cooling, Inc.	R. E. Becker Builders, Inc.
Comfort Solutions Heating & Air Conditioning LLC	Raiff Heating and Cooling, LLC
Comfort Xpress, LLC	Ray's Refrigeration, Inc.
Commercial Refrigeration Specialists	Refrigeration Control
Community Mechanical	Reliant Mechanical Inc.
Consolidated Hunter Heating & Plumbing, Inc.	Riber Heating & Cooling
Cool Solutions	Richard Sharp Heating & Air Conditioning
Crabtree Heating & Air Conditioning	Rick's Heating & Cooling, Inc.
Custom Heating & A/C, Inc.	Rineair Heating & Air Conditioning, Inc.
Damon Whorton	RK Plumbing and Home Services LLC
Dan Smith Heating & Cooling	Robinson Heating & Air, Inc.
Danco Enterprises Inc.	Roessner Energy Products Inc.
Dave's Services	Rose Heating & Cooling
Davis Refrigeration Inc.	Schmidt's Heating, Cooling & Refrigeration
Dawson Services	Schnippel Electric, Plumbing & Heating
Dayton Mechanical Services, Inc.	Scott's Heating & Air Conditioning, Inc.
Deer Heating & Cooling Inc.	Seiter Services LLC
DeLong Air, Inc.	Service Experts Heating and Air Conditioning
Del's Heating & Air Conditioning Co.	Shafer Heating & Cooling LLC
Dependable Heating & Air	Shawnee Heating & Air, LLC
Detmer and Sons, Inc.	Snyder's Heating & Cooling
Drake Heating & Air	South Home Air, Inc.
E.H. Noonan Inc.	Southtown Heating, Cooling, Plumbing & Electrical
Edington Heating & Cooling	Southwestern Ohio Heating and Air Conditioning, Inc.
Ed's HVAC, Plumbing, Electric	Spec Mechanical Inc.
EES Facility Services	Stebbins Plumbing & Heating
Eisert Plumbing & Heating, Inc.	Steve & Ted's Services, Inc.

Engineering Excellence Regional Services, LLC	Steven Brackman Htg & Cooling
EnviroControl Systems, Inc.	Stuck Heating and Air Conditioning
Environmental Doctor	Superior Mechanical Services, Inc.
Extreme's One Hour Heating & Air Conditioning	Systems C S Services Inc.
Faller Mechanical, LLC	Tanner Heating and Air Conditioning
Farquhar Heating & Air	Taylor Heating & A/C LLC
Favret Heating & Cooling	The Problem Solvers LLC
Fetz Plumbing, Heating & Air Conditioning	TK Mechanical
Fox Air HVAC LLC	Total Service Heating & Cooling
Franck Plumbing & Heating Co., Inc.	Townsend Heating & Air Conditioning
Frye Mechanical, Inc.	Townsend's Heating & Cooling, Inc.
Future Air	Trenton Heating & Air Conditioning
Gagel Plumbing & Heating, Inc.	Troy Plumbing, Heating & Air Conditioning Services, Inc.
Gallion Heating & Cooling Inc.	Tucker Heating & Air Conditioning, Inc.
Gateway Metal Contractors	Wallace Heating & Air
Gene E. Harris	Wat-Kem Mechanical, Inc.
Grilliot's Heating & Cooling Inc.	Watkins Heating & Cooling
H & M Heating & Cooling, Inc.	WebbtoWebb Construction Services
Hauck Bros., Inc.	Wells Brothers
Hauser Air Heating & Air Conditioning	West Jefferson Plumbing & Heating
Housh - The Home Energy Experts	Westfall Plumbing and Heating
Houston's HVACR, Inc.	Wind Bender & Associates
Howard Heating & A/C LLC	Wm. Brockman & Sons
Howdieshell Heating & Cooling LLC	Wyatt's Heating & Cooling
Howell Heating & Cooling	Yutzy Heating & Cooling Inc.

RESIDENTIAL HVAC DIAGNOSTIC & TUNE-UP

PROGRAM DESCRIPTION

This program is designed to obtain energy and demand savings by increasing the efficiency of residential central air conditioners and heat pumps. As originally filed, DP&L would have paid a portion of the cost of specific diagnostic and tune-up services focused on refrigerant charge adjustment and condenser coil cleaning.

Before launching the program, CSG did a thorough review of savings results from similar tune-up programs based on evaluation studies and its own program experience. Based on this review, CSG concluded that the tune-up program as originally designed was focused too narrowly on refrigerant charge and coil cleaning to garner significant savings. As a result, DP&L and CSG focused on redesigning the tune-up program to adjust the approach and ensure verified savings.

The objective of the program is to reduce energy consumption and peak demand savings by training contractors on best practices for performing tune-ups on HVAC systems. Customers are encouraged to hire contractors that are trained participants in the DP&L program.

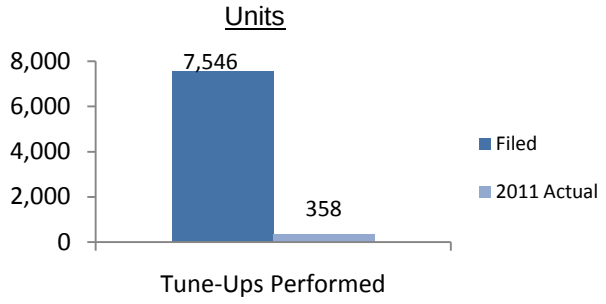
The program is designed for residential customers with central air conditioning or heat pump units in owner-occupied, single-family residential dwellings. All targeted customers taking delivery service from DP&L are eligible for the program regardless of their choice of generation supplier.

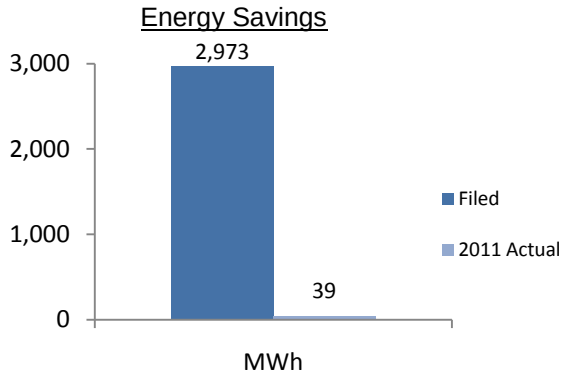
The program, under the name DP&L Certified HVAC Tune-Ups started in March 2010 with a training of a core group of 8 participating contractors. An additional 16 contractors were trained in 2010 and 2011, bringing the list of 2011 participating contractors to 24. In total, 358 HVAC tune-ups were performed through this program in DP&L residential customers' homes.

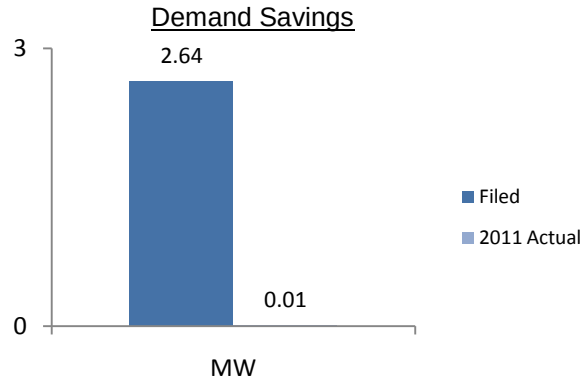
PERFORMANCE SUMMARY

During 2011, 358 HVAC tune-ups were performed in residential customers' homes, resulting in gross annualized energy savings of 39 MWh and peak demand savings of .01 MW. This performance is less than the anticipated 7,546 tune-ups and associated energy savings in the filing. The filed targets were based on the original program design and didn't take into account the challenges of recruiting and training a contractor network. And, as with any program start-up, it takes time to build up momentum and increase production. However, the second year of low program participation led DP&L to reevaluate the program design for the 2012 program year.

2011 Performance

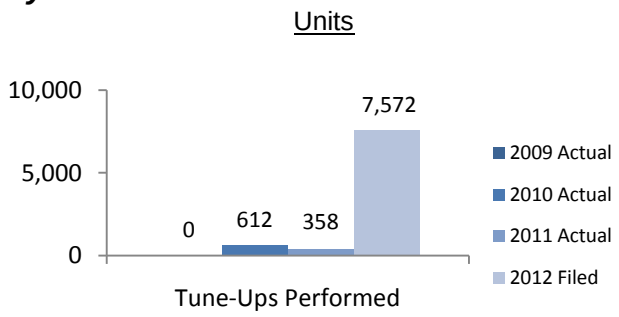


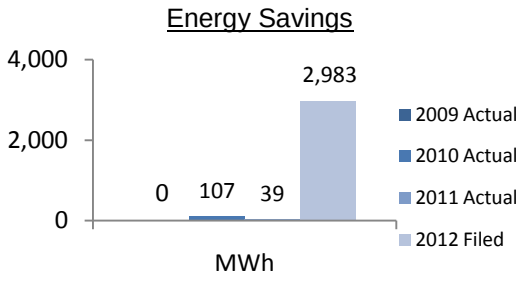


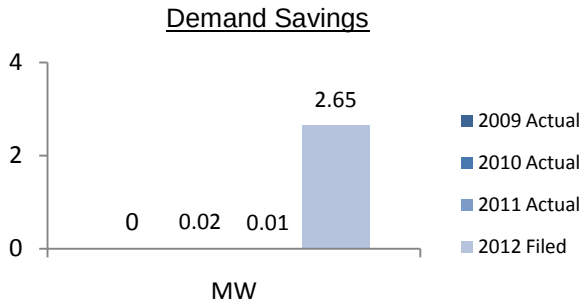


All "filed" numbers are taken from DP&L's program portfolio filing; Case No. 08-1094-EL-SSO.

Four-Year Trend Analysis







Budget, Cost Summary*

Budget Category	Filed, 2011	Actual, 2011	Filed, 2012
Incentive Costs	$804,479	$33,240	$833,450
Marketing & Admin	$402,240	$182,195	$416,725
Total Costs	$1,206,719	$215,435	$1,250,175

*With the approval of PUCO Staff and notification of DP&L's energy efficiency collaborative, DP&L reallocated 2011 budgets within the residential program portfolio. The reallocation is summarized on page 1-7. Shown above is the original filed budget for 2011.

IMPLEMENTATION REVIEW

Implementation Strategy

In 2008, DP&L researched potential implementation vendors and issued a request for proposal (RFP) to qualified vendors. Based on the responses to the RFP, Conservation Services Group (CSG) was chosen as DP&L's implementation partner. CSG is the vendor selected to also manage the Residential HVAC Rebates program. Since the Residential HVAC Diagnostic and Tune-Up program is a logical extension of the HVAC Rebates program, the most cost-effective approach is to utilize the same vendor to implement both programs.

Targeted Process

The contractor completes a thorough evaluation of the HVAC system, taking approximately 20 measurements, using advanced equipment. Central air conditioning and heat pump systems are eligible for this thorough evaluation every five years. Based on the evaluation, the following work may be completed:

- Clean the coils and filters to prevent the system from running longer than necessary.
- Clean and adjust blower components to provide proper system airflow.
- Adjust the refrigerant level to the ideal level for increased efficiency.

Incentives Offered

DP&L Certified HVAC Tune-Ups are very thorough and take longer to complete than annual maintenance tune-ups. As a result, DP&L pays participating contractors $40 - $110 per unit for the completion of each DP&L Certified HVAC Tune-Up, depending on the work that is completed. DP&L's payment helps compensate the contractors for their additional time and training, which helps contractors provide customers with a high quality tune-up. Customers are encouraged to shop around to find the price they're comfortable paying.

Tune-Ups Performed

System Type	Number of Tune-Ups Performed
Central Air Conditioner	324
Heat Pump	34

Targeted Contractors

CSG recruited a network of contractors to market and perform DP&L Certified HVAC Tune-Ups. Contractors were given the opportunity to be trained based on their acceptance and performance in the HVAC equipment rebates program. Partnering with contractors in the rebates program allowed CSG to select contractors who had been active participants in the equipment rebates program and had demonstrated their ability to follow program guidelines. Due to the technical nature of the newly designed tune-up, it was important that participating contractors were capable and willing to follow a series of pre-determined processes to accurately perform the tune-up. In 2010, all participating contractors attended an in-classroom training on the technical processes of the tune-up. In 2011, all new participating technicians were required to undergo an online training. All other participating contractors were required to undergo on site refresher training.

Staffing

The same local field staff hired by CSG for the HVAC rebate program performs the work associated with the tune-up program. The local field staff is responsible for maintaining relationships with HVAC contractors, ensuring that the program is mutually beneficial and successful. For contractors to be most successful in the program, they need to have a thorough understanding of program guidelines and buy-in to the DP&L program design and processes. For the tune-up program this is particularly significant, as the DP&L Certified HVAC Tune-Up is more thorough and takes longer to perform. As a result, the contractor is required to adjust their business processes from selling the tune-up to customers over the phone, scheduling fewer appointments in a day, and performing a different tune-up using different methods. CSG maintains regular contact with contractors to discuss program issues, potential solutions, and opportunities for improvement. Despite CSG and DP&L's efforts, participating contractors did not all buy-in to the program design and processes due to some of the challenges described in this paragraph. As a result, DP&L and CSG reevaluated and changed the program design for 2012.

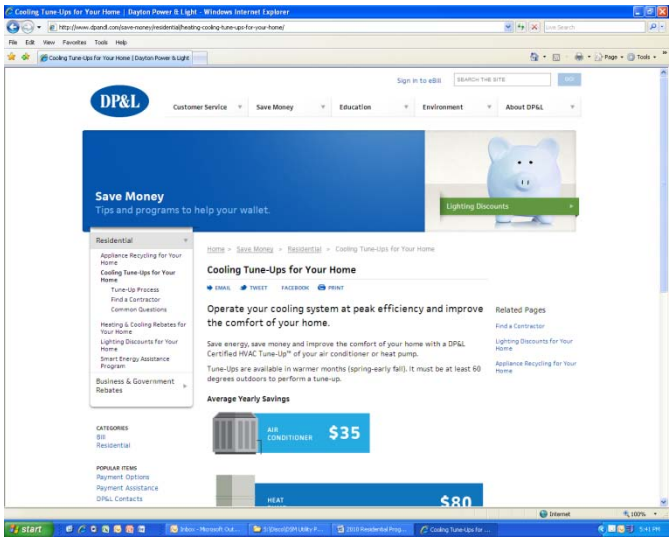
Due to the technical training involved in this program, CSG works closely with contractors to ensure the technical accuracy and quality of tune-ups performed. At the start of the program, CSG's staff regularly accompanied contractors to customers' homes to work alongside them and continue their training. Throughout the program

year, CSG continued to perform quality control checks on a portion of all tune-ups to ensure that contractors adhere to program guidelines. Contractors who exhibit a track record of poor quality work or customer complaints are removed from the program.

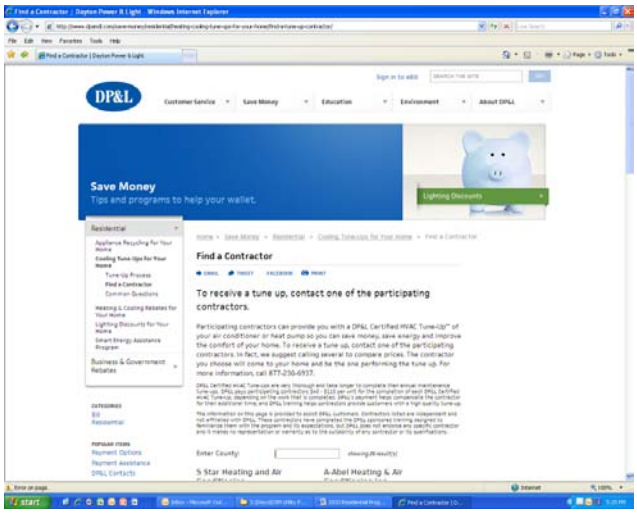
The local staff is supported by the experienced managers and support team located at the CSG main office. CSG's tune-up expert conducted the tune-up contractor training courses in Dayton.

Marketing

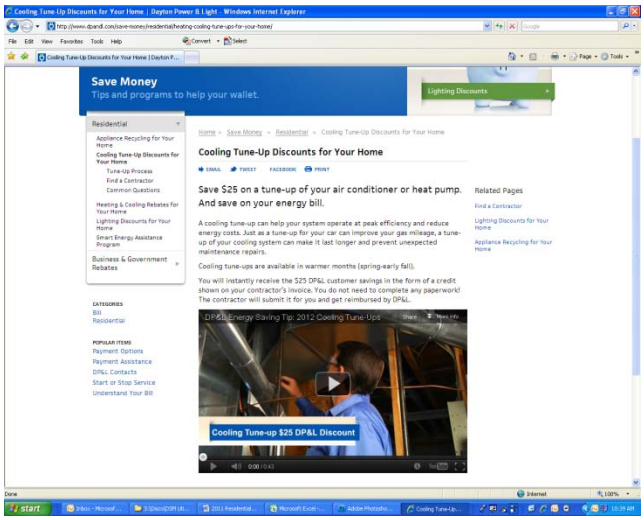
The program is designed to be marketed largely through participating HVAC contractors. Since contractors work directly with DP&L customers, they are able to offer tune-ups at the point-of-sale. Participating contractors are motivated to offer the rebates as a sales tool, providing a service that a non-participating contractor cannot. To support contractors and help advertise the program, DP&L created a series of marketing pieces including web pages, fliers, bill inserts, and print advertisements. The HVAC tune-up web pages on the DP&L company web site provide an overview of the program, a description of the tune-up process, and answers to frequently asked questions. One page is dedicated to helping customers find a participating contractor. Customers can search by their home county and see a list of all contractors serving that area.



Customer Web Pages
The HVAC tune-up program landing page gives a description of the residential HVAC tune-up program and allows customers to navigate to other pages for more information.



Web Site Contractor Locator
The contractor locator allows customers to search for participating contractors by their home county.



YouTube Video
The YouTube video, produced in 2011 and posted on the HVAC Tune-Up program landing page, educates customers about the benefits of tuning up their A/C.

Bill Insert
Bill inserts were mailed to 450,000 customers in May, July, and August. In addition, contractors were given a supply of the inserts to distribute to their customers.

Flyer
Program fliers were distributed to customers at community outreach events attended by the residential lighting program field staff, creating promotional efficiencies among programs.

Customer Service
In all programs, customer service is a critical element of program success. As such, DP&L designed a number of customer service elements into its program, some of which have been previously discussed.

The web pages and contractor locator (discussed in the Residential HVAC Rebates Marketing section) allow DP&L to provide a breadth of information for all customers with internet access. The contractor locator allows customers to conveniently access a way to participate in the program.

For those without internet access, or who want to speak to a person, DP&L set up a program hotline number staffed by CSG employees. The staff has been trained to answer detailed questions about the residential HVAC Tune-Up program and help customers locate participating contractors in their area. The hotline received approximately 3,893 calls in 2011 for both the HVAC Rebates and Tune-Up programs (CSG tracks calls for both programs together).

DP&L maintains its own customer service center, accepting calls regarding all functions of DP&L. DP&L program management staff conducted trainings for customer service center staff regarding program details. This was completed to ensure that DP&L phone representatives have a basic understanding of the program, can assist customers in finding participating contractors if need be, and direct customers to the information listed on the HVAC tune-up section of the web site.

DP&L employees in other areas of the company have also been educated about HVAC tune-ups so they can answer questions from customers. In addition, the program management staff attended meetings to inform and educate management and union leaders, as well as meter readers, who often have direct contact with customers.

CSG recruited and trained a group of contractors that were located throughout DP&L's service territory, making the rebates accessible to all customers. However, it has been important to keep the number of participating contractors limited in order to maintain the technical accuracy and quality of the tune-ups performed. There were 24 trained participating contractors in 2011.

The CSG local staff is another significant element of DP&L's customer service, serving both the contractors and the customers. For contractors to be most successful in the program, they needed to have a thorough understanding of program guidelines and buy-in to the program design and processes. CSG maintains regular contact with contractors to discuss program issues, potential solutions, and opportunities for improvement. As mentioned in the staffing section, despite CSG and DP&L's efforts, participating contractors did not all buy-in to the program design and processes. As a result, DP&L reevaluated the program design for 2012.

In addition, CSG quality control of contractors' work allows DP&L customers to receive a quality tune-up, as promised. CSG performs quality control checks on five percent of all tune-ups performed. Equipment is reviewed along with the accompanying paperwork to ensure that contractors adhere to the program guidelines. CSG's oversight ensures that the program's integrity is maintained and that customers are treated properly and fairly. Contractors who exhibit a track record of poor quality work or customer complaints are removed from the program.

Participating Contractors

5 Star Heating and Air Conditioning	Farquhar Heating & Air
A-Abel Heating & Air Conditioning Inc.	H & M Heating & Cooling, Inc.
Allied Services, Inc.	Johnson Mechanical, Inc.
Anderson Mechanical Associates, LLC	KC Services, LLC
Butler Heating and Air Conditioning Co.	Kogge Plumbing, Heating & A/C, Inc.
CJS Heating & Air	Logan Services
Climate Dragon LLC	New Comfort Heating & Cooling
Comfort Solutions Heating & Air Conditioning LLC	Scott's Heating & Air Conditioning, Inc.
Cool Solutions	Seiter Services LLC
Deer Heating & Cooling Inc.	Tanner Heating and Air Conditioning
Detmer and Sons, Inc.	Wind Bender & Associates
EnviroControl Systems, Inc.	Wm. Brockman & Sons
Environmental Doctor	Watkins Heating & Cooling

RESIDENTIAL APPLIANCE RECYCLING

PROGRAM DESCRIPTION

The residential appliance recycling program allows for the collection of working refrigerators and freezers. The appliances are picked up directly from customers' homes, at no cost, and are transported to a facility in Columbus, Ohio to be deconstructed and recycled according to the Environmental Protection Agency's (EPA) best practices. The participating customer receives a $25 rebate check for each unit recycled.

The objective of the program is to promote the retirement and recycling of inefficient appliances from households by offering an incentive for working equipment as well as information and education on the cost of keeping an inefficient unit in operation.

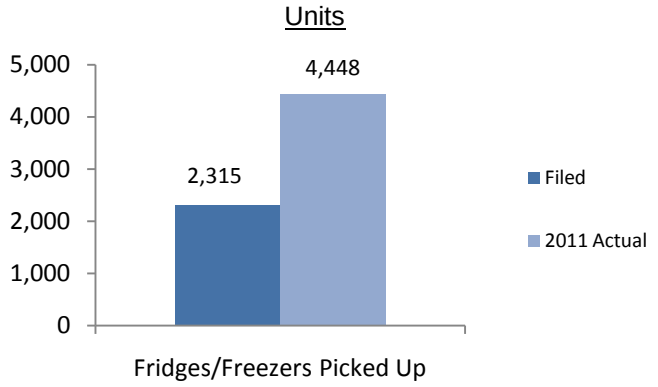
The residential appliance recycling program is designed for any residential customer with working refrigerators or freezers. The appliances must be plugged in and in working condition. All targeted customers taking delivery service from DP&L are eligible for this program regardless of their choice of generation supplier.

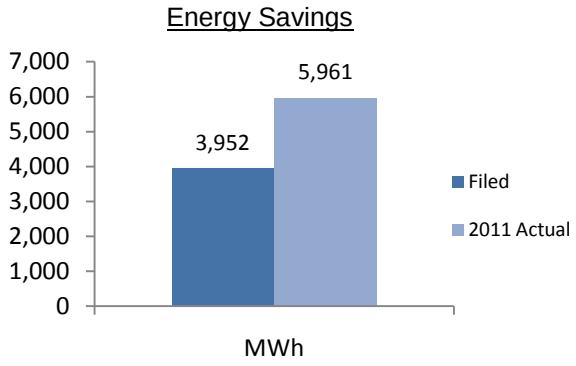
This program started in May 2009 and continues in 2012.

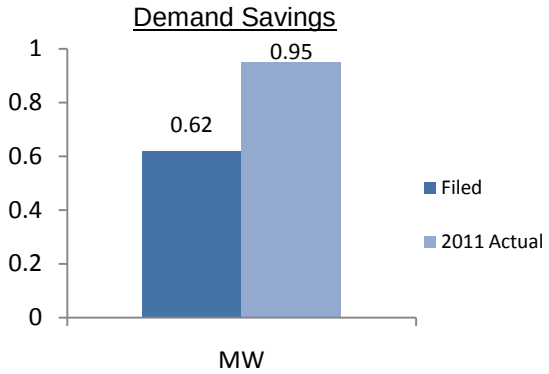
PERFORMANCE SUMMARY

With the approval of the PUCO and notification of the energy efficiency collaborative, the 2011 appliance rebate budget of $210,832 was transferred to the appliance recycling program. As a result, appliance recycling results exceeded filed amounts. During 2011, 4,448 appliances were collected throughout the DP&L service territory, resulting in gross annualized energy savings of 5,961 MWh and peak demand savings of .95 MW. A short-term promotion offering a $50 rebate check significantly increased collections during the promotion months of July and August.

2011 Performance

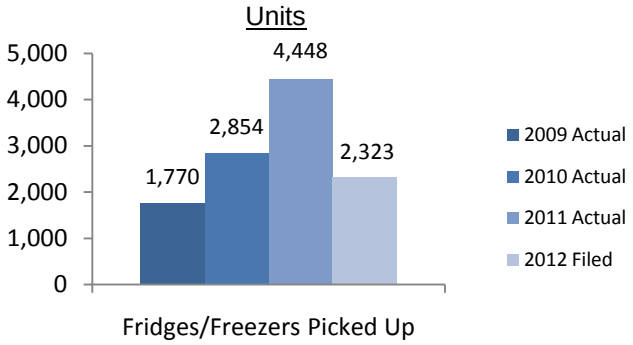


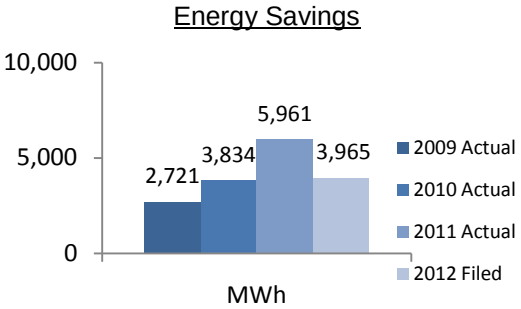


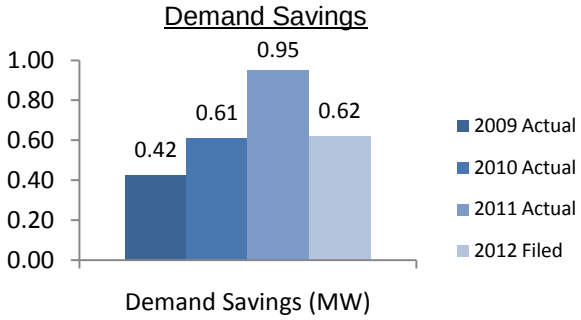


All "filed" numbers are taken from DP&L's program portfolio filing; Case No. 08-1094-EL-SSO.

Four-Year Trend Analysis







*Budget, Cost Summary**

Budget Category	Filed, 2011	Actual, 2011	Filed, 2012
Incentive Costs	$118,435	$185,625	$122,701
Marketing & Admin	$260,557	$548,108	$269,942
Total Costs	$378,992	$733,733	$392,643

*With the approval of PUCO Staff and notification of DP&L's energy efficiency collaborative, DP&L reallocated 2011 budgets within the residential program portfolio. The reallocation is summarized on page 1-7. Shown above is the original filed budget for 2011.

IMPLEMENTATION REVIEW

Implementation Strategy

Appliance recycling and proper disposal of materials require technical expertise, available recycling facilities, and qualified crews in the field. As such, DP&L determined that a third party implementation partner, specializing in this area, provided the best means of effectively managing the program. In 2008, DP&L researched potential implementation vendors and issued a request for proposal (RFP) to qualified vendors.

Based on the responses to the RFP, DP&L selected JACO Environmental as its implementation partner. In its proposal, JACO demonstrated a sound process for efficiently and properly collecting and deconstructing appliances, as well as the recycling and disposal of appliance components. JACO has experience running similar programs for more than 40 clients including PG&E, Southern California Edison, SMUD (California), PacifiCorp, and NJ Clean Energy.

In addition, JACO is being utilized by AEP Ohio and First Energy for their appliance recycling programs. Using the same vendor as AEP and First Energy creates efficiencies, lowering costs to DP&L, as well as other benefits. For instance, given the volume of recycling from DP&L and AEP, JACO decided to build a new recycling facility in Ohio rather than use the existing facility in Illinois. Also, by serving multiple companies, JACO has increased flexibility when scheduling crews, improving customer service.

Targeted Products

DP&L offers rebates for working refrigerators and freezers functioning both as secondary units and primary units, which are likely on their way to becoming secondary units in a garage or basement. The unit must be 10 to 30 cubic feet in size, which is the traditional size for units used in a residential setting.

Before an appliance is removed from the home, JACO inspects the appliance to ensure that it is in working condition and is plugged in. Non-working appliances or those that are unplugged are not eligible for removal.

Rebates Issued by Order Date

Month	Refrigerators	Freezers
January	63	9
February	42	8
March	66	13
April	74	19
May	89	30
June	177	64
July	340	135
August	906	350
September	1083	478
October	170	29
November	145	44
December	83	31
Total	**3,238**	**1,210**

Of the 4,448 units collected in 2011, the average year the appliances were made was 1982.

The rebate amount was $25 per unit collected, with the exception of July and August when a $50 rebate was offered to increase customer participation. Customers were paid via check mailed directly to their homes. Checks were processed and mailed an average of 21 days from the time the appliance was collected.

Targeted Locations

To make the residential appliance recycling program convenient and accessible to all residential customers, JACO crews were available to pick up appliances for every geographic area of the DP&L service territory. JACO scheduled pick-up dates and routes according to geography, targeting one region of the service territory each day. JACO visited the Dayton metropolitan area most frequently, matching the location of the highest volume of DP&L residential customers. The average wait time for customers was 17 days from the time the appointment was scheduled, to when the JACO crew visited the customer's home.

Staffing

JACO managed this program with staff located in the Portland, Oregon main office and at the recycling facility in Columbus, Ohio. A senior program manager in the main office served as the DP&L point-of-contact. The JACO program manager regularly communicated with the DP&L program manager to ensure that the program was on track to meet targets. The JACO program manager also coordinated all the project's tasks and served as the hub of communication to JACO support staff in technical support, customer service, check processing, and operations.

The recycling facility in Columbus, Ohio was managed by an on-site facility manager who planned the crew's pick-up routes and managed the deconstruction and recycling processes. Crews of two were dispatched each day from the facility to the pick-up routes while additional staff members worked in the facility, deconstructing the appliances. JACO safely disposes of toxins and chlorofluorocarbon (CFC-11) gases from foam insulation. After capturing toxins (oils, mercury, PCBs) and other substances (CFC-11 and other foam insulation blowing agents and CFC-12 and other refrigerants), JACO recycles all the plastic, metals and glass in the appliances. Nearly 100% of a refrigerator's components are reused rather than going to the landfill. The facility manager is responsible for ensuring that all material handling processes comply with the best practices of the EPA.

Marketing

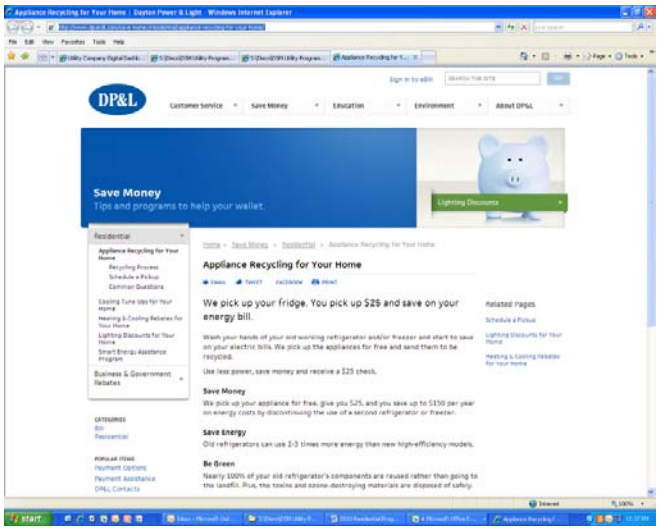
DP&L utilized a variety of marketing methods to promote the appliance recycling program to customers, including bill inserts, web pages, truck signs, and print advertisements. The program also significantly benefited from earned media coverage. The marketing collateral emphasized the cost of operating a second refrigerator or freezer and the rebate offered to program participants. In July and August, the volume of marketing increased in order to promote the short-term offering of a $50 rebate.

The customer web pages on the DP&L web site informed customers of program eligibility requirements, answers to frequently asked questions, and an overview of the recycling process. In addition, customers were able to register and schedule a pick-up via a web interface.

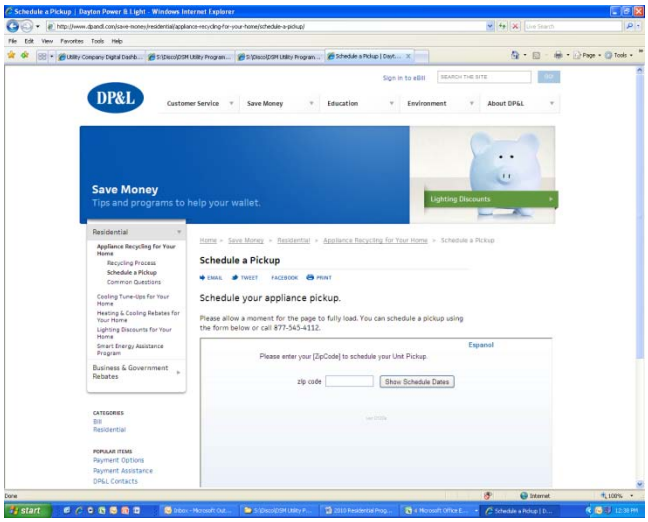
New Sears Partnership

A new element to the appliance recycling program in 2011 was the partnership with Sears retailers. Sears is a leading retailer of new refrigerators and freezers, and offers a home delivery service of customer's new appliances. JACO teamed up with Sears outlets across the country to offer a joint delivery of a new appliance along with a pick-up of an old appliance.

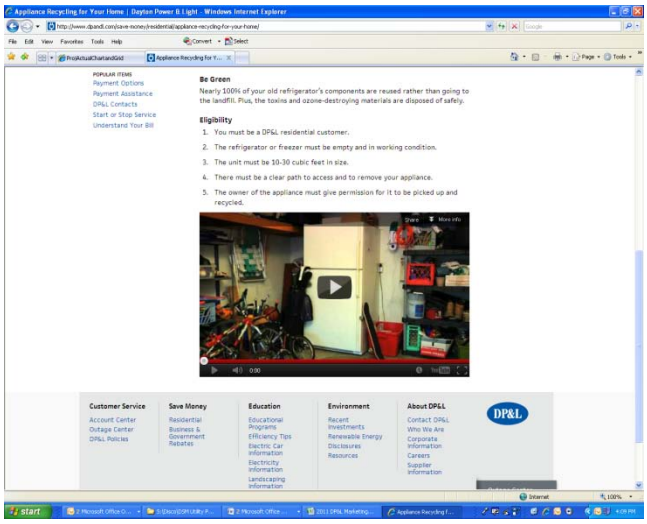
When a customer purchases a new refrigerator or freezer and is looking to get rid of an old appliance, the Sears sales representative will help him/her to register for participation in the DP&L appliance recycling program via an in-store computer kiosk. When the Sears crew member delivers the new appliance, he will confirm that the old appliance is working and meets the requirements of the DP&L program. The appliance will then be transported to a warehouse where it will be stored until JACO can perform a mass collection of appliances from the warehouse. This partnership offers an added convenience for customer participation. This service is marketed through signage on new appliances for sale in the Sears stores and mainly through Sears sales representatives. In 2011, 135 units were picked up through the Sears partnership.



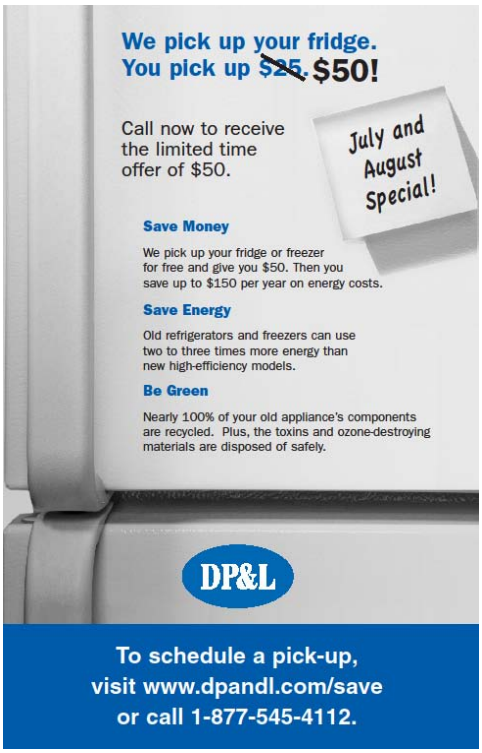
Customer Web Pages
The appliance recycling program landing page gives a description of the program and allows customers to navigate to other pages for more information.



Online Registration
Online registration allows customers to schedule a pick-up at their home.

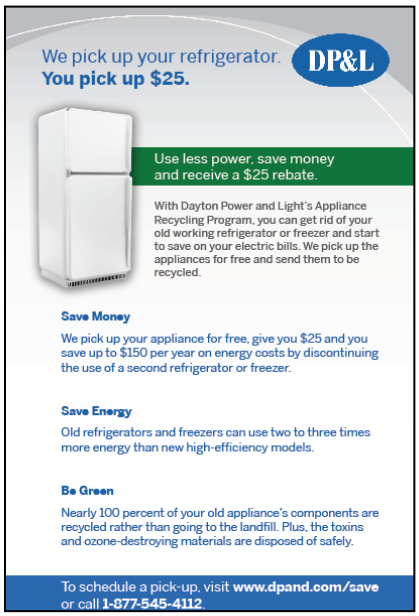


YouTube Video
The YouTube video, produced in 2011 and posted on the appliance recycling program landing page, educates customers about the savings opportunity from recycling an old fridge.



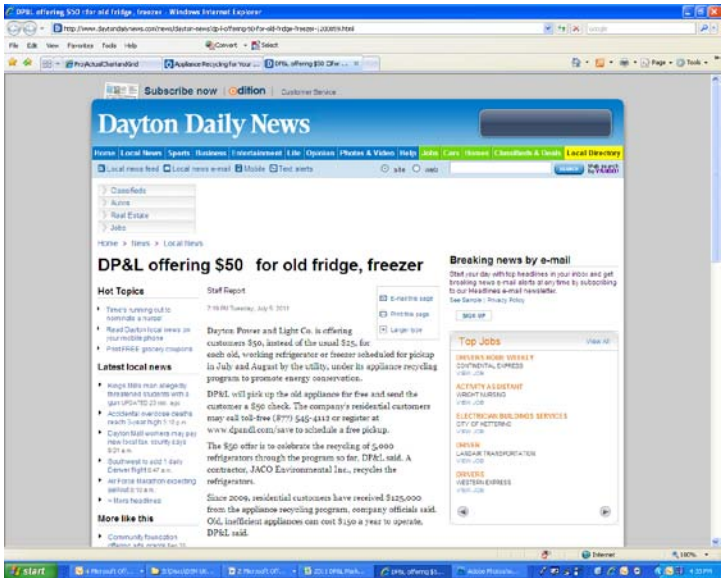
Bill Insert
Bill inserts were mailed to 450,000 customers in May, July and August.

Newspaper Advertisements
DP&L ran a series of newspaper advertisements to promote the program in May, July, and August.



Flyer
Program fliers were distributed to customers at community outreach events attended by the residential lighting program field staff, creating promotional efficiencies among programs.

Truck Sign
This sign, 253' x 90', was displayed on the sides of each JACO truck which performed pick-ups in DP&L neighborhoods.



Earned Media
The $50 rebate and the 5,000th appliance picked up through the program earned coverage in the Dayton Daily News.

Education, General Awareness

DP&L conducted a mass media education and general awareness campaign promoting the value of energy efficiency and the available residential programs, including appliance recycling. A complete discussion of this campaign can be found in Section 5.

Customer Service

In all programs, customer service is a critical element of program success. As such, DP&L designed a number of customer service elements into its program, some of which have been previously discussed.

The web portal and online registration tool serves as a convenient way for customers to learn about the program and schedule a pick-up of their appliance. Customers are able to search for times when a JACO crew will be working in their area and select the date of their choice for a pick-up. In 2011, 27 percent of appointments were scheduled via the online registration tool.

For those without internet access, or for customers who wanted to talk to a representative, DP&L set up a program hotline number staffed by JACO employees. The staff has been trained to answer detailed questions about the residential appliance recycling program and to assist customers in scheduling appointments. Customers are addressed promptly, as the average period of time a customer waited to speak to a customer service representative was 2 seconds. In 2011, the hotline received approximately 8,308 calls, and 73 percent of appointments were scheduled via the phone.

DP&L maintains its own customer service center, accepting calls regarding all functions of DP&L. DP&L appliance recycling management staff conducted trainings for customer service center staff regarding program details. This was completed to ensure that DP&L phone representatives have a basic understanding of the program, and can direct customers to the online registration or hotline phone number.

Customers' appliances were picked up an average of 17 days from the time the appointment was scheduled. In addition, JACO crews conveniently retrieved the appliances from hard-to-access locations, like basements; the customer needed only to clear a path to the appliance.

For the customer's convenience, JACO crews called 24 to 48 hours before the appointment date to confirm a four-hour window for the pick-up. On the day of the appointment, JACO crews called the customer 30 minutes prior to the expected arrival time.

The timeliness of the rebate check was a priority, with checks processed and mailed an average of 21 days from the appliance collection date. Customers were paid via check mailed directly to their homes. Check processing was managed by JACO.

The addition of the partnership with Sears was an added customer service in 2011, increasing the convenience of customer participation. The Sears partnership is discussed in detail in the Marketing section.

RESIDENTIAL LOW INCOME AFFORDABILITY

PROGRAM DESCRIPTION

Through the Residential Low Income Affordability Program, home energy audits and inspections are conducted, and cost-effective efficiency measures are installed for qualifying customers. Two categories of eligible measures are available to customers, depending on whether their home is heated or cooled with electricity. A limited number of health and safety measures may also be addressed through the program.

The objective of the low income affordability program is to identify and implement energy efficiency measures for qualifying homes, reducing the home owners' electric bill and saving energy. The program has the secondary benefit of reducing customer arrearages, which can help save money for all customers.

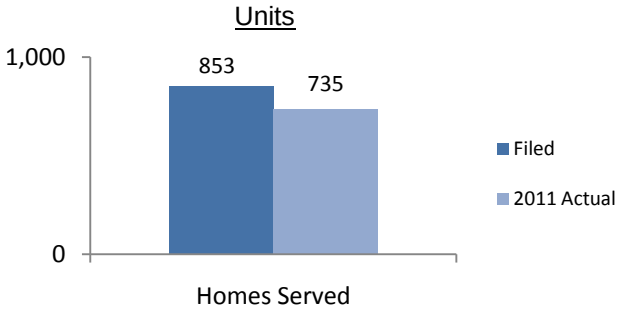
This program is available to low-income residential electric customers within the DP&L service territory with household incomes equal to or less than 200% of the federal poverty level or who are qualified and approved for one of the following: the Ohio Home Weatherization Assistance Program (HWAP), the Percentage of Income Payment Plan (PIPP), or the Home Energy Assistance Program (HEAP). Eligible households include single-family and multi-family homes. This program is available to all qualifying electric customers taking delivery service from DP&L, regardless of their choice of generation supplier.

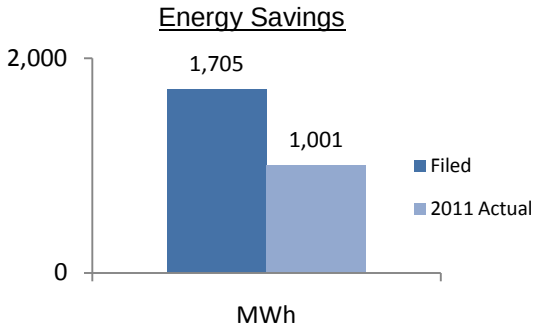
The program is implemented by the Ohio Partners for Affordable Energy (OPAE) through community action agencies located in DP&L's service area.

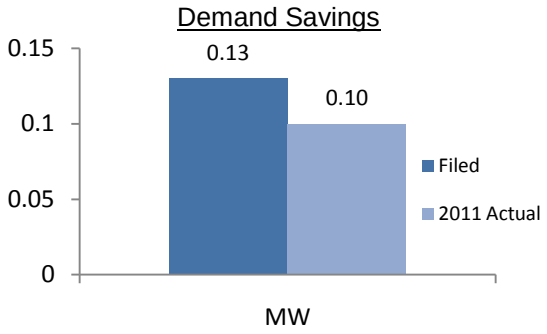
PERFORMANCE SUMMARY

During 2011, 735 customers' homes throughout our service territory were served through this program, resulting in gross annualized energy savings of 1,001 MWh and peak demand savings of 0.10 MW.

2011 Performance







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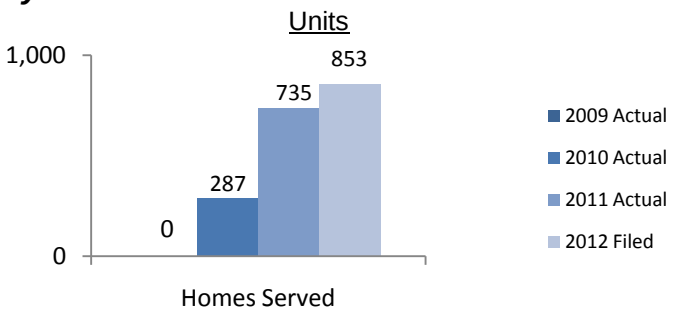
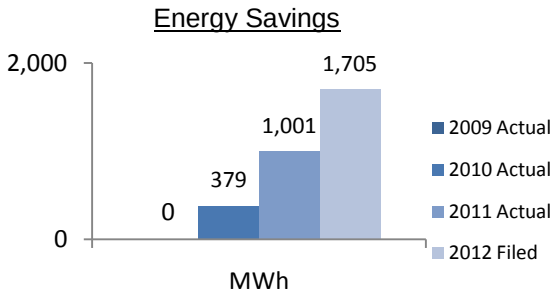
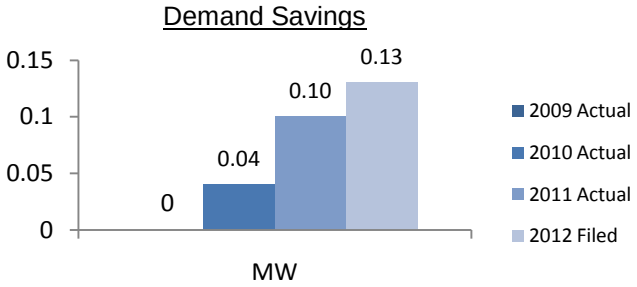
Four-Year Trend Analysis







Budget, Cost Summary

Budget Category	Filed, 2011	Actual, 2011	Filed, 2012
Incentive Costs	$841,143	$802,582	$868,482
Marketing & Admin	$224,151	$187,110	$231,436
Total Costs	$1,065,294	$989,692	$1,099,918

IMPLEMENTATION REVIEW

Implementation Strategy
DP&L has partnered with Ohio Partners for Affordable Energy (OPAE), based in Findlay, Ohio, to bring low-income customers the benefits of this program. OPAE implements this same type of program for FirstEnergy and AEP.

The program is provided to eligible customers at the same time (piggyback) as OPAE and subcontracting agencies deliver other state, utility, and community-based weatherization and energy efficiency services. The piggyback approach is designed to save administrative costs and provide more benefits in a timely, cost-effective manner.

Targeted Products
OPAE or subcontracting agencies may begin their work with a home audit to determine necessary measures. For the customers who heat or cool their homes with electricity, eligible measures may include: ceiling and perimeter insulation, duct sealing or insulation, repair or replacement of electric furnaces and/or baseboard electric heaters. For all other customers, eligible measures may include: installation of energy efficient light fixtures and light bulbs, metering and replacement of inefficient or inoperable refrigerators and freezers, and hot water tank wraps.

DP&L places a high priority on safety. We recognize that certain weatherization and energy efficiency measures cannot be completed or installed because of unsafe conditions like faulty outlets or overloaded circuits. Therefore, electrical safety and health measures are available to eligible customers, regardless of the fuel used as the primary heating source. Health and safety measures cannot exceed 15% of total program costs and may include: replacement of outlets, switches, fuse boxes, circuit breaker boxes, and wiring; repair or replacement of roofs, sump pumps, and well pumps; hot water tank replacement; and replacement of inefficient electric stoves and electric dryers.

Those electric solutions that are found to have a benefit/cost ratio greater than 1.0 will be funded through this program. Health and safety repairs are not subject to a cost effectiveness test although the total cost of those repairs may not exceed 15% of the overall program budget. The cost of the efficiency solutions funded through this program can be a maximum for any single family home of $5,000, and a multi-family home of $50,000.

Targeted Locations
OPAE delivers the program through the community action agencies located in the DP&L service area. These agencies include Community Action Program of the Greater Dayton Area; Clinton County Community Action Program; Community Action Agency of Delaware, Madison, and Union Counties; Community Action Commission of Fayette County; Highland County Community Action Organization; Pickaway County Community Action Organization; SOURCES; Tri-County Community Action Commission of Champaign, Logan, and Shelby Counties. This ensures that customers throughout the DP&L service area will be reached through the program.

Staffing
The program is managed by OPAE through the community action agencies. OPAE is responsible for managing the relationships with the agencies to ensure that eligible work is being performed in eligible customers' homes. Through the agencies, OPAE ensures that the participating contractors are trained and certified to complete work according to the Weatherization Program Standards (10th Edition). The OPAE staff processes the paperwork and documentation from contracted agencies regarding completed jobs and jobs in progress. OPAE is also responsible for monitoring and reporting program performance.

Marketing
This program is marketed and delivered to clients of the community action agencies. In 2011, DP&L performed no additional marketing.

Customer Service
Due to the unique nature of the program, OPAE, through the community action agencies, is responsible for delivering the program in a high quality and cost-effective manner. OPAE is responsible for ensuring that all services, materials, and supplies are of good quality and installed in a professional, workmanlike way, and that all contractors are trained and certified to complete work according to the Weatherization Program Standards (10th Edition).

Using the existing network of community action agencies allows program resources to be effectively administered. DP&L funds are used to piggyback with currently existing programs, creating efficiencies in program delivery.

DP&L maintains its own customer service center, accepting calls regarding all functions of DP&L. DP&L program management staff conducted trainings for customer service center staff regarding program details. This was completed to ensure that DP&L phone representatives have a basic understanding of the program and can direct customers to their local CAP agency for assistance.

NON-RESIDENTIAL PROGRAMS

NON-RESIDENTIAL PRESCRIPTIVE REBATES

PROGRAM DESCRIPTION

The Non-Residential Prescriptive Rebate Program (Rapid Rebates® Program) provides non-residential customers with incentives for new equipment purchases that reduce energy consumption and demand. Technologies that are covered in the program include energy efficient lighting, HVAC, motors, drives and compressed air.

The objective of the program is to help business and government customers overcome the upfront cost hurdle associated with energy efficient technologies.

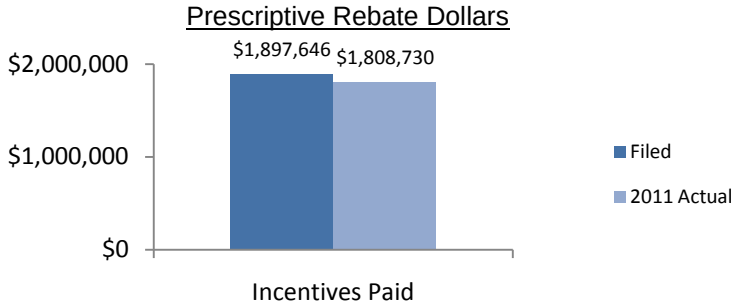
The Rapid Rebates® Program is designed for all DP&L business and government customers who purchase new energy efficient equipment through a manufacturer, distributor or contractor. All business and government customers taking delivery service from DP&L are eligible for this program regardless of their choice of generation supplier.

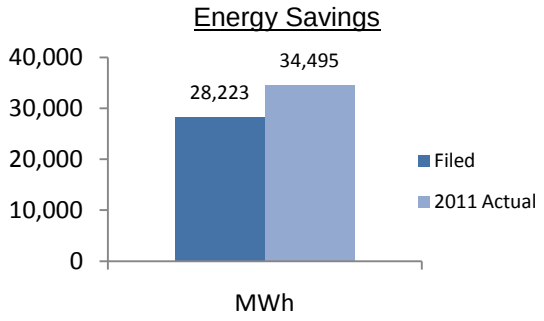
DP&L began accepting online Rapid Rebate® applications on April 1, 2009. In 2011, 133 unique measures were offered through the Rapid Rebates® Program. 107 of these were applied for and utilized by customers. In 2011, DP&L received 936 Rapid Rebate® applications, of which 729 were paid, 37 were denied approval or cancelled, and 170 applications were pending at the end of 2011.

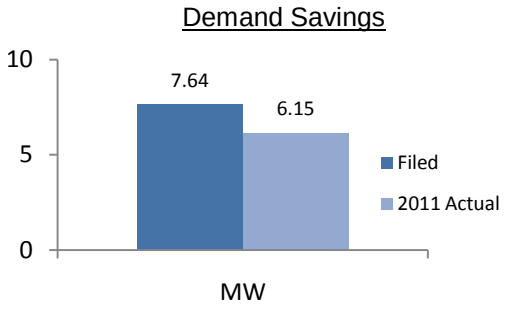
PERFORMANCE SUMMARY

During 2011, DP&L paid $1,808,730 in Rapid Rebates® to business and government customers, resulting in gross annualized energy savings of 34,495 MWh and peak demand savings of 6.15 MW. Keys to the program's success include continued operation of a customer-friendly online application system, quality customer service and follow through, and strong relationships with Channel Partners.

2011 Performance







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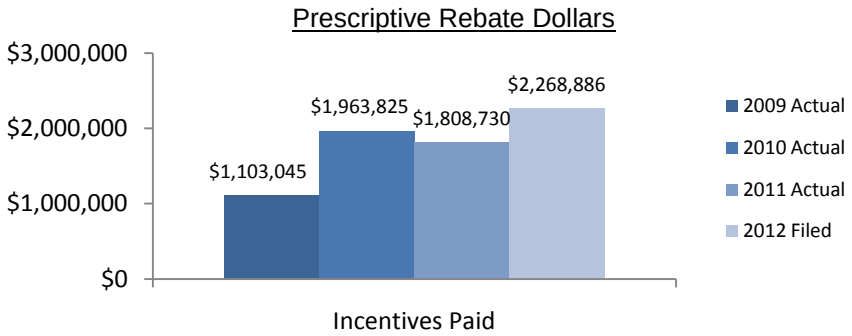
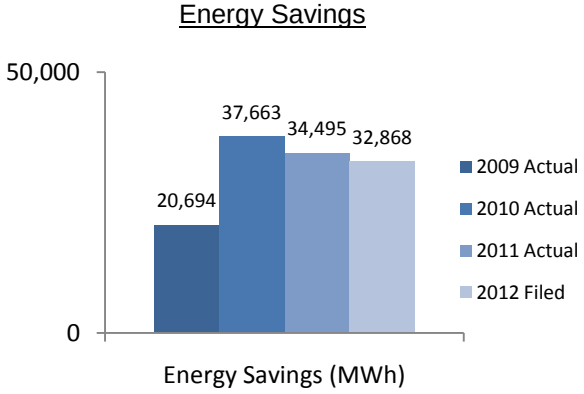
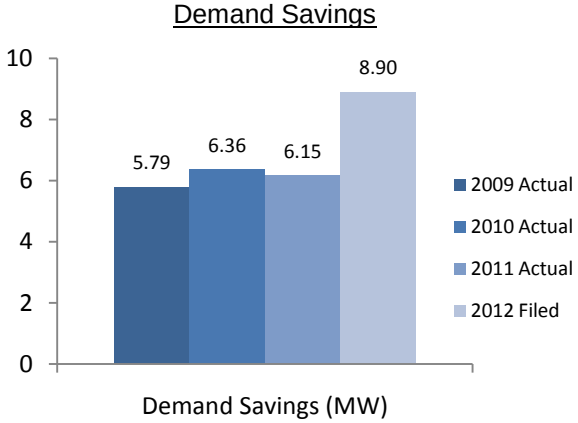
Four-Year Trend Analysis







Budget, Cost Summary

Budget Category	Filed, 2011	Actual, 2011	Filed, 2012
Incentive Costs	$1,897,646	$1,808,730	$2,268,886
Marketing & Admin	$834,964	$353,672	$998,310
Total Costs	$2,732,610	$2,162,402	$3,267,196

IMPLEMENTATION REVIEW

Implementation Strategy

Since 2009, DP&L has implemented and managed the prescriptive rebate program internally. DP&L chose this course of action, as opposed to hiring an outside implementer, for several reasons. First, implementing the program in-house significantly strengthens DP&L employee knowledge of energy efficiency programs and technologies. Second, it provides DP&L with the opportunity to build relationships with contractor networks and customers, leading to quality customer service. And third, unlike the residential programs, we do not believe that a third party rebate provider adds significant value at this point in the program. Potential rebate volume for business customers is lower than for residential customers, and DP&L continues to be able to process this lower volume of rebates internally.

Targeted Products

DP&L's prescriptive rebate program was designed to provide business and government customers with an extensive choice of energy efficient, retrofit opportunities. In 2011, 133 unique measures were available for Rapid Rebates®. This extensive list also broadens the number of customers who can potentially participate in programs. The list of measures was developed based on industry-accepted standards for high efficiency equipment and the associated energy and demand savings. The most popular retrofits are linear fluorescent lighting replacing both T12 and HID (high intensity discharge) lighting. Rebate checks disbursed to customers ranged from $16 to $48,300.

Prescriptive Rebate Allocation

Product Type	Rebate Dollars Paid	Energy Saved (MWh)	Demand Saved (MW)
Lighting	$1,428,136	29,742	5.18
HVAC	$163,486	1,638	0.45
Motors, Drives & Compressed Air	$191,217	2,984	0.50
Other	$25,891	131	0.02

DP&L does not endorse any equipment manufacturers or suppliers in the prescriptive rebate program. Business and government customers may purchase any brand of equipment from any supplier they choose, as long as the equipment is new and meets the eligibility requirements detailed on the measure lists. Additionally, equipment must use electricity as the fuel source and be replacing existing equipment or be installed as part of a retrofit project.

Application Process

DP&L's prescriptive rebate application process was designed to be customer friendly and comprehensive. The application is completely online which makes it convenient for customers and efficient for program control purposes. The application consists of two pages. The first page asks for basic customer information such as company name, address, installation address, DP&L account number, facility type and hours of operation, tax ID and contractor contact information. On the second page, customers choose from a drop-down list of measures, enter the manufacturer and model numbers, and input the appropriate quantities. When the customer has entered all measures for which they are applying, they "submit rebate" and receive a confirmation number. When customers or contractors have questions, DP&L staff is available to guide them through the process.

The online Rapid Rebate® application is electronically submitted to DP&L for review. Applications must be complete and include the necessary contact information, equipment specification, and equipment costs. DP&L then reviews the application, verifies the information provided, and sends a confirmation email that the application has been approved. If the application has been approved, the funds will be reserved. The customer or vendor must provide DP&L with proof of purchase within 60 days of the approval notification. Proof of purchase may come in the form of an invoice, purchase order or other supporting document. If proof of purchase is not received, the funds will no longer be reserved. Applicants can reapply for rebates but they will be placed in the back of the queue. The equipment must be installed and ready to operate within 120 days of application approval and DP&L must be notified of the installation. DP&L must be provided with a final invoice reflecting the true costs of purchasing and installing the energy savings measure (including all materials, labor, and equipment discounts) as well as equipment serial numbers. If the installation does not occur within 120 days, the customer may request an extension from DP&L using the Online

Extension Request Form. Extension requests are handled on a case by case basis. DP&L releases the rebate funds to the customer or the assigned vendor within approximately 30 days of receiving the verification of installation.

DP&L reserves the right to inspect the installed measure(s) prior to releasing any funds to ensure compliance with the program terms and conditions. A verification audit is performed on every prescriptive rebate greater than $10,000. Additionally, DP&L audits a random sampling of rebates less than $10,000. In 2011, 12.2% of Rapid Rebates less than $10,000 were audited. The breakdown in the number of audits performed is as follows:

Rebate Value	Lighting	HVAC	Motors	Other
>$10,000	33	3	2	0
<$10,000	67	7	10	1
% audits	13.1%	13.1%	13.8%	4.3%

In addition to the internal staff, third party engineers and contractors are utilized to perform pre- and post-installation verification audits for a sampling of projects rebated through the prescriptive rebate program.

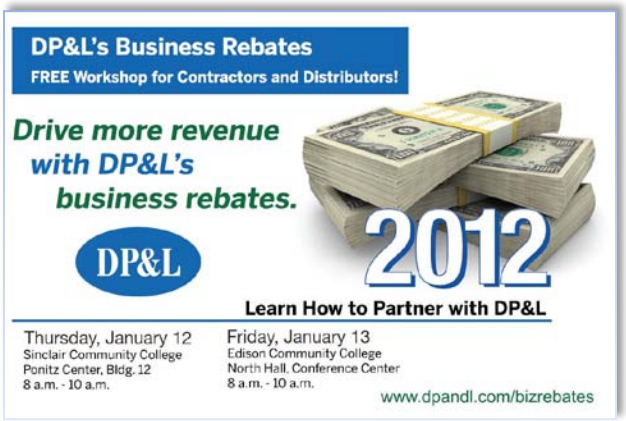
Staffing

DP&L has three program managers to manage the business rebate programs, including the prescriptive rebate program, and serve as DP&L's direct point-of-contact with customers. The internal staff is responsible for reviewing, approving and processing rebate applications. They track and report all incentive dollars as well as energy and demand savings. The staff is also responsible for promoting the program to customers through a variety of marketing tools and business and community events.

Marketing

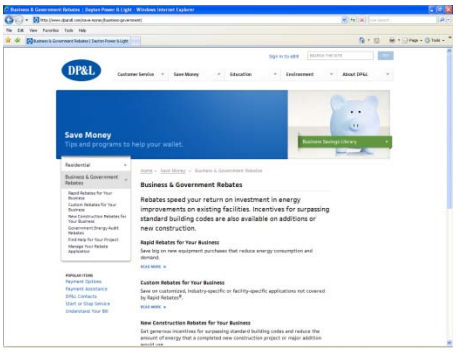
In order to promote the prescriptive rebate program to business and government customers, DP&L employed a variety of marketing methods. These methods included publication of program information on the company website, print literature, bill inserts, inserts in local business journals, presentations at community- and vendor-sponsored events, one-on-one marketing by DP&L major account managers, and the continued utilization of a Channel Partner network.

Channel Partners are contractors, engineers and distributors with energy efficiency experience. They have participated in DP&L rebate workshops and are familiar with using DP&L rebate programs to help customers save money. Channel Partners are viewed as an invaluable third party "marketing extension" of DP&L's internal group of program managers. They have direct contact with customers on a daily basis and can influence the customer's purchasing decisions. Of the $1,808,730 in prescriptive incentives paid to customers in 2011, Channel Partners were involved in securing $897,039 or 50% of those dollars.

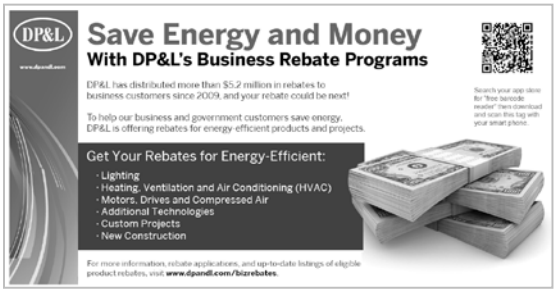


Channel Partners
Channel Partners have participated in DP&L rebate workshops and are familiar with using DP&L rebate programs to help customers save money.

Newsletter
Channel Partners are kept up-to-date on program news and changes through a quarterly Channel Partner newsletter, the "Rapid Review."



Web Portal
The Business Rebates pages on the DP&L website give a description of the prescriptive rebate program and allow customers to navigate to other pages for more information or apply online for a rebate.



Bill Insert
Bill inserts were mailed to 50,000 customers in April, August and October 2011.

Publication Inserts
The Business Rebate programs were advertised through placement of an insert in the 5/27, 8/5 and 11/4 issues of the Dayton Business Journal, which has a distribution of approximately 5,000.

Print Ads
The Business Rebate programs were advertised through placement of ads in local and regional magazines and newspapers, including the Dayton Daily News, which has a circulation of over 100,000.

Event Sponsorships
DP&L Business Programs frequently sponsor and participate in community- and vendor-sponsored events. Events in 2011 included: Dayton Business Journal's "Shades of Green," Montgomery County's "DRG3 Green Business Forum," Green Energy Ohio's "Ohio Leads the Way," and MEEA's 2011 "Ohio Energy Expo."

Print Literature
DP&L used standard print materials for hand outs at meetings with customers and at a variety of speaking events.

Collaborative Partners
DP&L continues to work with its collaborative partners to promote programs. For instance, DP&L is working with the OHA to promote programs to area hospitals.

Customer Service
In all programs, customer service is a critical element for success. As such, DP&L designed a number of customer service elements into the prescriptive rebate program, some of which have been previously discussed.

The Rapid Rebate® section of the DP&L website acts as the main information portal for customers, contractors, distributors and other program participants. It contains a listing of all eligible measures and the rebate amounts, as well as access to the online application. The online application process is akin to online shopping. When the customer has entered all measures for which they are applying, they "submit rebate" and receive a confirmation number. The confirmation number allows the customer access to their application's status, the ability to upload documents to their application, and the ability to assign their rebate to a vendor.

In addition to being an effective means of marketing the program, Channel Partners are also a valuable resource for delivering the program to customers in a quality manner. Channel Partners are trained on both the measures that are rebated through the program and on the application process. Many Channel Partners have taken the rebate

programs and used them to offer a “turn-key” experience for the customer, including the approximate rebates in customer quotes and applying for the rebates on behalf of customers. Through this process, customers can have confidence the proposed equipment will be eligible while allowing DP&L to work with the Channel Partner to clarify any issues that may arise. In short, the Channel Partners are an effective “middleman” for the program with proper upfront training and ongoing program communication.

To encourage Channel Partners to continue to provide excellent service to customers, the Channel Partner Rebate Rewards program was launched in 2011. Channel Partners who are listed on the rebate application are automatically enrolled. Once a minimum of $10,000 in DP&L Rapid Rebates® have been attributed to a Channel Partner, they begin to earn a cash bonus equal to 5% of the DP&L rebates paid to the customer. This incentivizes the Channel Partner to complete the rebate application for the customer. In 2011, DP&L paid $43,667 in Channel Partner Rebate Rewards.

As a quality control measure, the auditing process ensures that contractors and vendors are not misrepresenting the program. From a customer service perspective, customers appreciate and welcome the audit process, as it gives them unbiased energy savings data. They can use this data in submitting positive post-analysis reports on their capital projects.

To make communication convenient for the customer, the Business Programs staff maintains an Energy Efficiency Inbox, energyefficiency@dplinc.com, a clearinghouse for general program questions that business and government customers may have.

DP&L staffs its own business call center, the Business Solutions Center, catering to DP&L business customers and their billing and other general inquiries. DP&L Business Program management staff conducted training sessions for business solutions center staff regarding energy efficiency program details. This was to ensure that DP&L phone representatives had a basic understanding of the program, could assist customers in navigating the website or point them to the Energy Efficiency Inbox.

NON-RESIDENTIAL CUSTOM REBATES

PROGRAM DESCRIPTION

The Non-Residential Custom Rebate Program provides business and government customers with incentives for equipment purchases and industrial process improvements that reduce energy consumption and demand. Custom Rebates are for equipment that is not covered by DP&L's prescriptive rebate program and is generally best suited for customized industry-specific or facility-specific applications.

The objective of the program is to help business and government customers overcome the upfront cost hurdle associated with energy efficient technologies and to promote innovative and emerging technologies.

The Custom Rebate Program is designed for all DP&L business and government customers who purchase new energy efficient equipment through a manufacturer, distributor or contractor. All business and government customers taking delivery service from DP&L are eligible for this program regardless of their choice of generation supplier.

DP&L began accepting online Custom Rebate applications on April 1, 2009. In 2011, DP&L received 78 Custom Rebate applications, of which 61 were paid, 6 were denied approval, and 11 applications were pending at the end of 2011.

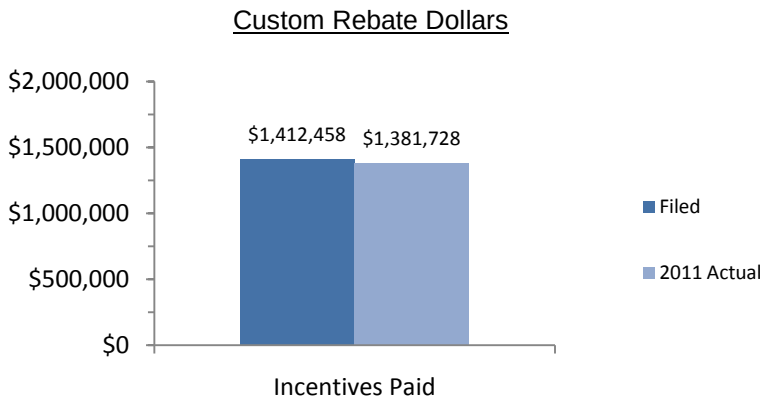
New Construction Rebates are included in the Custom Rebate Program. The New Construction Rebates promote energy efficient design strategies by incenting reductions in the amount of energy that a completed new construction project or major addition would use. In 2011, DP&L received 9 New Construction Rebate applications. These are in addition to the 27 New Construction Rebate applications received in 2010, none of which were completed or paid in 2010. (New construction projects have lead times spanning multiple months.) 14 of the outstanding 36 New Construction Rebates were paid in 2011, accounting for 1,597 MWh and 0.48 MW of annual savings.

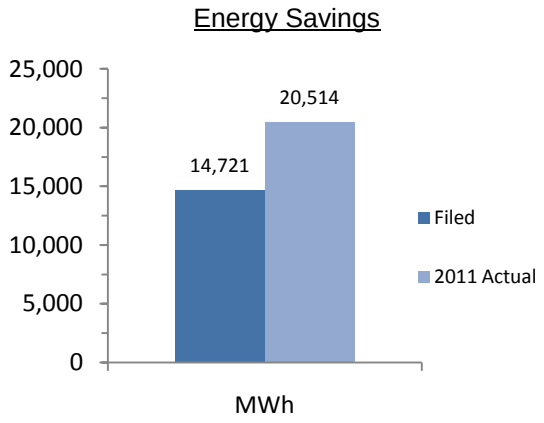
The Government Audit Program is also funded through the Custom Rebate budget. All local governments with facilities served by DP&L are eligible to participate, including counties, municipalities, cities, villages, townships and public schools. The objective of the audit program is to help government customers understand how energy is being used, prioritize potential projects, calculate project paybacks and identify rebates for which they are eligible. DP&L reimburses 50% of the cost of the audit and will pay the remaining 50% if the customer implements electricity-saving projects within 1 year of the audit. DP&L does not supply the auditing services. Rather, customers can choose the third-party audit firm they would like to utilize. In 2011, seventeen (17) entities applied for audits of 42 facilities. Since the program’s inception in September 2010, 18 audits have been completed.

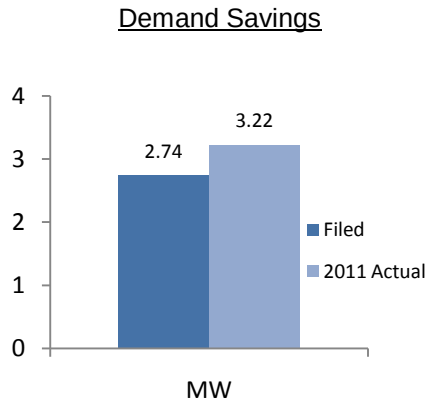
PERFORMANCE SUMMARY

During 2011, DP&L paid $1,381,728 in Custom Rebates to business and government customers, resulting in gross annualized energy savings of 20,514 MWh and peak demand savings of 3.22 MW. Keys to the program's success include continued operation of a customer-friendly online application system, quality customer service and follow through, and strong relationships with Channel Partners.

2011 Performance

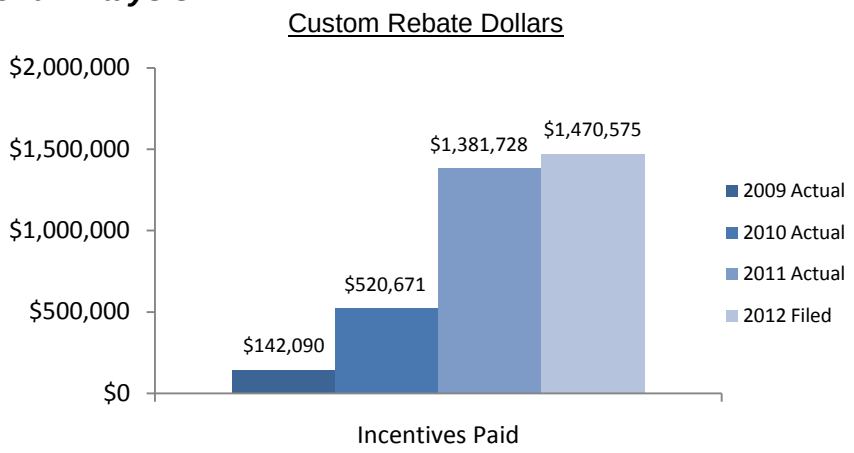


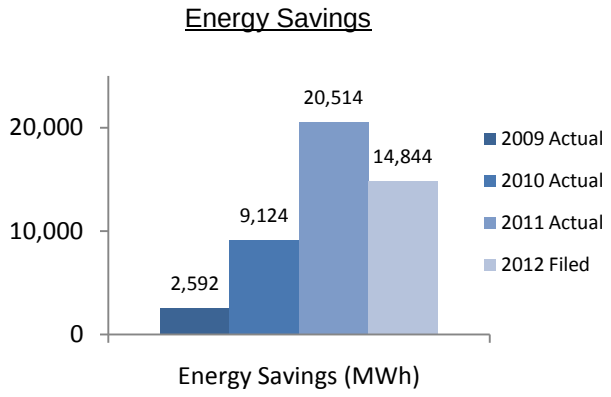


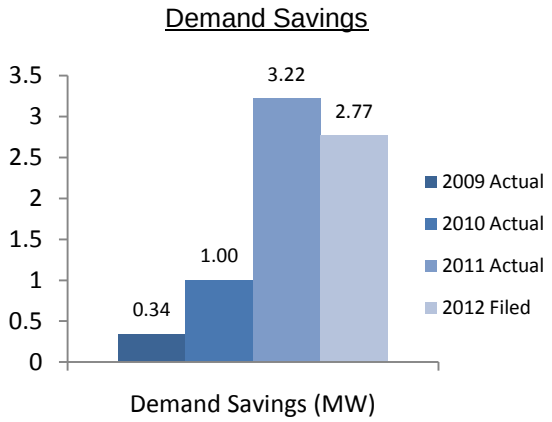


All "filed" numbers are taken from DP&L's program portfolio filing; Case No. 08-1094-EL-SSO.

Four-Year Trend Analysis







Budget, Cost Summary

Budget Category	Filed, 2011	Actual, 2011	Filed, 2012
Incentive Costs	$1,412,458	$1,381,728	$1,470,575
Marketing & Admin	$776,852	$332,706	$808,816
Total Costs	$2,189,310	$1,714,434	$2,279,391

IMPLEMENTATION REVIEW

Implementation Strategy

Since 2009, DP&L has implemented and managed the custom rebate program internally. DP&L chose this course of action, as opposed to hiring an outside implementer, for several reasons. First, implementing the program in-house significantly strengthens DP&L employee knowledge of energy efficiency programs and technologies. Second, it provides DP&L with the opportunity to build relationships with contractor networks and customers, leading to quality customer service. And third,

unlike with the residential programs, we do not believe that a third party rebate provider adds significant value at this point in the program. Potential rebate volume for business customers is lower than for residential customers, and DP&L continues to be able to process this lower volume of rebates internally.

Targeted Products

DP&L's custom rebate program was designed to provide business and government customers with an opportunity to receive rebates for implementing innovative energy efficient emerging technologies and process improvements. Rebate checks disbursed to customers ranged from $14 to $277,735.

Custom Rebate Allocation

Product Type	Rebate Dollars Paid	Energy Saved (MWh)	Demand Saved (MW)
Lighting	$323,741	4,243	0.52
HVAC	$179,342	4,675	1.10
Other, includes: • Barrel wraps on plastic extrusion machines • Multi-compressor compressed air systems	$757,050	9,999	1.12
New Construction	$121,595	1,597	0.48

In 2011, Custom Rebates were rebated per the following schedule:

Project Type	Rebate Calculation
Lighting	$0.05/kWh + $50/KW
HVAC	$0.10/kWh + $100/KW
Other	$0.08/kWh + $100/KW

DP&L does not endorse any equipment manufacturers or suppliers in the custom rebate program. Business and government customers may purchase any brand of equipment from any supplier they choose, as long as the equipment is new and meets the eligibility requirements. Equipment must use electricity as the fuel source and be replacing existing equipment or be installed as part of a retrofit project. Projects are required to have a payback of less than 7 years before rebates are applied. The 7-year maximum payback helps to promote cost effectiveness.

New Construction Rebates are calculated in one of two ways. The lighting power density (LPD) incentive encourages the inclusion or installation of lighting designs and equipment that provide quality lighting at lower installed wattages. The incentive is calculated on a per square foot basis for LPD performance exceeding ANSI/ASHRAE/IESNA Standard 90.1-2007.

$$Incentive_{LPD} = (LPD_{baseline} – LPD_{actual}) \times area \times \$0.30$$

Alternately, customers can choose to have their new building evaluated using the Whole Building Energy Performance Baseline Improvement method. This method incents customers who design their buildings to be more efficient than a baseline building constructed to ANSI/ASHRAE/IESNA Standard 90.1-2007. To be eligible for a whole building incentive, the customer must provide documentation of an energy model in accordance with ANSI/ASHRAE/IESNA Standard 90.1-2007, Appendix G. Incentives are calculated using the following incentive rate guidelines. To receive an incentive, a project must achieve an annual electric energy and demand savings of 5% or better than baseline.

Incentive Rate Guidelines		
First Year Annual Electric Reduction	**Energy Incentive Rate**	**Demand Incentive Rate**
5-10% over baseline	$0.05/kWh	$50/KW
>10% over baseline	$0.08/kWh	$75/KW
>20% over baseline	$0.10/kWh	$100/KW

Application Process

DP&L's custom rebate application process was designed to be customer friendly and comprehensive. The application is completely online which makes it convenient for customers and efficient for program control purposes. Customers must apply for a custom rebate prior to beginning their project. The pre-approval phase allows DP&L the opportunity to perform pre-installation auditing (in some cases, metering) of the affected systems. The application consists of two pages. The first page asks for basic customer information such as company name, address, installation address, DP&L account number, facility type and hours of operation, tax ID and contractor contact information. On the second page, customers enter a detailed project description, their baseline energy and demand usages, and their proposed energy and demand usages. When the customer has input all their data, they "submit rebate" and receive a confirmation number. When customers or contractors have questions, DP&L staff is available to guide them through the process.

The customer or vendor completes the online Custom Rebate application and submits it electronically to DP&L for review. Applications must be complete and include the necessary contact information, equipment specifications, and equipment costs. Additionally, applicants must submit a full description of how the energy and demand savings were calculated. DP&L then reviews the application, verifies the information provided, and sends a confirmation email that the application has been approved. If the application has been approved, the funds will be reserved. The customer or vendor must provide DP&L with proof of purchase within 60 days of the approval notification.

Proof of purchase may come in the form of an invoice, purchase order or other supporting document. If proof of purchase is not received, the funds will no longer be reserved. Applicants can reapply for rebates but they will be placed in the back of the queue. The equipment must be installed and ready to operate within 120 days of application approval and DP&L must be notified of the installation. DP&L must be provided with a final invoice reflecting the true costs of purchasing and installing the energy savings measure (including all materials, labor, and equipment discounts) as well as equipment serial numbers. If the installation does not occur within 120 days, the customer may request an extension from DP&L using the Online Extension Request Form. Extension requests are handled on a case by case basis. DP&L releases the rebate funds to the customer or the assigned vendor within approximately 30 days of receiving the verification of installation.

DP&L reserves the right to inspect the installed measure(s) prior to releasing any funds to ensure compliance with the program Terms and Conditions. A verification audit is performed on every custom rebate greater than $10,000. Additionally, DP&L audits a random sampling of rebates less than $10,000. In 2011, 17.6% of rebates less than $10,000 were audited. The breakdown in the number of audits performed is as follows:

Rebate Value	Custom
>$10,000	19
<$10,000	13
% audits	42.6%

In addition to the internal staff, third party engineers and contractors are utilized to perform pre- and post-installation verification audits for a sampling of projects rebated through the custom rebate program.

Staffing

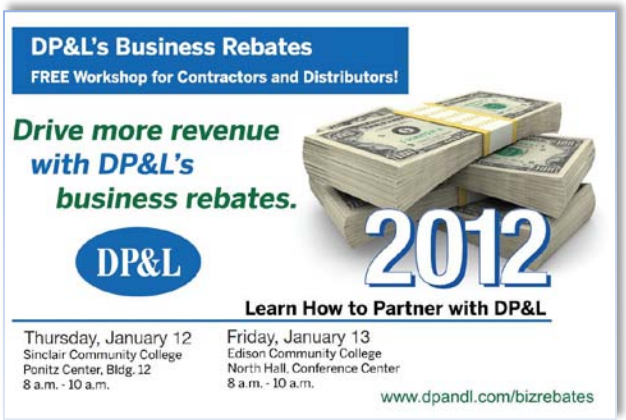
DP&L has three program managers to manage the business rebate programs, including the custom rebate program, and serve as DP&L's direct point-of-contact with customers. The internal staff is responsible for reviewing, approving and processing rebate applications. They track and report all incentive dollars as well as energy and demand savings. The staff is also responsible for promoting the program to customers through a variety of marketing tools and business and community events.

Marketing

For efficiency and cost-effectiveness purposes, DP&L often promoted the custom rebate program as it promoted its Rapid Rebates. DP&L employed a variety of marketing methods, including publication of program information on the company website, print literature, bill inserts, inserts in local business journals, presentations at community- and vendor-sponsored events, one-on-one marketing through major account managers, and the creation of the Channel Partner network.

Channel Partners are contractors, engineers and distributors with energy efficiency experience. They have participated in DP&L rebate workshops and are familiar with

using DP&L rebate programs to help customers save money. Channel Partners are viewed as an invaluable third party "marketing extension" of DP&L's internal group of program managers. They have direct contact with customers on a daily basis, and can influence the customer's purchasing decisions. Of the $1,381,728 in custom incentives paid to customers in 2011, Channel Partners were involved in securing $319,476 or 23.1% of those dollars.



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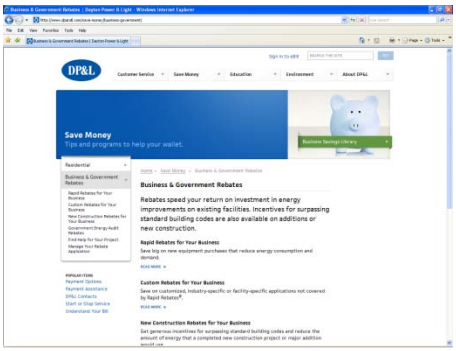

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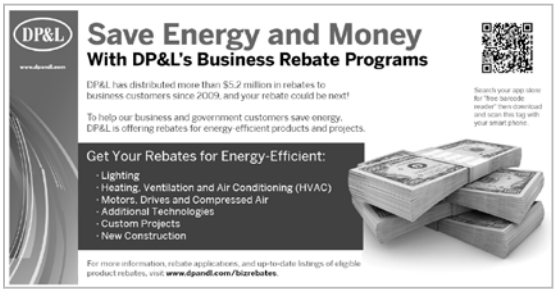

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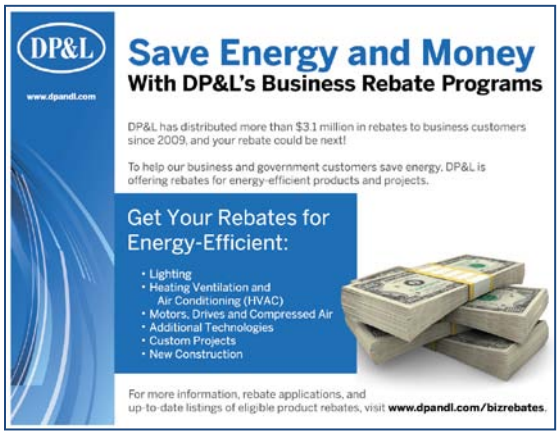

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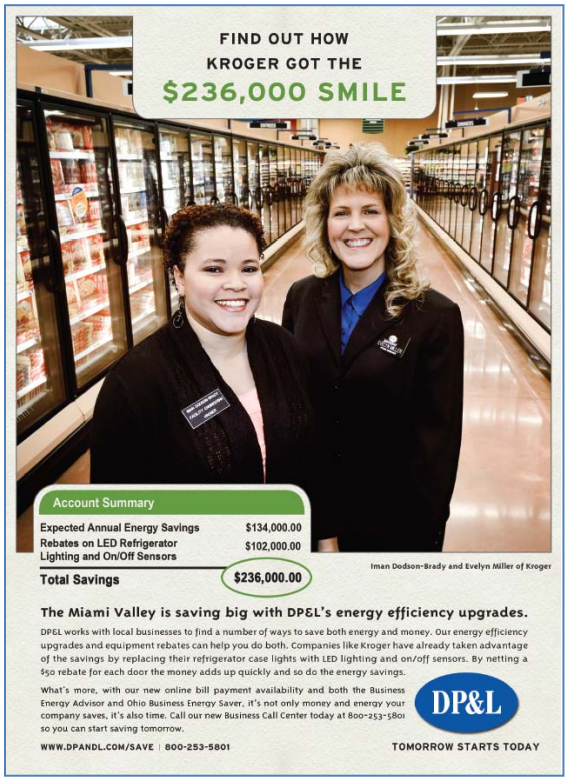

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To make communication convenient for the customer, the Business Programs staff maintains an Energy Efficiency Inbox, energyefficiency@dplinc.com, a clearinghouse for general program questions that business and government customers may have.

Lastly, DP&L maintains its own customer service center, accepting calls regarding all functions of DP&L. DP&L Business Program management staff conducted training sessions for customer service center staff regarding program details. This was to ensure that DP&L phone representatives had a basic understanding of the energy efficiency programs, and could assist customers in navigating the website or point them to the Energy Efficiency Inbox.

MERCANTILE SELF-DIRECT PROGRAM

PROGRAM DESCRIPTION

Pursuant to O.R.C §4928.66, mercantile customers may commit their peak demand reduction, demand response and energy efficiency projects for integration with an electric utility's programs. DP&L's self-direct program consists of the Company allowing mercantile customers to commit their resources for integration in DP&L's programs in exchange for a one-time payment, a commitment payment or exemption from the Energy Efficiency Rider (EER). This self-direct program is available to customers who consume 700,000 kWh or more per year or are part of a regional or national account and who commit their demand and energy savings to be integrated into DP&L's energy efficiency programs.

In 2011, consistent with the Commission's pilot program for mercantile customers to commit energy efficient/peak demand reduction adopted in Case No. 10-834-EE-EEC, DP&L's self-direct program allows mercantile customers who have successfully identified and documented savings from energy efficiency projects since January 1, 2008 to apply for a one-time incentive payment or an exemption from the EER. If a customer provides all the necessary project documentation, DP&L will file a joint application with the customer, requesting PUCO approval of an incentive payment or exemption from the EER for a period of time. Rules also permit a customer to file directly with the PUCO.

The one-time payments are reduced to 75% of the incentive amount the customer could have received for the same project under the 2011 prescriptive or custom rebate programs. EER exemption requests are based on the percentage of demand and energy saved versus the overall customer demand and energy consumed. The EER exemption is proposed to last as long as the percentage of savings achieved by the customer exceeds the legislated demand and/or energy targets. Customers may participate as an individual facility or have the option to aggregate all facilities into a single application. All applications are filed at the PUCO individually and reviewed on a case-by-case basis.

All mercantile applications must be approved by the PUCO prior to taking effect.

PERFORMANCE SUMMARY

During 2011, DP&L jointly filed thirteen (13) applications with customers requesting a one-time incentive payment for historical energy efficiency projects. These applications were filed using the PUCO-issued mercantile template format and resulted in demand savings of 1.56 MW and energy savings of 5,985 MWh.

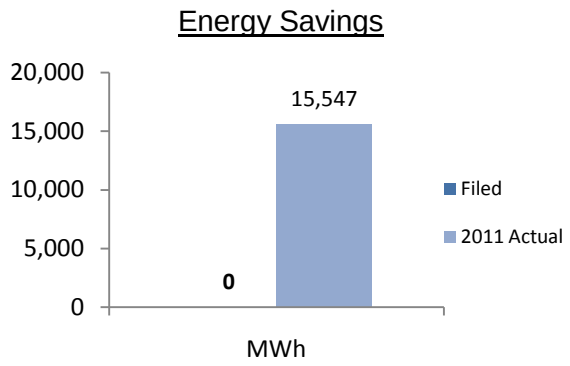
Two (2) joint applications for energy efficiency rider exemptions were filed in 2010, one for Honda of America, Mfg., Inc., and one for Wright-Patterson Air Force Base. Both of these applications were approved by the Commission on December 7, 2011.

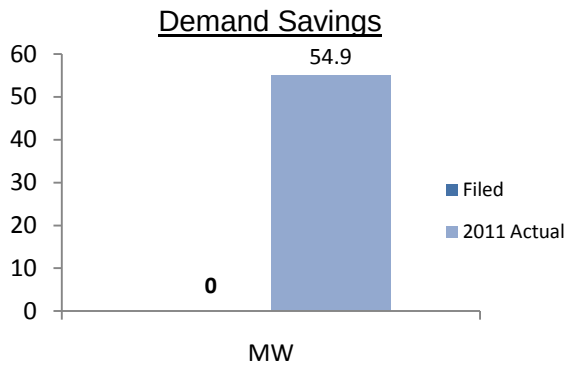
Additionally, in 2011, DP&L issued a request for proposal seeking demand reduction "commitments" from curtailment service providers (CSP's) on behalf of their DP&L mercantile customers. Four suppliers submitted proposals. The lowest bidder was selected.

A 2009 mercantile application requesting an EER exemption for 22.2 MW of committed demand response in 2011 remains pending before the PUCO.

2011 Mercantile Program Summary		Approved by PUCO	Energy Savings (kWh)	Demand Savings (kW)	Incentive Payment
One-Time Incentive Payments for Energy Efficiency					
Kroger	11-0729-EL-EEC	✓	952,131	108.7	$57,442.50
City of Washington Court House	11-1393-EL-EEC	✓	620,513	120.5	$24,708.75
City of Fairborn	11-2814-EL-EEC	✓	958,979	192.5	$34,295.25
The Fremont Company	11-2957-EL-EEC	✓	40,600	8.1	1,312.50
F&P America	11-3831-EL-EEC	✓	996,566	137.9	$23,482.50
Dayton Board of Education	11-5015-EL-EEC	✓	233,127	275.2	$35,845.66
Dayton Board of Education	11-5225-EL-EEC	✓	141,247	39.6	$9,959.82
Dayton Board of Education	11-5765-EL-EEC	✓	210,142	406.3	$38,352.83
Greene County Career Center	11-5741-EL-EEC	✓	499,656	57.0	$22,247.67
Dayton Board of Education	11-5860-EL-EEC	✓	171,581	13.7	$10,294.86
City of Moraine	11-5861-EL-EEC	✓	44,855	2.3	$1,447.50
Clinton Massie Local Schools	11-5991-EL-EEC	✓	785,861	158.3	$13,631.25
Miami Valley Hospital	11-5936-EL-EEC	✓	329,770	44.4	$16,425.00
Subtotal Energy Efficiency Incentive Payments			**5,985,028**	**1,564.5**	**$289,446.09**
Energy Efficiency Rider Exemptions					
Two (2) applications		✓	9,561,649	1,879.5	$671,648.98
Demand Response Rider Exemptions					
Appleton Papers	09-1701-EL-EEC		-	22,200.0	-
Demand Response Commitment Contract					
Subtotal Demand Response Commitments			**-**	29,220.0	$138,795.00
TOTAL 2011 Mercantile Savings			**15,546,677**	**54,864.0**	**$1,099,890.07**

2011 Performance





All "filed" numbers are taken from DP&L's program portfolio filing; Case No. 08-1094-EL-SSO. At the time of the filing, DP&L did not include a self-direct program.

Budget, Cost Summary

DP&L did not file a self-direct plan or budget with its program portfolio plan. Below are actual costs for 2011.

Budget Category	Actual, 2011	Filed, 2012
Incentive Costs	$1,099,890	$0
Marketing & Admin	$121,229	$0
Total Costs	$1,221,119	$0

IMPLEMENTATION REVIEW

Implementation Strategy

The mercantile self-direct program can require a significant investment of time on the part of the customer and can be somewhat complex to understand. As such, DP&L is implementing this program in-house, utilizing business program managers. This provides a dedicated point of contact at DP&L to assist the customer through the process. It is the program manager's responsibility to understand program details, communicate the program to customers, and help customers manage their way through the process.

Targeted Customers

DP&L has determined that approximately 1,200 customers qualify for the self-direct program based on the law's minimum usage criteria of 700,000 kWh per year, set forth in O.A.C. §4901:1-39(P). To date, initial interest has generally been from DP&L's larger, major account customers, who are already participating in the prescriptive and custom rebate programs.

Staffing
DP&L utilizes business program managers to manage the self-direct program. These managers focus on managing all stages of the self-direct program including program design, PUCO rule review, marketing and customer service.

Marketing
To promote the self-direct program, DP&L worked with its major account managers to identify large customers who participate in PJM Demand Response as well as those who may have implemented past efficiency projects. Additionally, DP&L educated industry contractors and distributors about the availability of the program. Their knowledge about local efficiency projects was used to establish leads for potential customers that may have implemented projects in the 2008 to 2010 timeframe.

Customer Service
Given the complexities of the program and filing requirements, the mercantile self-direct program requires extensive customer interaction throughout the planning, filing and reporting process. As such, DP&L utilizes its business program managers to provide customers with assistance and a single point of contact. DP&L's program managers are knowledgeable about program rules, requirements and procedures and can help customers with their initial analysis related to program savings and expected energy efficiency rider costs. Further, DP&L can provide the regulatory and legal support required to make initial filings and assist throughout the regulatory approval and reporting process.

EDUCATION, AWARENESS BUILDING, & MARKET TRANSFORMATION ACTIVITIES

In 2011, DP&L's education, awareness building and market transformation activities included school education through Ohio Energy Project (OEP) and customer education and awareness building through both mass media and DP&L's website.

Budget, Cost Summary*

Budget Category	Filed, 2011	Actual, 2011	Filed, 2012
School Education	--	$211,621	--
General Education, Awareness Building	--	$685,718	--
Total Costs	$1,619,625	$897,339	$1,671,553

*With the approval of PUCO Staff and notification of DP&L's energy efficiency collaborative, DP&L reallocated 2011 budgets within the residential program portfolio. The reallocation is summarized on page 1-7. Shown above is the original filed budget for 2011.

SCHOOL EDUCATION (OHIO ENERGY PROJECT)

PROGRAM DESCRIPTION

The School Education Program provides take-home energy savings kits for students as well as accompanying classroom energy efficiency curriculum and training for teachers. The objectives of the program are to: 1) reduce electricity use of program participants in selected schools; 2) educate students and their families about energy, energy efficiency, and the effects of their energy usage decisions; and 3) create energy awareness among students that will promote energy efficient habits throughout their lives.

The program is implemented by OEP. OEP is uniquely qualified to provide energy efficiency education based on its existing relationships with school districts and experience delivering similar programs throughout Ohio. OEP is currently operating the same type of program for AEP Ohio.

For the 2011-12 school year, DP&L has partnered with Vectren and Ohio Energy Project to deliver a school program which addresses both electric and natural gas savings. The joint effort with Vectren was pursued with the encouragement of DP&L's energy efficiency collaborative. The goal of the partnership is to increase the effectiveness of the program while eliminating duplication caused by separate gas and electric programs. This portfolio status report, however, discusses and reports savings for the 2010-11 school year only. Results for the 2011-12 school year will be presented in the 2012 annual portfolio status report.

Training and Curriculum

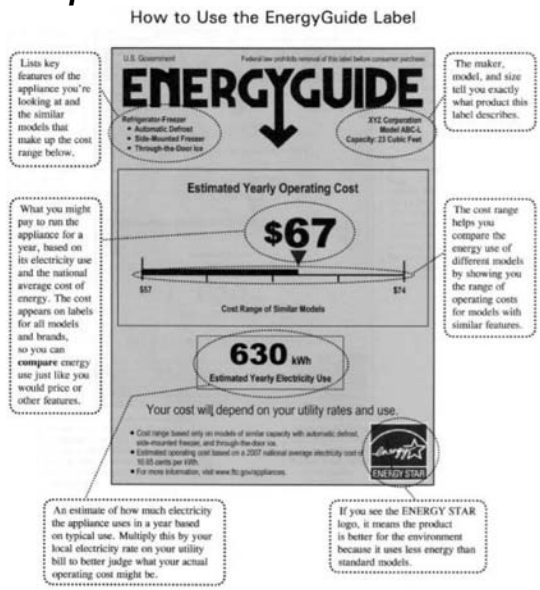
The program was offered to school districts across DP&L's service territory, grades 5-12. Teachers who volunteered to participate were required to attend professional development workshops to undergo training about program guidelines and curriculum. Once teachers completed the training, they were given one energy efficient kit for each of their students.

Each teacher was provided with a complete curriculum designed to accompany and educate students about the items contained in the take-home energy savings kit. The curriculum included classroom activities, experiments, and games, all meeting state of Ohio education standards. The curriculum also covered subjects like properties of energy, electric generation fuel sources, home energy audit suggestions, appliance energy usage comparisons, CFL versus incandescent cost comparisons, home temperature measurement exercises, and weatherization information.

In addition, teachers were given materials needed to complete experiments and activities, such as six Kill-A-Watt Meters, two radiometers, one canister of coal, two glow sticks, one pair of "Blaster Balls," one circuit ball, and one flashlight.

The program included a youth energy summit and energy fair. At the youth energy summit, high school students were trained so they could facilitate daylong workshops and hands-on activities for students, grades 5-9, at the energy fair.

Sample Classroom Activities



LET'S COMPARE !
10,000 Hours of Light

CFL (Compact Fluorescent Lightbulb) 23w	Incandescent Bulb 100w
Amount of light = 1700 lumens	Amount of light = 1585 lumens
Power in watts = 23 watts	Power in watts = 100 watts
Lifespan = 10,000 hours	Lifespan = 750 hours
Bulbs needed for 10,000 hours? 1	Bulbs needed for 10,000 hours? 13
Cost per bulb = $ 2.50	Cost per bulb = $ .26
Total bulb cost for 10,000 hrs? **$ 2.50**	Total bulb cost for 10,000 hrs? **$ 3.38**
23 watts X 10,000 hours = 230,000 watthours	100 watts X 10,000 hours = 1,000,000 watthours
Kilowatthours (kWh)? 230 kWh	Kilowatthours (kWh)? 1000 kWh
Cost per kWh = $ .10	Cost per kWh = $ .10
230 kwh x $ .10 /kwh = $ 23.00	1000 kwh x $ .10 /kwh = $ 100.00
Cost of electricity for 10,000 hours **$ 23.00**	Cost of electricity for 10,000 hours **$ 100.00**
Total cost for 10,000 hours = $ 2.50 + $ 23.00 = **$ 25.50**	Total cost for 10,000 hours = $ 3.38 + $ 100.00 = **$ 103.38**

SAVINGS = $103.38 - $ 25.50 = $77.88 !

Take-Home Energy-Saving Kits
Participating teachers were provided energy savings kits to be sent home with each participating student. Each component of the take-home kit was discussed in the classroom, informing students how to properly install and use the item, as well as the way it helps save energy.

Take-Home Kit Contents

Item	*Description*
2 23W Bright White CFL	Long-life light bulb with up to 75% energy savings. Lasts 10 times longer than an incandescent bulb. White color tone.
2 13W Soft White CFL	Long-life light bulb with up to 75% energy savings. Lasts 10 times longer than an incandescent bulb. Yellowish color tone.
Refrigerator Thermometer Card	Credit card-sized measuring device to determine whether refrigerator is at an efficient temperature.
LED Night Light	Light Emitting Diode (LED) technology creates suitable yet energy efficient light.
Self-Stick Energy Use Gauge Thermometer	Helps measure savings for heating and cooling costs.
Hot Water Temperature Card	Credit card-sized device measures the temperature of hot tap water. Card provides suggested range for setting water heater temperature to optimize efficiency.
DP&L Residential Energy Efficiency Programs Flier	Handout describing DP&L's energy efficiency programs which can help save energy and money.
CFL Recycling Brochure	Brochure explaining the small amount of mercury in CFLs and proper disposal methods.

PERFORMANCE SUMMARY
Through OEP, DP&L recruited and trained 84 teachers in 41 school districts throughout its service territory. In addition, 6,464 energy savings kits were distributed to teachers, to be taken home by students once the classroom lessons were complete. Savings garnered via the installation of compact fluorescent bulbs and LED night lights provided in students' take-home kits were gross annualized energy savings of 1,171 MWh and peak demand savings of .14 MW.

Since the core of this program is educational, it is difficult to measure on an absolute basis the long-term impact. To that end though, OEP conducted surveys to provide data to confirm the success of the program. Survey results are as follows:

- Students' energy knowledge before and after the training showed a 31 percent average improvement in test scores.
- Teachers rated the interest and motivation of students a 6 out of 7.

- Teachers rated the support and participation of families a 5 out of 7.
- Teachers rated the overall quality of the program a 6 out of 7.
- Students rated the overall quality of the program a 6 out of 7.

OEP also distributed surveys to participating teachers. These are a few comments from participating teachers regarding the program:

- OEP has had a huge impact on leadership and energy awareness in our community. Our students educate their parents and siblings.
- This has made a huge impact on our school – our students are more energy efficient in the classroom and say they are at home.
- These programs make students more energy conscience. They will be more aware of energy usage in the future.
- It is a wonderful experience and exposure to these activities is extremely beneficial to students and their families.
- It was a wonderful experience.
- I and my students have started to make daily changes to reduce our carbon footprint.

GENERAL EDUCATION, AWARENESS BUILDING, MARKET TRANSFORMATION

DP&L's 2011 education, awareness building and market transformation activities included a mass media campaign targeted to all customers, a CFL education campaign and a web-based resource library designed for business customers.

MASS MEDIA CAMPAIGN

During the course of 2011, DP&L aired a television and print campaign targeted to all of its customers. The goals of the campaign were to communicate the value of energy efficiency and increase the awareness of available energy efficiency programs. In addition, the campaign provided a general level of program marketing support, helping to promote the continued expansion of customer participation in energy efficiency programs.

The campaign ran from the week of April 25 through the week of July 25 and again from the week of August 29 through the week of November 18.

Television Script

Announcer Voice Over	Visuals	
There's a company the Miami Valley you can count on, To shed light on new ways to conserve, To help empower our region, To help take the first steps into the future. Our rebates on new air conditioners and heat pumps, discounts on CFLs, and free refrigerator recycling are just a few of the ways you can save both money and energy. Tomorrow starts today with DP&L.	Morning scene of Dayton. A number of lamps. Computers using energy. Little girl playing in front of A/C unit. Various CFLs. Refrigerator being lifted into truck. Various scenes of Dayton. Shot of control room grid. Logo, website.	

Print

YOUR FUTURE IS OUR FUTURE.
AND TOGETHER, WE CAN SHARE
IN ALL THAT THE MIAMI VALLEY HAS TO OFFER.
At Dayton Power and Light, we believe in our community and the many things our region has to offer. Together, with your help, we can look to the future with anticipation and a feeling of pride. Today DP&L is finding new ways to help you conserve. Our rebates on new heat pumps, discounts on energy-efficient lighting and free refrigerator recycling help you save both energy and money.
www.dpandl.com
TOMORROW STARTS TODAY
DP&L

COMPACT FLUORSCENT EDUCATION

During 2011, DP&L also ran a customer education campaign regarding the value of compact fluorescent lights. In addition to education, the campaign had the dual benefit of promoting the purchase of discounted compact fluorescents bulbs at area retailers through the DP&L residential lighting program.

The CFL education campaign consisted of newspaper, radio, and web-based advertising. The campaign began the week of July 11 and ran through the week of October 24.

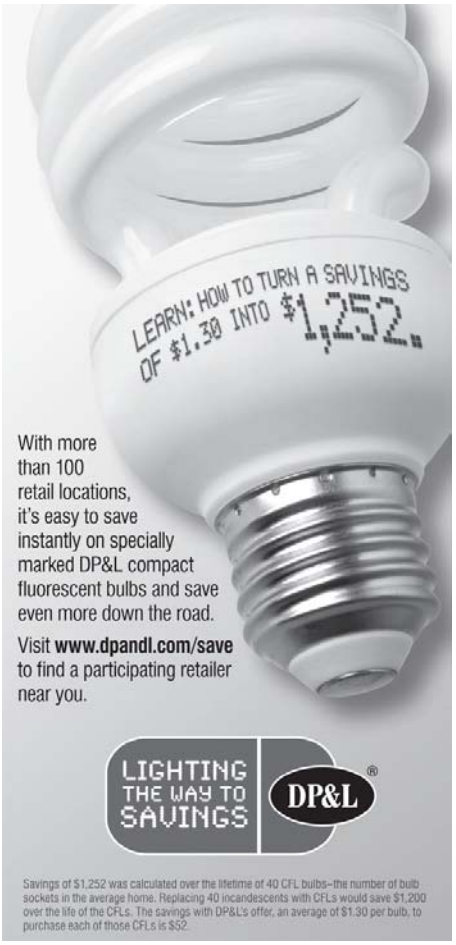
The goal of the campaign was to inform customers about the financial benefits of CFLs. To accomplish this, DP&L "did the math" for customers. It was assumed that the average home has 40 light sockets, and that a single CFL could save an average of $30 over its lifetime. When the DP&L discount is then factored into the initial price of the bulb, the potential total savings for each customer is $1,252. This message was emphasized to overcome a potential misperception that, while CFLs save energy, the savings might not be worth the effort.

Additional messages of the campaign included:

- CFLs use 75% less energy than incandescent bulbs and last 10 times longer.
- CFLs now come in a number of shapes, sizes, and applications.
- Discounted bulbs are available at area retailers.

As a part of the campaign, DP&L held two promotional events at area Lowe's stores. At the Saturday morning events, a radio station broadcast live from the store to promote the campaign, conducted interviews with the DP&L program manager, and a display was set up at the store staffed by program employees to personally explain the benefits of CFLs to customers. As an added educational tool, a bicycle used to light incandescent, fluorescent and LED bulbs demonstrated the efficiency of CFLs and LEDs. Customers who tried the bike experienced first-hand that more energy has to be generated to power incandescents, as opposed to CFLs and LEDs.

Sample Campaign Communications



Radio Ad Script 1

ANNCR VO:
Think using compact fluorescent bulbs doesn't make a difference on your wallet? Dayton Power and Light wants you to think again. That's because DP&L has teamed up with area retailers to save you an average of a dollar 30 on each CFL you buy.

So let's do the math.

SFX: Typing on calculator with print out.
DIRECTION: Announcer is talking out loud to himself

If the average home has 40 sockets for bulbs… let's see… that's a dollar thirty times 40, which is $52. And if each bulb saves $30 over its lifetime… that's 40 bulbs times $30 equals $1,200 plus the $52 in savings I got for buying those bulbs… $1,200 plus $52 equals… wow, that's $1,252 in savings, not too shabby.

And just think, CFLs use 75% less energy than regular bulbs and last 10 times as long. So visit dpandl.com, that's d-p-a-n-d-l.com, find a participating retailer near you and look for DP&L's specially marked bulbs.

We're DP&L. Lighting the way to savings.

Radio Ad Script 2

ANNCR VO:
Did you know Dayton Power and Light is offering instant savings when you purchase compact fluorescent bulbs?

That means the simple CLICK of a switch saves you CASH REGISTER. Just purchase specially marked "HELLO, DAYTON POWER AND LIGHT" CFLs when you visit area retailers such as, "Welcome to Sam's Club, Walmart, Ace Hardware, Lowe's, Home Depot, Dickman Supply, True Value, Kroger, Menard's, Meijer, Batteries Plus." Not only will you save CASH REGISTER now… an average of $1.30 per CFL to be exact… you'll also save CASH REGISTER on your energy bill.

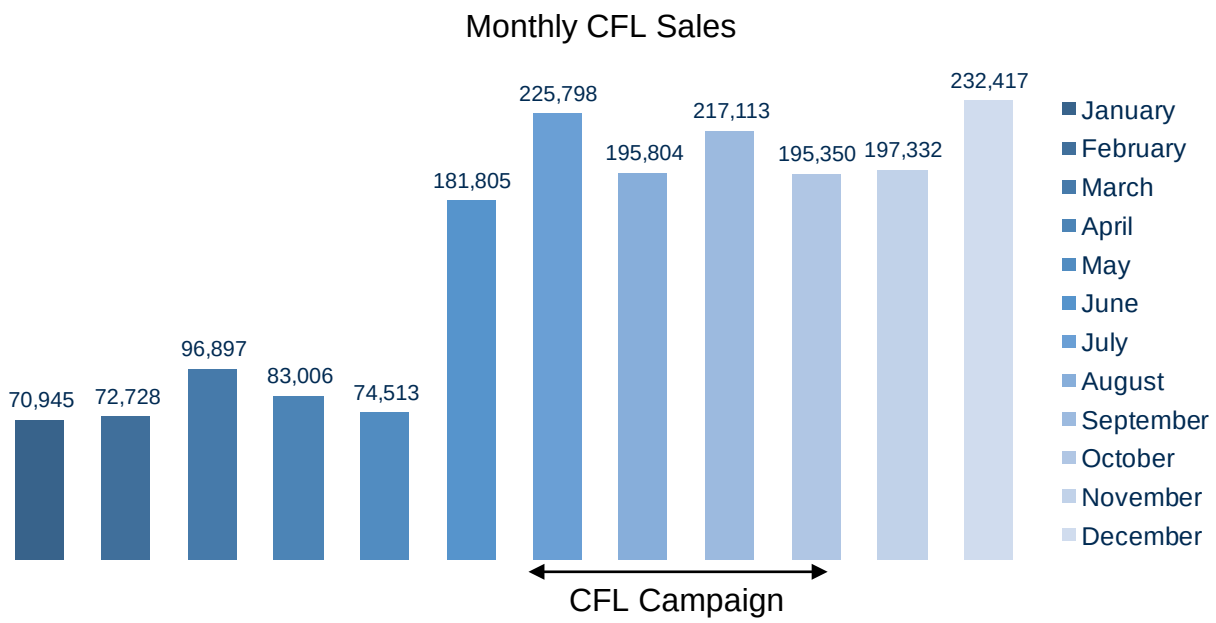
So let's go over that one more time. Visit any participating DING, and purchase specially marked compact fluorescents. You'll save CASH REGISTER instantly. Take them home and TWIST, TWIST, TWIST and then CLICK, AAAHHHHH *(angelic)*. And since CFLs use 75% less energy and last 10 times as long you'll save even more CASH REGISTER on your energy bill.

Visit dpandl.com, that's d-p-a-n-d-l.com, find a participating retailer near you and look for DP&L's specially marked bulbs.

We're DP&L. Lighting the way to CASH REGISTER.

PERFORMANCE SUMMARY

Market transformation and customer education is a long- term process and can be difficult to measure in the short-term. One measurement of the success of the CFL campaign is the monthly sales volume as measured before, during, and after the campaign. It should be noted that there are other factors that contribute to changes in monthly sales volume other than the education campaign, such as incentive amount adjustments which occurred in June of 2011. However, it is reasonable to conclude that the education campaign had a positive impact, capitalizing on the momentum created by changes in incentives and driving sales higher.



WEB-BASED RESOURCE LIBRARY

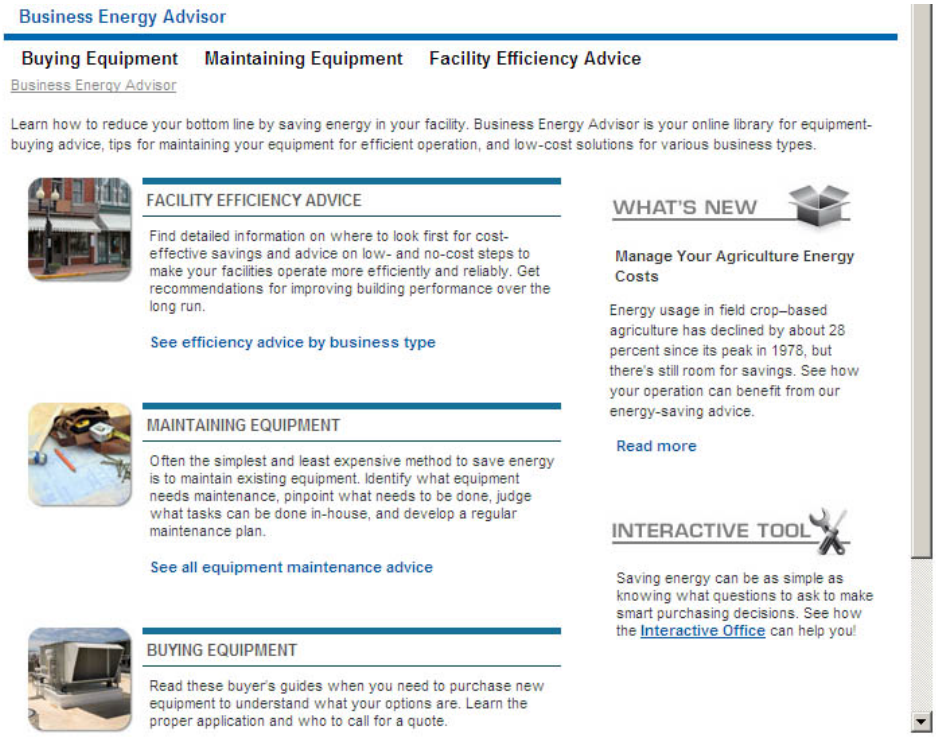
In 2011, DP&L continued to provide a resource library on its website for business customers which included a variety of energy efficiency information.

Topics in the library are divided into three main categories: Buying Equipment, Maintaining Equipment and Facility Efficiency Advice. Each category is further broken down into specific topics to allow customers to research their area of interest. The site also includes a calculator tool that allows customers to calculate potential savings and paybacks for a variety of retrofit projects.

Topics by Category

BUYING EQUIPMENT	MAINTAINING EQUIPMENT	FACILITY EFFICIENCY ADVICE
Building Automation Systems	Building Envelope	Agriculture
Building Envelope	C&I Equipment	Congregations
Cooling	Commissioning	Dairy Farms
Distributed Energy	Drivepower	Data Centers
Drivepower	HVAC & Refrigeration	Dry Cleaners
Elevators & Escalators	Lighting	Groceries
Heating	Ventilation & Air Handling	Hospitals
HVAC Controls & Strategy		Hotels & Motels
Lighting		Laboratories
Office Equipment		Manufacturing
Power Quality & Reliability		Multifamily Residences
Refrigeration		Office Buildings
Ventilation & Air Handling		Restaurants
Water Heating		Retail
		Schools
		Warehouses

Sample Web Pages



Business Energy Advisor

Buying Equipment Maintaining Equipment Facility Efficiency Advice

Business Energy Advisor

Learn how to reduce your bottom line by saving energy in your facility. Business Energy Advisor is your online library for equipment-buying advice, tips for maintaining your equipment for efficient operation, and low-cost solutions for various business types.

FACILITY EFFICIENCY ADVICE

Find detailed information on where to look first for cost-effective savings and advice on low- and no-cost steps to make your facilities operate more efficiently and reliably. Get recommendations for improving building performance over the long run.

See efficiency advice by business type

MAINTAINING EQUIPMENT

Often the simplest and least expensive method to save energy is to maintain existing equipment. Identify what equipment needs maintenance, pinpoint what needs to be done, judge what tasks can be done in-house, and develop a regular maintenance plan.

See all equipment maintenance advice

BUYING EQUIPMENT

Read these buyer's guides when you need to purchase new equipment to understand what your options are. Learn the proper application and who to call for a quote.

WHAT'S NEW

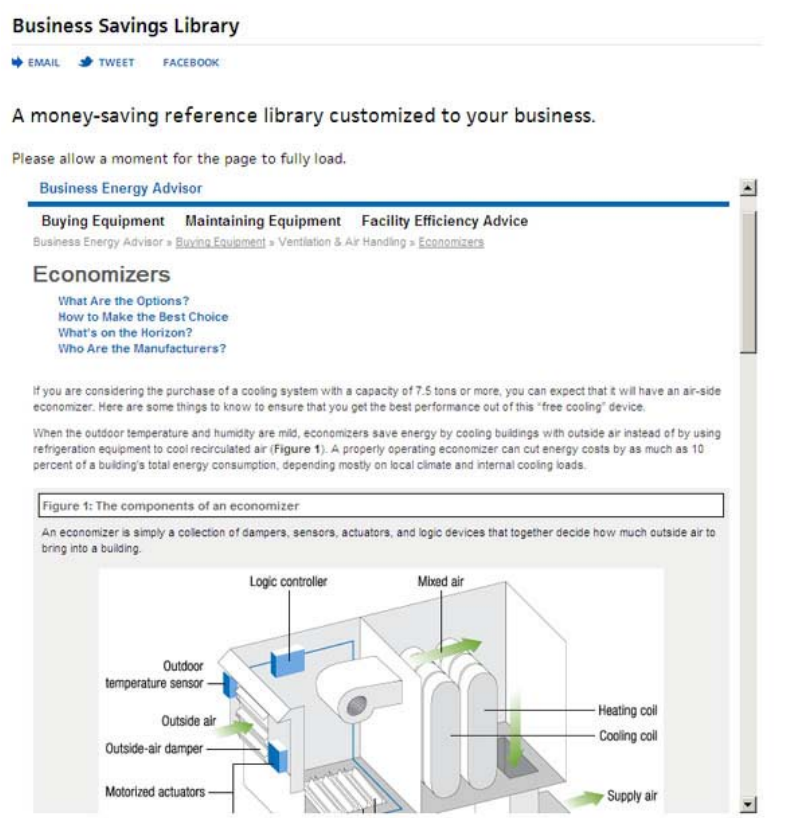
Manage Your Agriculture Energy Costs

Energy usage in field crop–based agriculture has declined by about 28 percent since its peak in 1978, but there's still room for savings. See how your operation can benefit from our energy-saving advice.

Read more

INTERACTIVE TOOL

Saving energy can be as simple as knowing what questions to ask to make smart purchasing decisions. See how the Interactive Office can help you!



Business Savings Library

EMAIL TWEET FACEBOOK

A money-saving reference library customized to your business.

Please allow a moment for the page to fully load.

Business Energy Advisor

Buying Equipment Maintaining Equipment Facility Efficiency Advice

Business Energy Advisor » Buying Equipment » Ventilation & Air Handling » Economizers

Economizers

What Are the Options?
How to Make the Best Choice
What's on the Horizon?
Who Are the Manufacturers?

If you are considering the purchase of a cooling system with a capacity of 7.5 tons or more, you can expect that it will have an air-side economizer. Here are some things to know to ensure that you get the best performance out of this "free cooling" device.

When the outdoor temperature and humidity are mild, economizers save energy by cooling buildings with outside air instead of by using refrigeration equipment to cool recirculated air (**Figure 1**). A properly operating economizer can cut energy costs by as much as 10 percent of a building's total energy consumption, depending mostly on local climate and internal cooling loads.

Figure 1: The components of an economizer

An economizer is simply a collection of dampers, sensors, actuators, and logic devices that together decide how much outside air to bring into a building.

OTHER ACTIVITIES

Over the course of 2011, DP&L performed other education and awareness activities, some at the request of organizations and customers. These included:

- The production of educational "You Tube" videos and the placement of the videos on the DP&L website. Topics include sealing air leaks, HVAC rebates, cooling tune-ups, business rebates, refrigerator recycling, and cfl discounts.

- Sponsorship of and participation in various events and conferences including Green Energy Ohio's "Ohio Leads the Way: Green Markets and Green Jobs" workshop, an energy fair at Wright-Patterson Air Force Base, the Midwest Energy Efficiency Alliance event at the Ohio Statehouse, and Shades of Green organized by the Dayton Business Journal.

- Energy efficiency presentations to community groups, using a presentation created by DP&L called "Top Ten Ways to Save Energy in the Home."

- Donation of Kill-A-Watt meters to the Marysville Public Library, the Greene County Public Library, and the New Carlisle Public Library for residents to check out.

- Various interviews with the news media, cable access television and the Dayton Dragons' during baseball telecasts.

RECOMMENDATIONS

The previous pages of this report contain a thorough description of each energy efficiency program, how it is being implemented and marketed, and the results produced to date. These recommendations are based on this program review, and as such, DP&L finds it unnecessary to duplicate that review in this section.

Overall, DP&L is pleased with the progress of its energy efficiency initiatives. The program spending in 2011 was 4% below filed budgets while program performance more than doubled filed targets.

As with any type of implementation, there is always opportunity to improve, including recommendations outlined in the Cadmus report (Exhibit 1). Over the course of the coming year, DP&L will continue to work with its implementation vendors, its collaborative members and its evaluations provider to make adjustments and improvements to its programs.

In terms of the filed programs, DP&L recommends continuing all of the programs that have been implemented. In 2009 and 2010, DP&L transferred the budgeted funds from the appliance rebate program to the appliance recycling program. In 2011, DP&L evaluated the feasibility and effectiveness of the appliance rebate program and presented its findings to its collaborative. As a result of this review, there was general agreement to transfer the appliance rebate budget to the appliance recycling program once again in 2011.

Given the recent review in 2011, DP&L plans to transfer the budget from the appliance rebate to the appliance recycling program again in 2012. DP&L will request Commission Staff approval and inform the energy efficiency collaborative.

Further, DP&L redesigned the residential HVAC tune up process in 2011 due to the limited participation that occurred during 2010 and 2011. The new tune up process was presented to its collaborative and will be used in 2012.

In 2012, DP&L will review the cost-effectiveness and feasibility of developing a direct load control program, as agreed to in the Stipulation in Case No. 09-1986-EL-POR, and present the findings to its energy efficiency collaborative.

Filed Program	Recommendation
Residential Lighting (CFL)	Continue
Residential HVAC Rebates	Continue
Residential HVAC Diagnostic & Tune Up	Continue (Tune Up Redesigned for 2012)
Residential Appliance Recycling	Continue
Residential Appliance Rebates	Transfer funds to Appliance Recycling
Residential Low Income Affordability	Continue
Non-Residential Prescriptive Rebates	Continue
Non-Residential Custom Rebates	Continue
Education, Awareness Building, Market Transformation	Continue

APPENDIX A

COMPLIANCE DEMONSTRATION USING PRO-RATED SAVINGS

This appendix provides the results of DP&L's 2011 energy efficiency programs calculated on a pro-rated basis. The table below summarizes the monthly "units" of each residential program, which is the basis for the pro-rated calculations.

- For CFLs, "units" represents the number of bulbs sold in that month.
- For HVAC rebates, "units" represents the number of systems the contractors installed that month.
- For HVAC diagnostic and tune up, "units" represents the number of tune-ups contractors completed during that month.
- For appliance recycling, "units" represents the number of units that were picked up from the customer during the month.
- For Low Income, "units" represents the number of home audits and measure installations completed that month.
- For school education, "units" represents the number of kits distributed to students after the electric unit was taught in the classroom. Since this program runs throughout the school year, all bulbs installed during the fall of 2010 are counted as installed in January on the table below.

The business programs are not conducive to reporting by units installed due to the varying types of measures involved in these programs. For the business rebate programs, pro-rated savings are based on the date the measures were installed.

Pro-rated demand savings are calculated by excluding the coincident peak demand impacts for all program activity after September 1.

2011 UNITS BY MONTH BY PROGRAM (AS APPLICABLE)

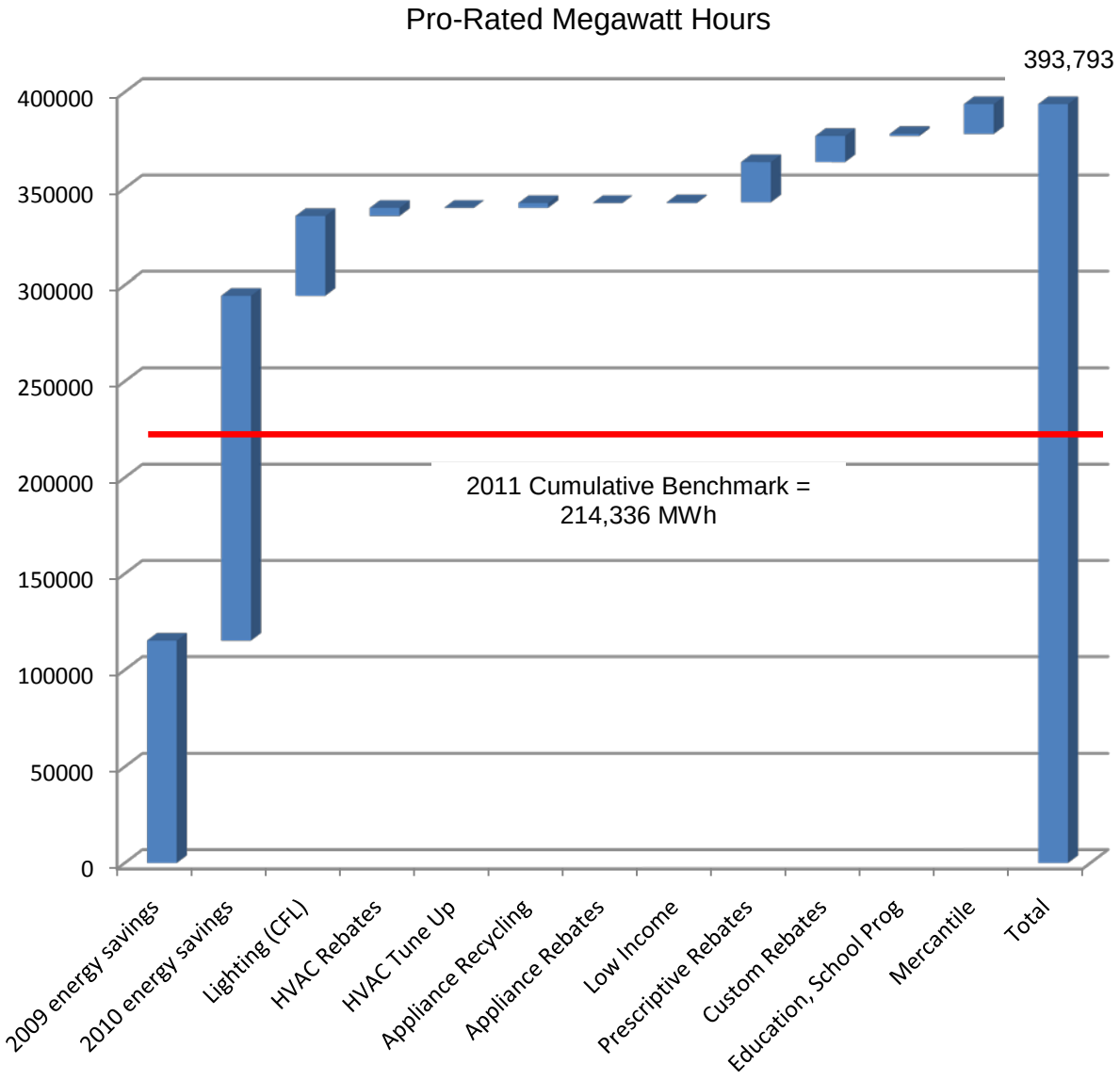
Program (units installed/sold)	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	2011 Total
Residential Lighting (CFL) (000)	71	73	97	83	75	182	226	196	217	195	197	232	1,844
Residential HVAC Rebates	306	155	177	223	398	587	528	422	304	305	242	235	3,882
Residential HVAC Diagnostic & Tune Up	0	0	3	40	43	93	120	47	5	5	2	0	358
Residential Appliance Recycling	72	50	79	93	119	241	475	1,256	1,561	199	189	114	4,448
Residential Appliance Rebates	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential Low Income Affordability	16	73	47	37	70	37	49	65	99	123	78	41	735
Education, School Programs	1,637	1,130	1,420	1,507	681	89	0	0	0	0	0	0	6,464

2011 FILED VERSUS ACTUAL ENERGY SAVINGS (PRO-RATED)

Program	Filed, 2011 (MWh)	Actual, 2011 (MWh)	Variance (MWh)
Residential Lighting (CFL)	28,505	41,144	12,639
Residential HVAC Rebates	1,685	4,209	2,524
Residential HVAC Diagnostic & Tune Up	2,973	21	-2,952
Residential Appliance Recycling	3,952	2,475	-1,477
Residential Appliance Rebates[(1)]	958	0	-958
Residential Low Income Affordability	1,705	432	-1,273
Non-Residential Prescriptive Rebates	28,224	20,905	-7,319
Non-Residential Custom Rebates	14,721	13,576	-1,145
Education, School Programs	0	999	999
Mercantile Customer Commitments	0	15,547	15,547
Total	**82,723**	**99,308**	**16,585**

(1) With the approval of PUCO Staff and notification of DP&L's energy efficiency collaborative, DP&L transferred the 2011 appliance rebate budget to the appliance recycling program, see page 1-7.

2011 ENERGY ACTUALS (PRO-RATED) COMPARED TO CUMULATIVE BENCHMARKS



	MWh
2009 Actuals	115,279
2010 Actuals	174,249
2010 Mercantile Commitments	4,957
2011 Pro-Rated Actuals	83,761
2011 Mercantile Commitments	15,547
Cumulative 2009-2011 Total Savings	393,793
Cumulative 2011 Benchmarks	214,336

2011 ACTUAL ENERGY SAVINGS BY MONTH (PRO-RATED)

Program (in MWh)	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	2011 Total
Residential Lighting (CFL)	3,661	3,432	4,284	3,178	2,515	5,370	5,912	4,186	3,765	2,331	1,589	921	41,144
Residential HVAC Rebates	677	354	330	349	525	644	465	335	220	168	95	47	4,209
Residential HVAC Diagnostic & Tune Up	0	0	0	1	3	7	8	2	0	0	0	0	21
Residential Appliance Recycling	98	62	89	94	107	189	318	701	695	67	42	13	2,475
Residential Appliance Rebates	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential Low Income Affordability	12	51	58	23	48	24	60	38	47	45	21	5	432
Non-Residential Prescriptive Rebates	6,613	3,461	1,036	3,025	1,043	1,448	1,686	591	917	473	333	279	20,905
Residential Custom Rebates	2,565	4,722	341	104	2,524	201	79	2,748	60	108	122	2	13,576
Education, School Programs	305	185	222	203	76	8	0	0	0	0	0	0	999
Mercantile[1] Customer Commitments	--	--	--	--	--	--	--	--	--	--	--	--	15,547
Total	**13,931**	**12,267**	**6,360**	**6,977**	**6,841**	**7,891**	**8,528**	**8,601**	**5,704**	**3,192**	**2,202**	**1,267**	**99,308**

[1] Mercantile commitments from historical energy efficiency projects are not impacted by pro-rated calculations.

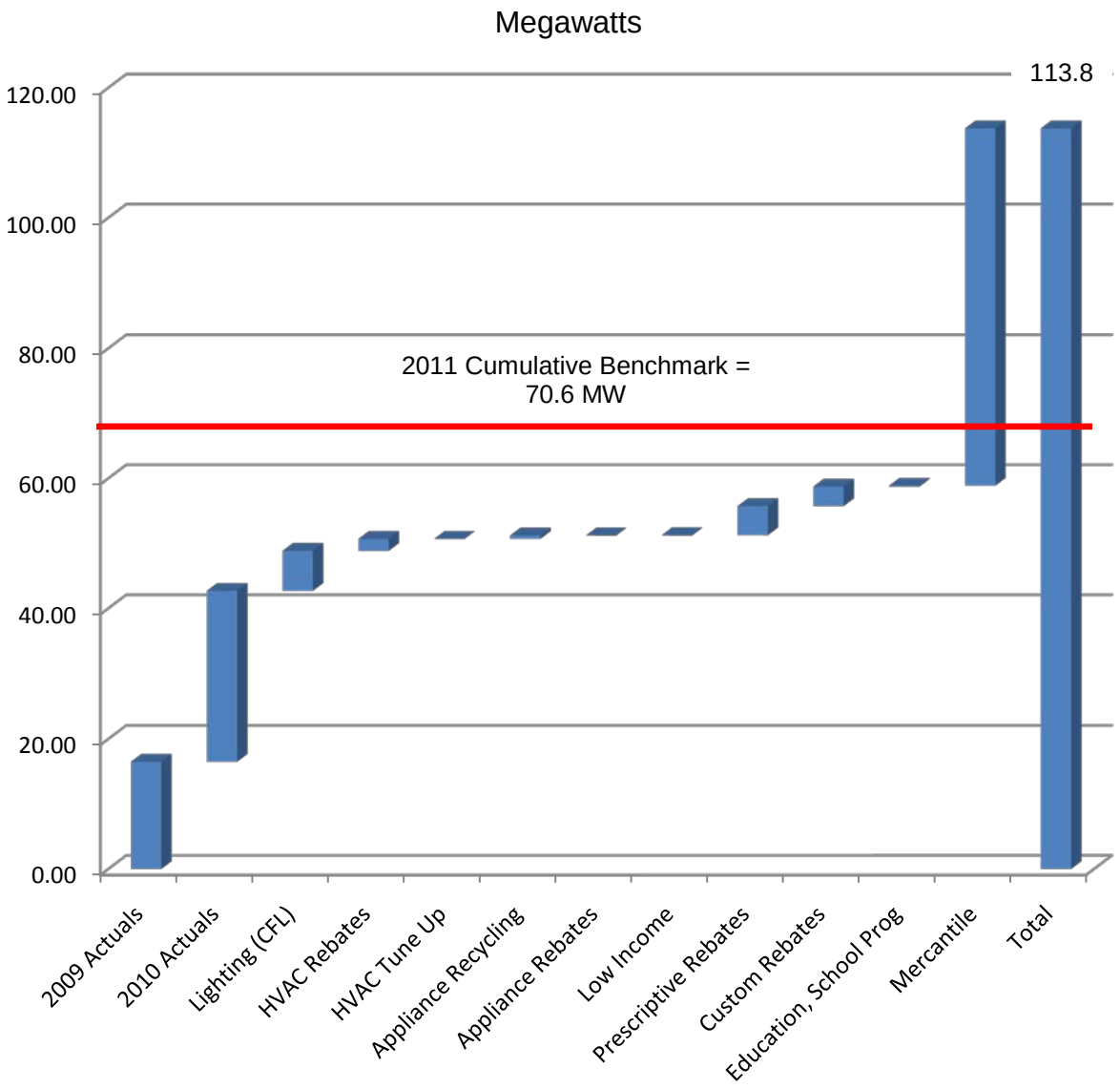
2011 FILED VERSUS ACTUAL DEMAND SAVINGS (PRO-RATED)

Program	Filed, 2011 (MW)	Actual, 2011 (MW)	Variance (MW)
Residential Lighting (CFL)	2.43	6.16	3.73
Residential HVAC Rebates	1.50	1.83	0.33
Residential HVAC Diagnostic & Tune Up	2.64	0.01	-2.63
Residential Appliance Recycling	0.62	0.51	-0.11
Residential Appliance Rebates[(1)]	0.12	0.00	-0.12
Residential Low Income Affordability	0.13	0.05	-0.08
Non-Residential Prescriptive Rebates	7.64	4.47	-3.17
Non-Residential Custom Rebates	2.74	3.01	0.27
Education, School Programs	0.00	0.14	0.14
Mercantile Customer Commitments[(2)]	0.00	54.87	54.87
Total	**17.82**	**71.05**	**53.23**

(1) With the approval of PUCO Staff and notification of DP&L's energy efficiency collaborative, DP&L transferred the 2011 appliance rebate budget to the appliance recycling program, see page 1-7.

(2) Mercantile Customer Commitments include 51.42 MW of PJM Demand Response committed to DP&L by mercantile customers.

2011 DEMAND ACTUALS (PRO-RATED) COMPARED TO BENCHMARKS



	MW
2009 Actuals	16.5
2010 Actuals	24.7
2010 Mercantile Commitments*	1.5
2011 Pro-Rated Actuals	16.2
2011 Mercantile Commitments	54.9
Cumulative 2009-2011 Total Savings	113.8
Cumulative 2011 Benchmarks	70.6

*Mercantile commitments for PJM Demand Response do not carry over from year to year. Therefore, 2010 PJM Demand Response commitments have been removed from the cumulative total.

2011 ACTUAL DEMAND SAVINGS BY MONTH (PRO-RATED)

Program (in MW)	Jan	Feb	Mar	April	May	June	July	Aug	2011 Total
Residential Lighting (CFL)	0.44	0.45	0.61	0.50	0.45	1.10	1.41	1.20	6.16
Residential HVAC Rebates	0.19	0.10	0.11	0.14	0.27	0.39	0.35	0.28	1.83
Residential HVAC Diagnostic & Tune Up	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Residential Appliance Recycling	0.02	0.01	0.02	0.02	0.03	0.04	0.10	0.27	0.51
Residential Appliance Rebates	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential Low Income Affordability	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.05
Non-Residential Prescriptive Rebates	1.14	0.51	0.28	0.72	0.28	0.47	0.67	0.40	4.47
Non-Residential Custom Rebates	0.37	1.10	0.07	0.01	0.38	0.04	0.07	0.97	3.01
Education, School Programs	0.04	0.03	0.03	0.03	0.01	0.00	0.00	0.00	0.14
Mercantile Customer Commitments [(1)]									54.87
Total	**2.20**	**2.21**	**1.13**	**1.43**	**1.42**	**2.04**	**2.61**	**3.14**	**71.05**

(1) Mercantile demand commitments from historical energy efficiency projects and PJM Demand Response programs are not impacted by pro-rated calculations.

THE DAYTON POWER & LIGHT COMPANY
2011 Benchmark Report

The Dayton Power and Light Company ("DP&L" or "the Company") herewith submits its updated Benchmark Report ("Benchmark Report") pursuant to section 4901:1-39-05(C)(1)(a) of the Ohio Administrative Code ("O.A.C"). In this report, DP&L identifies the energy and demand baselines for kilowatt-hour sales and kilowatt demand for reporting year 2011 based on the preceding three calendar years (2008, 2009 and 2010) as specified in section 4928.66(A)(2)(a) of the Ohio Revised Code ("O.R.C."), along with DP&L's energy saving and peak demand reduction statutory benchmarks. In this report, DP&L also makes adjustments pursuant to O.R.C. §4928.66(A)(2)(c) and O.A.C §4901:1-39-05(B) to adjust its sales and demand baselines to normalize for weather and changes to DP&L's customer base related to mercantile opt-out applications, lost load and, in some cases, load growth. DP&L's benchmarks and adjustments are supported by the descriptions shown below, including the method of calculating the baselines, supporting data, assumptions, rationales and calculations as required by O.A.C. §4901:1-39-05(B).

DP&L 2011 Energy Efficiency Baseline Calculation

Consistent with the definition of "Energy baseline" pursuant to O.A.C. §4901:1-39-01(J), DP&L's Total Retail sales for the three preceding calendar years (2008, 2009, and 2010), which are shown below, were taken from DP&L's most recent long-term forecast report found on the EDU Service Area Energy Delivery Forecast (PUCO FORM FE-D1) and included as Workpaper A.

2008: 14,795,127 MWh
2009: 13,727,277 MWh
2010: 14,282,324 MWh

DP&L 2010 Peak Demand Baseline Calculation

Consistent with the definition of "Peak-demand baseline" pursuant to O.A.C. §4901:1-39-01(S), DP&L's Peak Demands for the three preceding calendar years (2008, 2009, and 2010), which are shown below, were taken from DP&L's most recent long-term forecast report found on the EDU System Seasonal Peak Load Demand Forecast (PUCO FORM FE-D3) and included as Workpaper B.

2008: 3,027 MW
2009: 2,909 MW
2010: 2,924 MW

Normalizing Adjustments

Significant Loss/Growth of Customer Loads

O.A.C. §4901:1-39-05(B) permits an electric distribution utility to adjust its baselines for changes in the number of customers, sales and peak demand that are outside of the electric

distribution utility's control. DP&L adjusted its 2011 baselines to account for customers with significant load who reduced, ceased or expanded their operations during the reporting period. Because there will always be some customers lost over the course of time, which can be balanced against DP&L's natural load growth, the customers identified in this adjustment are only large customer loads that grew or were lost and which, due to size, are not expected to be replaced under ordinary growth and contraction business cycles. Specifically, DP&L's adjustments include only customers with load changes of 2 MW or greater.

Adjustments for lost customer loads are necessary and will continue to be necessary as the lost loads represent customers that will not be available to take advantage of DP&L's Energy Efficiency programs. These eliminated or soon to be eliminated loads should be excluded from the baseline calculation in order to more accurately reflect the potential energy savings, which can be reasonably expected from DP&L's customers in current and future years. In other words, lost customer loads will have the impact of decreasing both the Energy Efficiency and Peak Demand Reduction baselines.

For the sake of balance, when accounting for changes in number of customers, sales and peak demand, DP&L likewise adjusted its baselines to account for atypical growth in customer load. DP&L believes it is appropriate to adjust for extraordinary customer load growth, as these customers will be able to take advantage of DP&L's Energy Efficiency programs now and going forward. Customer load growth will have the effect of increasing both the Energy Efficiency and Peak Demand Reduction baselines. Adjustments for customer load changes are reported in Workpaper C.

Adjustment for Mercantile Customers

Pursuant to O.R.C §4928.66(A)(c), an electric distribution utility must adjust its baseline to exclude the effects of all energy efficiency or peak demand reduction programs that may have existed during the period used to establish the baseline. Therefore, in addition to the adjustment for customer load change, DP&L also adjusted its baseline to account for the energy efficiency and peak demand reduction that was realized in connection with the approval of mercantile opt-out applications. With the exception of two applications, such mercantile applications, which included energy efficiency projects for the 2008-2010 timeframe, were approved by the Commission under the 60 day automatic approval in 2010 and 2011, pursuant to the Commission's pilot program for Mercantile Customers as established in Case No. 10-834-EL-EEC. Two of the mercantile applications (Honda and Wright Patterson Air Force Base) were approved by the Commission for exemption from DP&L's Energy Efficiency Rider as a result of implementation of energy efficiency projects. The adjustment for Mercantile Customers is shown in more detail in Workpaper D.

Weather normalization

Weather-normalization adjusts actual weather-sensitive retail sales by class (Residential, Commercial, and Public Authority) to account for the difference between actual and normal

heating and cooling degree days based on historical use per customer per day per cooling degree day and heating degree day relationships for these classes.

Workpapers E1–E3 calculate the weather normalized retail sales and peak demands for the period. The weather normalization factor is the ratio of weather normalized values to actual values (sales or peak demands) and is calculated on Workpaper F.

The annual MWh sales adjusted for loss/growth in customer loads and mercantile opt out applications are multiplied by the Weather Normalization Factor to yield the Normalized Retail Energy Sales (MWh). The same process is applied to calculate Weather Normalized Peak Demands (MW).

DP&L 2011 Normalized Energy Efficiency Baseline Calculation

DP&L's 2010 Normalized Energy Efficiency baseline calculation is shown on Schedule 1. The methodology is consistent with O.A.C. §4901:1-39-01(J) and includes the adjustments described above. The normalized retail energy sales for 2008, 2009, and 2010 are averaged over the three years, to produce DP&L's 2011 Normalized Energy Efficiency Baseline of 14,099,979 MWh.

DP&L 2011 Energy Efficiency Reduction Benchmark Calculation

As described in O.R.C. §4928.66(A)(1)(a), beginning in 2009, an electric distribution utility shall:

> "Implement energy efficiency programs that achieve energy savings equivalent to at least three-tenths of one per cent of the total, annual average, and normalized kilowatt-hour sales of the electric distribution utility during the preceding three calendar years to customers in this state. The savings requirement, using such a three-year average, shall increase to….. an additional seven-tenths of one per cent in 2011."

DP&L's 2011 Normalized Energy Efficiency Baseline of 14,100,267 MWh is multiplied by the 2011 Energy Efficiency Reduction Benchmark percentage of 0.70% pursuant to O.R.C. §4928.66(A)(1)(a). The result is DP&L's 2011 Incremental Energy Efficiency Reduction Benchmark of 98,700 MWh. DP&Ls 2011 cumulative Energy Efficiency Reduction Benchmark is 214,336 MWh. The calculations are shown on Schedule 1.

DP&L 2011 Normalized Peak Demand Baseline Calculation

DP&L's 2011 Normalized Peak Demand Reduction baseline calculation is shown on Schedule 2. The methodology is consistent with O.A.C. §4901:1-39-01(S) and includes the adjustments described above. DP&L's Normalized Peak Demands for 2008, 2009, and 2010 are averaged over the three years, to produce DP&L's 2011 Normalized Peak Demand Baseline of 2,824 MW.

DP&L 2011 Peak Demand Reduction Benchmark Calculation

As described in O.R.C. §4928.66 (A)(1)(b), beginning in 2009, an electric distribution utility shall:

> "Implement peak demand reduction programs designed to achieve a one per cent reduction in peak demand in 2009 and an additional seventy-five hundredths of one per cent reduction each year through 2018."

DP&L's 2011 Normalized Peak Demand Reduction Baseline of 2,824 MW is multiplied by the 2011 Peak Demand Reduction Benchmark percentage of 2.50% pursuant to O.R.C. §4928.66 (A)(1)(b). The result is DP&L's 2011 Peak Demand Reduction Benchmark of 70.6 MW. The calculation is shown on Schedule 2.

Schedule 1

THE DAYTON POWER & LIGHT COMPANY
2011 Benchmark Report
Energy Efficiency Baseline and Benchmark Calculation

		2008	2009	2010	2011
1	**Baseline Calculation Components**				
2	Retail MWh Sales [1]	14,795,127	13,727,277	14,282,324	
3					
4	**Normalizing Adjustments**				
5	Significantly Reduced Customer Sales [2]	(365,767)	(116,092)	(35,022)	
6	Significantly Expanded Customer Sales [3]	67,362	60,245	44,978	
7	Total Customer Sales Adjustment (5)+(6)	(298,405)	(55,847)	9,956	
8	Mercantile Customer Adjustment [4]	11,705	15,822	16,818	
9	Total Adjusted Retail Sales (2)+(7)+(8)	14,508,427	13,687,252	14,309,098	
10	Weather Normalization Factor [5]	1.00089	1.01859	0.96700	
11	Normalized Retail Energy Sales (9)*(10)	14,521,340	13,941,698	13,836,898	
12					
13	**2011 Normalized Energy Efficiency Baseline**				
14	3 Year Normalized Average (MWh)				14,099,979
15					
16	**Calculation of 2011 Energy Efficiency Reduction Benchmark**				
17	Normalized Preceding 3 Year Average Sales (14)				14,099,979
18	2011 Incremental Energy Efficiency Reduction Benchmark % [6]				0.70%
19	2011 Incremental Energy Efficiency Reduction Benchmark (17)*(18)				98,700
20	2009-2010 Energy Efficiency Reduction Benchmark [7]				115,636
21	**2011 Cumulative Energy Efficiency Reduction Benchmark (19)+(20)**				**214,336**

[1] Retail sales for the period 2008-2010 are reported in PUCO Form FE-D1 (Case No. 11-2505-EL-FOR). See Workpaper A, Column (6).

[2] Significantly reduced customer sales include those who ceased or reduced their operations during the period. See Workpaper C for details on load reductions.

[3] Significantly expanded customer sales include those who started or expanded their operations during the period. See Workpaper C for details on load expansions.

[4] See Workpaper D for calculation of Mercantile Customer Adjustment.

[5] See Workpaper E for calculation of the weather normalization factor.

[6] Energy Efficiency benchmark as established in O.R.C. §4928.66(A)(1)(a).

[7] 2009-2010 Energy Efficiency Reduction Benchmark as established in Case No. 11-1276-EL-POR, Schedule 1, line 21.

Schedule 2

THE DAYTON POWER & LIGHT COMPANY
2011 Benchmark Report
Peak Demand Baseline and Benchmark Calculation

		2008	2009	2010	2011
1	**Baseline Calculation Components**				
2	Peak MW Demand [1]	3,027	2,909	2,924	
3					
4	**Normalizing Adjustments**				
5	Significantly Reduced Customer Load [2]	(60)	(12)	(3)	
6	Significantly Expanded Customer Load [3]	14	13	9	
7	Total Customer Load Adjustment (5)+(6)	(46)	1	6	
8	Mercantile Customer Adjustment [4]	3	4	4	
9	Total Adjusted Peak Demand (2)+(7)+(8)	2,984	2,914	2,934	
10	Weather Normalization Factor [5]	0.98612	0.97525	0.91621	
11	Normalized Peak Demand (9)*(10)	2,943	2,842	2,688	
12					
13	**2011 Normalized Peak Demand Reduction Baseline**				
14	3 Year Normalized Average (MW)				2,824
15					
16	**Calculation of Normalized 2011 Peak Demand Reduction Benchmark**				
17	Normalized Preceding 3 Year Average Peak Demand (14)				2,824
18	2011 Peak Demand Reduction Benchmark % [6]				2.50%
19	**2011 Peak Demand Reduction Benchmark (17)*(18)**				**70.6**

[1] Peak demand for the period 2008-2010 is reported in PUCO Form FE-D3. See Workpaper B.

[2] Significantly reduced customer load include those who ceased or reduced their operations during the period. See Workpaper C for a complete list of customers.

[3] Significantly expanded customer load include those customers who started or expanded their operations during the period. See Workpaper C for a complete list of customers.

[4] See Workpaper D for calculation of Mercantile Customer Adjustment.

[5] See Workpaper E for calculation of weather normalization factor.

[6] Peak Demand Reduction benchmark as established in O.R.C § 4928.66(A)(1)(b).

THE DAYTON POWER & LIGHT COMPANY
2011 Benchmark Report

PUCO FORM FE-D1: ELECTRIC UTILITY OHIO SERVICE AREA ENERGY CONSUMPTION FORECAST
(Megawatt-Hours Per Year)

		(1)	(2)	(3)	(4)	(5)	(5a)	(6)	(7)	(8)
	YEAR	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	TRANSPORTATION (a)	OTHER (b)	ENERGY EFFICIENCY & DEMAND RESPONSE	TOTAL END USER CONSUMPTION 1+2+3+4+5-5a	LOSSES AND UNACCOUNTED FOR	NET ENERGY FOR LOAD 6+7
-5	2006	5,246,924	3,837,549	4,289,908	6,410	1,418,636		14,799,427	542,790	15,342,217
-4	2007	5,535,174	3,993,917	4,260,307	5,016	1,465,954		15,260,368	649,056	15,909,424
-3	2008	5,425,661	3,920,511	4,007,203	4,835	1,436,917		14,795,127	790,093	15,585,220
-2	2009	5,227,724	3,727,122	3,372,617	3,153	1,396,661		13,727,277	797,678	14,524,955
-1	2010	5,516,004	3,767,233	3,571,504	1,467	1,426,116		14,282,324	419,500	14,701,824
0	2011	5,210,884	3,793,596	3,618,591	1,467	1,435,236	(82,722)	13,977,053	539,183	14,516,236
1	2012	5,281,627	3,830,417	3,678,979	1,467	1,442,071	(170,345)	14,064,216	542,469	14,606,685
2	2013	5,271,723	3,854,964	3,704,812	1,467	1,450,293	(263,755)	14,019,505	540,783	14,560,288
3	2014	5,306,619	3,881,329	3,708,413	1,467	1,460,485	(357,396)	14,000,917	540,083	14,540,999
4	2015	5,342,329	3,907,935	3,707,884	1,467	1,471,770	(451,265)	13,980,120	539,299	14,519,418
5	2016	5,393,635	3,934,204	3,705,764	1,467	1,485,535	(530,832)	13,989,773	539,662	14,529,435
6	2017	5,424,479	3,958,793	3,704,269	1,467	1,500,733	(610,533)	13,979,208	539,264	14,518,472
7	2018	5,472,557	3,980,270	3,699,969	1,467	1,517,685	(666,775)	14,005,172	540,243	14,545,415
8	2019	5,524,777	4,001,517	3,697,560	1,467	1,533,754	(716,301)	14,042,775	541,661	14,584,435
9	2020	5,577,418	4,023,196	3,699,316	1,467	1,548,024	(765,025)	14,084,396	543,230	14,627,625
10	2021	5,630,560	4,044,993	3,701,072	1,467	1,562,426	(813,804)	14,126,714	544,825	14,671,539

(a) Transportation includes railroads & railways.

(b) Other includes Street & Highway Lighting, Public Authorities and Interdepartmental Sales.

THE DAYTON POWER & LIGHT COMPANY
2011 Benchmark Report

PUCO FORM FE-D3: ELECTRIC UTILITY OHIO SEASONAL PEAK LOAD DEMAND FORECAST
(Megawatts)

		Native Load				Internal Load			
	Year	Summer	Demand Response	Net Summer	Winter (a)	Summer	Demand Response	Net Summer	Winter (a)
-5	2006	3240			2681	3240			2681
-4	2007	3270			2623	3270			2623
-3	2008	3027			2708	3027			2708
-2	2009	2909			2434	2909			2434
-1	2010	2924			2403	2924			2403
0	2011	2952	18	2934	2426	2952	18	2934	2426
1	2012	2995	37	2958	2461	2995	37	2958	2461
2	2013	3020	58	2962	2482	3020	58	2962	2482
3	2014	3040	78	2962	2499	3040	78	2962	2499
4	2015	3060	99	2961	2515	3060	99	2961	2515
5	2016	3081	119	2962	2532	3081	119	2962	2532
6	2017	3100	138	2962	2548	3100	138	2962	2548
7	2018	3120	156	2964	2564	3120	156	2964	2564
8	2019	3141	171	2969	2581	3141	171	2969	2581
9	2020	3162	186	2976	2599	3162	186	2976	2599
10	2021	3183	201	2983	2616	3183	201	2983	2616

(a) Winter load reference is to peak loads which follow the summer peak load.

Workpaper C

THE DAYTON POWER & LIGHT COMPANY
2011 Benchmark Report
Significant Change in Customer Loads

		Consumption (MWh)			Coincident Peak (MW)		
Ln	Customer	2008	2009	2010	2008	2009	2010
1	**REDUCTIONS/ELIMINATIONS**						
2	Customer 1	(22,186)	(12,492)	-	(3)	(2)	-
3	Customer 2	(57,721)	(36,944)	(18,259)	(7)	(5)	(3)
4	Customer 3	(22,915)	(7,209)	(6,676)	(4)	(2)	(1)
5	Customer 4	(112,749)	(19,106)	-	(25)	-	-
	Customer 5	(12,038)	(11,975)	(4,362)	(2)	(2)	-
6	Customer 6	(15,201)	(7,020)	(7,413)	(3)	(1)	(1)
7	Customer 7	(13,333)	(912)	(34)	(2)	-	-
8	Customer 8	(16,515)	(6,666)	(23)	(3)	(1)	-
9	Customer 9	(34,845)	(9,401)	(1,130)	(6)	(1)	-
10	Customer 10	(28,566)	(6,257)	(1,710)	(2)	-	-
11	Customer 11	(5,037)	(2,478)	-	(1)	-	-
12	Customer 12	(24,661)	4,368	4,585	(2)	2	2
13	**TOTAL**	**(365,767)**	**(116,092)**	**(35,022)**	**(60)**	**(12)**	**(3)**
14							
15	**EXPANSIONS**						
16	Customer 13	19,193	19,193	14,640	3	3	3
17	Customer 14	16,522	21,249	11,961	7	5	3
18	Customer 15	11,848	2,302	1,869	-	1	-
19	Customer 16	4,762	2,464	1,471	-	-	(1)
20	Customer 17	15,037	15,037	15,037	4	4	4
21	**TOTAL**	**67,362**	**60,245**	**44,978**	**14**	**13**	**9**
22							
23	**TOTAL CHANGE**	**(298,405)**	**(55,847)**	**9,956**	**(46)**	**1**	**6**

THE DAYTON POWER AND LIGHT COMPANY
2011 Benchmark Report
Adjustment for Mercantile Customers

Ln	Customer	Demand Savings (kW) 2008	Demand Savings (kW) 2009	Demand Savings (kW) 2010	Energy Savings (kWh) 2008	Energy Savings (kWh) 2009	Energy Savings (kWh) 2010
1	**2010 Mercantile Customer Adjustment ***						
2	Delphi	499.4	499.4	499.4	797,788	1,914,690	1,914,690
3	Mercer County Hospital	13.2	13.2	13.2	202,161	202,161	202,161
4	Wilmington City Schools	294.5	294.5	294.5	359,743	959,998	959,998
5	Thermoseal	-	91.5	91.5	-	91,554	91,554
6	J&M Manufacturing	261.5	261.5	261.5	261,565	261,565	261,565
7	Neaton	237.0	237.0	237.0	1,000,430	1,000,430	1,000,430
8	City of Urbana	97.1	97.1	97.1	526,864	526,864	526,864
9	**Total 2010 Adjustment**	**1,402.7**	**1,494.2**	**1,494.2**	**3,148,551**	**4,957,262**	**4,957,262**
10							
11	**2011 Mercantile Customer Adjustment ***						
12	Kroger	-	28.9	108.7	5,097	241,494	952,131
13	Washington Court House	-	120.5	120.5	5,004	620,513	620,513
14	City of Fairborn	192.5	192.5	192.5	402,153	958,979	958,979
15	Fremont Company	-	-	-	-	-	1,310
16	F&P America	129.4	129.4	137.9	711,011	969,324	980,601
17	Dayton BOE -Boys Prep	-	-	-	-	-	4,410
18	Dayton BOE - Residence Park	-	-	-	-	-	42,768
19	EER Exemption Applications	1,425.0	1,615.9	1,555.1	7,432,721	8,074,276	8,299,736
20	**Total 2011 Adjustment**	**1,746.9**	**2,087.2**	**2,114.7**	**8,555,986**	**10,864,586**	**11,860,448**
21							
22	**Total 2010 & 2011 Adjustment**	**3,149.6**	**3,581.4**	**3,608.9**	**11,704,537**	**15,821,848**	**16,817,710**

* These Mercantile Applications (except the EER exemption applications of Honda of America and Wright Patterson Air Force Base) were approved by the Commission in 2010 and 2011 respectively under the 60 day automatic approval, pursuant to the Commission's pilot program for Mercantile Customers as established in Case No. 10-834-EL-EEC. These adjustments are prorated and based on the timeframe that the energy efficiency was achieved. Honda of America and Wright Patterson Air Force Base were approved by the Commission in 2011 for exemption from DP&L's Energy Efficiency Rider.

THE DAYTON POWER & LIGHT COMPANY

2011 Benchmark Report

2008 Weather Normalization

2008 Actual Calendar Retail Sales

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD
Residential Non-Heating	356,986	279,467	288,252	231,449	222,025	332,905	393,999	379,931	270,865	219,885	256,632	357,926	3,590,322
Residential Heating	274,584	251,530	229,487	121,173	72,320	108,747	119,110	119,954	90,807	100,105	164,512	290,025	1,942,354
Total Residential	**631,570**	**530,997**	**517,739**	**352,622**	**294,345**	**441,652**	**513,109**	**499,885**	**361,672**	**319,990**	**421,144**	**647,951**	**5,532,676**
Commercial	351,232	295,448	311,825	296,541	328,040	363,158	388,376	347,750	318,490	352,686	298,227	307,363	3,959,136
Industrial	291,331	362,364	313,392	321,216	333,801	340,607	368,149	370,549	360,099	324,452	327,872	272,541	3,986,373
Public Authorities	109,887	109,386	108,954	111,338	121,172	118,312	126,141	121,582	115,236	128,112	112,215	98,612	1,380,947
Street Railway	441	556	304	395	413	335	275	486	291	479	509	366	4,850
Street Lighting	6,048	5,798	5,792	5,673	5,570	5,487	5,517	5,515	5,584	5,624	5,695	5,825	68,128
Total Non-Residential	**758,939**	**773,552**	**740,267**	**735,163**	**788,996**	**827,899**	**888,458**	**845,882**	**799,700**	**811,353**	**744,518**	**684,707**	**9,399,434**
Total Retail	**1,390,509**	**1,304,549**	**1,258,006**	**1,087,785**	**1,083,341**	**1,269,551**	**1,401,567**	**1,345,767**	**1,161,372**	**1,131,343**	**1,165,662**	**1,332,658**	**14,932,110**

Peak
MW
September
Actual
3027
Load Factor[1]
53.29%

2008 Weather Normalized Retail Sales

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD
Residential Non-Heating	364,597	269,815	280,838	238,344	240,101	316,772	418,942	403,496	261,740	217,946	250,449	356,646	3,619,686
Residential Heating	289,747	231,009	209,093	131,772	69,095	105,383	124,487	125,000	88,708	100,254	150,356	287,197	1,912,101
Total Residential	**654,344**	**500,824**	**489,931**	**370,116**	**309,196**	**422,155**	**543,429**	**528,496**	**350,448**	**318,200**	**400,805**	**643,843**	**5,531,787**
Commercial	358,051	287,880	308,866	296,541	342,108	359,273	395,278	354,070	314,060	351,934	296,565	306,424	3,971,050
Industrial	291,331	362,364	313,392	321,216	333,801	340,607	368,149	370,549	360,099	324,452	327,872	272,541	3,986,373
Public Authorities	111,422	108,131	108,954	111,338	122,906	117,927	126,760	122,162	114,935	127,993	112,215	98,488	1,383,231
Street Railway	441	556	304	395	413	335	275	486	291	479	509	366	4,850
Street Lighting	6,048	5,798	5,792	5,673	5,570	5,487	5,517	5,515	5,584	5,624	5,695	5,825	68,128
Total Non-Residential	**767,293**	**764,729**	**737,308**	**735,163**	**804,798**	**823,629**	**895,979**	**852,782**	**794,969**	**810,482**	**742,856**	**683,644**	**9,413,632**
Total WN Retail Sales	**1,421,637**	**1,265,553**	**1,227,239**	**1,105,279**	**1,113,994**	**1,245,784**	**1,439,408**	**1,381,278**	**1,145,417**	**1,128,682**	**1,143,661**	**1,327,487**	**14,945,419**

WN Peak[2]
MW
September
WN
2985

All sales in MWh

[1] **Peak Load Factor is calculated by dividing peak month sales by the number of hours in the month then dividing the result by the peak demand [peak month sales/hours in month)/peak demand]**

[2] **Weather normalized peak is calculated by applying the peak load factor to the normalized peak month sales [(peak month sales/hours in month)/peak month load factor]**

THE DAYTON POWER & LIGHT COMPANY

2011 Benchmark Report

2009 Weather Normalization

2009 Actual Calendar Retail Sales

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD
Residential Non-Heating	384,529	252,915	245,025	214,560	231,900	306,235	343,465	354,076	232,226	227,612	227,607	331,800	3,351,950
Residential Heating	315,366	242,564	160,892	99,287	81,566	90,453	108,155	116,978	82,263	110,954	131,367	228,252	1,768,097
Total Residential	**699,895**	**495,479**	**405,917**	**313,847**	**313,466**	**396,688**	**451,620**	**471,054**	**314,489**	**338,566**	**358,974**	**560,052**	**5,120,047**
Commercial	351,924	270,376	293,797	279,006	302,385	339,903	318,490	367,430	275,842	294,467	272,587	311,673	3,677,880
Industrial	230,837	284,671	244,371	275,283	279,417	298,594	294,016	301,349	313,307	278,746	289,032	263,124	3,352,747
Public Authorities	113,449	102,284	104,136	105,638	114,496	120,700	102,837	124,719	108,674	110,250	99,132	109,230	1,315,545
Street Railway	554	426	375	352	268	14	92	168	85	117	153	418	3,022
Street Lighting	5,874	5,729	5,347	5,542	5,457	5,392	5,381	5,550	5,625	5,697	5,722	5,869	67,185
Total Non-Residential	**702,638**	**663,486**	**648,026**	**665,821**	**702,023**	**764,603**	**720,816**	**799,216**	**703,533**	**689,277**	**666,626**	**690,314**	**8,416,379**
Total Retail	**1,402,533**	**1,158,965**	**1,053,943**	**979,668**	**1,015,489**	**1,161,291**	**1,172,436**	**1,270,270**	**1,018,022**	**1,027,843**	**1,025,600**	**1,250,366**	**13,536,426**

Peak
MW
June
Actual
2909

Load Factor[1]
55.45%

2009 Weather Normalized Retail Sales

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD
Residential Non-Heating	367,768	259,103	261,284	196,496	233,625	285,861	457,204	373,390	269,274	225,627	241,596	330,527	3,501,755
Residential Heating	286,156	256,306	196,073	99,240	81,673	86,318	132,794	121,470	90,226	98,362	162,460	225,386	1,836,464
Total Residential	**653,924**	**515,409**	**457,357**	**295,736**	**315,298**	**372,179**	**589,998**	**494,860**	**359,500**	**323,989**	**404,056**	**555,913**	**5,338,219**
Commercial	333,903	274,875	297,213	273,144	303,422	336,132	348,896	374,603	287,930	298,126	274,308	310,735	3,713,287
Industrial	230,837	284,671	244,371	275,283	279,417	298,594	294,016	301,349	313,307	278,746	289,032	263,124	3,352,747
Public Authorities	107,907	102,866	104,136	104,761	114,600	120,237	105,670	125,258	109,717	110,250	99,132	109,104	1,313,638
Street Railway	554	426	375	352	268	14	92	168	85	117	153	418	3,022
Street Lighting	5,874	5,729	5,347	5,542	5,457	5,392	5,381	5,550	5,625	5,697	5,722	5,869	67,185
Total Non-Residential	**679,075**	**668,567**	**651,442**	**659,082**	**703,164**	**760,369**	**754,055**	**806,928**	**716,664**	**692,936**	**668,347**	**689,250**	**8,449,879**
Total WN Retail Sales	**1,332,999**	**1,183,976**	**1,108,799**	**954,818**	**1,018,462**	**1,132,548**	**1,344,053**	**1,301,788**	**1,076,164**	**1,016,925**	**1,072,403**	**1,245,163**	**13,788,098**

WN Peak[2]
MW
June
WN
2837

All sales in MWh

[1] **Peak Load Factor is calculated by dividing peak month sales by the number of hours in the month then dividing the result by the peak demand [peak month sales/hours in month)/peak demand]**

[2] **Weather normalized peak is calculated by applying the peak load factor to the normalized peak month sales [(peak month sales/hours in month)/peak month load factor]**

THE DAYTON POWER & LIGHT COMPANY

2011 Benchmark Report

2010 Weather Normalization

2010 Actual Calendar Retail Sales

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD
Residential Non-Heating	354,522	258,858	263,664	203,306	245,866	353,434	428,783	479,014	243,507	199,042	246,067	340,943	3,617,006
Residential Heating	314,486	234,210	169,658	97,379	97,539	116,261	140,235	129,590	93,722	98,488	142,356	270,668	1,904,592
Total Residential	**669,008**	**493,068**	**433,322**	**300,685**	**343,405**	**469,695**	**569,018**	**608,604**	**337,229**	**297,530**	**388,423**	**611,611**	**5,521,598**
Commercial	302,665	277,871	302,608	269,824	318,672	317,820	378,028	385,363	322,214	284,653	269,686	312,026	3,741,430
Industrial	254,217	271,670	274,023	299,991	319,337	352,685	305,353	306,694	317,996	309,254	302,290	268,483	3,581,993
Public Authorities	94,835	116,238	107,316	104,585	124,228	112,401	131,524	130,471	118,374	109,601	99,925	112,041	1,361,539
Street Railway	202	90	243	135	102	111	75	66	52	47	75	88	1,286
Street Lighting	6,021	6,433	5,640	5,564	5,685	5,409	5,535	5,556	5,632	5,804	5,831	6,115	69,225
Total Non-Residential	**657,940**	**672,302**	**689,830**	**680,099**	**768,024**	**788,426**	**820,515**	**828,150**	**764,268**	**709,359**	**677,807**	**698,753**	**8,755,473**
Total Retail	**1,326,948**	**1,165,370**	**1,123,152**	**980,784**	**1,111,429**	**1,258,121**	**1,389,533**	**1,436,754**	**1,101,497**	**1,006,889**	**1,066,230**	**1,310,364**	**14,277,071**

Peak
MW
August
Actual
2924

Load Factor[1]
66.04%

2010 Weather Normalized Retail Sales

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD
Residential Non-Heating	347,836	242,522	273,403	206,303	225,285	298,401	377,019	399,263	206,555	199,921	248,281	320,566	3,345,355
Residential Heating	301,603	200,335	189,078	122,271	93,516	104,210	128,870	112,021	85,562	108,390	147,494	227,097	1,820,447
Total Residential	**649,439**	**442,857**	**462,481**	**328,574**	**318,801**	**402,611**	**505,889**	**511,284**	**292,117**	**308,311**	**395,775**	**547,663**	**5,165,802**
Commercial	295,985	263,138	305,036	269,824	311,921	303,429	364,381	364,137	314,243	284,653	270,124	294,344	3,641,215
Industrial	254,217	271,670	274,023	299,991	319,337	352,685	305,353	306,694	317,996	309,254	302,290	268,483	3,581,993
Public Authorities	93,023	112,924	107,316	104,585	123,580	111,007	130,209	128,436	117,525	109,601	99,925	108,285	1,346,416
Street Railway	202	90	243	135	102	111	75	66	52	47	75	88	1,286
Street Lighting	6,021	6,433	5,640	5,564	5,685	5,409	5,535	5,556	5,632	5,804	5,831	6,115	69,225
Total Non-Residential	**649,448**	**654,255**	**692,258**	**680,099**	**760,625**	**772,641**	**805,553**	**804,889**	**755,448**	**709,359**	**678,245**	**677,315**	**8,640,135**
Total WN Retail Sales	**1,298,887**	**1,097,112**	**1,154,739**	**1,008,673**	**1,079,426**	**1,175,252**	**1,311,442**	**1,316,173**	**1,047,565**	**1,017,670**	**1,074,020**	**1,224,978**	**13,805,937**

WN Peak[2]
MW
August
WN
2679

All sales in MWh

[1] **Peak Load Factor is calculated by dividing peak month sales by the number of hours in the month then dividing the result by the peak demand [peak month sales/hours in month)/peak demand]**

[2] **Weather normalized peak is calculated by applying the peak load factor to the normalized peak month sales [(peak month sales/hours in month)/peak month load factor]**

THE DAYTON POWER & LIGHT COMPANY
2011 Benchmark Report
Weather Normalization Factors

Year	Actual Calendar Retail Sales[1]	Weather Normalized Retail Sales[2]	Energy Weather Normalization Factor[3]
	(a)	(b)	(c)
2008	14,932,110	14,945,419	1.00089
2009	13,536,426	13,788,098	1.01859
2010	14,277,071	13,805,937	0.96700

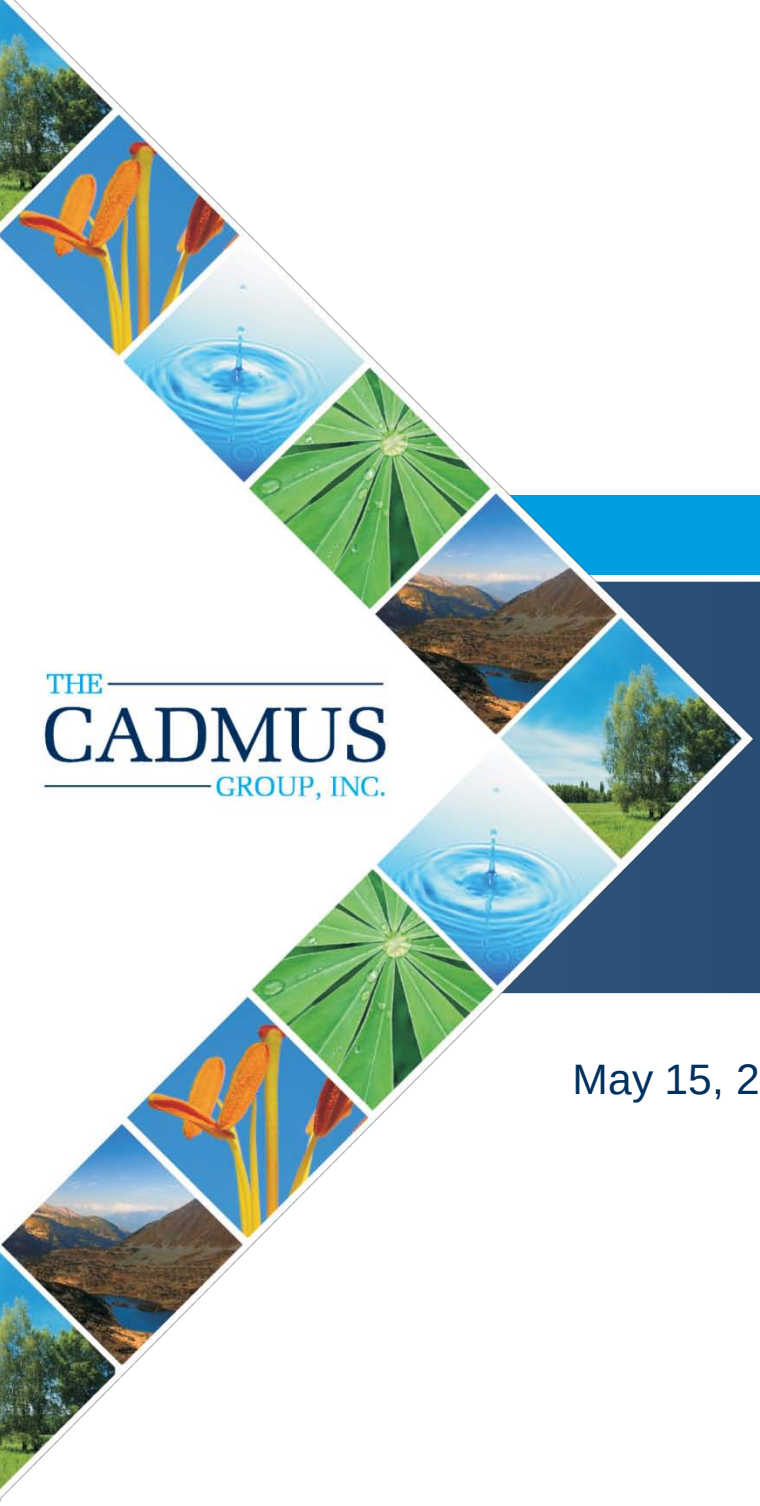
	Actual System Peak Demands[1]	Weather Normalized Peak Demands[2]	Demand Weather Normalization Factor[3]
2008	3,027	2,985	0.98612
2009	2,909	2,837	0.97525
2010	2,924	2,679	0.91621

[1] Workpaper E1-E3.

[2] Weather normalization sales and peaks are based on normal heating and cooling degree day adjustments (Workpaper E1-E3).

[3] Weather normalization factor (c)= (b)/(a).

EXHIBIT 1



2011 Evaluation, Measurement, and Verification Report

May 15, 2012

Prepared by:

The Cadmus Group, Inc.
Energy Services Division
720 SW Washington Street, Suite 400
Portland, OR 97205
503.467.7100

Prepared for:

Dayton Power and Light
1900 Dryden Rd,
Dayton, OH 45439

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Prepared by:
Steve Cofer
Katie Albee
Cameron Ramey
Josh Keeling
Scott Reeves
Aisling Nagel
Travis Walker
Aquila Velonis
Jessica Aiona
M. Sami Khawaja, Ph.D.
The Cadmus Group, Inc.

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EXECUTIVE SUMMARY

In 2008, Dayton Power and Light (DP&L) filed a seven-year Energy Efficiency and Demand Response Plan portfolio for residential and business programs, in response to Senate Bill 221 (S.B. 221). S.B. 221 called for a 1.5% cumulative reduction in total electricity sales, and a 2.5% reduction in peak demand in 2011, with requirements for continued energy savings, extending through 2025. Additionally, the portfolio of energy-efficiency programs had to be cost-effective.

DP&L hired The Cadmus Group Inc. (Cadmus) in 2009 to perform impact and process evaluations for all programs. This is the third annual evaluation report.

The impact evaluation had the following objectives:

- Determine program and portfolio cost-effectiveness;
- Assess the appropriateness of the program's gross *ex ante* claimed savings; and
- Calculate gross *ex post* saving estimates.

Primary process evaluation objectives included:

- Assess overall satisfaction with the program;
- Identify any changes to program design and delivery that would improve performance;
- Assess the effectiveness of program marketing and outreach; and
- Identify barriers and how effectively the programs are overcoming them.

DP&L's 2011 annual kWh and peak demand reduction goals represent approximately 14%, respectively, of its seven-year filed goals. Table 1 provides DP&L saving goals by program, both as claimed and evaluated. DP&L exceeded its 2011 kWh and kW goals.

Ex ante and *ex post* (adjusted gross) measure-level savings were the same or similar for many programs, due to DP&L adopting Cadmus' preliminary evaluation findings. For instance, Cadmus conducted its impact evaluation for the Be E^3 Smart program in December 2011, allowing DP&L to incorporate these findings into its reporting. To this end, measure-level realization rates are similar or the same in many instances.

All but two portfolio programs achieved their 2011 kWh savings goals (the exceptions being: HVAC Tune-Up and Low-income). Energy savings were less than expected for these programs due to lower-than-anticipated participation and outside factors such as the American Recovery and Reinvestment Act. All but two programs also achieved their kW savings goals (the exceptions being: HVAC Tune-Up and Prescriptive C&I). Demand savings were less than expected for these programs due to lower-than-anticipated participation in the HVAC Tune-Up program and lower than expected verified coincidence factors for several projects in the Prescriptive C&I program.

Table 1. Overall Evaluation Results

Program	Program Goals*		*Ex Ante* Claimed Savings		Verified Gross Savings		Adjusted Gross Savings	
	Gross kWh	Gross kW	Gross kWh	Gross kW	Gross kWh	Gross kW	Gross kWh	Gross kW
Residential								
Lighting	28,505,171	2,426.0	92,841,910	11,104.7	92,842,547	11,104.7	92,842,547	9,819.9
Appliance Recycling	3,951,705	618.1	5,960,728	954.4	5,960,728	954.4	4,702,308	749.5
Low-income	1,705,147	128.8	1,001,451	103.9	1,049,415	109.5	1,072,132	134.1
HVAC Rebate	1,685,320	1,504.8	8,016,356	2,558.1	8,016,356	2,558.1	7,792,357	2,460.6
HVAC Tune-Up	2,973,124	2,641.1	39,034	7.7	34,722	24.2	106,699	40.2
Be E^3 Smart**	N/A	N/A	1,171,055	136.7	1,171,055	136.7	1,171,055	120.9
Commercial								
Prescriptive	28,223,448	7,643.4	34,494,782	6,144.1	33,765,640	6,218.1	34,537,857	6,124.0
Custom	14,720,771	2,743.1	20,513,721	3,222.2	19,893,535	3,146.7	19,612,273	3,070.4
TOTAL	81,764,686	17,705.3	164,039,037	24,231.7	162,733,998	24,252.4	161,837,228	22,519.5

* DP&L filed values.
** There are no goals filed with the Public Utilities Commission of Ohio (PUCO) for the Be E3 Smart Program.

The overall portfolio was found cost-effective, with a total resource cost (TRC) of 1.71. While the overall portfolio was cost-effective, we found individual residential programs falling below 1.0 TRC. Commercial and industrial programs were cost-effective.

General process findings include:

- Participants across all programs express high levels of satisfaction among all program elements, i.e., rebate amount, energy savings, incented equipment, and overall program experience. The majority of customers were "somewhat" to "very satisfied" in all the programs where this was evaluated. Comparing these results with similar evaluations across the country, DP&L customers generally rank their experience higher than the benchmarked averages.

- Other program performance metrics generally meet or exceed evaluation findings from other comparable utility programs, such as saving realization rates.

- The overwhelming majority of DP&L customers (97%) are familiar with CFLs. Those that already have them installed (87%) report being very or somewhat likely to replace them with CFLs upon burn out.

- Participation is only an issue for one program (Certified HVAC Tune-Up). DP&L and the program implementer have taken significant steps in redesigning the program to increase participation. Early 2012 communications indicate this redesign shows promise.

INTRODUCTION AND PURPOSE OF THE STUDY

For the impact evaluations, Cadmus assessed and documented program savings, including the gross realization rate relative to *ex ante* claimed saving values. For the process evaluations, we sought to:

- Document satisfaction and feedback from the perspectives of program and implementation staff, and of participant and market actors; and
- Provide timely feedback to enable program process improvements.

Table 2 provides the general researchable questions and supporting activities. Program specific, researchable questions are presented in the various sections below. The evaluation plan spanned multiple program years (2010–2012); therefore, not all researchable questions were addressed in the 2011 evaluation. Questions not addressed this year were omitted from this report.

Table 2. Overall Researchable Questions and Supporting Activities

Researchable Question	Activity Used to Support Question
What changes to design and delivery would improve program performance?	• Trade ally interviews • Participant surveys • Program database review
How effective have the programs been in recruiting and training market actors?	• Participant survey
What are the barriers to increased customer participation, and how effective are the programs in overcoming those barriers?	• Trade ally interviews • Participant survey
What are the gross and demand reductions?	• Engineering analysis • Data verification • Billing analysis • Regression analysis
How satisfied are customer and market actors with the program?	• Trade ally interviews • Participant surveys
Are the programs cost-effective? Is the portfolio cost-effective?	• Cost-effectiveness tests

Overall Evaluation Methodology

Each program had a unique set of verification and evaluation activities. Primary evaluation activities included:

- Using engineering calculations to verify program *ex ante* claimed savings, and to determine adjusted program gross kilowatt hour (kWh) and kilowatt (kW) reductions.
- Performing site visits to verify measure installation.
- Developing statistical regression models to determine adjusted gross program savings.
- Conducting a detailed review of project documentation, calculations, audit reports, and assumptions.

- Conducting telephone surveys with participants and market actors to evaluate program processes and to inform the impact evaluation.
- Benchmarking important metrics from each program evaluation against metrics from recent comparable programs to provide additional context in interpreting the results.

In the tables below, we report the following:

1. ***Ex Ante* Claimed Savings:** Savings based on *ex ante* participation and calculation assumptions. DP&L used multiple sources for claimed savings—primarily the draft State of Ohio Energy Efficiency Technical Reference Manual (TRM), filed August 6, 2010 under Case No. 09-0512-GE-UNC (draft Ohio TRM) and results from previous Cadmus evaluation work. Therefore, *ex ante* savings and adjusted gross savings may be similar when DP&L applies preliminary evaluation results. Table 3 summarizes sources used to calculate *ex ante* savings.

Table 3. *Ex Ante* Claimed Savings: Summary of Sources

Program	*Ex Ante* Savings Source
Lighting	Draft Ohio TRM CFL calculation.
HVAC Rebate	Multiple sources: Cadmus billing analysis, draft Ohio TRM saving calculations, secondary sources and calculations.
HVAC Tune-Up	Draft Ohio TRM Tune-Up calculation, with an adjustment to full load cooling hours.
Appliance Recycling	Draft Ohio TRM CFL calculation.
Low-income	Multiple sources: Draft Ohio TRM and Cadmus preliminary measure calculations.
Be E^3 Smart	Multiple sources: Draft Ohio TRM and preliminary results from Cadmus regarding installation rates.
Prescriptive	Multiple sources: Draft Ohio TRM where applicable. Cadmus deemed saving estimates provided in 2010 and 2011.
Custom	Custom calculations

2. **Verified Gross Savings:** Savings due to adjustments to *ex ante* participation, based on phone or on-site verification. The unit energy savings (UES) estimation approach (e.g., draft Ohio TRM or deemed savings) remained the same as *ex ante* claimed savings.
3. **Adjusted Gross Savings:** Savings due to adjustments to *ex ante* participation, based on phone or on-site verification, and adjustments to UES, based on engineering reviews of savings, statistical models, or other approaches.[1]

Adjusted gross savings are final evaluated *ex post* gross saving estimates.

[1] In several cases where draft Ohio TRM calculations or assumptions were used, Cadmus also incorporated feedback from the *Joint Objections and Comments to the August 6, 2010 Draft Technical Resource Manual from Ohio Edison Company, The Cleveland Electric Illuminating Company, The Toledo Edison Company, Columbus Southern Power Company, Ohio Power Company, Duke Energy Ohio, Inc., The Dayton Power And Light Company and Industrial Energy Users-Ohio*, filed November 3, 2010, in PUCO Case No. 09-512-GE-UNC (draft Ohio TRM Joint Objections and Comments). This noted in the text where appropriate.

Each program-specific section below provides a detailed explanation of adjustments made to calculate verified and adjusted gross savings.

Threats to Validity

The following list provides known threats to this evaluation's validity, possible bias sources, and the ways we addressed these issues:

- Potential sample representativeness bias. Where applicable, data were weighted to address this potential bias. This was found to only be necessary for the Lighting program general population survey.
- The lighting phone survey was based on a randomly generated list of DP&L residential customers, not on a true random digit dial, where a sample is purchased by ZIP code or county. This may have resulted in a bias towards single-family homes, which have a one-to-one relationship with a residence and a meter. Multifamily dwellings may be master metered. We used appropriate weighting of results to correct for possible lack of representation of renters.
- For the Appliance Recycling Program (ARP), Cadmus assessed sources of uncertainty and bias resulting from differences in the implementer's assessment of appliance characteristics, specifically the age and usage of units. Implementer staff may be trained differently regarding how to recognize qualifying units (e.g., age, working condition), all of which would be uploaded into the tracking database. This potentially could have biased DP&L's tracking database.
- To address telephone survey nonresponse bias, Cadmus utilized survey best practices, including: calling at different times of day; calling on weekends; and scheduling call-backs.
- In all cases where regression models were used, every attempt was made to guard against errors associated with omitted variables, improper functional forms, and inclusion of erroneous data.

Telephone Survey Best Practices and Reporting

Telephone surveys constituted a large part of the 2011 evaluation, informing both the impact and process evaluations for several programs. For general population surveys (e.g., participant customers), special care addressed potential issues in the following areas:

- Sample selection (which customers to include in the survey sample frames).
- Response (whether customers answering the survey as a group were representative of the sample frame).
- Data analysis and reporting (whether analysis was conducted that considered sample selection and limitations of survey data collection).

We conducted all surveys using Discovery Research Group (Discovery Research), a survey research and telephone data collection provider. Survey response and cooperation rates, calculated for general population surveys, are reported in the program-specific sections. Survey

response and cooperation rates were calculated adhering to American Association for Public Opinion Research (AAPOR) minimum definitions.[2]

Response and cooperation rates were calculated using the following equations:

$$RR1 = \frac{I}{(I + P) + (R + NC + O) + (UH + UO)}$$

$$COOP1 = \frac{I}{(I + P) + R + O}$$

Where:

I	= Complete interview
P	= Partial interview
R	= Refusal and break-off
NC	= Noncontact
O	= Other
UH	= Unknown if household occupied
UO	= Unknown other

Appendix I summarizes the final disposition results for each general population survey effort.

[2] See: http://www.aapor.org/AM/Template.cfm?Section=Standard_Definitions2&Template=/CM/ContentDisplay.cfm&ontentID=3156

DESCRIPTION OF PROGRAMS COVERED IN STUDY

In 2011, DP&L offered six residential and two commercial and industrial programs (mercantile customer participation and associated savings were not evaluated). Table 4 provides claimed participation by program. For all programs except the residential HVAC Tune-Up, the number and mix of participants is what was expected when Cadmus developed the evaluation plans. Lower-than-anticipated participation—and plans to change the program design in 2012—required modifying the Tune-Up program's evaluation approach. The HVAC Tune-Up evaluation's program section addresses those changes.

Table 4. Claimed Program Participants

Program	Claimed Quantity	Unit Type
Residential Lighting	1,843,708	CFLs sold
Residential HVAC Rebate	3,882	Units rebated
Residential HVAC Tune-Up	358	Equipment Tuned-Up
Residential Appliance Recycling	4,448	Recycled Appliances
Residential Low-income	735	Participants
Residential Energy Education	6,464	Distributed student kits
Commercial Prescriptive	729	Projects
Commercial Custom	93	Projects

Detailed program overviews can be found in the DP&L Annual Report sections 3, 4 and 5.

RESIDENTIAL LIGHTING PROGRAM

This chapter describes the evaluation approach, detailed findings, and conclusions and recommendations for the Residential Lighting Program.

Evaluation Overview

Cadmus' evaluation of the 2011 Residential Lighting Program followed the researchable questions and evaluation activities outlined in the DP&L 2010–2012 Evaluation, Measurement, and Verification Plan. Table 5 identifies key researchable evaluation questions.

Table 5. Key Researchable Questions

Researchable Question	Activity Used to Support Question
What is the current level of CFL purchases? Who purchases CFLs? Who does not purchase CFLs and why not?	• Random digit dial phone surveys (n=300).
How satisfied are customers with CFLs?	• Random digit-dial phone surveys.
How are customers disposing of CFLs?	• Random digit-dial phone surveys.
How familiar are customers with LEDs and halogens? How can LEDs and halogens be promoted?	• Random digit-dial phone surveys.
What are the gross savings?	• Review of secondary sources and Ohio TRM. Calculate savings.

Detailed Evaluation Findings

The following key findings have been drawn from our review of energy-saving assumptions and calculations, and from the telephone survey:

- The program had total claimed *ex ante* gross kWh savings of 92,841,910 kWh, and Cadmus-adjusted gross kWh savings of 92,842,547, for a program realization rate of nearly 100%. The small difference in adjusted gross savings from *ex ante* are due to rounding.

Table 6. Residential Lighting Claimed and Achieved Energy Savings

Measure	*Ex Ante* Claimed Savings		Verified Gross Savings		Adjusted Gross Savings		
	Gross kWh	Gross kW	Gross kWh	Gross kW	Gross kWh	Gross kW	Precision at 90% Confidence
CFL	92,841,910	11,104.7	92,842,547	11,104.7	92,842,547	9,819.9	±6%

- Phone survey data revealed that approximatley 94% of respondents were familiar with CFLs (Figure 1), indicating high familiarity in DP&L's territory, in comparison with other utilities.
- Retention rates appear promising, as 87% said they were very or somewhat likely to replace a burned out CFL with another CFL (as shown in Figure 4).

- In comparing LEDs to halogens, respondents were more familiar with halogens, and used these bulbs more frequently than LEDs. This could indicate that if a customer was to choose an energy saving bulb other than a CFL, they might be more likely to choose a halogen over an LED.
- Of all CFLs purchased in the past 12 months, 11% were intended for business purposes, rather than for residential use. Lowes, Sam's Club, and Home Depot were the most common outlets for those CFLs. This contrasts with residential purchases, where CFLs most commonly were purchased at mass merchandise stores, such as Wal-Mart.
- Eleven percent of CFLs purchased were reported for commercial purposes, which typically have longer operation hours and greater energy savings.

Data Collection Methods

Telephone Survey

Cadmus conducted telephone surveys with customers in DP&L's service territory. We planned 300 telephone surveys, and achieved 301. The cooperation rate was 8%. Surveys were conducted in October and November 2011. Discovery Research received a list of over 2,000 DP&L residential customers for their survey calls, based on a randomization process. Appendix I shows the distribution results of calls.

The survey asked respondents about the following:

- Awareness of energy-saving light bulbs;
- CFL awareness, use, and general satisfaction;
- CFLs purchased for business use;
- Where lighting products were purchased;
- CFL installations;
- Whether or not behaviors changed since installing CFLs;
- Disposal or hypothetical disposal of CFLs;
- LED and halogen purchases; and
- Demographic information.

Baseline Assumptions

Incandescent light bulbs served as the existing baseline equipment.

Impact Methodology

CFL *ex ante* gross savings were derived from the draft Ohio TRM. Cadmus found no discrepancies in CFL counts, and used the draft Ohio TRM time-of-sale calculation for verified gross savings, modifying the calculations' installation rate to determine adjusted gross savings.

Cadmus recommends using the savings inputs presented in the draft Ohio TRM. A discussion follows regarding the process used to achieve this conclusion.

When calculating actual savings for the program, Cadmus found a difference between *ex ante* gross kWh savings and verified gross kWh savings, which occurred due to rounding.

Waste Heat Factor for Demand

The draft Ohio TRM has a waste heat factor for demand of 1.21. For 2011, in response to comments provided in the Draft Ohio TRM Joint Objections and Comments document following the 2010 evaluation, we performed a high level review of waste heat factors for demand from other comparable TRMs. While we did not perform primary data collection or analysis, we concluded that the Joint Utility Comments were reasonable and more appropriate for the 2011 evaluation. This change resulted in the difference between the *ex ante* gross kW claimed savings and the adjusted gross kW savings presented in Table 6.

Installation Rate

Site visits conducted for the 2010 program evaluation identified a 76% installation rate. The draft Ohio TRM recommends a 77% installation rate. According to the 2011 end-use customer phone survey, CFLs had a 68.3% installation rate. However, no statistical difference was detected between the 2010 site visit-derived value and the 2011 survey-based value. Consequently, Cadmus agreed with the draft Ohio TRM calculation methodology, and applied the same value as the draft Ohio TRM to the savings calculation.

Hours of Use

For our analysis, we calculated HOU using statistical model estimates from a combined multistate, multiyear database of light logger data. These data were a compilation of raw meter data from evaluations in Maryland, Missouri, and Michigan, as well as the logger data from the DP&L 2009 evaluation. This model expressed average HOU as a function of room type, existing CFL saturations, and the presence of children in a home. Using the bulb distributions found in the phone survey, along with supplemental secondary data, we predicted average HOU for the 2011 program. This resulted in an average Hours of Use (HOU) of 2.39. Cadmus also examined: a Mid-Atlantic study with a 2.96 HOU value; a Vermont study with a 1.81 HOU value; and a Pennsylvania study with a 3.0 HOU value.

We conducted difference of means comparison between our 2.39 and the draft Ohio TRM 2.85 and found the difference not statistically significant at 90% level of confidence.

Cadmus believes the 2.85 draft Ohio TRM value presents a reasonable assumption for this evaluation's purposes.

Delta Watts

Cadmus recommends using the 3.25 delta watts value as stipulated in the draft Ohio TRM. Cadmus reviewed various technical reference manuals that included delta watt assumptions, as shown in Table 7. In addition, Cadmus calculated a delta wattage multiplier base on DP&L tracking data from 2010. Our analysis assumes the replacement bulb has the equivalent lumens as the baseline incandescent. This analysis resulted in a delta watts value of 3.35. As part of our review, Cadmus determined what DP&L's average reported delta watt multiplier would be based

on tracking data from 2010. Based on all of these sources, we concluded that the draft Ohio TRM was reasonable.

Table 7. CFL Delta Wattage Multiplier Source Comparison

DWM Input	Year	NY TRM 2010	Regional Technical Forum 2011	Mid-Atlantic TRM 2012	CT TRM 2011	Draft OH TRM 2010	Cadmus Review (2010 Data)	DP&L Results (2010 Data)
Delta Watt Multiplier	2011	2.53	2.60	2.95	3.00	3.25	3.35	3.36

Process Findings

Data Weighting

Table 8 shows the weighting scheme developed for the phone survey. Two demographic factors often are related to CFL use: homeownership and education (specifically, underrepresentation of renters and of those with less than a high school education in survey responses).[3] When comparing the composition of respondents completing surveys to U.S. Census estimates, households with these characteristics were underrepresented. Therefore, Cadmus weighed telephone survey data to reflect homeownership and education for 16 counties in Ohio, based on American Community Survey (ACS) three-year estimates for 2007 to 2009.

Table 8. Population, Sample Sizes, and Weights for Phone Survey Data by Homeownership and Education

Homeownership	Education	Population (households)	Sample Size	Weight
Owner-occupied	Less than high school graduate	41,161	11	1.78
	High school graduate (including equivalency)	147,743	60	1.17
	Some college or an associate's degree	128,134	72	0.85
	Bachelor's degree or higher	105,348	93	0.54
Renter-occupied	Less than high school graduate	30,569	5	2.92
	High school graduate (including equivalency)	63,352	12	2.52
	Some college or an associate's degree	63,814	24	1.27
	Bachelor's degree or higher	25,951	12	1.03
TOTAL		606,072	289*	

* Of 301 phone survey participants, 12 individuals did not provide their homeownership and/or education status. We assigned these individuals a weight of 1.

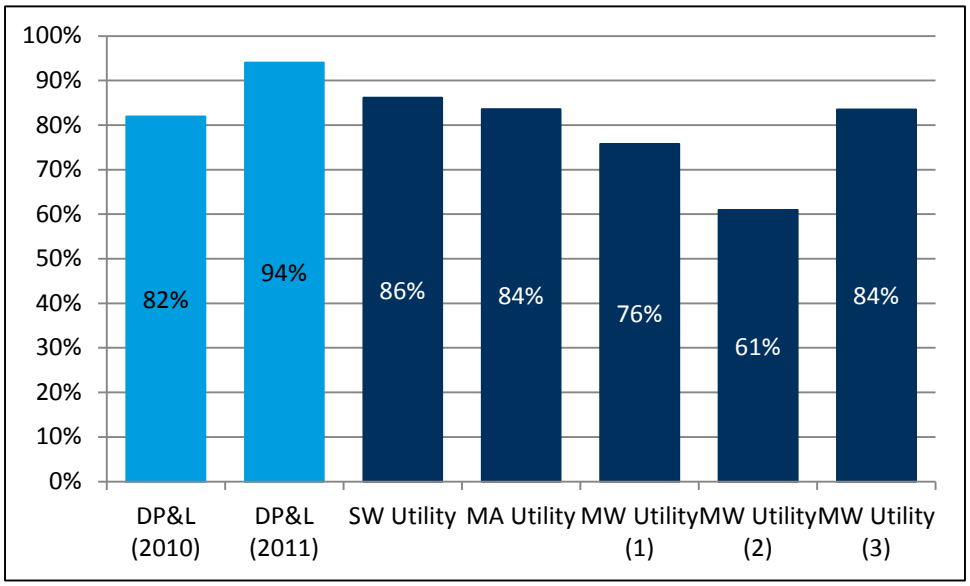
[3] Such underrepresentation is common in phone surveys. For example, see: Galesic, M., R. Tourangeau, M.P. Couper. 2006. "Complementing Random-Digit-Dial Telephone Surveys with Other Approaches to Collecting Sensitive Data." *American Journal of Preventive Medicine*. Volume 35, Number 5.

Telephone Survey Results

Awareness and Use of Energy-Efficient Lighting

Ninety-four percent of respondents reported being familiar with CFLs, with 79% of them reporting "somewhat" to "very familiar" with CFLs. Figure 1 shows results from the 2010 multistate study (as well as DP&L 2011 results), which reflect the level of familiarity with CFLs among those participating in site visits in their respective states (DP&L was a participant in this study as well). Note that the 2010 data in Figure 1 reflect the familiarity of just those who participated in site visits. Among all phone survey respondents in 2010, familiarity was 93% and thus familiarity has not changed much in the past year.

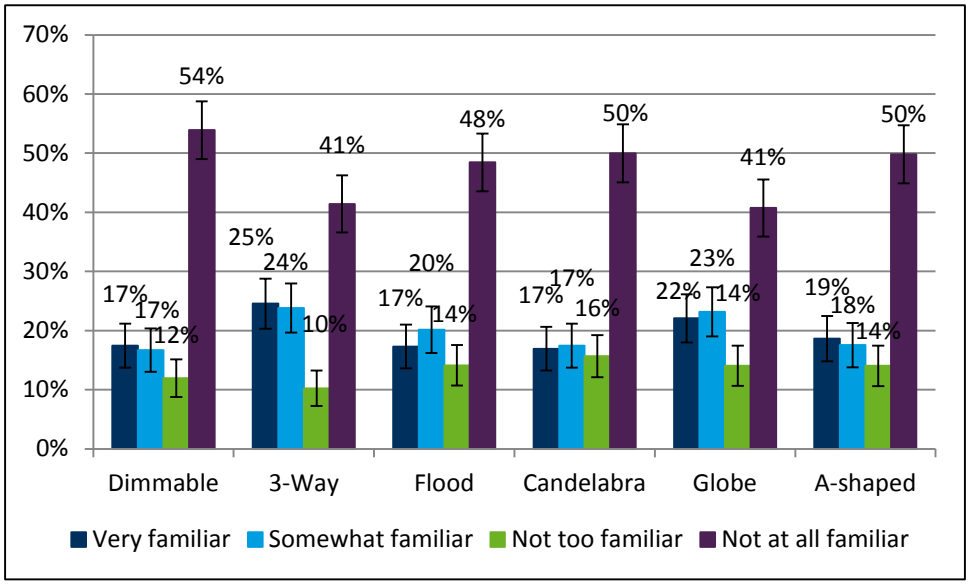
Figure 1. 2010 Familiarity with CFLs



Source: 2010 multistate data and 2011 phone survey data (the multistate data reflect just those who participated in site visits).

Figure 2 shows respondents' familiarity with specialty CFLs. Over half of all respondents were not familiar with specialty bulbs, indicating potential may exist to increase adoption rates through education regarding the availability of specialty bulbs.

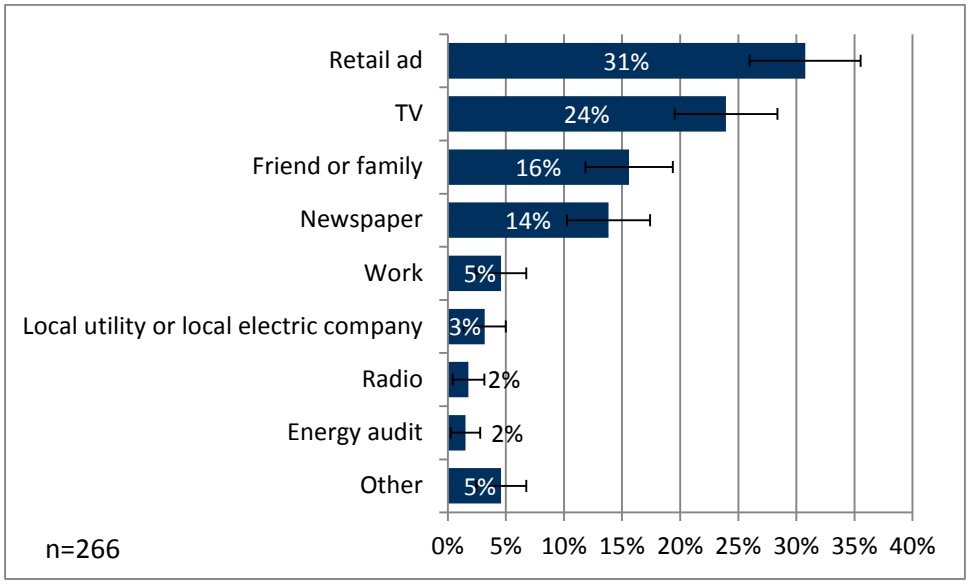
Figure 2. Familiarity with Specialty CFLs (With Precision at 90% Confidence)



Dimmable n=286, 3-way n=287, Flood n=286, Candelabra n=284, Globe n=285, A-shaped n=284
Source: DP&L Residential Lighting Telephone Survey, A5.

Figure 3 shows the reported mode through which respondents first learned about CFLs.

Figure 3. Means Through which Respondent First Learned about CFLs (With Precision at 90% Confidence)



* Multiple responses
Source: DP&L Residential Lighting Telephone Survey, B1.

Nearly one-third (32%) learned of CFLs through a retail store display or advertisement, closely followed by a TV advertisement or story.

Seventy-three percent of respondents reported they or someone in their house bought or had been given CFLs. Over half of all respondents (61%) reported buying CFLs in the last 12 months (an average of 8.8 bulbs purchased and 6.1 installed).

Respondents were asked:

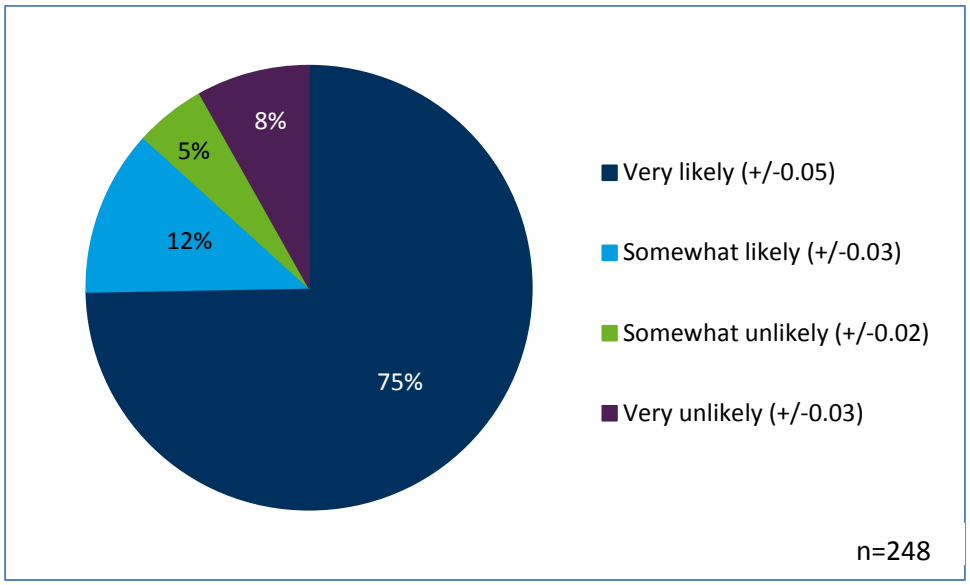
> *"Of the CFLs purchased in the past 12 months, how many were installed in a business or will be installed in a business rather than your home?"*

For this question, 11% of those purchases were intended for business purposes (most were purchased from Lowes, Sam's Club, and Home Depot).

Of the 6.1 CFLs purchased and installed, an average of 2.9 replaced a burned out or broken CFL (as opposed to a different type of bulb, such as a traditional, incandescent bulb).

The majority of respondents (87%) said they would likely replace a burned-out CFL with another CFL, as shown in Figure 4.

Figure 4. How likely are you to replace a burned out CFL with another CFL? (With Precision at 90% Confidence)

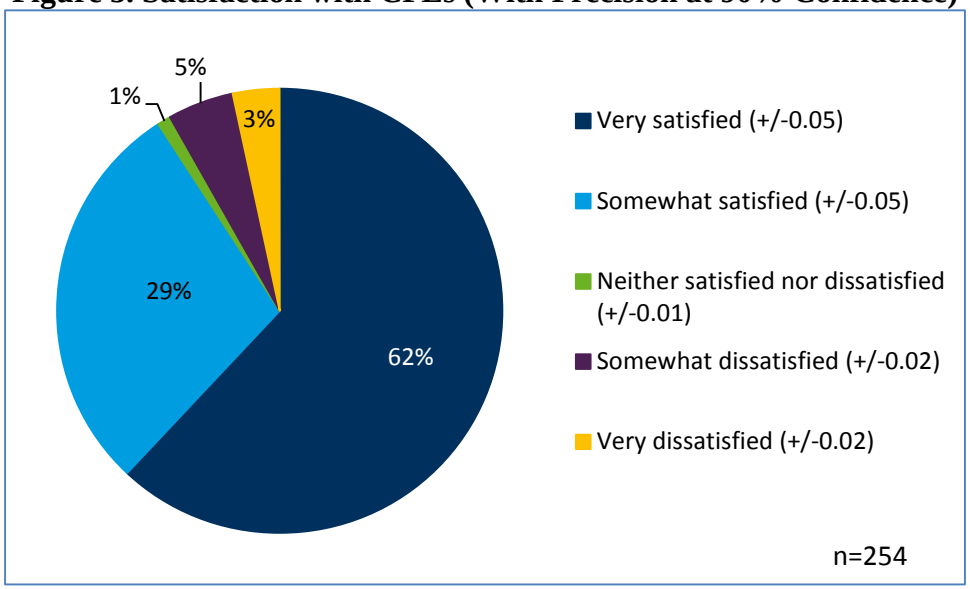


Source: DP&L Residential Lighting Telephone Survey, B14.

CFL Satisfaction

The majority (91%) of respondents reported satisfaction with CFLs, as shown in Figure 4.

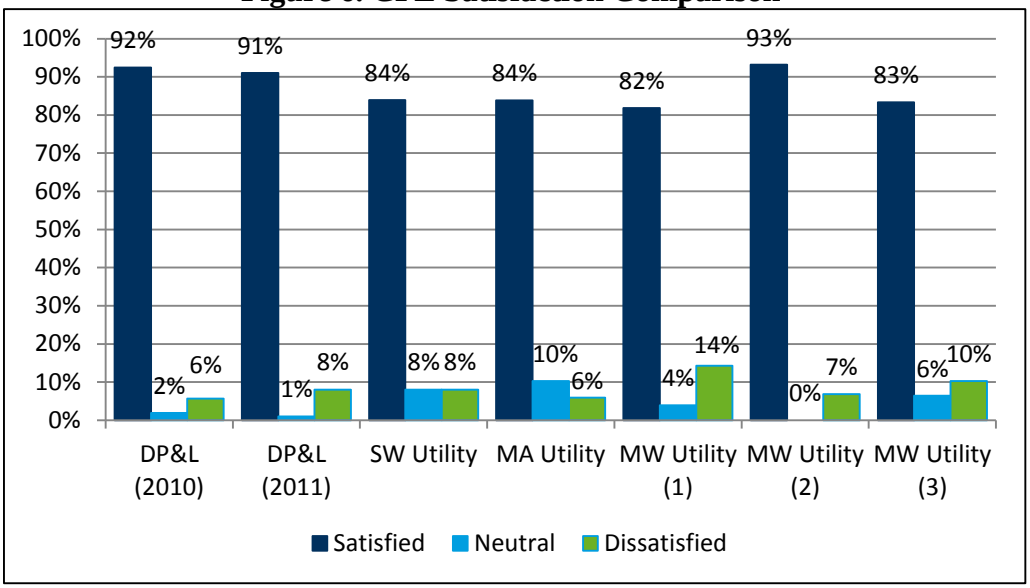
Figure 5. Satisfaction with CFLs (With Precision at 90% Confidence)



Source: DP&L Residential Lighting Telephone Survey, B17.

As shown in Figure 6, DP&L customers tended to be more satisfied with CFLs, compared to customers of other utilities across the country.

Figure 6. CFL Satisfaction Comparison



Source: 2010 multistate data and 2011 phone survey data (the multistate data reflect just those who participated in site visits).

Among those not satisfied, reasons cited included:

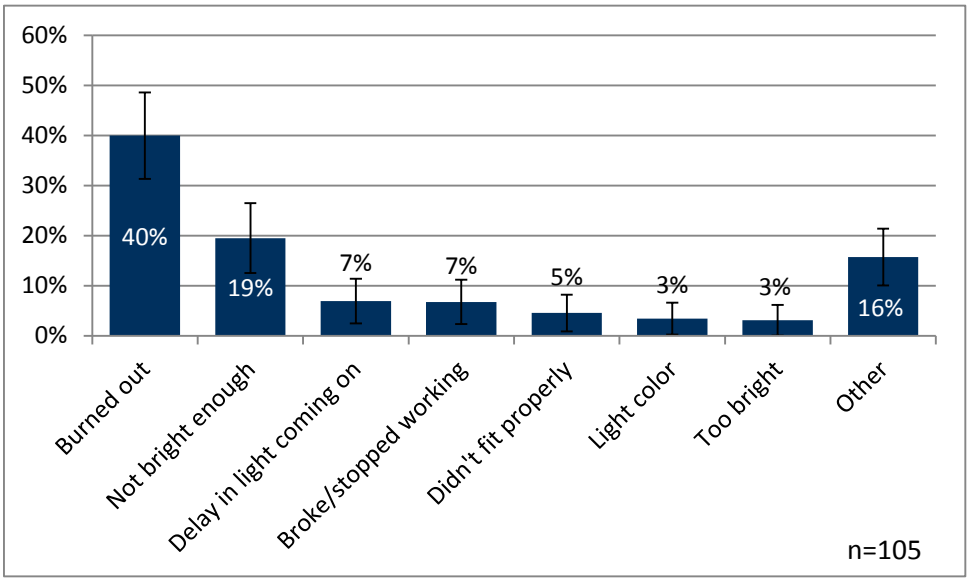
- "Takes a long time to reach full brightness." (32%)
- "Expensive." (11%)
- "Don't like that they contain mercury." (6%)

Other responses included:

- "Don't like the lighting."
- "They burn out faster."
- "LEDs are better."

Among 37% of respondents who installed and later removed a CFL, 40% said they did so because the CFL burned out, followed by the CFL not being bright enough, as shown in Figure 7.[4]

Figure 7. Reason for Removing a CFL* (With Precision at 90% Confidence)

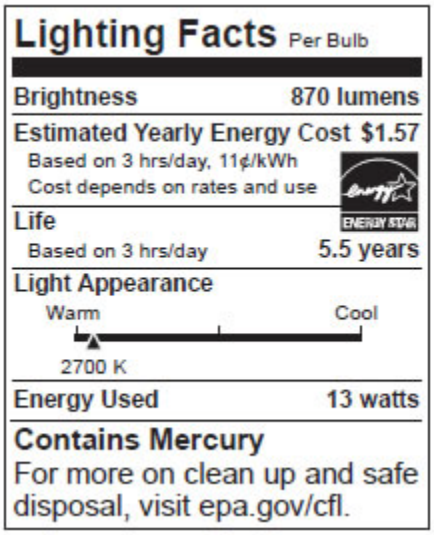


* Multiple responses
Source: DP&L Residential Lighting Telephone Survey, B16.

Besides bulbs burning out or breaking, the top complaint about CFLs was bulbs were not bright enough. Consumers want a certain brightness level for specific applications, but tend to equate bulbs wattage with brightness, and not lumens (a measure of how bright a bulb is). The issue of consumers linking wattage with brightness will be exacerbated in coming years as the Energy Independence and Security Act (EISA) legislation phases in. However, the lighting facts label (shown in Figure 8) will soon appear on light bulb packages across the nation.

[4] Multiple response question.

Figure 8. Example of Lighting Facts Label



This label seeks to aid consumers in choosing the right light bulb for their needs. If properly understood, the label will help consumers choose the best CFL for their particular needs. Sit-down focus group sessions with consumers at another utility service area found most participants thought the lighting facts label useful in helping select bulbs to buy, but believed the label did not go far enough in helping choose the best bulb for their needs. Many participants expressed concerns that people not educated on lighting terminology may have difficulty understanding all label components.

Motivation to Use CFLs

When asked why they used CFLs, 52% of respondents said they did so to save energy, followed by 25% who said to save money. Helping the environment proved to be a lesser factor, as only 4% reported this as their motivating factor for using CFLs. Other responses included:

- "They last longer."
- "Peer pressure."
- "Wanted to give them a try."
- "They came with the home."
- "They were on sale."

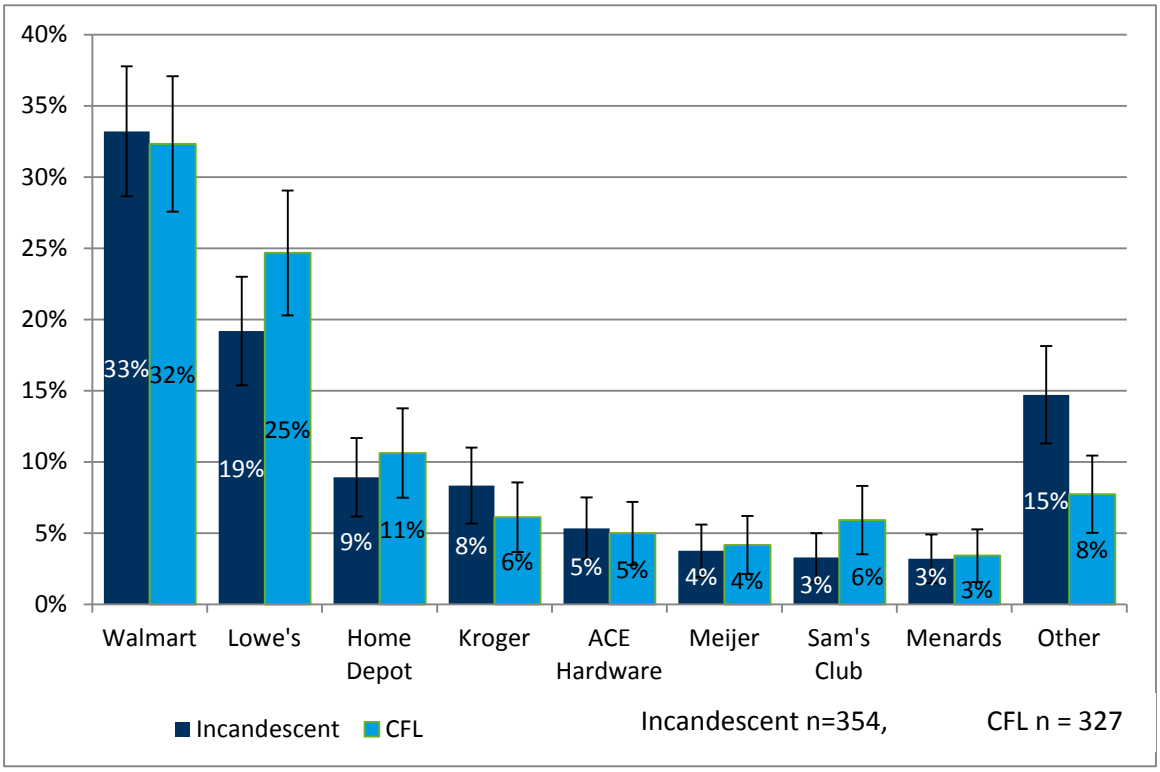
In 2010, the top motivating responses for using CFLs were:

- They save money (44%);
- They save energy (42%); and
- They help the environment (10%).

Purchasing and Disposal Habits

Respondents most commonly reported purchasing incandescent bulbs at Wal-Mart, followed by Lowe's, and Home Depot, a pattern mirrored by the most commonly reported CFL purchase outlets, as shown in Figure 9.

Figure 9. Most Likely Place to Purchase a Bulb* (With Precision at 90% Confidence)



Source: DP&L Residential Lighting Telephone Survey, C1 and C2.

In the 2010 survey results, consumers also purchased incandescent bulbs and CFLs most commonly at mass merchandise stores, followed by home improvement stores.

Eight percent of respondents said their light usage changed since installing CFLs. Reasons included:

- "Leave the light on longer." (n=6)
- "Don't have to change the bulb as often." (n=4)
- "Use less due to brightness." (n=3)

Forty-four percent of respondents reported disposing of CFLs. Among these respondents, the majority (74%) reported throwing them away. Over one-quarter (26%) reported recycling them or bringing them to a retail store for recycling. Among 56% of respondents who did not dispose of CFLs, 66% reported they would throw the bulb away. Thirty percent said they would recycle them or bring them to a retail store for recycling. Other responses included: following recommendations on the package; or researching what to do with the bulbs.

In 2010, 77% threw the bulbs away, and 22% recycled them. Sixty-two percent said they would throw them away, and 30% said they would recycle them. It seems that awareness or initiative it takes to properly dispose of a CFL has not changed much.

Table 9. CFL Disposal Actions

Action	2010	2011
Disposed of a CFL	42%	44%
Threw CFL away	77%	74%
Recycled CFL	22%	19%
Brought CFL to a retail store to recycle	0.4%	7%
Have not disposed of a CFL	58%	56%*
Would throw CFL away	62%	66%
Would recycle CFL	30%	21%
Would bring CFL to a retail store to be recycled	8%	9%

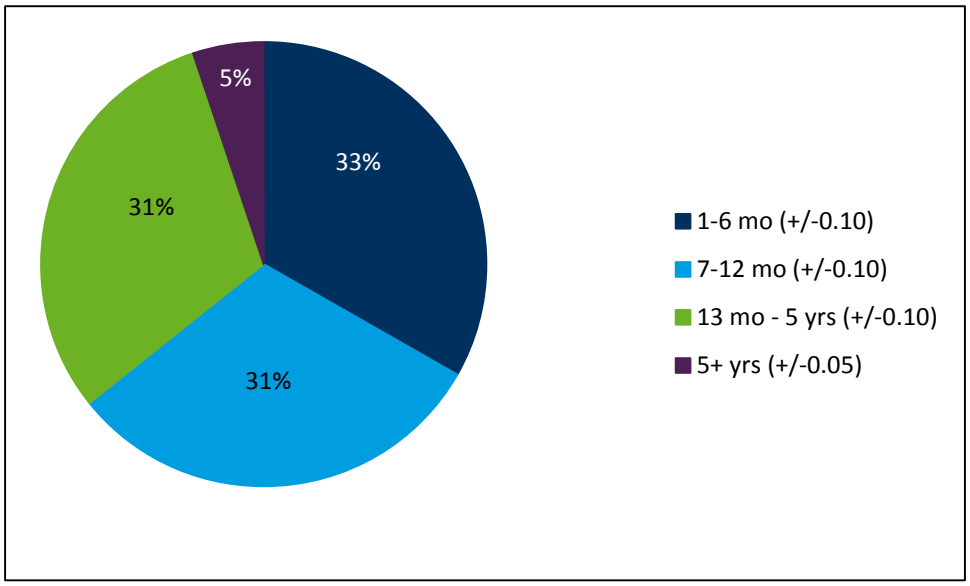
* Sub-values do not add to 100% due to "other" responses.
Source: DP&L Residential Lighting Telephone Survey, D1, D2, and D3.

LEDs and Halogens

About half of respondents (51%) were familiar with LEDs, nearly the same as 2010 respondents (50%). Among those familiar with LEDs, 23% said they currently use them and 33% said they had purchased them before.

Among those previously purchasing LEDs: about one-third (33%) first began using them one to six months ago; 31% began using them seven to 12 months ago; and 31% began using them 13 months to five years ago (as shown in Figure 10). These data indicate low LED adoption, and, among those adopting them, the majority doing so recently.

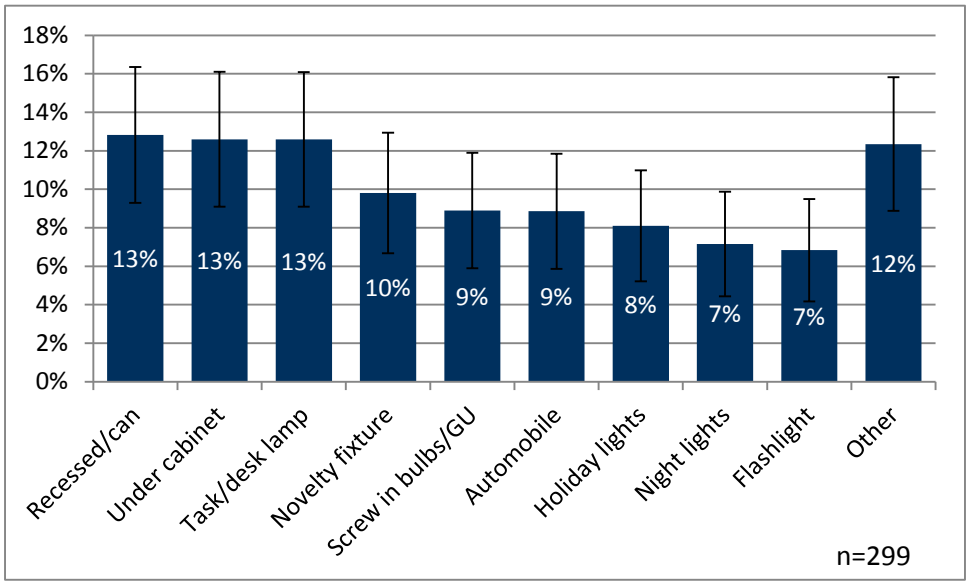
Figure 10. When did you first use an LED? (With Precision at 90% Confidence)



Source: DP&L Residential Lighting Telephone Survey, E4.

As shown in Figure 11, LEDs were most commonly installed in the following fixtures: recessed/can lighting (13%); under cabinet lighting (13%); and task/desk lamps (13%).

Figure 11. Where Respondents Installed an LED* (With Precision at 90% Confidence)

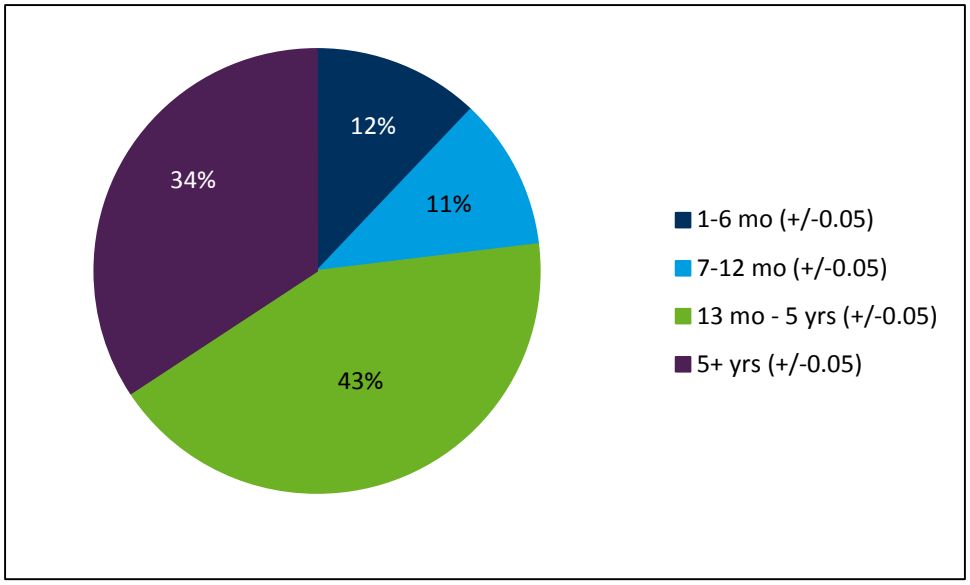


* Multiple responses
Source: DP&L Residential Lighting Telephone Survey, E6.

Over half of respondents (66%) said they were familiar with halogen bulbs, and 24% currently used halogens. Compared to LEDs, respondents were more familiar with halogens and used them more commonly. This could indicate that, if a customer chooses an energy-saving bulb other than a CFL, they may be more likely to choose a halogen over an LED.

Over half of respondents (59%) reported having purchased a halogen bulb. Among those previously purchasing halogen bulbs, the majority (77%) first purchased a halogen 13 months ago or more (as shown in Figure 12).

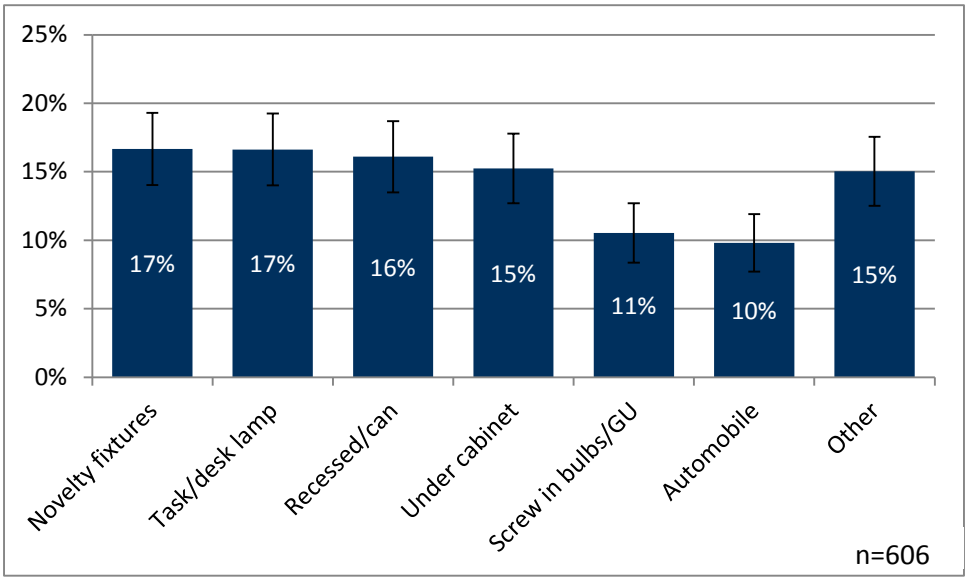
Figure 12. When did you first use a halogen bulb? (With Precision at 90% Confidence)



Source: DP&L Residential Lighting Telephone Survey, E11.

As shown in Figure 13, halogens were most commonly installed in the following fixtures: novelty fixtures (17%); task/desk lamps (17%); and recessed/can lighting (16%).

Figure 13. Where Respondents Installed a Halogen (With Precision at 90% Confidence)*



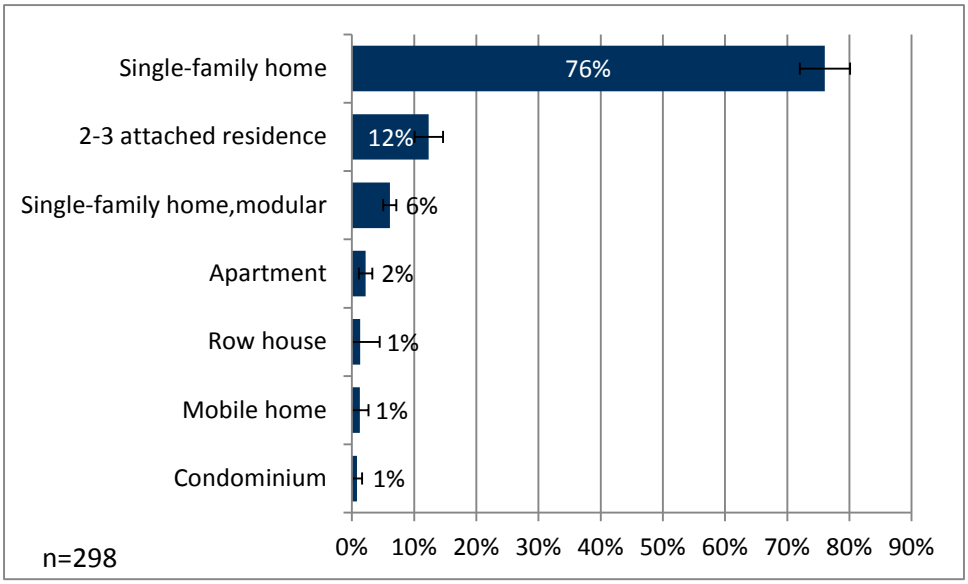
* "GU" indicates a bi-pin bayonet mount. The bulb has two parallel pins on either side and is secured in the fixture with a twist-lock.

Source: DP&L Residential Lighting Telephone Survey, E13.

Participant Survey Demographics

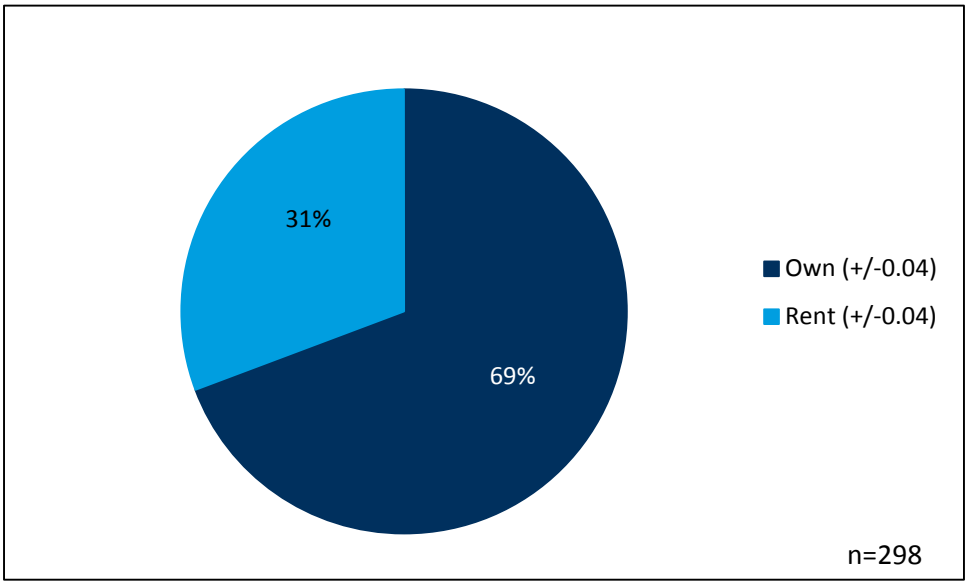
The majority of respondents live in single-family homes (76%, Figure 14) and were homeowners (69%, Figure 15).

Figure 14. Housing Type (With Precision at 90% Confidence)



Source: DP&L Residential Lighting Telephone Survey, F1.

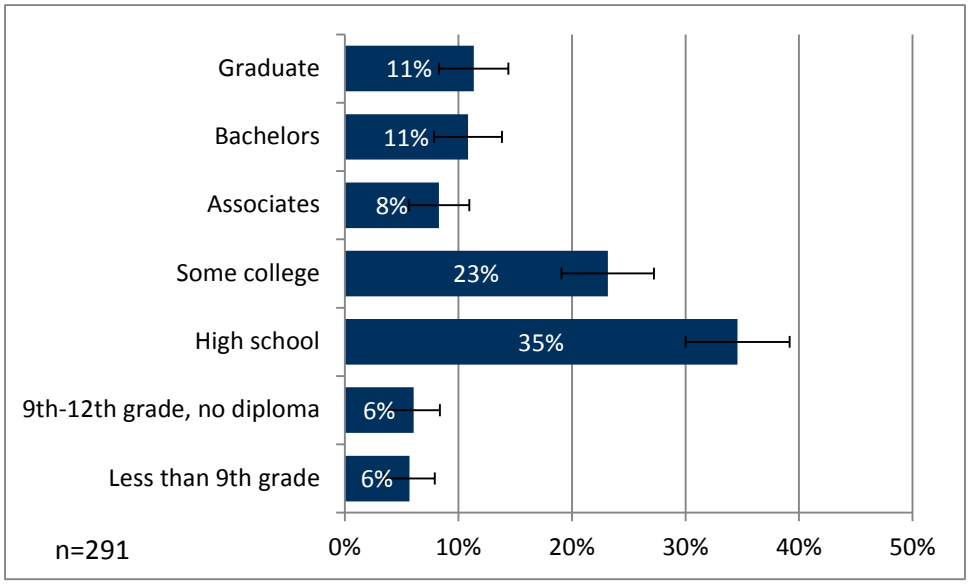
Figure 15. Own or Rent (With Precision at 90% Confidence)



Source: DP&L Residential Lighting Telephone Survey, F2.

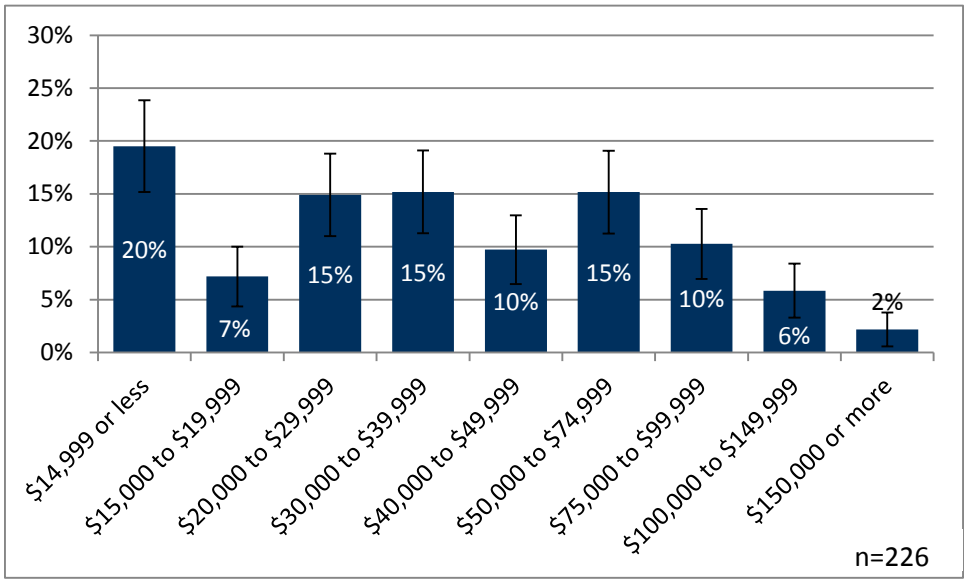
Regarding the highest education level received, 35% of respondents had finished high school, and 23% had completed some level of college (Figure 16). Over half of all respondents earned less than $50,000 per year (Figure 17).

Figure 16. Highest Level of Education (With Precision at 90% Confidence)



Source: DP&L Residential Lighting Telephone Survey, F8.

Figure 17. Pre-tax Income* (With 90% Confidence Intervals)



* Multiple responses
Source: DP&L Residential Lighting Telephone Survey, F12.

Recommendations

Given the preceding findings, Cadmus offers the following recommendations:

- DP&L should continue to advertise its program through television ads. Survey respondents reported these as the most commonly used marketing channels for

information about CFLs. This is a good means for customer awareness to continue to grow.

- Eleven percent of CFLs purchased in the last 12 months were installed in commercial settings. Commercial buildings tend to have longer operation hours and, hence, savings. DP&L should consider claiming a percentage of CFL sales under this program for the C&I prescriptive program. Specific items for consideration include:
    1. Can this be done under the current policy?
    2. How would CFL sales and energy savings be tracked between residential customers and commercial customers?
- DP&L should consider developing supplemental educational materials and point-of-purchase displays to help consumers interpret terminology used on the Lighting Facts label, and to select the appropriate bulbs for their needs. This may help consumers reporting disatisfaction with their CFL selections due to brightness issues.
- Approximately half of respondents were familiar with LEDs, which offer consumers another energy-efficiency option. Though LEDs remain cost-prohibitive for the typical consumer, prices are dropping. DP&L should continue to monitor LED retail pricing, and determine the retail price (with an utility incentive) as which LEDs become a cost-effective option for promotion.
- Proper disposal of CFLs has not changed much from 2010 to 2011. Continued education about the importance of recycling CFLs and the simplicity of the process is recommended.

RESIDENTIAL APPLIANCE RECYCLING PROGRAM

The following sections describe the ARP evaluation approach, detailed findings, and conclusions and recommendations.

Evaluation Overview and Methodology

Cadmus' 2011 ARP evaluation followed researchable questions and evaluation activities outlined in the DP&L 2010–2012 Evaluation, Measurement, and Verification Plan. Table 10 identifies key researchable evaluation questions. No process evaluation was conducted this year.

Table 10. Key Researchable Questions

Researchable Question	Activity to Support Question
What are the average energy savings associated with participating refrigerators and freezers?	• Analysis of program and secondary data sources

Detailed Evaluation Findings

The following key findings relate to the 2010 telephone survey and multivariate regression model:

- Table 11 shows the program claimed *ex ante*, verified, and adjusted gross savings. *Ex ante* savings were derived using the draft Ohio TRM. Verified measure quantities were then applied to the *ex ante* per-unit savings value to calculate the verified gross savings. We then applied unit energy consumption (UEC) estimates from the multivariate regression model, developed for the evaluation, to total verified measure quantities to calculate adjusted gross savings.

Table 11. Total Appliance Recycling Claimed and Achieved Energy Savings

Measure	Ex Ante Claimed Savings		Verified Gross Savings		Adjusted Gross Savings		
	Gross kWh	Gross kW	Gross kWh	Gross kW	Gross kWh	Gross kW	Precision at 90% Confidence
Refrigerator	4,455,488	712.4	4,455,488	712.4	3,667,339	585.5	±5%
Freezer	1,505,240	242.0	1,505,240	242.0	1,034,968	165.0	±13%
TOTAL	5,960,728	954.4	5,960,728	954.4	4,702,308	749.5	±5%

- The Cadmus regression model found adjusted per-unit annual savings of 1,133 kWh (refrigerators) and 855 kWh (freezers). The mean values in this analysis were lower than those seen in the 2010 program evaluation, primarily because the analysis used for the 2011 program captured effects of heating and cooling seasons. This was not possible in the previous evaluation, as only summer metering data were available. Winter metering data, recently collected in the Midwest, made it possible to estimate impacts of

particularly cold temperatures on units in unconditioned spaces. As expected, units operating exposed to low temperatures consumed considerably less energy than those maintained at or above room temperatures.

Data Collection Methods

Primary data collection was not conducted for the 2011 evaluation. Rather, Cadmus developed a multivariate regression model to estimate the average UEC of retired refrigerators and freezers. This evaluation used data from the 2010 participant survey and appliance characteristics from the implementer database to populate key model parameters.

Baseline Assumptions

The existing baseline assumption is: a working refrigerator or freezer, between 10 and 30 cubic feet, continuing to operate.

Impact Methodology and Findings

Summary of Program Participation

As a preliminary evaluation step, we reviewed the program implementer, JACO Environmental (JACO), participant database to test the reliability of program data, resulting in some 4,117 total participant records from January 2011 through December 2011. Some participants recycled more than one appliance through the program.

Table 12 shows distributions of refrigerators and freezers in the JACO database.

Table 12. Program Participation by Measure

Measure	Participation
Recycled Refrigerator	3,238
Recycled Freezer	1,210
TOTAL	4,448

Table 13 shows typical refrigerator and freezer configurations identified in the database.

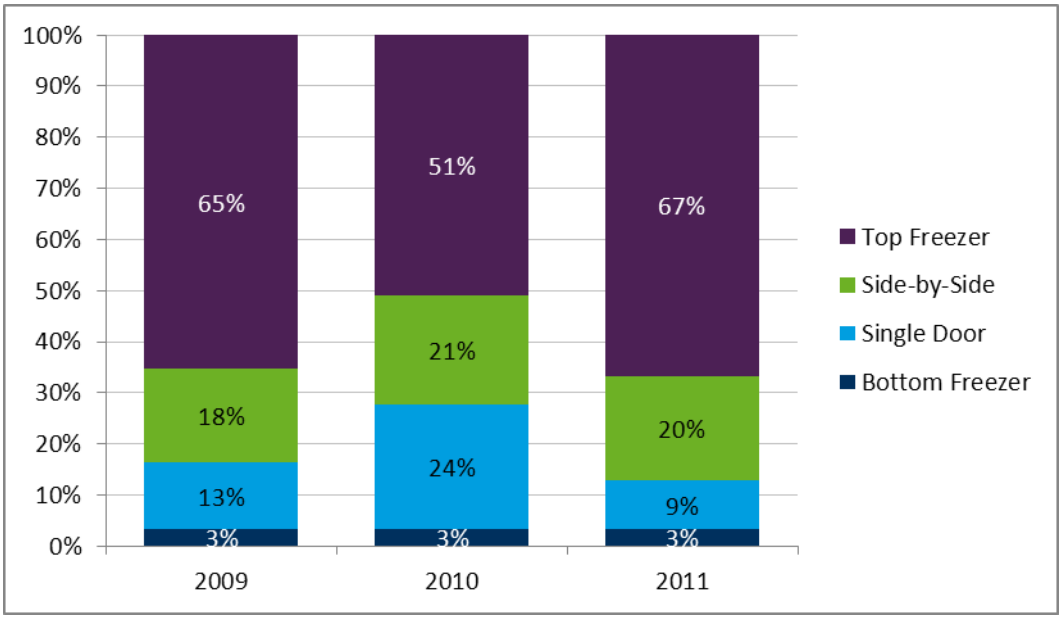
Table 13. Refrigerator and Freezer Configurations

Measure	Configuration
Refrigerator	Bottom Freezer
	Side-by-Side
	Single Door
	Top Freezer
Freezer	Chest
	Upright

As shown in Figure 18, the program realized a similar composition of units seen at the program's beginning. The 2010 program year appeared to be the outlier, with a much higher concentration of single-door units than typically seen. The 2011 program, however, appeared to follow the

typical trend seen when other appliance recycling evaluations mature, with increases in shares of units with top freezer or side-by-side configurations.

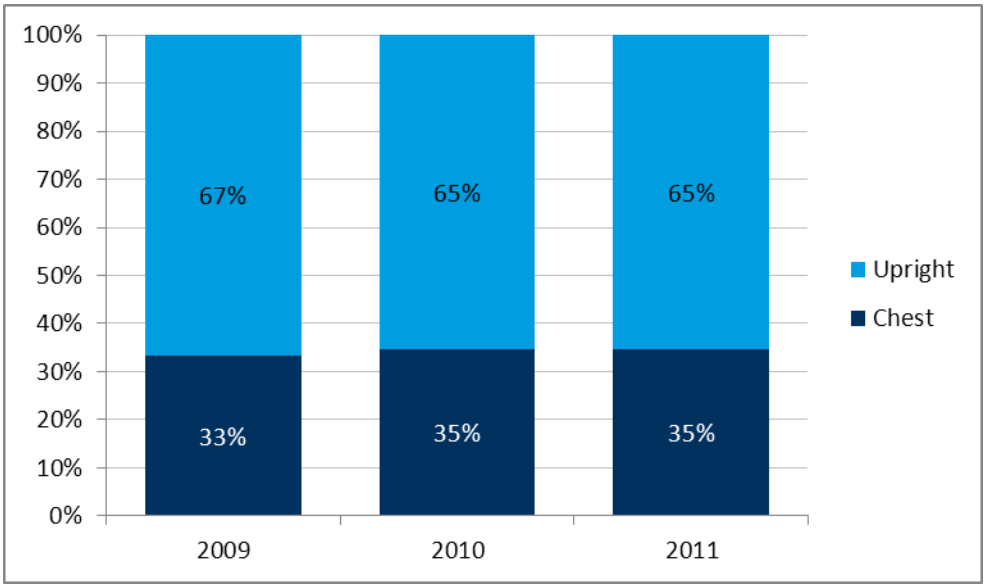
Figure 18. Refrigerator Configuration by Program Year*



* Unit configurations for previous years were categorized as described above.

Freezer configurations have not substantially changed over the program's life, as shown in Figure 19.

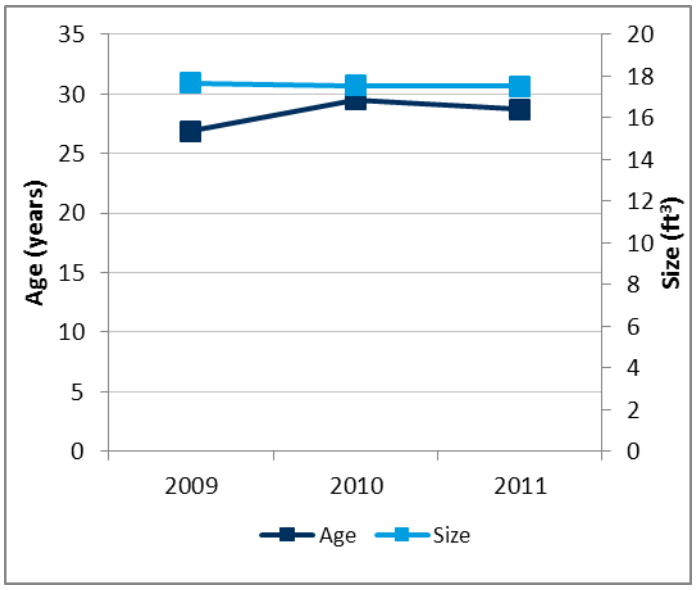
Figure 19. Freezer Configuration by Program Year*



* Unit configurations for previous years were categorized as described above.

In 2011, recycled appliances averaged 29 years old, with 18 ft3 of internal capacity. As seen in Figure 20, average appliance age and size have not changed considerably since the program's inception.

Figure 20. Appliance Age and Size by Program Year



Determination of Average Annual Gross Energy Consumption

Cadmus developed a multivariate regression model to estimate gross UEC for retired refrigerators and freezers, estimating model coefficients using an aggregated *in situ* metering[5] dataset, composed of over 400 appliances (metered as part of four California and Michigan evaluations conducted between May 2009 and April 2011).[6] Collectively, these evaluations offered a wide distribution of appliance ages, sizes, configurations, usage scenarios (primary or secondary), and climate conditions. The dataset's diverse nature provided an effective secondary data source for estimating energy savings when Ohio-specific metering could not be conducted.

For two reasons, Cadmus prefers using in-home metering data for estimating energy consumption, as opposed to the U.S. Department of Energy's (DOE) testing protocols:

- First, metering an appliance in its original location captures impacts of critical external factors on appliance energy use (such as door openings, unit locations, and weather). These factors cannot be accounted for when relying on DOE databases, which contain data on units metered under controlled conditions.

[5] *In situ* metering involves metering units in the environment in which they are typically used. This contrasts with lab testing, where units are metered under controlled conditions.

[6] Southern California Edison, Pacific Gas & Electric, San Diego Gas & Electric, DTE Energy, and Consumers Energy.

- Second, most existing DOE databases estimate energy consumption at the time of appliance manufacture, not by unit retirement.[7] Consequently, evaluations require devising and applying additional assumptions in appliance degradation. In-home metering data reflect observed usage of appliances actually participating in ARPs at the time of retirement, and as used in the homes from which they were removed.

Each observation in the aggregated dataset represented an appliance metered for a minimum of 10 days, in a manner consistent with its preprogramed use (e.g., in the same location, cooling food, used by the home's occupants). Cadmus mapped weather data to participating homes' ZIP code-specific National Oceanic and Atmospheric Administration (NOAA) weather stations, and collected additional on-site data on relevant appliance characteristics to ensure data consistency with administrator tracking databases.

Cadmus' approach to model specification weighed the impacts of including alternative independent variables, using a variety of criteria. The model specification process sought to include variables adequately reflecting program design, while maintaining model simplicity. For each set of estimated parameters, the analysis assessed variance inflation factors (VIFs), adjusted R^2s, and measures of statistical significance.[8]

Cadmus used the following modeling considerations in the specification process:

- **Using an ordinary least squares method to estimate model parameters**. Data were approximately distributed normally, an important condition for the analysis. An examination of the final model's residual plot supported this hypothesis of normality.
- **Considering all relevant appliance characteristics for inclusion in the model.** These included: configuration, defrost type, age, size, and (in the case of refrigerators) primary or secondary designations. Age was considered as: a continuous variable (capturing degradation); dummy variables for decades of manufacture (to approximate vintages); and a dummy variable for units manufactured before enactment of 1990's National Appliance Energy Conservation Act (NAECA), which required new refrigerators and freezers to be more energy efficient.
- **Considering two environmental factors in the *in situ* model.** In addition to terms pertaining to appliance characteristics, the analysis considered two environmental factors in the *in situ* model: cooling/heating degree-days (CDD/HDD); and primary or secondary appliances. Appliances in warmer climate zones were assumed to consume greater energy—as were primary appliances—due to more frequent door openings.
- **Including interaction terms only due to theoretical importance to the model.** The model only included one interaction term, between units located in garages and CDDs, to account for additional impacts of warmer temperatures on refrigerators in unconditioned spaces.

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7 The California Energy Commission maintains one such database, which can be accessed online at: http://www.energy.ca.gov/appliances/database/historical_excel_files/Refrigeration/

8 VIFs, R^2s, and statistical significance are tests of the validity of a regression model.

- **Considering transformations of explanatory variables**. These included logged and squared values, based on theoretical and empirical grounds.

Cadmus used regression models to estimate consumption for refrigerators and freezers (Table 15). Each independent variable's coefficient indicated the influence of that variable on daily consumption, holding all other variables constant. A positive coefficient indicated an upward influence on consumption; a negative coefficient indicated a downward effect.

The coefficient's value indicated the marginal impact of a one-point increase in the independent variable on the UEC. For instance, a 1 cubic foot increase in refrigerator size resulted in a 0.083 kWh increase in daily consumption. In the case of dummy variables, the value of the coefficient represented the difference in consumption, if the given condition was true. For example, in the refrigerator model, the coefficient for the variable indicating a refrigerator as a primary unit was 0.642, indicating, all else being equal, a primary refrigerator consumed 0.642 kWh per day more than a secondary unit.

Refrigerator Regression Model

Table 14 details the final model specification used to estimate energy consumption of participating refrigerators.

Table 14. Refrigerator UEC Regression Model Estimates (Dependent Variable = Average Daily kWh, Adj. R^2 = 0.29)

Independent Variables	Coefficient	p-Value	VIF
Intercept	0.769	<.0001	0.0
Age (years)	0.008	0.016	2.0
Dummy: Manufactured Pre-1990	0.827	<.0001	1.7
Size (ft.^{3})	0.083	<.0001	1.9
Dummy: Single Door	-1.316	<.0001	1.3
Dummy: Side-by-Side	0.862	<.0001	1.6
Interaction: Unconditioned Space x CDDs	0.031	<.0001	1.3
Interaction: Unconditioned Space x HDDs	-0.049	<.0001	1.2
Dummy: Primary	0.642	<.0001	1.5

Results indicated:

1. Older refrigerators experienced higher consumption due to year-on-year degradation.
2. Refrigerators manufactured before the 1990 NAECA standard consumed more energy.
3. Larger refrigerators consumed more energy.
4. Single-door units consumed less energy, as these units typically do not have full freezers.
5. Side-by-side refrigerators experienced higher consumption due to greater exposure to outside air when opened, and due to through-door features, common in these units.
6. Primary appliances experienced higher consumption due to increased usage.

7. At higher temperatures, refrigerators in unconditioned spaces consumed more energy.
8. At colder temperatures, refrigerators in unconditioned spaces consumed less energy.

Freezer Regression Model

Table 15 details: final model specifications used to estimate energy consumption of participating freezers; and model results.

Table 15. Freezer UEC Regression Model Estimates (Dependent Variable = Average Daily kWh, Adj. R^2 = 0.47)

Independent Variables	Coefficient	p-Value	VIF
Intercept	-0.372	0.043	0.0
Age (years)	0.036	<.0001	2.0
Dummy: Unit Manufactured Pre-1990	0.632	<.0001	2.1
Size ($ft.^3$)	0.107	<.0001	1.2
Dummy: Chest Freezer	-0.293	<.0001	1.2
Interaction: Unconditioned Space x CDDs	0.047	<.0001	1.1
Interaction: Unconditioned Space x HDDs	-0.052	<.0001	1.0

The results indicate:

1. Older freezers experienced higher consumption due to year-on-year degradation.
2. Freezers manufactured before the 1990 NAECA standard consumed more energy.
3. Larger freezers consumed more energy.
4. Chest freezers consumed less energy than upright units, due to reduced heat infiltration from door openings in these units.
5. At higher temperatures, freezers in unconditioned spaces consumed more energy.
6. At colder temperatures, freezers in unconditioned spaces consumed less energy.

Extrapolation

After estimating the final regression models, Cadmus analyzed the corresponding characteristics (the independent variables) for participating appliances (as captured in the JACO database). Table 16 summarizes program averages or proportions for each independent variable.

Table 16. 2009–2010 Participant Mean Explanatory Variables*

Appliance	Independent Variables	Participant Population Mean Value
Refrigerator	Age (years)	27.84
	Dummy: Manufactured Pre-1990	0.76
	Size (ft.3)	17.85
	Dummy: Single Door	0.06
	Dummy: Side-by-Side	0.20
	Interaction: Unconditioned Space x CDDs	1.02
	Interaction: Unconditioned Space x HDDs	5.62
	Dummy: Primary	0.51
Freezer	Age (years)	31.10
	Dummy: Unit Manufactured Pre-1990	0.85
	Size (ft.3)	16.63
	Dummy: Chest Freezer	0.34
	Interaction: Unconditioned Space x CDDs	1.31
	Interaction: Unconditioned Space x HDDs	7.39

* CDDs/HDDs are weighted average CDDs/HDDs from TMY3 data for weather stations mapped to participating appliance ZIP codes. TMY3 is a typical meteorological year, using median daily values for a variety of weather data collected from 1991–2005.

For example, using values from Table 15 and Table 16, the estimated annual UEC for freezers was calculated as:[9]

$$Freezer\ UEC = 365.25\ days * (-0.372 + 0.036 * [31.10\ years\ old] + 0.632 * [85\%\ units\ manufactured\ pre - 1990] + 0.107 * 16.63\ ft.3 - 0.293 * 34\%\ units\ that\ are\ chest\ freezers + 0.047 * 1.31\ Unconditioned\ CDDs - 0.052 * 7.39\ Unconditioned\ HDDs = 965\ kWh/year$$

Figure 21, below, compares distributions of estimated UEC values for refrigerators and freezers.

[9] This equation illustrates the inputs, but Cadmus' analysis took a slightly different approach to calculating average UECs, using the regression coefficients to predict an average daily UEC for each unit in the administrator tracking database. The annualized average of these predictions represented the average UEC for the participant population during the program period. This approach ensured the resulting UEC would be based on specific units recycled through DP&L's program. The two approaches would be mathematically identical if the tracking database was 100% complete. Due to rare instances of missing data, results from the two approaches may differ slightly.

Figure 21. 2009–2010 Distribution of Estimated Annual UECs by Appliance Type

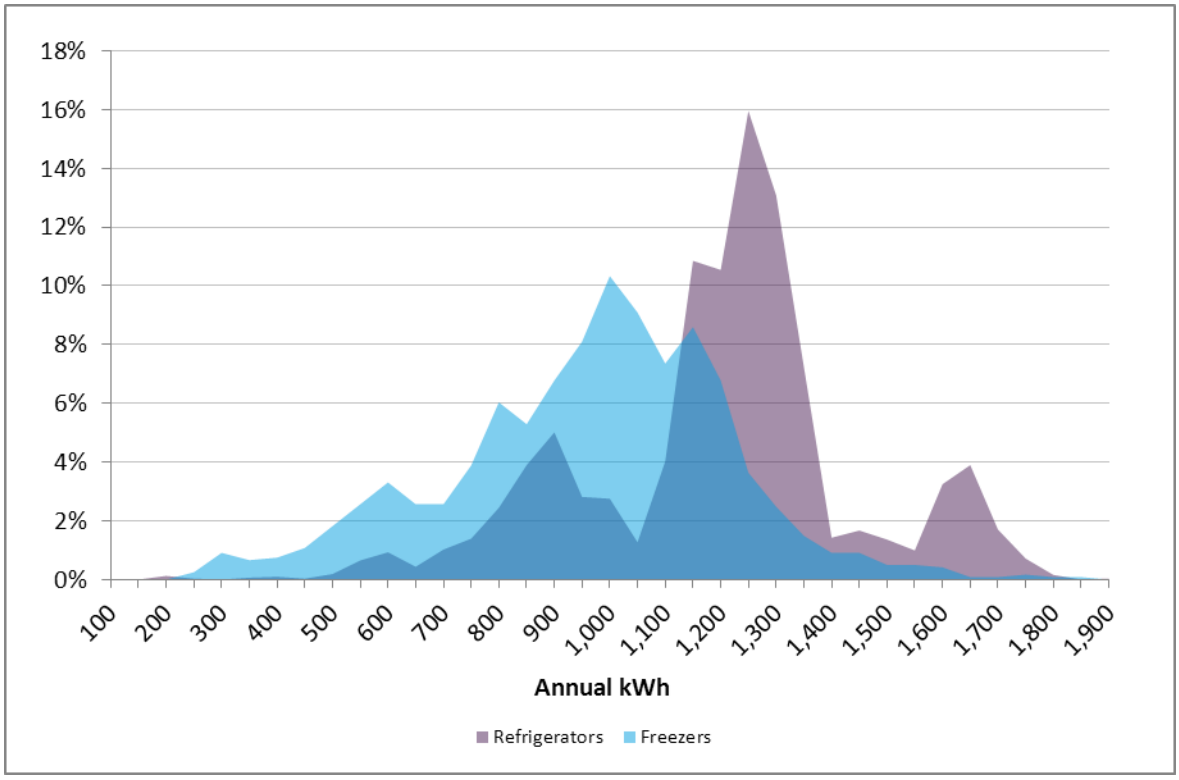


Table 17 presents estimated per-unit average annual energy consumption for refrigerators and freezers recycled by DP&L in 2011. The next section describes how we adjusted these estimates to arrive at gross per-unit saving estimates for participant refrigerators and freezers.

Table 17. Estimate of Per-Unit Annual Energy Consumption

Appliance	*Ex Ante* Annual UEC (kWh/year)	*Ex Post* Annual UEC (kWh/year)	Precision at 90% Confidence Interval
Refrigerators	1,376	1,200	±2%
Freezers	1,244	965	±4%

Cadmus recommends an additional adjustment, applying a part-use factor to account for units not plugged in year-round. This is discussed in further detail in the Determination of Gross Savings section, below.

Mean values in this analysis were lower than those seen in the 2010 program evaluation, largely because the analysis used for the 2011 program captured effects for both heating and cooling seasons. This was not possible in the previous evaluation, as only summer metering data were available. Winter metering data recently collected in Michigan made it possible to estimate the impact of particularly cold temperatures on units in unconditioned spaces. As expected, units operating exposed to low temperatures consumed considerably less energy than those maintained at or above room temperatures.

Applying the Part Use Factor

To determine average per-unit gross energy savings for refrigerators and freezers, Cadmus calculated and applied the program's part-use factor, which accounted for participating appliances not plugged in year-round prior to participation. Retirement of appliances not previously in operation or operated for only part of the year would not yield the full year of energy savings presented in Table 17. We analyzed data from the 2010 participant survey to calculate part-use factors, which were used in the following three participant categories:

- Participating units **not used for at least one full year** prior to being recycled were assigned a part-use factor of **0**. As the unit did not consume electricity, no savings were generated by its retirement.
- Recycled units **operating the full year** prior to participation were assigned a part-use factor of **1**.
- To determine part-use factors for units used only a portion of the previous year, we divided the average number of months such units were used by 12. The part-use factor for these appliances ranged between 0 and 1.

In 2010, participants indicating they did not run the appliance for the full year estimated their refrigerator was used an average seven months a year; freezers averaged two months a year. Final, part-use adjusted gross savings resulted from the weighted average of the three usage scenarios outlined above.

Table 18 illustrates how we applied part-use factors for each of the three categories to determine average per-unit gross annual energy savings for refrigerators and freezers.

Table 18. Part-Use Adjusted Gross Per-USE for Refrigerators and Freezers

	Refrigerators			Freezers		
Operational Status	Percent of Total Recycled Refrigerator	Average Part-Use Factor	Part-Use Adjusted Energy Savings (kWh/Year)	Percent of Total Recycled Freezers	Average Part-Use Factor	Part-Use Adjusted Energy Savings (kWh/Year)
Not Running	3%	0	0	8%	0	0
Running Part Time	6%	0.58	700	4%	0.17	161
Running All Time	91%	1.00	1,200	88%	1.00	965
TOTAL	100%	94.4%	1,133	100%	88.7%	855

Based on the adjusted, part-use, per-unit gross annual energy savings presented in Table 18, we determined program-wide annual gross energy savings generated by DP&L's participation in 2011, as presented in Table 19.

Table 19. 2010 Adjusted Part-Use Gross Annual Energy Savings

Appliance	Adjusted Gross Energy Savings (kWh/Year)	Adjusted Gross Demand Savings (kW/Year)*	2011 Participation	Total Program Gross Savings (kWh/Year)	Total Program Gross Demand (kW/Year)	Precision at 90% Confidence
Refrigerator	1,133	0.18	3,238	3,667,339	584.5	±5%
Freezer	855	0.14	1,210	1,034,968	165	±13%
TOTAL			4,448	4,702,308	749.5	±5%

*We derived refrigerator and freezer summer coincident peak demand savings by applying the draft Ohio TRM formula. For the change in kWh input, we used results from this evaluation.

Recommendations

Given the preceding findings, Cadmus offers the following recommendation:

- DP&L should consider updating its per-unit assumptions to reflect this evaluation in order to ensure that planning estimates of program savings are in line with evaluated savings.

RESIDENTIAL LOW-INCOME PROGRAM

The following sections describe the evaluation approach, detailed findings, and conclusions and recommendations for the residential low-income weatherization program.

Evaluation Overview and Methodology

Table 20 identifies key researchable evaluation questions provided in the evaluation plan.

Table 20. 2011 Key Researchable Questions

Researchable Question	Discussion	Activity to Support Question
What gross electric savings and demand reductions were generated by the program?	The amount of gross electric savings and demand reductions will help create a business case to continue running the program, and will be useful for planning future program designs.	• Program database review • Engineering analysis • Participant surveys
What barriers exist to program delivery? What changes could be made to improve program performance?	The evaluation can elicit stakeholder opinions and provide valuable insights to refinements needed in the program design and/or delivery.	• Program stakeholder interviews
Are program participants satisfied with the weatherization services provided? Were all measures installed? Are participants experiencing any decrease in their bills? What other benefits, such as health improvements, have they experienced?	The evaluation will seek to determine participant satisfaction, verify measure installations, and assess any non-energy benefits determined through the participant survey.	• Participant surveys • Site visits
Are customers aware that DP&L is funding a portion of weatherization services?	Participants will experience statewide services. It may be in DP&L's best interest for their customers to understand that DP&L is funding part of the project.	• Participant surveys • Program stakeholder interviews
How effective has the program been in recruiting and training weatherization contractors?	Having an adequate supply of qualified contractors minimizes change orders, disputes, and quality control issues. With ramped-up federal funding, weatherization contractors are in short supply.	• Program stakeholder interviews
What are the barriers for community action agencies using DP&L energy funds?	How does DP&L funding compare to other funding sources? Are there administrative or other barriers preventing community action agencies from using these funds?	• Program stakeholder interviews

Detailed Evaluation Findings

The following key findings relate to the impact results, telephone surveys, and site visits:

- Final total adjusted gross savings of 1,072,132 annual kWh and 134.0 kW (as shown in Table 21). The program kWh realization rate is 107%, relative to *ex ante* totals. However, the program did not achieve its 2011 program goal of 1,705,147 annual kWh savings.

Table 21. Residential Low-income Weatherization Claimed and Achieved Energy Savings

Measure*	*Ex Ante* Claimed Savings		Verified Gross Savings**		Adjusted Gross Savings***		
	Gross kWh	Gross kW	Gross kWh	Gross kW	Gross kWh	Gross kW	Precision at 90% Confidence
CFLs	299,363	35.6	347,327	41.2	347,327	41.2	±6%
Photo Cell for Light	703	0.0	703	0.0	703	0.0	N/A
Refrigerator Replacement	297,680	45.5	297,680	45.5	381,555	66.8	±10%
Freezer Replacement	70,568	10.6	70,568	10.6	70,568	10.6	±10%
Insulation (Attic/Wall/Foundation)	202,379	0.9	202,379	0.9	202,379	0.9	±10%
Air Sealing / CFM Reduction	19,911	0.1	19,911	0.1	19,911	0.1	±10%
Energy-efficient Showerhead	10,710	1.2	10,710	1.2	3,270	0.4	±10%
Faucet Aerator	2,437	0.3	2,437	0.3	273	0.0	±4%
Water Heater Wrap	395	0.1	395	0.1	705	0.1	±12%
Central AC Replacement	524	0.4	524	0.4	524	0.4	±10%
Heat Pump Replacement	0	0.0	0	0.0	0	0.0	±10%
Dryer Replacement	130	4.3	130	4.3	130	4.3	±10%
Dishwasher Replacement	51	1.7	51	1.7	51	1.7	±10%
Ductless Mini-Split	96,600	3.2	96,600	3.2	44,736	7.5	±14%
TOTAL	1,001,451	103.9	1,049,415	109.6	1,072,132	134.1	±5%

* Additional measures (e.g., water heater replacement, stove replacement) and repairs paid for by DP&L as health and safety upgrades, for which savings were not assigned.

- Seven percent of CFLs were reported missing by participants, either because they were not received or were removed (as shown in Table 33). The measure-level CFL installation rate (including reinstallations) reported through participant surveys (94%) was above the 81% draft Ohio TRM in service rate for CFLs directly installed by the program.
- Nearly three-quarters of respondents (72%) remembered agency staff providing energy-savings tips. The most frequently reported energy-saving strategies remembered included turning off lights in empty rooms and turning down thermostats or furnaces (as shown in Table 24)
- Approximately 85% of respondents felt more comfortable in their homes following weatherization work (as shown in Table 28).

- Ninety-six percent of respondents were "very satisfied" or "somewhat satisfied" with the program services, while only two respondents expressed dissatisfaction (as shown in Table 30).

Data Collection Methods

In addressing program energy-saving impacts, Cadmus primarily relied on DP&L participant tracking data, along with savings algorithms provided in the draft Ohio TRM. Additionally, Cadmus conducted five stakeholder interviews, 120 participant phone surveys, and 25 site visits to evaluate program processes, determine participant benefits, and verify measure installations.

Program Database Review

Participant and installation information was provided by DP&L in the Ohio Partners for Affordable Energy's (OPAE's) C-3 data collection forms, which were compiled by individual community action agencies (agencies) on a quarterly basis. Data included participant contact information, limited measure-level data, savings estimates, and cost information for each site served by the program.

Stakeholder Interviews

Cadmus conducted interviews with: DP&L; three of the eight local agencies implementing the program; and OPAE, which serves as an advocate and intermediary between the state, agencies, and utilities.

Telephone Survey

In November 2011, Cadmus conducted a phone survey of 120 participants, and recruited customers for site visits. The participant survey and sample were developed by Cadmus, and were implemented by Discovery Research.

Table 22 provides details regarding the telephone survey's planned and achieved completes.

Table 22. Participant Telephone Survey Diagnostics

	Quantity
Total Participants	472
Eligible Participants in Call List	420
Screened out due to change in occupancy or bad phone number	5
Completed Surveys	120
Number of Calls Required to Achieve Sample	1,010
Response Rate (RR1)	28%
Cooperation Rate (COOP1)	12%
Sample Size Goal	120

Cadmus pulled a sample of participants from the entire participant population available in November 2011. The database contained 472 participants. Analysis sought a target of 120 completed survey responses, which would achieve at least 10% precision at the 90% confidence level, after employing the finite population correction factor. Cadmus sought a slightly larger sample than necessary to account for more responses, covering a broader range of different measures installed through the program.

Participant surveys were fielded in November 2011 to meet the required evaluation timeline. Therefore, impacts from insulation or reduced air infiltration in winter months had not yet been fully experienced by program participants.

On-Site Data Collection

Cadmus conducted site visit recruitment after completing telephone surveys, ultimately performing 25 on-site visits for participants expressing interest during the survey calls. The site visits sought to perform measure verification, collect anecdotal evidence about program delivery, and refine our knowledge of the implementation effort. Cadmus surveyors walked through participating residences, and collected data on energy-savings measures paid for by DP&L.

Impact Methodology

Ex ante claimed savings were calculated using a range of sources, primarily based on the draft Ohio TRM, but also including engineering algorithms from Cadmus' evaluation work. Appendix D shows sources used for each measure.

Verified gross savings were consistent with *ex ante* savings for all measures other than CFLs and night-lights. The CFL installation rate (94%; see Table 33 for calculations) was based on telephone survey results instead of the 81% draft Ohio TRM's in-service rate.

For many measures, adjusted gross savings were the same as verified gross savings. Table 23 shows sources used where adjusted gross savings differed from verified gross savings.

Table 23. Sources for Adjusted Gross Savings Calculations

Measure	Source
Refrigerator Replacement	Draft Ohio TRM Joint Objections and Comments.
Energy-efficient Showerhead	Draft Ohio TRM Joint Objections and Comments.
Faucet Aerator	Draft Ohio TRM Joint Objections and Comments.
Water Heater Wrap	Internal engineering algorithms from other evaluations.
Ductless Mini-Split	Pennsylvania TRM.

Specific adjustments made in estimating adjusted gross savings can be found in Appendix D.

Program Database Findings

While detailed information for certain measures was provided (e.g., CFL quantities by wattage), the C-3 form did not provide other information necessary for estimating savings and for assisting with site visits. This information included:

- Pre and post R-values of existing conditions and efficiency upgrades (i.e., wall insulation);
- A list of specific measures contributing to cubic feet per minute (CFM) reduction; and
- Measure details for many non-standard measures listed under "Other Measure," including: data surrounding installations of heat pumps, ductless mini-splits, water heaters, clothes dryers, and dishwashers.

Much of this information was collected through audit forms by individual agencies, though the C-3 forms provided to DP&L did not contain these data.

A new version of the C-3 reporting form (developed in mid-2010) was fully employed by agencies in 2011. Many essential data were collected through the agencies work and through some follow-up work by DP&L staff. However, we identified some inconsistencies, including one customer listed with gas heating fuel actually having baseboard heating equipment, and some cases where home square footage was entered in place of heating and cooling efficiencies. This may have occurred due to multiple parties attempting to compile program data at different times. Cadmus will work with DP&L and OPAE at the start of the 2012 program year to confirm all necessary inputs are being collected.

Measure-Specific Findings

Appendix B provides a list of energy-saving measures (and quantities) installed through the program.

A series of measures paid for by DP&L were installed in homes with gas heating or water heating, thus no electric savings were reported. For homes receiving insulation, only electric heating savings were calculated for insulation installed in electrically-heated homes (174 out of 216 total homes receiving insulation). Electric cooling savings were reported for 17 homes with central air conditioning.

Similarly, we only calculated savings for CFM reductions if the home had electric heating or central air conditioning (58 homes out of 85 total homes). Additionally, some water heating measures were installed in homes where gas water heating was reported; electric savings were only claimed for 21 energy-efficient showerheads and 39 faucet aerators, out of the totals reported above.

Process Findings

The process evaluation section presents key findings by topic areas from each of the different evaluation activities.

Program Goals and Objectives

Agencies described the program in terms of two main goals:

- To serve as many people as possible; and
- To ensure each household would save as much energy as possible.

One DP&L objective in 2011 was to secure greater program participation, thus realizing higher electric savings. A significant improvement from 2010 has been an increase in agency production and spending of DP&L funding. In 2011, approximately 93% of a total allocated program budget was spent, compared to 2010 expenditures, where only 38% of a total program budget was used. This likely resulted from American Recovery and Reinvestment Act (Recovery Act) funding, depleted around mid-2011, as well as a concerted effort on the part of the agencies to also prioritize utility funding.

Program Delivery

Program Overview and Design

DP&L's low-income weatherization program is delivered through the same infrastructure and under the same rules as the Ohio Home Weatherization Assistance Program (HWAP), leveraging state and federal funding sources and local delivery systems. Within DP&L's service territory, eight community action agencies implement the program. OPAE manages the program and agencies, and also serves as a liaison between these agencies, the utilities, and the state (i.e., Ohio Department of Development [DOD]).

Budget Constraints

Agencies reported two budget-related challenges in implementing DP&L's portion of the weatherization program: the per-home spending limit and the lack of start-up funds at the program year's beginning. One agency reported the $5,000 per home spending limit often limited the agency's ability to install CFLs, refrigerators, and freezers, once costs for weatherization measures had been spent. Another agency explained it has been difficult to cover costs at the program year's beginning without start-up money, as DP&L provides reimbursement after receiving invoices for completed work.

Delivery Changes

One agency reported starting to perform water heater replacements through DP&L this year. They indicated receiving permission to replace old water heaters that did not function or had rusted-out bottoms.

Another agency reported weatherizing more apartment complexes than in previous years, partly due to Recovery Act funding. In the absence of these additional funds, the agency said it will attempt to complete one apartment complex each year.

Recovery Act Funding Implications

The influx of Recovery Act funds created challenges for agencies spending DP&L dollars. First, as Recovery Act funds had to be fully spent by March 31, 2012, they had priority over other funding sources. While this certainly interfered with how DP&L funds were used in 2010 (resulting in unspent dollars and lower-than-expected production), agencies did a better job of spending DP&L funds in 2011: nearly all allocated funds were spent (93%), and production levels increased substantially.

In the 2012 program year, federal dollars that usually provide for weatherization will be drastically reduced in Ohio. With reduced federal funding and exhausted Recovery Act funding, utility funding will take a more central role for agencies delivering the program.

Additionally, DP&L (and other utility) funding will serve to help retain agency staff and weatherization workers hired and trained over the last three years. Already, agencies have started reducing staff, and plan to hire contractors to perform weatherization, rather than maintaining an in-house crew.

Agency Spending and DP&L Funding

Two agencies interviewed expressed little difficulty in juggling multiple funding sources in the 2011 program year.

Agencies reported receiving additional funding from OPAE at multiple points in the year, as existing funds had been spent. OPAE reallocates funds distributed to agencies based on production. The agencies were appreciative of OPAE's responsiveness to these requests, as it allowed agencies to continue serving customers and to increase production beyond initially projected levels.

One agency indicated it did not check refrigerators during home inspections, nor offered refrigerator replacements. This agency would be open to replacing refrigerators if a budget share was earmarked for this, but said refrigerators currently were not a priority in the agency's "whole house" approach.

Invoicing: CFM Reduction and Energy Education

OPAE explained CFM reduction invoicing had not been standardized; each agency could invoice based on itemized air sealing measures, or charge based on air-flow reduction. OPAE encouraged agencies to invoice based on air-flow reduction, but did not want to mandate a single method. Only one agency charged DP&L for CFM reduction, and only when completing insulation and air sealing on a home.

Agencies used different approaches to charging DP&L for energy education. Two agencies reported providing energy-education handouts to customers, but billed that service to HWAP. The third agency simply provided energy education tips verbally during a home inspection, and did not charge labor costs. Based on a review of the program database, two agencies appeared to charge DP&L $15 per person for consumer education; Cadmus did not interview these agencies.

Communication

All three agencies reported working directly with OPAE and having little (if any) direct contact with DP&L. The agencies added they did not see a need for direct communication with DP&L; the current communication structure worked well for them. DP&L also reported little interaction with the agencies, but said it wishes the agencies to know they are welcome to contact the utility directly with questions at any time.

OPAE reported being frequently in touch with DP&L, and was happy with DP&L's level of involvement in administering the program. OPAE said DP&L staff did an exceptional job and were always eager to help. One interviewee remarked DP&L staff members were very knowledgeable about the program.

Agency Training and Certification

Agencies reported their staff participated in required training sessions on multiple topics, such as: general weatherization, base load measures, heating units, and inspections. Staff had to be re-certified every three years, but one agency also had staff attend monthly courses on special topics. Training could be provided by the agency, led by hardware store staff, or hosted by COAD (Corporation for Ohio Appalachian Development) at the facility where state training requirements were fulfilled. OPAE emphasized it is particularly important for implementers to be trained how to weatherize mobile homes. Low-income households in Ohio using electric heating primarily are mobile homes and multifamily complexes; so implementers must be aware how the weatherization approach for mobile homes differs from that for other types of housing stock.

Quality Assurance and Control

The state DOD monitored and inspected approximately 5% of completed weatherization projects. Each project also had multiple points of review through agency staff, including: assessment of work completed in the field; and review of paper documentation at an administrative level. Additionally, OPAE field staff performed inspections of agency files, mostly reviewing data collection, invoicing, and other administrative issues.

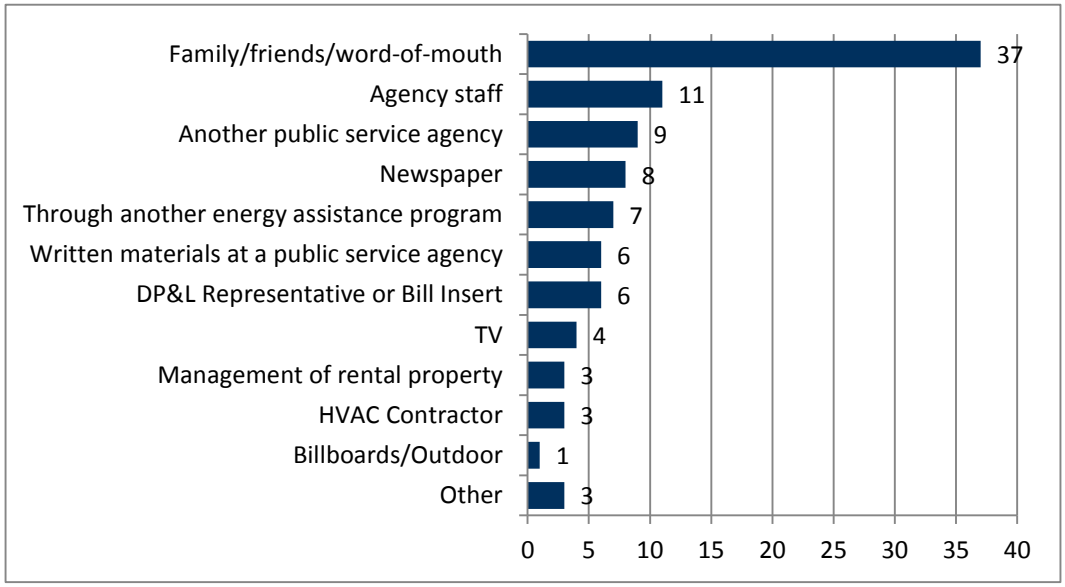
Participant Telephone Survey Findings

To inform the 2011 process and impact evaluations, we conducted a participant survey. For ease of reading, we removed "don't know" and "refused" responses from analysis, unless otherwise specified. The following sections provide findings.

Participant Awareness

Over one-third of respondents (37%) heard about the program by word-of-mouth, as shown in Figure 22.

Figure 22. Residential Low-Income Marketing Channels (n=98)



Source: Low-Income Participant Survey, A1

We asked participants if they knew DP&L had paid for part of the weatherization services, and 37% responded affirmatively. While this percentage is higher than the 29% reported in 2010, the increase does not amount to a statistically significant difference (p-value = 0.314).

Take-Back

The survey asked participants several questions designed to identify take-back effects, including changes in usage patterns, numbers of occupants, or household activities. Only 5% of respondents reported increasing temperature settings on their thermostats, and 35% of respondents reported decreasing the temperature settings. Nearly all respondents indicated no change in the number of people present in their homes, or in the number of rooms used since

work was performed. Only 3% of respondents had family or roommates move in, and only 5% reported anyone moving out of the home. Similarly, only 4% reported using more rooms, and 3% said they used fewer rooms once the work was completed.

Energy Education

Nearly three-quarters of respondents (72%) remembered agency staff providing energy-savings tips, and over two-thirds (65%) of respondents recalled receiving a booklet or pamphlet with information on how to save energy. Of those who reported receiving energy-savings verbally or in writing, 76% said they had implemented some tips.

Table 24 lists the most common energy-saving tips respondents put into practice.

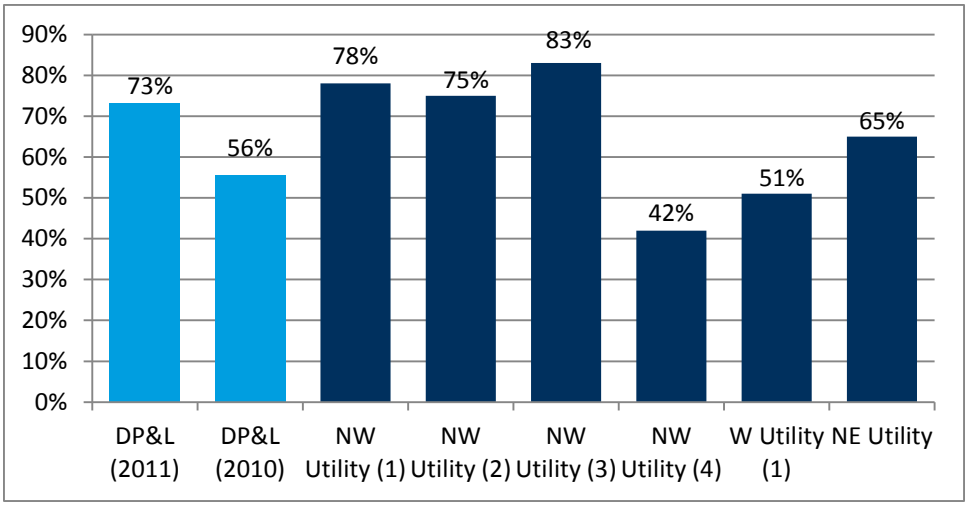
Table 24. Most Frequently Claimed Energy-Saving Tips (n=72)

Energy Saving Tip	Frequency	Percent	Precision at 90% Confidence
Turns Lights Off When not in Use	22	31%	±9%
Adjust Heating	18	25%	±9%
Use Energy Efficient Lighting	13	18%	±8%
Draft Reduction (keep doors/windows sealed tight)	10	14%	±7%
Adjust Hot Water Heater	6	8%	±5%
Unplug Appliances when not in Use	4	6%	±4%
Keep Windows/Doors Shut	3	4%	±4%
Decreased Shower Time	1	1%	±2%

Source: Low-Income Participant Survey, B5.

To provide comparison points, levels of DP&L participant recollection of receiving energy education were similar to some of the highest percentages seen in other evaluations of low-income weatherization programs. Figure 23 compares participant recollection of receiving energy education through the program.

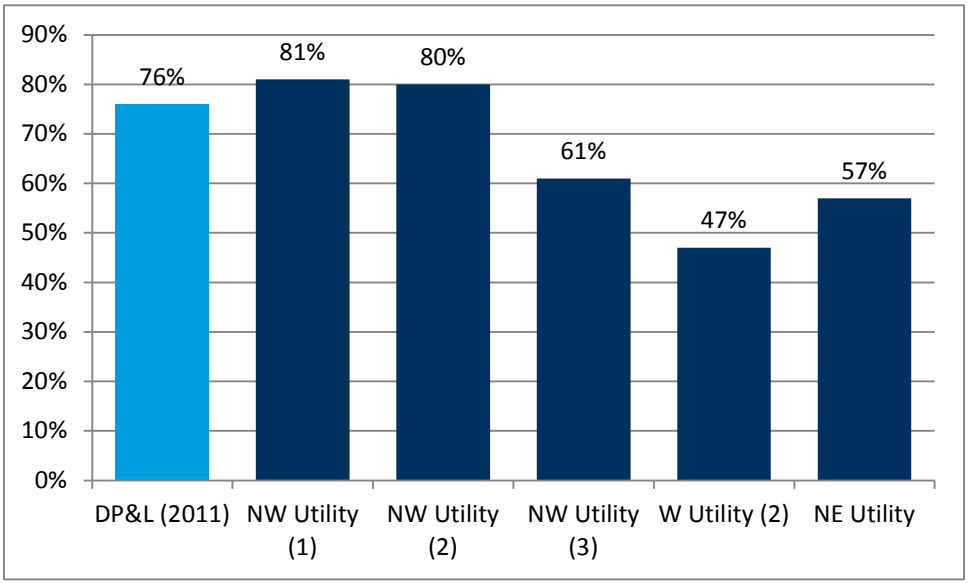
Figure 23. Energy Education Recall Comparison



Energy education recollection was higher in 2011 than in 2010, with improvement statistically significant.

The DP&L program also showed above-average levels of reported participant actions regarding implementing tips participants remembered, as shown in Figure 24.

Figure 24. Energy Education Tip Implementation



Of participants that recalled receiving tips, Table 25 compares energy-saving behaviors participants reported adopting due to the program, across different studies.

Table 25. Energy-Savings Behavior Changes Comparison

Activity	DP&L 2011	NW Utility (1)	NE Utility	NW Utility (3)
Turns Lights Off When not in Use	31%	28%	48%	13%
Adjust Heating	25%	33%	42%	22%
Use Energy Efficient Lighting	18%	33%	15%	29%
Draft Reduction (keep doors/windows sealed tight, reduce heat escape)	14%	31%	18%	25%
Adjust Hot Water Heater	8%	11%	N/A	14%
Unplug Appliances when not in Use	6%	18%	50%	9%
Keep Windows/Doors Shut	4%	10%	5%	9%
Decreased Shower Time	1%	6%	12%	1%

Non-Energy Benefits

Respondents' reported mixed experiences regarding changes in their energy bills due to program activities. Table 26 provides a distribution of participants' changes in utility bill affordability, with 47% citing their energy bills became more affordable after receiving weatherization services, and half indicating their bills remained about the same.

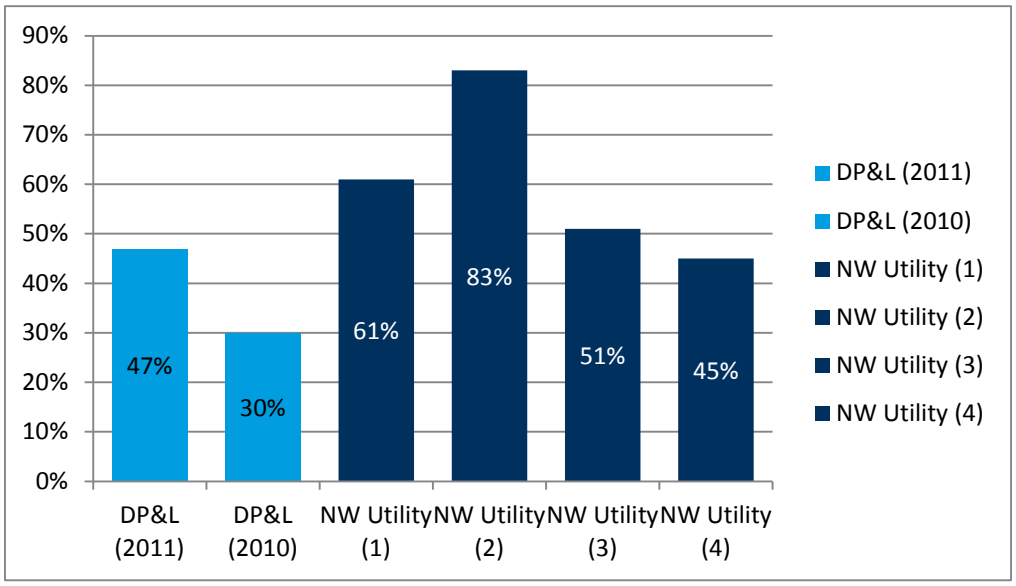
Table 26. Changes in Utility Bill Affordability (n=32)

Affordability of Utility Bill After Program Services	Frequency	Percent	Precision at 90% Confidence Interval
Much more affordable	9	28%	±13%
Somewhat more affordable	6	19%	±12%
About the same	16	50%	±15%
Less affordable	1	3%	±5%
TOTAL	32	100%	

Source: Low-Income Participant Survey, C2

This result was slightly lower than those reported in other studies, where respondents indicated a positive effect on utility bill affordability due to weatherization, as shown in Figure 25.

Figure 25. Utility Bill Affordability Comparison



The perception of increased affordability was higher in 2011 than in 2010, though this change was not statistically significant.

Some non-energy benefits, such as changes in health and comfort, could be attributed more to shell improvements than to base-load measure installations, such as CFLs and refrigerator replacements. Consequently, results of the following non-energy benefit questions have been based on respondents receiving insulation paid for by DP&L (n = 36), rather than on the total respondent sample.

Thirty-five percent of respondents identified an improvement in their health due to services provided through the program, as shown in Table 27. None of the respondents reported a decline in health due to program participation (in contrast to 9% reporting a decline in 2010).

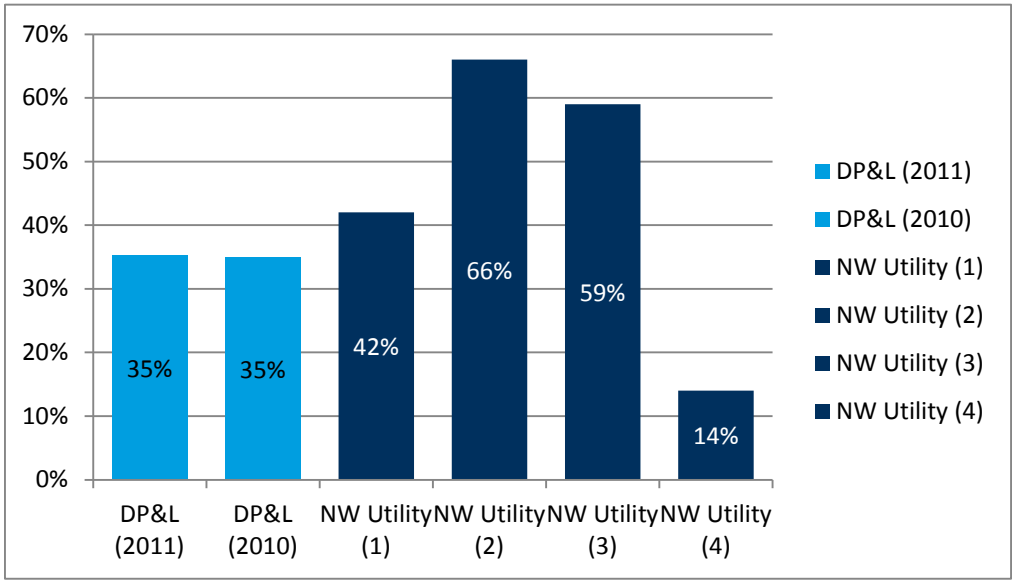
Table 27. Health Improvements (n=34)

Health Changes as a Result of Program Participation	Frequency	Percent	Precision at 90% Confidence
Positive effect	12	35%	±14%
No change	22	65%	±14%
TOTAL	34	100%	

Source: Low-Income Participant Survey, C3 (only for shell measure recipients).

Comparison of different utility program respondents indicated a positive health effect attributed to weatherization, as presented in Figure 26.[10]

Figure 26. Health Improvements Comparison



Though health improvements were reported by fewer DP&L participants than were reported by participants from some NW Utility programs cited above, participants described a variety of other health-related, non-energy benefits from the program. Multiple DP&L participants reported their homes felt warmer, and they did not get sick as frequently (e.g., they had fewer colds). Others said they had less trouble with "varmints" or mold in the home, and their stress levels improved.

Another non-energy benefit widely reported by program participants related to improvements in comfort. Table 28 provides distributions of participant responses.

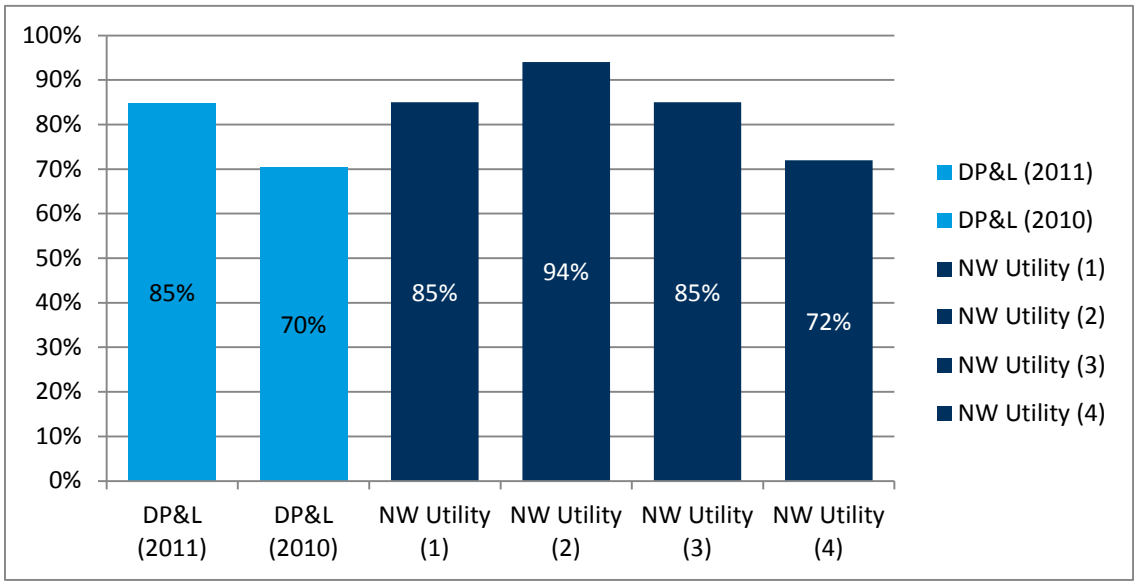
Table 28. Changes in Comfort (n=33)

Comfort Changes Since Program Participation	Frequency	Percent	Precision at 90% Confidence
A lot more comfortable in your home	20	61%	±14%
Somewhat more comfortable in your home	8	24%	±13%
About the same level of comfort in your home	5	15%	±11%
TOTAL	33	100%	

Source: Low-Income Participant Survey, C1 (only for shell measure recipients)

Eighty-five percent of respondents reported feeling more comfortable in their homes since work was performed, representing an increase over 2010, when 70% of respondents (n=44) reported an improvement in comfort. This year's higher incidence of improved comfort is comparable to results from other studies, as shown in Figure 27.

Figure 27. Increased Comfort Comparison



Comfort improvements were higher in 2011 than in 2010, though the change was not statistically significant (p-value = 0.125).

Participants were asked a few questions addressing the issue of forced mobility. Significant financial and emotional burdens are often associated with customers forced to move from their homes. As shown in Table 29, 43% of respondents reported being less likely to move following work done to their homes.

Table 29. Changes in Mobility (n=30)

Are you any more or less likely to move now that this work has been done to your home?	Frequency	Percent	Precision at 90% Confidence
Less likely to move	13	43%	±15%
No change	17	57%	±15%
TOTAL	30	100%	

Source: Low-Income Participant Survey, C6.

Participants were asked whether they considered additional benefits due to work performed through the program. Several respondents noted the effectiveness of particular measures, saying they were "not getting as much dust and particles" inside the home, or the home was "not quite as drafty" after doors were fixed. Others reported measures they received gave them "freedom of mind." One respondent went so far as to say: "the knowledge that my health is better makes me so much happier and content to stay here."

Participant Satisfaction

Table 30 provides distributions of participant responses of overall satisfaction with services delivered though the program.[11]

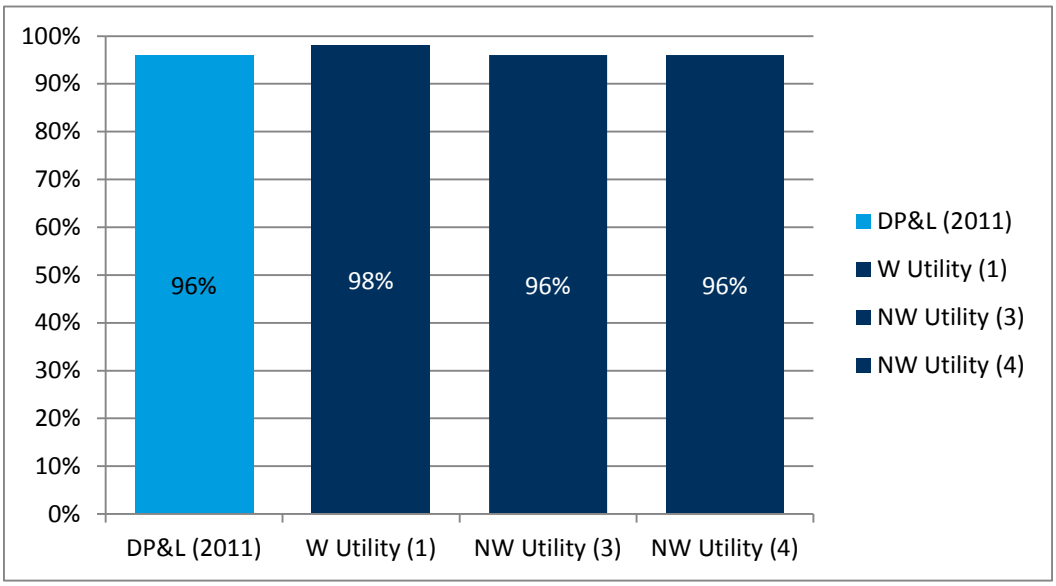
Table 30. Overall Satisfaction with Program Services Provided (n=117)

Overall Satisfaction with Program Services	Frequency	Percent	Precision at 90% Confidence
Very satisfied	94	80%	±6%
Somewhat satisfied	19	16%	±6%
Neither satisfied nor dissatisfied	2	2%	±2%
Somewhat dissatisfied	2	2%	±2%
TOTAL	117	100%	

Source: Low-Income Participant Survey, D2.

Ninety-six percent of respondents reported being "very satisfied" or "somewhat satisfied" with the program services, while two respondents expressed dissatisfaction. This is consistent with program satisfaction reports from other studies, as shown in Figure 28.

Figure 28. Program Satisfaction Comparison



Of respondents reporting problems, two were unhappy with wait times for services after being approved to participate in the program. One respondent claimed work was not completed, contractor left doors and windows open while working, used up all of the customer's propane, and left a large hole in a wall. Another complained that workers left the central air conditioning system unhooked (which proved to be expensive). Another claimed workers broke the heating system, and removed a working, relatively-new water tank for replacement with a smaller one.

We asked participants how courteous agency staff working on their homes were. Table 31 provides a distribution of their responses.

Table 31. Satisfaction with Agency Staff (n=111)

Courtesy of Contractors	Frequency	Percent	Precision at 90% Confidence
Very courteous	97	87%	±5%
Somewhat courteous	13	12%	±5%
Not at all courteous	1	1%	±1%
TOTAL	111	100%	

Source: Low-Income Participant Survey, D1.

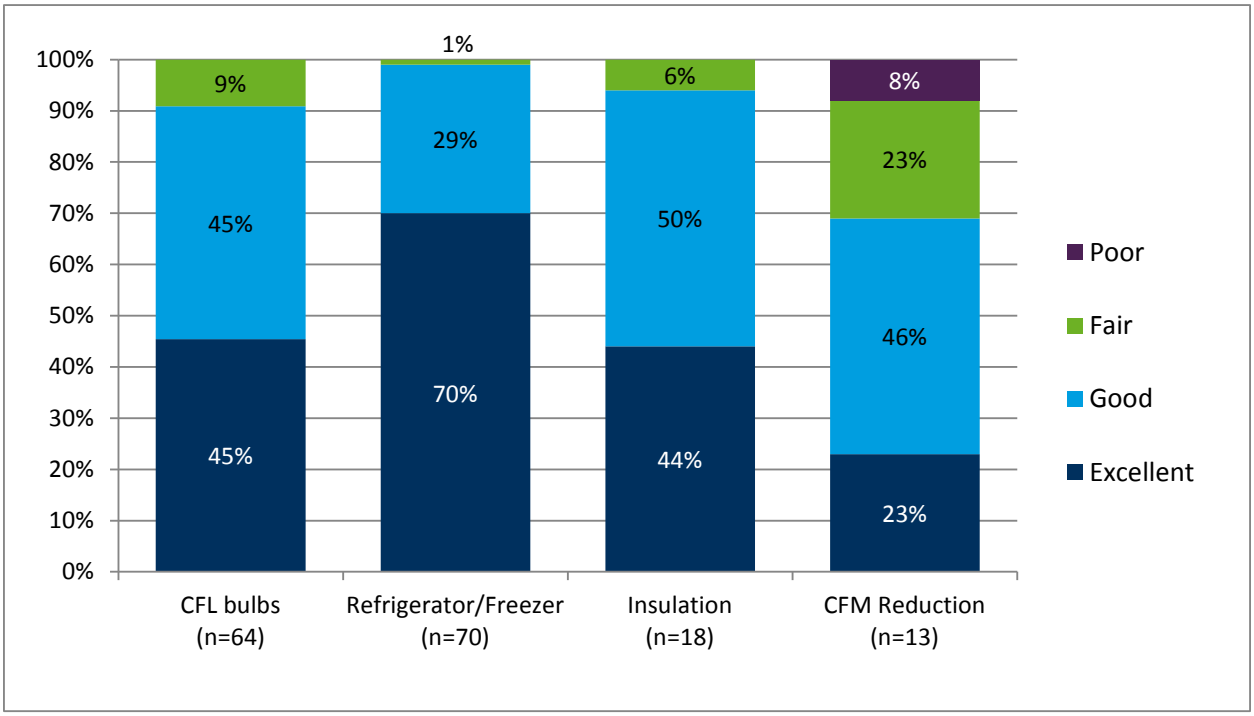
Ninety-nine percent of respondents felt agency staff were courteous and respectful, an increase over 94% of respondents who characterized agency staff as such during 2010.

Respondents provided a variety of suggestions for program improvements. Several stressed a need for improved communication, particularly in returning phone calls and in keeping participants informed of wait list status and project timelines. Others suggested improving wait times for services, advertising the program more broadly, and reducing paperwork would make it easier for people to get the help they need. One respondent specifically noted windows as a measure people cannot afford to replace, but which old homes may especially need.

Measure Satisfaction

A series of survey questions sought to elicit a verbal confirmation that measures DP&L paid for had been installed in participants' homes, and what degree of satisfaction participants expressed in this regard. While participants likely received other measure installations through non-DP&L funding sources, survey questions were limited only to DP&L-funded measures. Participants were also asked to rate new measures on a four-point scale: excellent, good, fair, or poor. Figure 29 presents participant ratings for each measure. Overall, respondents rated their new equipment quite favorably, with the majority rating each item as "excellent" or "good."

Figure 29. Measure Installation by Rating



Source: Low-Income Participant Survey, A4, A10, A13, and A16.

Additional details regarding measure-specific satisfaction follow below.

CFL Installations

Of those who recalled receiving light bulbs, 90% (58 of 64 respondents) rated them as "excellent" or "good," an increase over 2010's 81%. Table 32 provides the participant rationale for the CFL ratings. .

Table 32. CFL Installation Rating (n=64)*

Type of Response	Rationale for Response	Frequency	Percent	Precision at 90% Confidence
Positive	They save energy	20	31%	±10%
	They're just fine or I just like them	13	20%	±8%
	I won't have to change the bulb frequently	12	19%	±8%
	They give good light	7	11%	±7%
	They (will) save me money	6	9%	±6%
	They're better than the bulbs I had	3	5%	±4%
	I like the way they look	2	3%	±4%
Negative	The light is too dim	4	6%	±5%
	They take too long to light up	3	5%	±4%
	They burn out quickly	1	2%	±3%
Other		5	8%	±6%
	TOTAL	76		

* Multiple responses allowed
Source: Low-Income Participant Survey, A5.

The most commonly reported positive reaction to CFLs was the bulbs saved energy. The main reasons for negative responses were: light from the bulbs was too dim; and the bulbs took too long to light up—a notable shift from 2010, when the CFL light color was the only negative response offered.

Table 33 details the CFL installation rate calculation.

Table 33. CFL Installation Rate

Measure	Respondents (n)	Bulbs
C-3 Reported Bulbs Given to Participants	77	1,203
Never Received Bulbs	10	62
Removed Bulbs	8	28
Replaced Removed Bulbs with CFLs	4	21
Installation Rate (without reinstalled CFLs)	77%	93%
Installation Rate (with reinstalled CFLs)	82%	94%

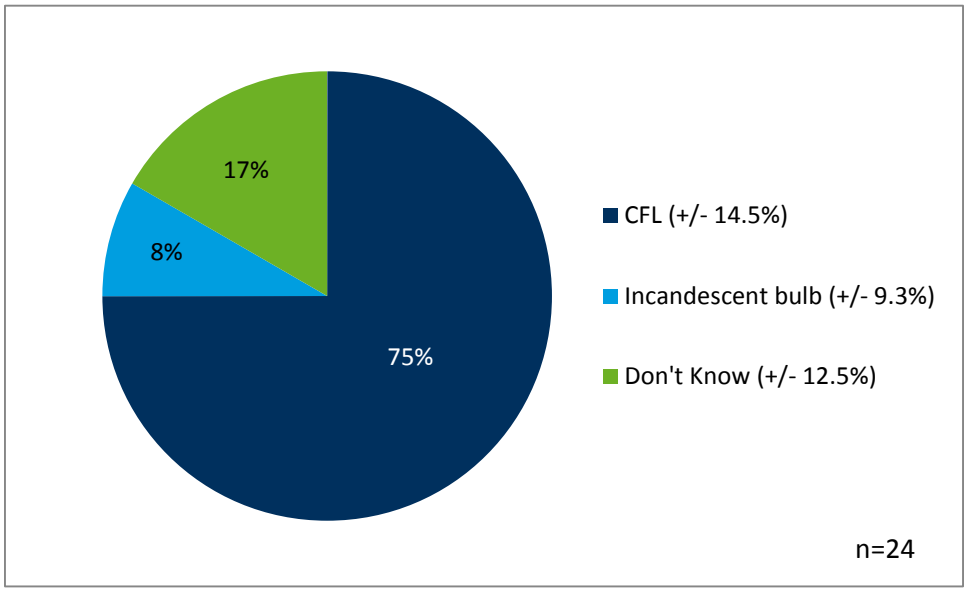
Source: Low-Income Participant Survey, A6 and A7.

Ten out of 77 participants receiving CFLs (13%) claimed they did not recall receiving new light bulbs. Of participants that acknowledged receiving CFLs, eight reported removing some program CFLs that had been installed. A 94% CFL installation rate was achieved (including reinstalled CFLs), which was an increase from the 80% installation rate calculated for the 2010 evaluation report. .

While direct-install provided the primary means of CFL distribution, 15% of respondents receiving CFLs (12 of 77) indicated the contractor left CFLs behind for the participant to install themselves. These findings are similar to those identified through the site verification, discussed below.

Figure 30, below, shows most participants who replaced program-provided CFLs did so using other CFLs.[12]

Figure 30. Bulbs Installed by Participants to Replace Burned-Out Program Bulbs



Source: Low-Income Participant Survey, A6, A7, A8, and A9

Refrigerator/Freezer Replacement

Ninety-nine percent of respondents receiving refrigerators or freezers (69 of 70) rated the new equipment as excellent or good, compared to 86% from 2010. Of the respondents that provide feedback around their rating, Table 34 details respondent opinions on the new appliances.

Table 34. Refrigerator/Freezer Replacement Rating (n=65)*

Type of Response	Rationale for Response	Frequency	Percent	Precision at 90% Confidence
Positive	It works	15	23%	±9%
	It is just fine or I just like it	14	22%	±9%
	It saves energy	12	18%	±8%
	My old refrigerator stopped working/wasn't working well	9	14%	±7%
	The refrigerator or freezer is a good size	8	12%	±7%
	I like the way it looks	6	9%	±6%
	I needed a new refrigerator or freezer anyway	6	9%	±6%
	It keeps the food at the right temperature	5	8%	±6%
	It was free	2	3%	±4%
	I was glad not to have to clean out my old refrigerator	1	2%	±3%
Negative	The refrigerator or freezer is too small	4	6%	±5%
	installation trouble or other problem with the unit	3	5%	±4%
	unhappy with refrigerator's features	2	3%	±4%
	I don't like the way it looks	1	2%	±3%
	I just didn't like it	1	2%	±3%
Other		2	3%	±4%
	TOTAL	91		

* Multiple responses allowed
Source: Low-Income Participant Survey, A11.

Insulation Installation

Ninety-four percent of respondents receiving insulation (17 of 18) rated the measure excellent or good, compared to 72% from 2010. Of the respondents that provide feedback around their rating, Table 35 details opinions participants expressed about insulation they received.

Table 35. Insulation Installation Rating (n=17)*

Type of Response	Rationale for Response	Frequency	Percent	Precision at 90% Confidence
Positive	It keeps the house warmer / cooler	5	31%	±20%
	The house is more comfortable	4	25%	±19%
	It lowers the electric bill	3	19%	±17%
	It saves energy/electricity	1	6%	±11%
	The contractor did a nice job	1	6%	±11%
Negative	It didn't help keep the house more comfortable	1	6%	±11%
Other		2	13%	±14%
	TOTAL	17		

* Multiple responses allowed
Source: Low-Income Participant Survey, A14.

More participants chose the response that “the house is more comfortable” this year than last year, and several respondents said their installed insulation “lowers the electric bill,” a new response added to this year’s survey.

Participant Survey Demographics

Demographic findings from the participant survey are provided in Appendix J.

Site Visit Findings

Cadmus completed 25 site visits. These visits occurred in late November 2011, and focused on measures the C-3 reported as having installation paid for by DP&L.

Participants all seemed highly aware of locations and types of installations made through the program. Some electric-saving measures installed in homes were not reported on DP&L's C-3 report, including: two refrigerators, a water heater, a central air conditioning system, and an electric furnace. Other funding sources likely were used to pay for these measures.

Measure-Specific Findings

CFLs

Site visits uncovered inconsistencies between the number and wattage of bulbs installed and those reported on the C-3 forms. Most differences occurred across wattages, not bulb types.

Despite the small sample size, Cadmus calculated a 96% CFL installation rate by comparing the total number of program bulbs distributed to the number of bulbs verified as installed across the 25 homes visited. Table 36 lists quantities of installed and removed bulbs.

Table 36. Site Visit CFL Installation Rate

	Number of Sites	Quantity of Bulbs
Total Program Bulbs	14	309
From C-3	15	271
Extra bulbs	10	92
Never received	7	54
Bulbs uninstalled	6	12
Installation Rate (based only on C-3 bulbs)	N/A	76%
Installation Rate (including extra bulbs)	N/A	110%

Fifty-four bulbs listed in the C-3 form were not received by participants. However, an additional 92 CFLs not listed on the C-3 were identified on site, likely paid for using other funding sources. The installation rate calculated should be used for purely comparative purposes, as we used telephone survey results for energy-saving calculations.

Appliances

All seven freezers from the C-3 were verified as installed. Two more refrigerators were installed than those listed on the C-3 (one at a site which did not have any units listed in the database, and two at a site which had only one unit on record). These likely can be explained by the mix of funding sources agencies used to complete weatherization projects. The remaining appliance types each had one more unit verified as installed than those listed on the C-3: central air conditioning, water heater, and electric furnace.

Insulation

Whenever possible, we confirmed insulation listed on the C-3 with residents. The C-3 reported attic installation at two sites visited. One was a manufactured home without an attic, but the occupant claimed floor installation was installed instead, even though this was not mentioned on the C-3. (The engineer could not access the floor insulation to verify this). The second site only

reported attic insulation on the C-3, though the participant reported that wall insulation was also installed by the program contractors. The engineer noted evidence of vents cut from the side walls for blowing insulation in two places, but he could not access the attic or wall for direct verification.

In addition to sites listed on the C-3, seven homes visited claimed to have received attic insulation, and two others claimed to have received wall insulation. Of the nine sites not documented on the C-3, most were inaccessible, and only one instance of attic insulation could be verified.

CFM Reduction

Air sealing was verified at one site the C-3 form listed as having received CFM reduction measures. Of agencies interviewed, only Fayette County CAP reported directly invoicing for CFM reduction, based on changes in blower door readings resulting from insulation and sealing crawl spaces.

Weather-stripping, caulking, and foam also were found at eight other sites, though the C-3 did not reflect a specific invoice to DP&L for CFM reduction. At these sites, field staff primarily found weather-stripping on windows and doors, and foam and caulking on vents. Foam air sealing was the main method used in other areas around the homes (foundations, band joists, and crawl spaces). None of the 25 sites visited received duct sealing.

Recommendations

Based on the preceding findings, Cadmus offers the following recommendations:

- **Data Collection Improvements:** As the new data collection system is released for the 2012 program year, DP&L should work with OPAE, the agencies, other utilities funding similar work, and Ohio's DOD to determine a method for achieving more consistent reporting across the Low-income Weatherization program. Some measure details, such as variations of CFL wattage/type, may be too detailed for the C-3 collection form, while, for other measures, such as insulation, more detail must be provided to enhance energy-saving estimates (e.g., heating/cooling equipment types and efficiencies).

  It will also be important for data provided to the utility on program-funded installations to be consistent with measures found in participant homes. As site visits results indicated consistent discrepancies in reporting the number and variety of CFLs installed, it may be more efficient to streamline data collection in recording wattages (and potentially room types), but then only differentiating by standard and specialty bulb types.

- **Funding Electric-Saving Measures:** DP&L's current policy allows shell measures if the home is electrically heated or electrically cooled. However, program data revealed a number of homes receiving insulation or CFM reduction measures where no electric savings could be claimed (31 homes and 27 homes, respectively). DP&L should work with OPAE to ensure that all agencies are clear on the eligible shell measure policy. Additionally, DP&L should ensure that agencies are aware that DP&L will only pay for water heating measures in customer homes with electric water heat.

- **Nonprogrammatic Savings:** DP&L should work with OPAE and other utilities to gain approval for nonprogrammatic savings. As noted, DP&L funding for health, safety, or repair measures make it possible to use other funding sources to pay for energy-savings improvements, without which a home may be turned away from service (due to costs not covered by other funding sources, such as HWAP).
- **Standardize Measure Incentives:** In a recommendation similar to one made in 2010, DP&L should continue working with OPAE to standardize an approach for invoicing measures based on labor and material costs, rather than the per-unit rebate (specifically for CFM reduction). While OPAE reported agencies had their choice in methods for rebating CFM reduction, overcharging seems possible if one funding source paid for insulation or other shell measures, while another funding source was billed for per-unit CFM reduction, as substantial overlap occurs with measures contributing to air sealing.
- **Encourage Refrigerator Replacements:** DP&L should work with OPAE to encourage agencies to test and deliver refrigerator replacements for all qualifying participants. Based on one agency reporting it did not offer this measure, and given the high electric savings associated with refrigerator replacements, it will be important for DP&L to work with OPAE to encourage installation in all cases, where applicable.
- **Pilot Studies for Increased Electric Savings:** DP&L (in working closely with OPAE) should consider running pilot programs seeking to achieve higher electric savings. One option could be running a pilot focused on targeting high-usage electric customers for weatherization. Efficient targeting programs first identify high-energy use qualifying participants, and then deliver weatherization. DOE weatherization guidelines identify high-energy usage as a category states can use for prioritizing potential program participants. Many states, however, do not integrate this criterion into their prioritization calculations. Targeted high-usage pilot weatherization programs have been implemented by other states and utilities, including: Pennsylvania (PPL, Philadelphia Gas Works); New Jersey (Comfort Partners program - six utility partnership); and Indiana (Indiana Power & Light, Citizen's Gas).

  Another pilot program option could target the effect of electric room heater removal from gas-heated homes. OPAE indicated coming into contact with gas-heated homes that, prior to weatherization, used multiple 1,500-watt room heaters across the home as a primary heating source. With delivery of weatherization measures, improving shell characteristics and potentially repairing furnaces, these homes would shift from a reliance on electric room heat to using their central heating systems more reliably and affordably. The key to electric savings would be to remove most electric space heaters upon weatherization and reimburse residents. DP&L could work with OPAE to run a small pilot program on 30 homes. A billing analysis on those households would define impacts of removing electric heaters and repairing central gas systems. A process evaluation would elicit participants' feedback on their program experience.
- **Incorporate Non-energy Benefits into Cost-Effectiveness Calculations:** DP&L should consider further quantifying non-energy benefits associated with the weatherization work, and incorporate these benefits into its assessment of program cost-effectiveness. While standard cost-effectiveness testing using the TRC test accounts for all program costs,

only including energy savings as program benefits clearly omits some genuine non-energy benefits experienced by participants.

While health, safety, and repair benefits can be difficult to quantify, they provide genuine benefits for participants. Though specific benefit aspects (e.g., increased comfort, reduced fire damage) can be shared out and considered separately, Cadmus recommends, at a minimum, setting benefits associated with these measures equal to costs. This approach assumes that, if the benefit of the health and safety work did not at least equal costs, the work would not have been performed.

- **Standardize Energy-Savings Education:** Based on interviews with OPAE and the agencies, it appears the approach to providing energy-saving education has not been standardized across agencies. While some provide written materials (developed through the HWAP program), other agencies only provide participants energy-savings tips upon initial home walkthroughs. One agency charged DP&L for delivering energy education, while others indicated they did not charge for such services. A standardized approach to delivering energy-savings education may help all DP&L participants receive the same education level, in addition to ensuring the quality of the energy-education curriculum. DP&L should work with OPAE to consider standard procedures for delivery. Additionally, DP&L should consider developing its own curriculum or materials (e.g., handouts, refrigerator magnets), focusing on high electric-savings behavior changes (e.g., thermostat and water heater setbacks, unplugging appliances or turning off lights).

RESIDENTIAL HEATING AND COOLING REBATE PROGRAM

The following sections describe the evaluation approach, detailed findings, and conclusions and recommendations for the Residential Heating and Cooling Rebate program.

Evaluation Overview and Methodology

Table 37 identifies key researchable evaluation questions provided in the evaluation plan.

Table 37. Key Researchable Questions

Researchable Question	Discussion	Activity to Support Question
What changes to the program design and delivery would improve its performance?	Our evaluation review can provide valuable insights into refinements needed to the program design and delivery.	• Program and implementation staff interviews • Participant surveys • Program database review
What is customer satisfaction with the program?	It is important to assess customer satisfaction with the various program components.	• Participant surveys
How effective has the program been in recruiting and training HVAC contractors?	Program savings will be driven by contractor support and participation. Contractors will be a main driver in selling program measures. Successfully recruiting the right contractors, and providing them with the necessary training, tools, and support, will impact program results.	• Program and implementation staff interviews
How can the program increase its energy and demand savings?	A wide variety of issues can affect energy savings resulting from the program, such as efficiency levels, size, and program influence. We will investigate each of these in our evaluation to provide the best estimates of gross energy savings as well as opportunities for increasing energy savings.	• Program and implementation staff interviews • Billing analysis
What were the gross electric savings and demand reductions?	The amount of gross electric savings and demand reductions will help create a business case to continue running the program, and will be useful for planning future program designs.	• Participant billing analysis • Draft Ohio TRM calculation and assumption review • Program database review • Participant surveys

Detailed Evaluation Findings

The following key findings relate to the impact evaluation and the participant survey:

- The program achieved 7,792,357 kWh savings and 2,460.6 kW in demand reduction. Compared against claimed *ex ante* claimed savings, the program had realization rates of: 97% for energy savings; and 96% for demand savings.

Table 38. Residential Heating and Cooling Rebate Program Claimed and Achieved Energy Savings

Program	*Ex Ante*		Verified		Adjusted		
	Claimed kWh	Claimed kW	Gross kWh	Gross kW	Gross kWh	Gross kW	Precision at 90% Confidence
AC Early Retirement 14/15 SEER	1,623,820	892.4	1,623,820	892	1,509,656	849	±4%
AC Early Retirement 16+ SEER	1,184,986	685.2	1,184,986	685	1,117,167	675	±3%
AC New Construction 14/15 SEER	19,090	18.4	19,090	18	15,738	16	±10%
AC New Construction 16+ SEER	16,848	13.2	16,848	13	15,871	12	±10%
AC Std Replacement 14/15 SEER	12,880	12.4	12,880	12	13,968	13	±16%
AC Std Replacement 16+ SEER	11,232	8.8	11,232	9	11,325	9	±10%
GSHP Early Retirement 13/15 EER	27,612	4.0	27,612	4	31,361	2	±10%
GSHP Early Retirement 16+ EER	1,070,289	131.8	1,070,289	132	1,127,496	137	±10%
GSHP New Construction 13/15 EER	6,798	1.1	6,798	1	8,662	0	±10%
GSHP New Construction 16+ EER	208,296	26.4	208,296	26	221,227	18	±10%
GSHP Std Replacement 13/15 EER	3,399	0.6	3,399	1	3,030	0	±10%
GSHP Std Replacement 16+ EER	47,340	6.0	47,340	6	45,581	4	±10%
HP Early Retirement 14/15 SEER	2,176,250	381.9	2,176,250	382	2,024,604	374	±5%
HP Early Retirement 16+ SEER	1,344,096	328.2	1,344,096	328	1,390,088	306	±6%
HP New Construction 14/15 SEER	52,332	13.4	52,332	13	47,169	13	±10%
HP New Construction 16+ SEER	35,650	9.6	35,650	10	35,530	10	±10%
HP Std Replacement 14/15 SEER	36,312	9.3	36,312	9	33,035	9	±10%
HP Std Replacement 16+ SEER	22,816	6.1	22,816	6	24,739	6	±10%
Mini-Split A/C New Construction 16+ SEER	504	0.5	504	1	324	0	±21%
Mini-Split HP New Construction 14/15 SEER	4,184	0.2	4,184	0	4,184	0	±44%
Mini-Split HP New Construction 16+ SEER	109,344	8.2	109,344	8	109,322	8	±43%
Mini-Split HP Replacement 16+ SEER	2,278	0.2	2,278	0	2,278	0	±43%
TOTAL	8,016,356	2,558.1	8,016,356	2,558.1	7,792,357	2,460.6	±3%

*Values in table may not sum to 100% due to rounding.

- Compared to goals, the program had realization rates of 459% for energy savings and 163% for demand savings.
- Early replacement measure categories continue to have the largest numbers of participants, and generate the highest UES levels.
- Contractors and dealers continue to serve as an important information source for customers about the program.
- Customer demand for the program remains high, as does overall customer satisfaction, and is comparable to similar utility HVAC programs across the country.

Evaluation Data Collection Methods

Cadmus used the approaches detailed below in evaluating of the 2011 program.

Impact Methodology

Savings estimates were developed using multiple methods, which included: draft Ohio TRM Calculations (some adjustments were made to draft Ohio TRM assumptions); results from the Cadmus 2009–2010 participant billing analysis; and two other studies referencing ductless mini-split savings.

Ex ante claimed savings were reported by Conservation Services Group (CSG) in its annual production report. Cadmus calculated verified gross savings estimates using participant data from the final 2011 program tracking database, and reported per-unit *ex ante* energy savings (kWh) and demand savings (kW) estimates.

Multiple methods were used to estimate total adjusted gross saving estimates. We attempted to use a utility bill regression analysis for all program measures, but, due to small sample sizes for many of the measure categories, we determined the saving bounds too large to suggest significance. Therefore, the alternative methods cited above were used. Specific sources, by measure, can be found in Appendix D.

Appendix B provides reported 2011 program participants by measure. A review of the program tracking database indicated accurate reporting of the program population.

Program Participant Surveys

In December 2011 and January 2012, we surveyed participants, reviewed the program implementer database,[13] and determined a sampling strategy to achieve findings with 90% confidence and 10% precision appropriate at the equipment-type level for early replacement and replace-on-burnout program participants.

The new construction participation decision-making process differs significantly from early replacement or replace-on-burnout. Further, program participation in this replacement type is limited. Just 7% of incented units and 5% of reported kWh savings in the program tracking database provided were new construction participants. Therefore, as in the 2010 evaluation, these participants were not included in the general program participant survey. Table 39 and Table 40 provide additional detail.

Table 39. January through October Program Participation (Incented Units)

	Equipment Type					
Replacement Type	AC	ASHP	GSHP	MSAC	MSHP	TOTAL
Early Replacement	1,954	868	131	0	0	2,953
Replace on Burnout	78	44	10	0	1	133
New Construction	103	64	32	2	40	241
TOTAL	2,135	976	173	2	41	3,327

[13] Provided on November 18, 2011, and contained program participants through October 2011.

Table 40. January through October Program Savings (kWh)

Replacement Type	Equipment Type					
	AC	ASHP	GSHP	MSAC	MSHP	TOTAL
Early Replacement	2,464,396	2,934,024	814,958	0	0	6,213,378
Replace on Burnout	22,990	51,646	46,005	0	2,278	122,919
New Construction	30,760	76,504	151,488	336	90,748	349,836
TOTAL	2,518,146	3,062,174	1,012,451	336	93,026	6,686,133

A separate survey was designed and fielded for the new construction mini-split group, mirroring the general program participant survey. The abbreviated survey primarily focused on data to inform impact calculations. This survey's stratum contained few program participants; so a census was attempted. Table 41 provides final survey targets for the participant surveys.

Table 41. Program Participant Survey Targets*

Replacement Type	Equipment Type					
	AC	ASHP	GSHP	MSAC	MSHP	TOTAL
Early Replacement	66	63	44	0	0	173
Replace on Burnout	36	27	9	0	1	73
New Construction	0	0	0	0	38	38
TOTAL	102	90	53	0	39	284

* Several strata contain minor adjustments to the 90/10 calculated values as a limited number of program participants installed >1 incented unit.

Table 42 provides the number of achieved surveys by stratum.

Table 42. Achieved Program Participant Surveys

Replacement Type	Equipment Type					
	AC	ASHP	GSHP	MSAC	MSHP	TOTAL
Early Replacement	67	65	44	0	0	176
Replace on Burnout	31	15	3	0	1	50
New Construction	0	0	0	0	10	10
TOTAL	98	80	47	0	11	236

Program Participant Utility Bill Regression Analysis

In February 2012, Cadmus conducted a billing analysis of program participants. As no significant changes occurred between the 2009, 2010, and 2011 program years, participants from all three years were considered for analysis. Billing analysis results were used to evaluate measure-level kWh savings estimates.

Baseline Assumptions

The evaluation used the following measure baseline assumptions:

- **Central Air Conditioning and Air Source Heat Pump (Early Replacement):** We assumed the baseline condition to be the existing, inefficient unit for the remaining useful life of the unit, and then, for the remainder of the measure life, the baseline became a new replacement unit, meeting the minimum federal efficiency standards (13 SEER).

- **Central Air Conditioning and Air Source Heat Pump (Standard Replacement):** We assumed the baseline equipment to be a ducted, split control central A/C unit or an air source heat pump, meeting minimum federal efficiency level standards (13 SEER).
- **Ground Source Heat Pump (Early Replacement):** We assumed the baseline condition to be the existing, inefficient ground-source heat pump unit for the remaining useful life of the unit, and then, for the remainder of the measure life, the baseline became a new replacement air-source heat pump unit meeting the minimum federal efficiency standards (13 SEER and 11 EER).
- **Ground Source Heat Pump (Standard Replacement):** We assumed the baseline equipment to be an air source heat pump, meeting federal standard efficiency levels (13 SEER and 11 EER).
- **Mini-Split Heat Pump:** Baseline equipment is assumed to be a room air conditioner, meeting minimum efficiency level standards of 9.8 EER for cooling and electric resistance for heating. Heating savings are adjusted to 79% of the calculated amount to account for customers with existing gas heating.

Impact Methodology and Findings

Program Participant Utility Bill Regression Analysis

Cadmus used a pre- and post-fixed effects modeling approach, allowing for directly developing early replacement savings estimates for each program measure category.

Cadmus received billing data for program participants from October 2008 through December 2011, pairing monthly billing information pre- and post-installation of incented equipment. This ensured the same months were used in the pre- and post-periods, preventing bias resulting from using mismatching months. We found a model that included participants with 11 months of pre- and post-billing information provided the most accurate results.

We obtained daily weather data from NOAA weather stations, corresponding to program participant ZIP codes. From the daily weather data, we obtained the base 65 reference temperature heating and cooling degree days, and then matched participant billing data to the nearest weather station by ZIP code, and matched each monthly billing period to the associated base 65 heating and cooling degree days.

Model Specification

We used a fixed effects modeling method, where we employed pooled monthly time-series (panel) billing data. The modeling approach corrected for differences between pre- and post-weather as well as for differences in usage magnitudes between participants. The fixed effects component was characterized by normalization of variations across the range of participants by including a separate intercept for each customer. This assured model savings estimates would not be skewed by unusually high usage or low usage participants. Appendix E provides model specification and output data.

Data Screening

Cadmus used the following criteria to screen customer billing data:

- We removed participants with fewer than 11 paired months in the pre- or post-period from the analysis. This screen removed most 2011 program participants from analysis.
- We excluded participants with expected deemed savings over 70% of the pre-usage from analysis. In effect, this eliminated low-usage accounts, where expected savings from measure installations were too large in reference to the total pre-period usage.
- We excluded accounts changing usage from the pre- to post-period by more than 70%.
- We removed participants using less than 1,825 kWh in the pre- or post-year, and participants using less than 5 kWh per day in the pre- or post-period from the analysis. This would indicate insufficient cooling or heating usage, or vacant participant homes.

These screens eliminated 45% of the participants.

Model Results

Table 43 summarizes measure savings for the program. Generally, model savings estimates were similar to deemed estimates, falling between the CSG planning and draft Ohio TRM deemed savings estimates.

Table 43. Measure Savings Estimates (kWh)

Measure	N	Model Savings	Precision at 90% Confidence	CSG Deemed	Draft Ohio TRM	CSG Realization Rate	TRM Realization Rate
AC Early Retirement 14/15 SEER	1,342	1,125	±4%	1,210	1,078	93%	104%
AC Early Retirement 16+ SEER	883	1,265	±3%	1,342	1,302	94%	97%
AC Std Replacement 14/15 SEER	56	249	±16%	230	232	108%	107%
HP Early Retirement 14/15 SEER	625	3,239	±6%	3,482	2,466	93%	131%
HP Early Retirement 16+ SEER	416	3,342	±7%	3,231	3,122	103%	107%

To verify the screening process outlined above did not introduce bias, and the billing analysis sample population was comparable to the 2011 program population for these measure categories, we compared the two populations in the following areas:

- Average SEER rating of the newly installed unit;
- Average size (tons) of the newly installed unit; and
- Average age (years) of the replaced unit.

Table 44 compares these populations (with data tracking errors removed). We found the two populations to be comparable, and billing analysis results could be applied to the 2011 program measure population.

Table 44. Billing Analysis Sample Comparison to Program Population

Measure	Average SEER		Average Size		Average Age	
	Billing Analysis Population	2011 Program Population	Billing Analysis Population	2011 Program Population	Billing Analysis Population	2011 Program Population
AC Early Retirement 14/15 SEER	14.5	14.3	2.6	2.6	20.7	19.8
AC Early Retirement 16+ SEER	16.3	16.2	2.5	2.7	20.5	19.1
AC Std Replacement 14/15 SEER	14.8	14.3	2.5	2.8	22.6	22.7
HP Early Retirement 14/15 SEER	15.2	14.9	2.6	2.7	17.8	18.2
HP Early Retirement 16+ SEER	16.7	16.6	2.8	2.9	18.1	17.1

UES identified through the participant billing analysis were applied to the program population to derive adjusted gross savings.

Table 45. Adjusted Gross Energy Savings from Participant Billing Analysis

Measure	Participating Units	UES Estimate (kWh)	Total Annual Adjusted Gross kWh Savings
AC Early Retirement 14/15 SEER	1,342	1,125	1,509,656
AC Early Retirement 16+ SEER	883	1,265	1,117,167
AC Std Replacement 14/15 SEER	56	249	13,968
HP Early Retirement 14/15 SEER	625	3,239	2,024,604
HP Early Retirement 16+ SEER	416	3,342	1,390,088
TOTAL	3,322	N/A	6,055,484

Draft Ohio TRM Calculations

Cadmus deferred to the draft Ohio TRM when calculating demand savings (kW) for measures with billing analysis energy savings estimates, and when calculating energy and demand savings estimates for all measures not included in the billing analysis (except the mini-split savings, which were calculated using findings from two mini-split evaluations).[14]

We applied draft Ohio TRM energy savings (kWh) equations and assumptions to the 2011 program participants, resulting in the annual energy savings (kWh) estimates provided in Table 46.

[14] See: http://www.bpa.gov/energy/n/pdf/Monmouth_year_2_FINAL_1007_1019.pdf and http://www.env.state.ma.us/dpu/docs/electric/09-64/12409nstrd2ac.pdf

Table 46. Adjusted Gross Energy Savings from Draft Ohio TRM Calculations

Measure	Participating Units	Total Adjusted Gross Annual kWh Savings
AC New Construction 14/15 SEER	83	15,738
AC New Construction 16+ SEER	39	15,871
AC Std Replacement 16+ SEER	26	11,325
GSHP Early Retirement 13/15 EER	6	31,361
GSHP Early Retirement 16+ EER	171	1,127,496
GSHP New Construction 13/15 EER	2	8,662
GSHP New Construction 16+ EER	44	221,227
GSHP Std Replacement 13/15 EER	1	3,030
GSHP Std Replacement 16+ EER	10	45,581
HP New Construction 14/15 SEER	49	47,169
HP New Construction 16+ SEER	25	35,530
HP Std Replacement 14/15 SEER	34	33,035
HP Std Replacement 16+ SEER	16	24,739
TOTAL	506	1,620,765

When calculating energy savings, Cadmus adhered to all savings equations and assumptions articulated in the draft Ohio TRM, with the exceptions described below.

Central Air Conditioning and Air-Source Heat Pump

- The draft Ohio TRM lists 631 as the full-load cooling hours for the Dayton, Ohio, area. However, this estimate included a 33% reduction for oversizing of newly installed equipment. We established this oversizing correction was not applicable for this program, based on discussions with program staff; we used full-load cooling hours from the ENERGY STAR® Calculator (947). The billing analysis results also implied cooling hours in the draft Ohio TRM were too low.
- The draft Ohio TRM indicated that, where available, actual installation data (e.g., replaced unit size and SEER rating) should be used instead of draft Ohio TRM assumptions. The participant database contained all necessary data to calculate energy and demand savings. However, 10 early replacement central air conditioning and air-source heat pump installations lacked the SEER rating of replaced units. When calculating savings for these measures, an average of SEER ratings of equipment replaced from the same incented measure category was used as a proxy.

Ground-Source Heat Pump

- The full-load cooling hours for the Dayton, Ohio, area were updated to match the ENERGY STAR Calculator value.
- Noted in the draft Ohio TRM Joint Objections and Comments document, the energy savings algorithm for replace-on-burnout, ground-source heat pump measures misses the "/1000" component of the equations. This was included in the gross savings calculations.
- Fifteen early replacement installations lacked data on the SEER value of the replaced unit. Average SEER estimates from the same measure categories were used as proxies.

- The draft Ohio TRM did not include an energy savings calculation for early replacement, ground-source heat pump installations. Therefore, we used the replace on burnout saving calculation, but included the SEER rating of the replaced unit. The program tracking database did not capture the Heating Seasonal Performance Factor of the replaced unit; so the federal minimum standard between 1992 and 2006 was assumed (included in the footnote on page 28 of the draft Ohio TRM in HVAC Tune-Up section).
- Ground-source heat pumps tend to be sized for heating rather than cooling. In an area such as Ohio, this leads to equipment oversized on the cooling side. Draft Ohio TRM savings equations use overall capacity of the unit to determine savings. This may overstate cooling savings from the unit. To correct for this oversizing when calculating cooling savings for early replacement and replace-on-burnout units, we used the capacity of the replaced unit. For new construction, we could not make this adjustment, and used the capacity of the newly installed unit.

Outside of Ohio Engineering Sources

Savings equations and assumptions for mini-split air conditioners and heat pumps were not available in the draft Ohio TRM, and too few participants could be included in the billing analysis to provide precise savings estimates. We followed the same approach used for the 2010 evaluation: we applied results from two outside sources noted above, then multiplied the average UES by the number of 2011 program participants in each measure type, resulting in the annual savings estimates provided in Table 47.

Table 47. Adjusted Gross Energy Savings from Outside Sources

Measure	Participating Units	Total Adjusted Gross Annual kWh Savings
Mini-Split A/C New Construction 16+ SEER	3	324
Mini-Split HP New Construction 14/15 SEER	2	4,184
Mini-Split HP New Construction 16+ SEER	48	109,322
Mini-Split HP Replacement 16+ SEER	1	2,278
TOTAL	54	116,108

Calculating Peak Demand Savings

We used the draft Ohio TRM peak demand savings (kW) estimates for all measures in the 2011 participant database, except the mini-split measures. We did not deviate from draft Ohio TRM equations or assumptions when calculating demand savings for these measures—with three exceptions. The draft TRM does not have a section for early replacement air-source or ground-source heat pumps. For air-source heat pumps the equation provided for central air conditioners was used. For ground-source heat pumps, the ground-source heat pump replace-on-burnout equation was used, incorporating the SEER rating of the replaced unit. Demand UES for mini-split measures were calculated using the aforementioned mini-split studies.

Table 48. Adjusted Gross Demand Savings (kW)

Measure	Participating Units	Total Adjusted Gross Annual kW Savings
AC Early Retirement 14/15 SEER	1,342	848.6
AC Early Retirement 16+ SEER	883	674.6
AC New Construction 14/15 SEER	83	15.6
AC New Construction 16+ SEER	39	12.4
AC Std Replacement 14/15 SEER	56	12.8
AC Std Replacement 16+ SEER	26	8.9
GSHP Early Retirement 13/15 EER	6	2.1
GSHP Early Retirement 16+ EER	171	136.7
GSHP New Construction 13/15 EER	2	0.5
GSHP New Construction 16+ EER	44	17.9
GSHP Std Replacement 13/15 EER	1	0.2
GSHP Std Replacement 16+ EER	10	3.8
HP Early Retirement 14/15 SEER	625	373.6
HP Early Retirement 16+ SEER	416	305.8
HP New Construction 14/15 SEER	49	12.9
HP New Construction 16+ SEER	25	9.6
HP Std Replacement 14/15 SEER	34	9.1
HP Std Replacement 16+ SEER	16	6.4
Mini-Split A/C New Construction 16+ SEER	3	0.3
Mini-Split HP New Construction 14/15 SEER	2	0.2
Mini-Split HP New Construction 16+ SEER	48	8.2
Mini-Split HP Replacement 16+ SEER	1	0.2
TOTAL	3,882	2,460.6

Process Findings

Program Participant Survey

To inform the 2011 process and impact evaluations, we conducted two participant surveys: one for early replacement and replace-on-burnout participants; and one for participants with mini-split heat pumps. The following sections provide findings from both surveys.

Survey Sampling and Diagnostics

The two participant surveys targeted stratified samples of DP&L participants. As indicated in Table 41 and Table 42, above, survey targets in several strata were missed, even though survey best practices were employed.

Table 49. Participant Survey Targets and Completes

Measure Category	Program Population*	Survey Target	Surveys Achieved	Precision at 90% Confidence
Early Replacement AC	1,919	66	67	±10%
Early Replacement Air-Source HP	861	63	65	±10%
Early Replacement Ground-Source HP	124	44	44	±8%
Replace on Burnout AC	77	36	31	±9%
Replace on Burnout Air-Source HP	44	27	15	±15%
Replace on Burnout Ground-Source HP	10	9	3	±66%
New Construction Mini-Split HP	38	38	10	±22%
TOTAL	3,073	283	235	

* Non-unique program participants

DP&L provided contact information for 3,271 unique participants. Participant contact information was reviewed to ensure it contained no duplicate entries (within the same measure type) and customer names and phone numbers were available. Participants in strata not selected for surveys were removed from sample frames.

Table 50 and Table 51 provide survey diagnostics.

Table 50. Early Replacement and Replace on Burnout Survey Diagnostics

	Count
Total Contacts	3,028
Contacts in Sample Frame	2,953
Number of Completed Surveys	226
Number of Calls Required to Achieve Sample	2,075
Response Rate (RR1)	10.9%
Cooperation Rate (COOP1)	15.5%

Table 51. New Construction Mini-Split Survey Diagnostics

	Count
Total Contacts	38
Contacts in Sample Frame	37
Number of Completed Surveys	10
Number of Calls Required to Achieve Sample	140
Response Rate (RR1)	7.1%
Cooperation Rate (COOP1)	32.3%

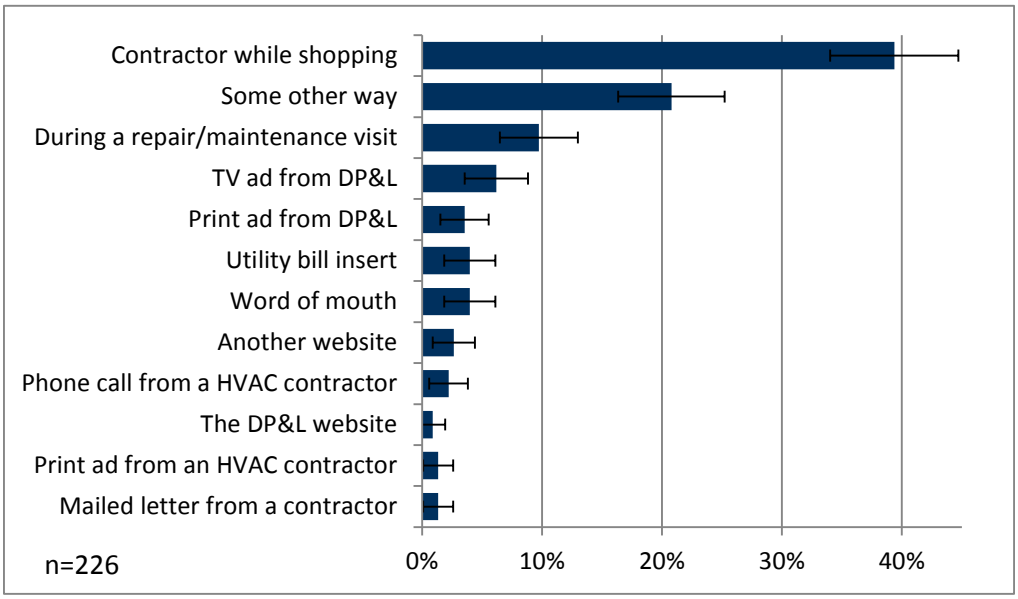
Survey Findings

For ease of reading, we have presented relevant survey findings by survey (general participant or mini-split), regardless of replacement equipment type. In addition, we removed “don’t know” and “refused” responses from analysis, unless otherwise specified.

Participant Awareness

At a midstream position in its focus, the program leverages HVAC contractors to spread awareness and to encourage customer participation. Participant survey results indicated this approach has been effective. When asked, most survey respondents indicated they heard about the program from a contractor (through phone calls, print advertising or other means), or while shopping for new cooling equipment. Figure 31 provides the distribution of responses.[15]

Figure 31. Sources of Participant Information (With Precision at 90% Confidence)



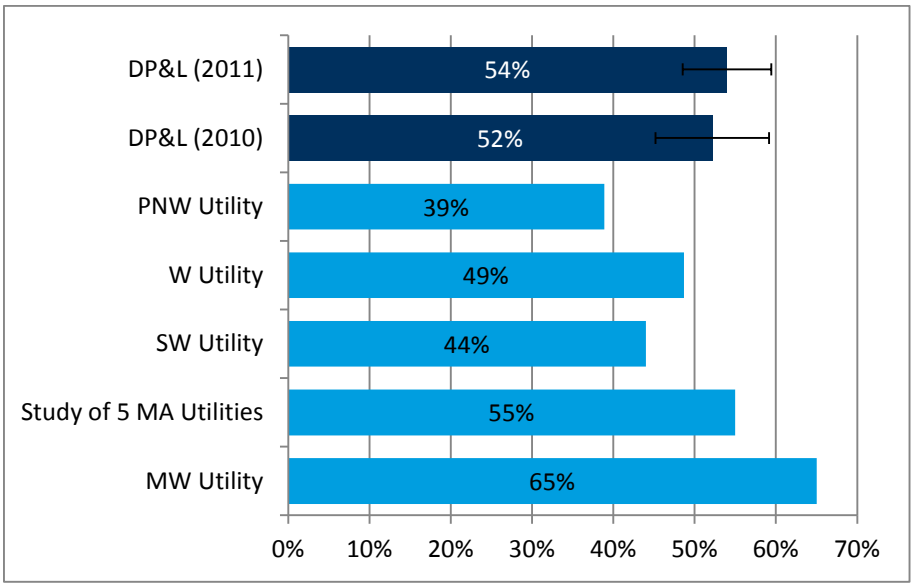
Source: Residential Heating & Cooling Rebate Program Participant Survey, B2.

Verbatim responses from respondents indicating "some other way" generally also alluded to the importance of contractors' decision-making process. Five respondents cited a contractor by name, without prompting.

When comparing this finding to survey findings from the 2010 program year evaluation (Figure 32), a small increase occurred in percentages of respondents claiming to have first heard about the program from a contractor. This trend is not statistically significant.

[15] If the respondent indicated >1 source, only the source from which they first heard about the program is included in Figure 31.

**Figure 32. Contractors as Sources of Information about Program*
(With Precision at 90% Confidence)**



* DP&L percentages include respondents cited the following information sources: Mailed letters from contractors; print ad from contractors; phone calls from contractors; during repair/maintenance visits; and from contractors while shopping.

We also found that the program closely resembles other HVAC programs across the country.

DP&L appeared to successfully spread awareness about the program (Figure 33). Many respondents indicated they had some knowledge of the rebate program, even before a contractor performing work on their cooling equipment mentioned the availability of rebates. Surveys also indicated the majority of contractors explained the utility rebates to homeowners when installing rebate equipment.

Figure 33. HVAC Contractors and Program Awareness

Before the contractor discussed the available DP&L rebates, were you aware DP&L was offering incentives for high efficiency heating and cooling equipment?	Did the contractor that installed the [HEATING/COOLING] unit explain DP&L rebates were available to help you purchase an energy efficient [HEATING/COOLING] for your home?
•35% answered in the affirmative •[n=23. Absolute precision.: 16%]	•92% answered in the affirmative •[n=203. Absolute precision: 3%]

Surveys indicated that, in general, contractors helped raise customers' awareness about energy-efficiency benefits, through leave-behind materials, and that customers read them, as shown in Table 52.

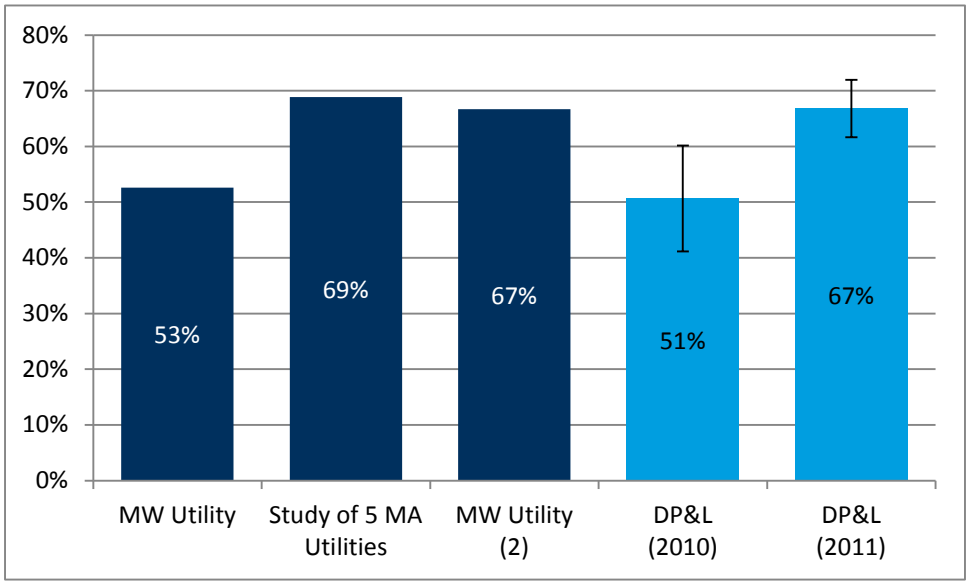
Table 52. Leave-Behind Energy-Efficiency Literature

Did the contractor provide any literature about the rebate or the benefits of high efficiency [HEATING/COOLING]? (n=226)	% of Responses	Precision at 90% Confidence
Yes	67%	±5%
What did they provide? (n=151)		
Brochure	48%	±7%
One page handout	20%	±5%
Link to website	6%	±3%
Other	7%	±3%
Did you read any of the information provided? (n=123)		
Yes	83%	±6%

Source: Residential Heating & Cooling Rebate Program Participant Survey, B6, B7, and B8

When comparing this finding to survey findings from the 2010 program year evaluation (Figure 34), we saw significant increases in the percentage of respondents claiming to have received energy-efficiency material from their HVAC contractor. This trend is statistically significant.

Figure 34. Leave-Behind Energy Efficiency Literature (With Precision at 90% Confidence)



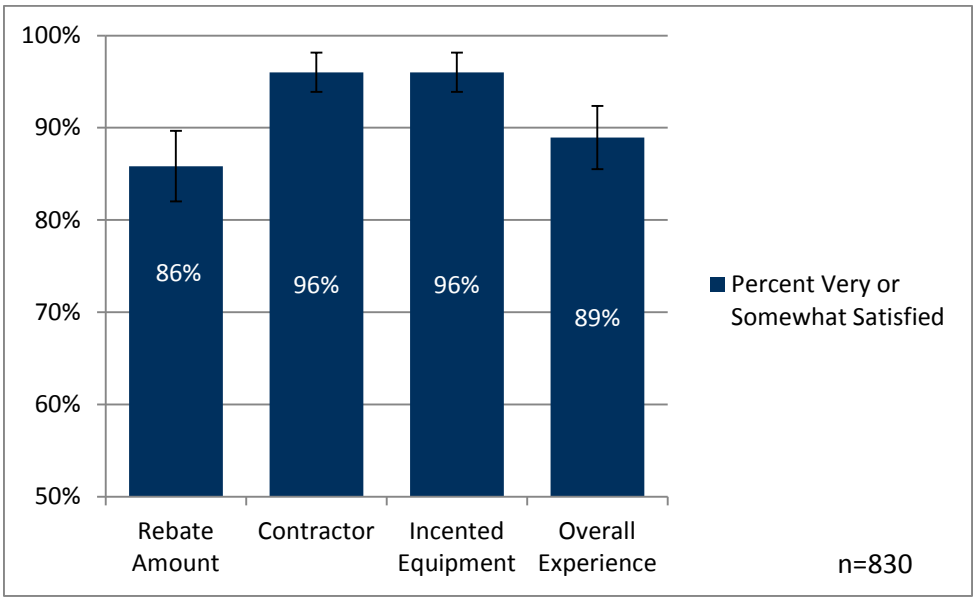
We also found that, with this increase, the program more closely resembles other HVAC programs across the country.

Participant Satisfaction

Program participants surveyed indicated a high satisfaction level across program elements: rebate amounts; contractors performing work; incented equipment; and their overall experience.

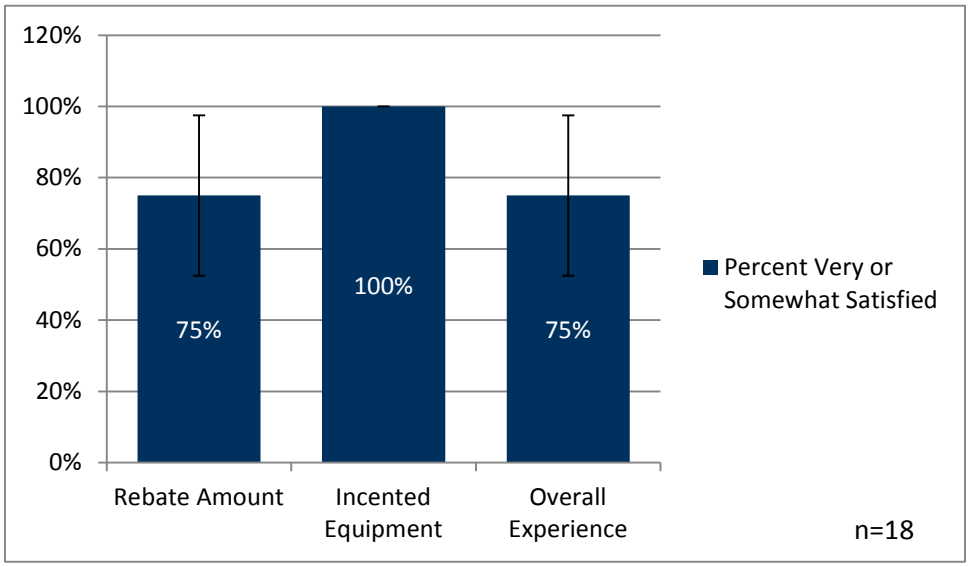
Figure 35 and Figure 36 provide the full distribution of responses.

Figure 35. Program Satisfaction: General Participant Survey (With Precision at 90% Confidence)



Source: Residential Heating & Cooling Rebate Program Participant Survey, G7.

Figure 36. Program Satisfaction: Mini-Split Survey (With Precision at 90% Confidence)

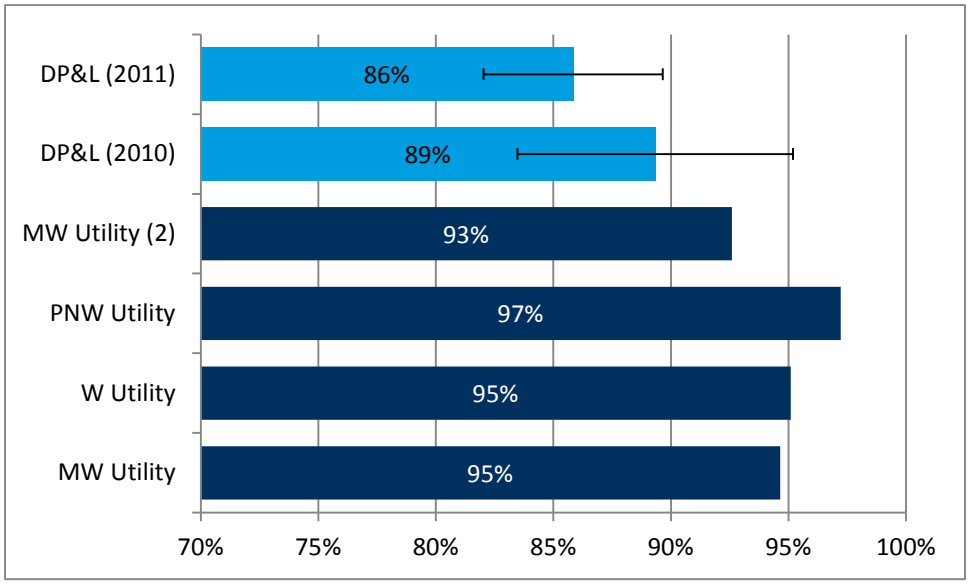


Source: Residential New Construction Mini-Split Participant Survey, D4.

We compared 2011 satisfaction survey responses from the general participant survey (as the program design for these measures was more common) to the 2010 evaluation surveys results and to survey results from comparable programs across the country.

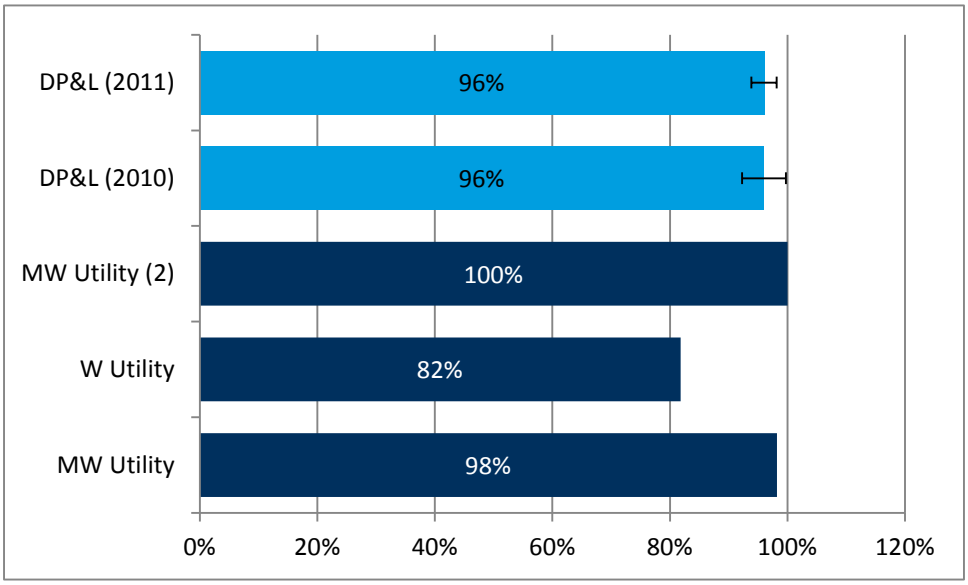
Overall program satisfaction was very high, but, compared to some other programs across the country (as shown in Figure 37), DP&L ranked slightly lower. Satisfaction in the program rebate amount dropped slightly from 2010 to 2011. However, this is not statistically significant.

Figure 37. Satisfaction with Rebate Amount (With Precision at 90% Confidence)



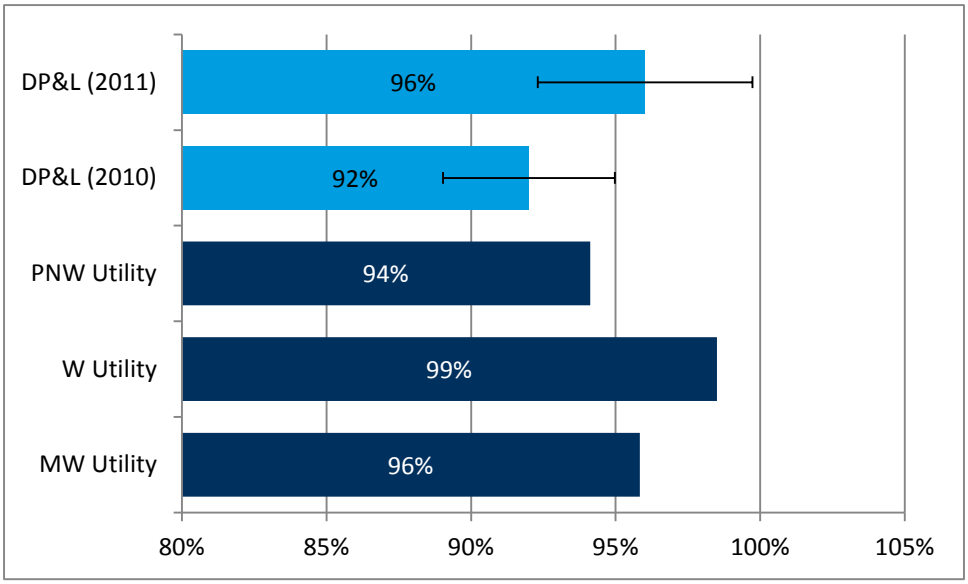
Customer satisfaction with contractors installing incented equipment was very high, and similar to other comparable programs, as shown in Figure 38.

Figure 38. Satisfaction with Contractor that Installed Incented Equipment (With Precision at 90% Confidence)



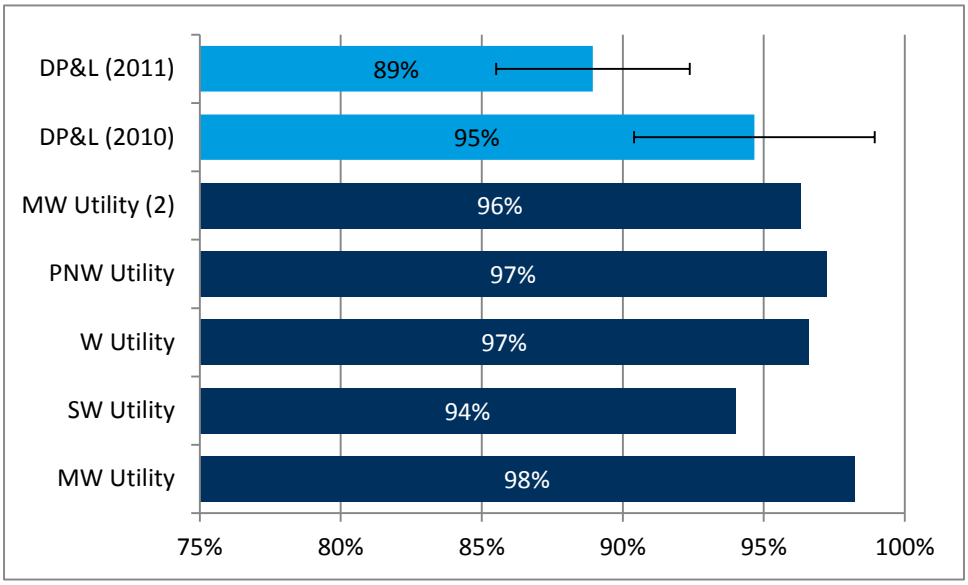
We found satisfaction in the incented equipment to be in line with findings from other evaluations. Satisfaction appeared to have increased between the 2010 and 2011 survey effort, but this trend is not statistically significant.

Figure 39. Satisfaction with Incented Equipment (With Precision at 90% Confidence)



We found overall program satisfaction similar with comparable programs. Satisfaction appeared to have dropped slightly from the 2010 to 2011 survey effort. This trend is statistically significant.

Figure 40. Overall Program Satisfaction (With Precision at 90% Confidence)

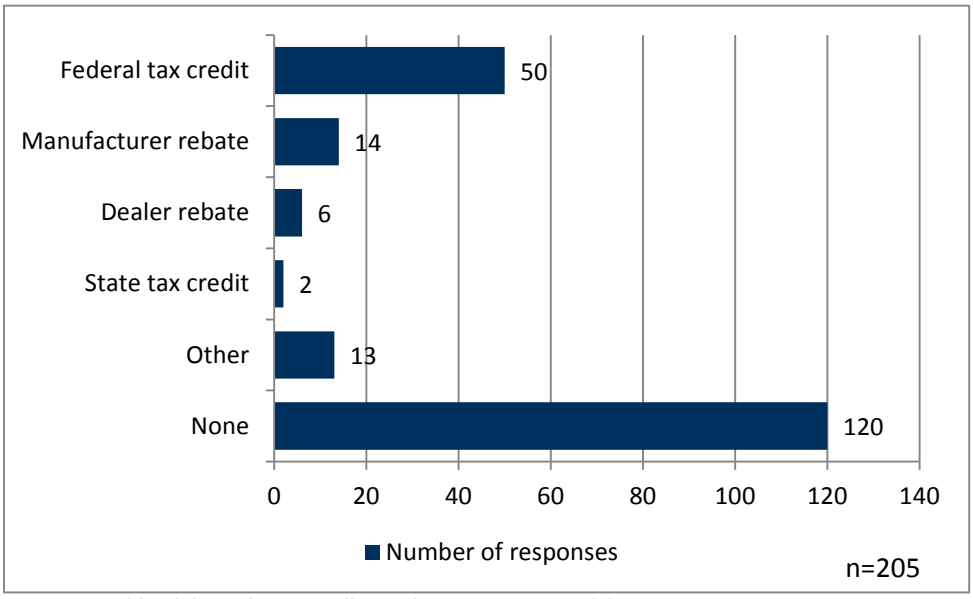


Other Rebates and Incentives

Program participants often made use of other rebates and incentives to offset costs of new cooling equipment, in addition to rebates offered by DP&L. The most commonly cited incentive among general participant survey respondents was the federal tax credit and manufacturer rebates, as shown in Figure 41. Of 13 respondents indicating "other," eight indicated they also

received an incentive from Vectren. Three mini-split survey respondents also indicated they applied for the federal tax incentive.

Figure 41. Additional Rebates and Incentives

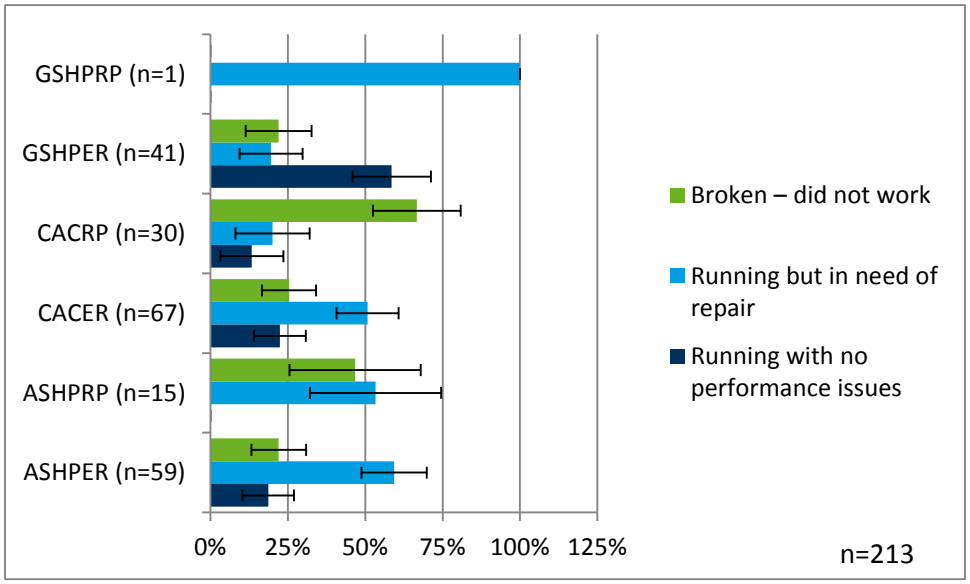


Source: Residential Heating & Cooling Rebate Program Participant Survey, F1

Existing Equipment

Program participants in the early replacement and replace on burnout measure categories were asked about the condition of their existing cooling equipment, prior to installation of the incented energy-efficient equipment. Responses varied, but, notably, a large number of early replacement survey respondents indicated their equipment was broken and did not work. This was acceptable in measure requirements, provided the equipment could be repaired for less than $1,000. Figure 42 provides distributions of responses by measure.

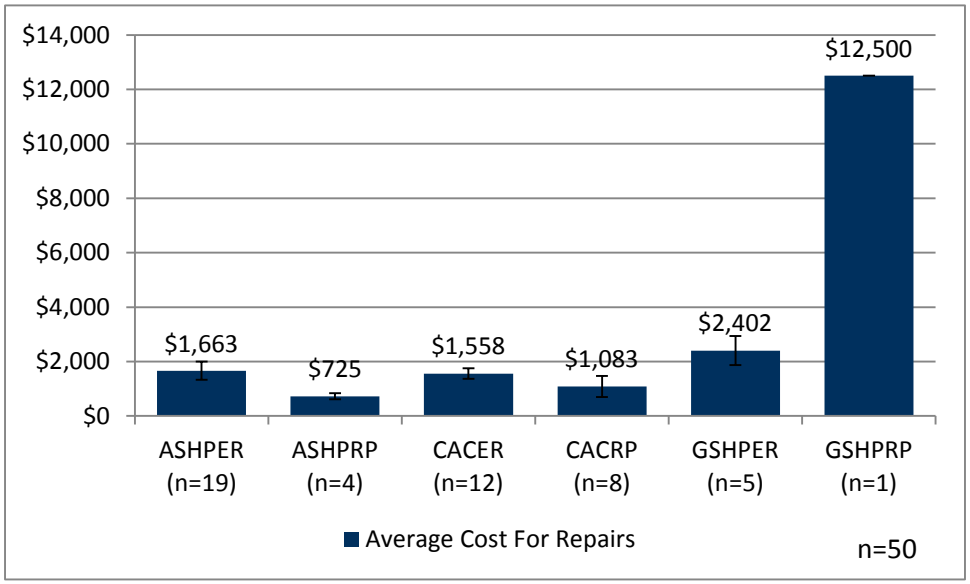
Figure 42. Condition of Replaced Equipment (With Precision at 90% Confidence)



Source: Residential Heating & Cooling Rebate Program Participant Survey, E2.

Survey respondents indicating their cooling equipment needed repairs were asked what repairs would have cost, had they not replaced the equipment. Average estimated repair costs for equipment in the early replacement category exceeded the replace-on-burnout category. Additionally, the average estimated early replacement repair cost exceeded the repair cost threshold in the measure criteria.

Figure 43. Estimated Cooling Equipment Repair Costs (With Precision at 90% Confidence)



Source: Residential Heating & Cooling Rebate Program Participant Survey, E4.

Several reasons may have resulted in this finding, including limited sample sizes. However, some contractors may have adjusted their repair bids upward to entice customers to purchase

new equipment, and then recorded repair costs below $1,000 to qualify for the early replacement rebate.

Replacing rather than repairing cooling equipment generally is more profitable for HVAC contractors. Conversations with the program implementer indicated they have encountered this issue outside of the DP&L program, and are actively taking steps through contractor outreach and program quality assurance to ensure this does not become a problem.

Participant Demographics

Demographic findings from the participant survey are provided in Appendix J.

Recommendations

Drawn from the preceding findings, Cadmus offers the following recommendations:

- Review early replacement approval procedures. Surveys suggest the screening procedure for early replacement participants should be reviewed to help ensure steps are in place to steer participants with clearly nonfunctioning equipment to the regular replacement program incentive.
- Continue to maintain and develop strong trade alley relationships. Surveys found trade allies were the primary information source for program partcipants about the program.

RESIDENTIAL CERTIFIED HVAC TUNE-UP PROGRAM

Program Design Changes

Due to limited uptake among contractors and customers in the 2010 and 2011 program years, DP&L and CSG chose to make changes to the 2012 Residential Certified HVAC Tune-Up Program. The proposed 2012 Residential HVAC Tune-Up program will resemble more typical, checklist-based tune-up programs. Under the proposed program, participant contractors will conduct a series of required tests and adjustments designed to achieve energy savings for most cooling equipment. To ensure quality work is conducted, contractors will be required to use quality, correctly calibrated tools. CSG will conduct follow-up verification site visits.

This program's design seeks to encourage high participation levels by placing the tune-up more in line with services contractors regularly offer. Higher program participation will be used to offset any reductions in per-UES savings from tune-up procedures. Program and implementation staff anticipate adding further requirements to increase the per-UES.

Given these changes, Cadmus did not conduct the planned participant survey. Rather, Cadmus conducted a market characterization survey, aimed at gauging interest and potential uptake of the modified tune-up program planned for the 2012 program year.

Evaluation Overview and Methodology

For the 2011 evaluation, we followed impact researchable questions and evaluation activities, outlined in the Dayton power and Light 2011 Evaluation, Measurement, and Verification Plan. Table 53 identifies key impact researchable evaluation issues, outlined in the original plan, addressed in the 2011 evaluation.

Table 53. Key Researchable Questions

Researchable Question	Activity to Support Question
How can the program increase its energy and demand savings?	• Program and implementation staff interviews • Billing analysis
What were the gross electric savings and demand reductions?	• Program database review • Participant billing analysis • Draft Ohio TRM calculation and assumption review
What changes to the program design and delivery would improve its performance?	• Program and implementation staff interviews • Program database review
How effective has the program been in recruiting and training HVAC contractors?	• Program and implementation staff interviews

Detailed Evaluation Findings

The following key findings relate to the impact evaluation, stakeholder interviews, and market characterization study:

- The program achieved 106,699 kWh and 40.2 kW in demand. The realization rate, compared against claimed *ex ante* claimed savings, was 273% for energy savings and 522% for demand savings.

Table 54. HVAC Tune-Up Program Claimed and Achieved Energy Savings

Program	*Ex Ante*		Verified		Adjusted		
	Claimed kWh	Claimed kW	Gross kWh	Gross kW	Gross kWh	Gross kW	Precision at 90% Confidence
Central AC Equipment Tune-Up	39,034	7.7	26,780	21.7	88,389	36.5	±29%
Air-Source Heat Pump Equipment Tune-Up			7,942	2.6	18,310	3.7	±36%
TOTAL	39,034	7.7	34,722	24.2	106,699	40.2	±25%

- Compared to its goals, the program experienced a realization rate of 4% for energy savings and 2% for demand savings, primarily as energy savings were considerably lower than expected due to participation (the program anticipated significantly higher contractor and customer program uptake). Original program goals also predicted higher energy savings per tune-up than those realized.
- Participation continued to be a significant issue in the 2011 program year, which DP&L and the program implementer were aware of and have taken significant steps in redesigning the program to increase participation. Early 2012 communications indicate this redesign shows promise.
- The market characterization survey responses indicated interest may exist in the proposed 2012 Tune-Up program design.

Data Collection Methods

Evaluation of the 2011 program utilized the following approach.

Program Management and Implementer Interview

In July 2011, we interviewed three representatives: two from DP&L, and one from CSG. Representatives were selected to provide unique perspectives, and to illuminate nuances of 2011 program design and implementation.

Program Participant Utility Bill Regression Analysis

In February 2012, we conducted a billing analysis of program participants. As no significant changes occurred between the 2010 and 2011 program years, participants from both years were included in the analysis. Billing analysis results were used to evaluate measure-level savings estimates.

Baseline Assumptions

Existing units receiving program services were residential central air conditioning units or air-source heat pumps. Units had to pass test-ins and test-outs to qualify for the larger program incentive.

DP&L Customer Market Characterization Survey

In October 2011, we surveyed a random sample of DP&L customers. Only customers not appearing in 2010 and year-to-date 2011 Residential Certified HVAC Tune-Up Program records were included in the sample frame. The survey planned and achieved 100 completes.

Impact Methodology and Findings

Claimed e*x ante* gross savings were derived from the draft Ohio TRM. Verified gross savings were derived by applying draft Ohio TRM savings equations and assumptions to the group of tune-ups in the program tracking database if they successfully passed the test-in and test-out tune-up steps.

Adjusted gross savings were derived by conducting a participant billing analysis, and applying the resulting UES estimates to the population of tune-ups in the program tracking database if they successfully passed the test-in and test-out requirement. For units passing the test-in, but failing the test-out, we applied the 5% draft Ohio TRM maintenance energy saving factor.

Verified and adjusted gross demand saving were calculated using the draft Ohio TRM. Adjusted gross demand savings included tune-ups failing the test-out step.

Table 55 provides the reported 2011 program population.

Table 55. Total Reported Incented Units by Measure Type

Measure	Pass (in) | Fail (out)	Pass (in) | Pass (out) *	Total
Central AC Equipment Tune-Up	133	191	324
Air-Source Heat Pump Equipment Tune-Up	16	18	34
TOTAL	149	209	358

* DP&L only claimed savings for units passing both the test-in and test-out tune-up steps.

Program Participant Utility Bill Regression Analysis

Cadmus used a pre- and post-fixed effects modeling approach, allowing direct development of savings estimates for both eligible equipment types.

Upon receiving billing data for program participants from February 2009 through December 2011 we paired monthly billing information pre- and post-equipment tune-up. This ensured using the same months in both pre- and post-periods, preventing bias from using mismatching months. A model that included participants with 11 months of pre- and post-billing information provided the most accurate results.

We obtained daily weather data from NOAA weather stations corresponding to program participant ZIP codes. From daily weather data, we obtained the base 65 reference temperature heating and cooling degree days. We then matched participant billing data to the nearest weather station by ZIP code, and matched each monthly billing period to the associated base 65 heating and cooling degree days.

Model Specification

We used a fixed effects modeling method, employing pooled monthly time-series (panel) billing data. The modeling approach corrected for differences between pre- and post-weather as well as for differences in usage magnitudes between participants. The fixed effects component was characterized by normalization of variations across the range of participants by including a separate intercept for each customer. This assured model savings estimates were not skewed by unusually high or low usage participants. Appendix E provides model specifications and output data.

Data Screening

The following criteria were used to screen customer billing data:

- Analysis excluded participants with fewer than 11 paired months in the pre- or post-period. This screen removed most 2011 program participants from analysis.
- Analysis excluded participants also participating in the HVAC Rebate program.
- Analysis excluded participants that did not pass the implementer test, and did not receive the full $110 rebate.
- Analysis excluded participants with expected deemed savings over 70% of pre-usage. In effect, this eliminated low-usage accounts, where expected savings from measure installations were too large in reference to total pre-period usage.
- Analysis excluded accounts changing usage from the pre- to post-period by more than 70%.
- Analysis excluded participants using less than 1,825 kWh in the pre- or post-year, and participants using less than 5 kWh per day in the pre- or post-period, as this indicated insufficient cooling or heating usage, or vacant participant homes.

Screens eliminated 55% of the participants.

Model Results

Table 56 summarizes measure savings for the program. Generally, model savings estimates were significantly above deemed estimates.

Table 56. Measure Savings Estimates (kWh)

Measure	N	Model Savings	Precision at 90% Confidence	CSG Average UES	Draft Ohio TRM*	CSG Realization Rate	TRM Realization Rate
Central AC Equipment Tune-Up	191	362	±37%	187	140	194%	258%
Air-Source Heat Pump Equipment Tune-Up	18	610	±70%		441	327%	138%

* Average draft Ohio TRM UES for units passing the test-in and test-out steps. Average draft Ohio TRM UES for units failing the test-out step and included in the adjusted gross energy savings are AC=144 kWh and ASHP=458 kWh.

UES estimates identified through the participant billing analysis were applied to the program population of tune-ups passing *both* the test-in and test-out steps.

Table 57. Adjusted Gross Energy Savings from Participant Billing Analysis

Measure	Participating Units	Adjusted Gross UES (kWh)	Total Adjusted Gross Annual kWh Savings
Central AC Equipment Tune-Up	191	362	69,191
Air-Source Heat Pump Equipment Tune-Up	18	610	10,987
TOTAL	209	973	80,178

Draft Ohio TRM Calculations

Cadmus deferred to the draft Ohio TRM in calculating demand savings (kW) for units with billing analysis energy savings estimates (units passing both the test-in and test-out steps), and when calculating energy and demand savings estimates for units passing the test-in, but failing the test-out steps.

Table 58 provides adjusted gross energy saving estimates after making the above adjustments.

Table 58. Adjusted Gross Energy Savings from Draft Ohio TRM Calculations

Measure	Participating Units	Total Annual kWh Savings
Central AC Equipment Tune-Up	133	19,198
Air-Source Heat Pump Equipment Tune-Up	16	7,323
TOTAL	149	26,521

When using the draft Ohio TRM to calculate energy savings, Cadmus adhered to all equations and assumptions articulated in the manual with the following exception: the draft Ohio TRM lists 631 as full-load cooling hours for the Dayton, Ohio, area. However, this estimate included a 33% reduction for oversizing of newly installed equipment. We established this oversizing correction was not applicable for this program, based on discussions with program staff, and, instead, used full-load cooling hours derived from the ENERGY STAR Calculator (947). The billing analysis results also implied the cooling hours in the manual were too low.

Calculating Peak Demand Savings

We used draft Ohio TRM peak demand savings (kW) estimates for all tune-ups in the 2011 participant database. In calculating demand savings, Cadmus adhered to all equations and assumptions articulated in the manual, with the following exceptions:

- Following adjustments suggested in the draft Ohio TRM Joint Objections and Comments document, coincidence factors (CF) were adjusted from the 0.5 draft Ohio TRM value to 0.44.
- Following adjustments suggested in the draft Ohio TRM Joint Objections and Comments document, the maintenance demand savings factor (MFd) was adjusted from the 0.02 TRM value to 0.05, setting it equal to the draft Ohio TRM maintenance energy savings factor (MFe).

Table 59. 2011 Adjusted Gross Demand Savings (kW)

Measure	Participating Units	Total Annual kW Savings
Central AC Equipment Tune-Up	324	36.5
Air-Source Heat Pump Equipment Tune-Up	34	3.7
TOTAL	358	40.2

Process Findings

Program Management and Implementer Interview

The DP&L tune-up program is unique among utility-sponsored tune-up programs, in that it requires thorough training in the form of a two-day course, correct equipment calibration, and, in some cases, investment in new equipment. The program also requires a test-in and test-out, and minimum energy-efficiency improvements to qualify for the complete incentive.

Program staff have expressed ongoing concerns regarding demand for the service throughout program implementation. In addition, due to the program's unique qualities (i.e., the test-in and test-out steps), some uncertainty remains about achievable savings. No significant program design changes have occurred between 2010 and 2011. Similar to the 2010 program, total savings for the 2011 year were significantly lower than anticipated.

The program has experienced low trade-ally uptake, both in recruitment and retention, and in the number of incented tune-ups performed by active trade allies. As a result of program uptake, DP&L and CSG expected participation goals for the 2011 program year would not be met.

Program representatives attributed the low uptake to the program's complexity compared to standard equipment tune-ups, and difficulties contractors have experienced in differentiating the incented tune-up from standard offerings, when presenting the program to customers.

To address these barriers, the program plans on implementing a scaled-back version of the tune-up in 2012. The new program will have some 2011 program elements (e.g., requirements around measurement equipment calibration), but will be centered on a checklist of required steps rather than on the thorough test-in and test-out process—a model following the approach taken by several other utility programs. The 2012 program anticipates lower per-measure savings, but significantly higher program participation, as contractors will be able to integrate the program more easily into existing business practices.

Program and implementation staff view the planned 2012 program as a way to build awareness and demand for more thorough tune-ups than might generally be offered, while still achieving appreciable energy savings. Program and implementation staff plan to modify the tune-up program over time, ensuring the program continues to transform the market.

Market Characterization Findings

To gauge interest in the planned 2012 tune-up program, we fielded a market characterization survey among a random sample of DP&L customers.

Survey Sampling and Diagnostics

DP&L provided contact information for 4,003 customers, which was reviewed to ensure it did not contain duplicate entries or tune-up program participants. Customers were evenly distributed geographically in the sample frame, which contained contacts for customers in 22 of DP&L's 24 service territory counties. Table 60 provides additional detail on the sample frame.

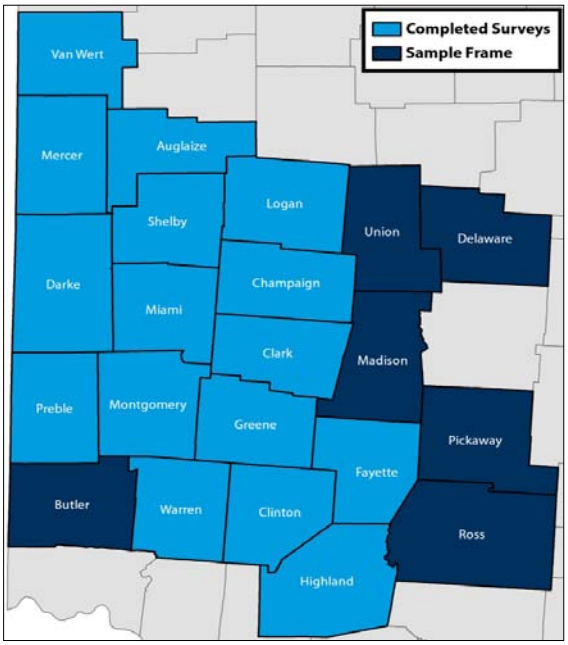
Table 60. Geographic Distribution of Sample Frame and Survey

	Sample Frame	Completed Survey
Total Contacts	4,003	100
Sample Frame	4,001	N/A
Zip Codes	164	57
Counties	22*	16
Average Contacts/Zip	24.4	1.8
Min Contacts/Zip	1	1
Max Contacts/Zip	155	7

* Excludes four entries represented by three 5-digit numbers that are not valid ZIP codes.

Figure 44 shows distributions of completed surveys.

Figure 44. Geographic Distribution of Sample Frame and Survey



The six counties where no customers completed surveys represented a relatively small number of DP&L customers: combined, contacts for these counties represented approximately 2% of the survey sample frame.

Table 61 provides survey diagnostics.

Table 61. Survey Diagnostics

Completed Surveys	Count
Number of Calls Required to Achieve Sample	2,812
Response Rate (RR1)	2.5%
Cooperation Rate (COOP1)	5.9%

Survey Findings

For ease of reading, we have provided relevant survey findings (regardless of equipment type) in the following text, figures, and tables. In addition, we removed "don't know" and "refused" responses from analysis, unless otherwise specified.

Target Market Segment

The survey applied the following screening criteria:

- DP&L residential customer;
- Homeowner;
- Eligible equipment installed at a residence;
- Has not participated in 2010 or 2011 Certified tune-Up program; and
- Has a maintenance contract or seeks regular service for their cooling equipment.

Of 100 respondents, 86 had a central air conditioner, and 16 had an air-source heat pump.

Few respondents had regular maintenance contracts—just 13 out of 100 (13%). However, over half of all respondents (57) indicated they sought regular service for their cooling equipment. As indicated in Table 62, respondents with maintenance contracts maintained them an average of five years.

Table 62. Equipment Maintenance

	Count/Percent	Precision at 90 % Confidence Interval
Respondents with regular maintenance contracts (n=100)		
With contracts	13	N/A
Average length of contract (yrs)	5.8	±17%
Respondents without regular maintenance contracts that seek maintenance (n=87)		
Seek regular maintenance	57	N/A
Frequency of regular maintenance—with and without contracts (n=73)*		
Seek maintenance multiple times a year	49%	±10%
Seek maintenance year	19%	±8%
Seek maintenance every other year	12%	±6%
Seek maintenance every three years	8%	±5%
Seek maintenance less than every three years	4%	±4%

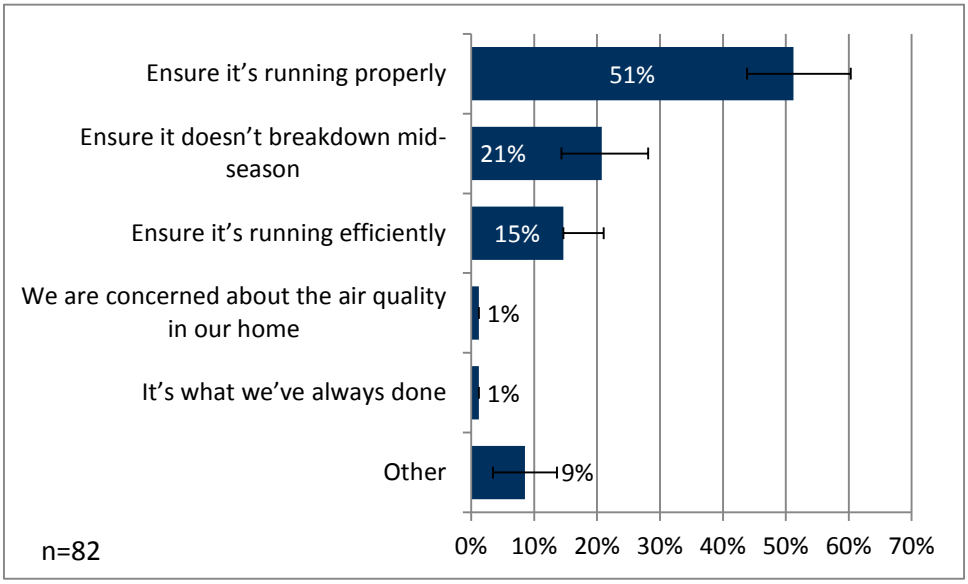
* Respondents that indicated they were not sure if they had a regular maintenance contractor or had their equipment maintained were included in this group.

Source: HVAC Tune-Up Survey, B1, B2, B3, and B4

Respondents with maintenance contracts and those seeking regular maintenance were asked to estimate how often their equipment received some form of maintenance. Surprisingly, nearly half indicated they sought maintenance multiple times per year, indicating significant opportunities for energy-efficient tune-ups. Out of 73 respondents, 49 indicated they utilized one contractor for all of their maintenance needs.

Reasons for seeking regular maintenance (with and without a maintenance contract) varied, though preventative maintenance was the most common rationale. Figure 45 provides additional detail.

Figure 45. Reasons for Seeking Maintenance (With Precision at 90% Confidence)

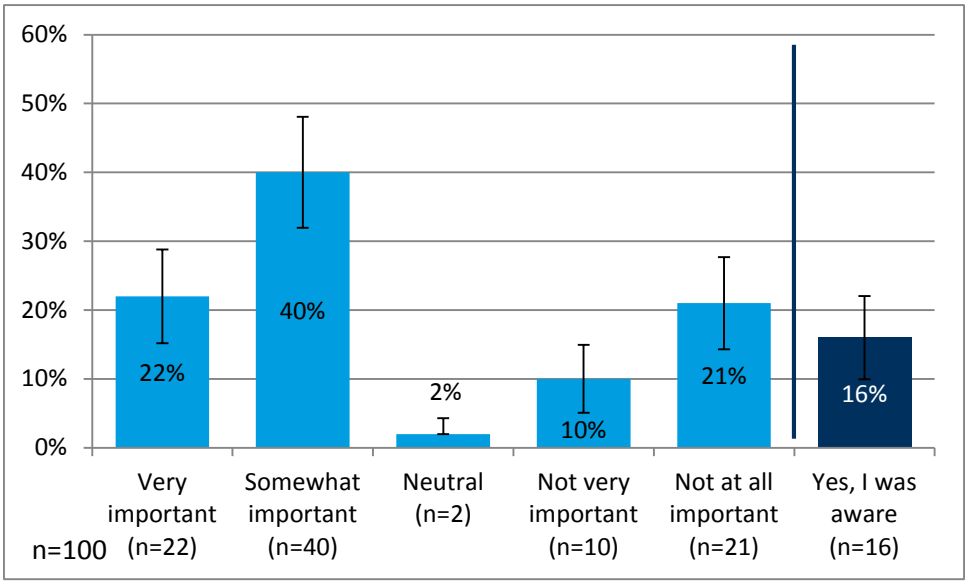


Source: HVAC Tune-Up Survey, B5.

A principal feature of the current tune-up program requires DP&L to certify the quality of work performed on cooling equipment. By participating in the DP&L program, customers have work performed by technicians that have additional training and calibrated tools, and they have additional tests conducted. Further, call-center implementation and field staff perform quality control to ensure: only equipment requiring adjustment receives a tune-up; and work performed adheres to strict program requirements.

To identify the value customers place on this service, we briefly described the program to customers, and then asked them how important it was that their HVAC contractor be certified by DP&L. As indicated in Figure 46, responses were mixed, though 16% of respondents knew DP&L provided this service.

Figure 46. DP&L Recognition of Contractor (With Precision at 90% Confidence)



Source: HVAC Tune-Up Survey, B7.

As noted, most respondents received regular maintenance for their cooling equipment. However, standard maintenance did not necessarily translate directly into energy-efficiency improvements. We asked respondents if they had their equipment adjusted to improve its energy usage. As shown in Table 63, nearly one-third of respondents indicated they received such a service, on average, about a year-and-a-half ago.

Table 63. Interest in Energy-Efficiency Tune-Up

	Percent	Precision at 90 % Confidence Interval
Have you ever had your equipment adjusted so that it is more energy efficient? (n=100)		
Yes	27%	±7%
Average time (yrs) since adjustment	1.4	±26%
Would you be interested in this if DP&L helped cover the cost? (n=59)		
Yes	32%	±10%

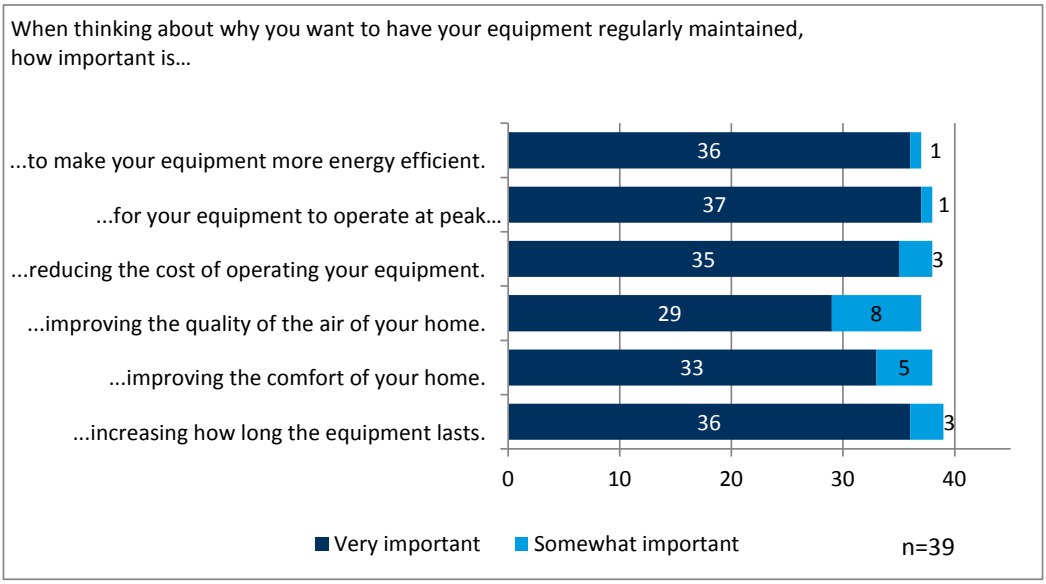
Source: HVAC Tune-Up Survey, B10, B11, and B12.

Roughly one-third of respondents, having had never received an adjustment to increase their equipment's energy efficiency, indicated they would be interested in doing so, if DP&L helped cover costs.

Cadmus asked survey respondents seeking regular maintenance to rank the importance of several topics appearing in 2011 program marketing messages

The overwhelming majority of respondents indicated all of the program's messaging was "very" or "somewhat" important in their decision. While still important to the majority of respondents, improving the quality of air in the home appears to be the least important messaging.

Figure 47. Factors in Decision to Seek Regular Maintenance



Source: HVAC Tune-Up Survey, Section C

Respondents indicated that, on average, their equipment was approximately 10 years old. However, a wide distribution in responses occurred. Table 64 provides statistics addressing these responses.

Table 64. Age of Installed Equipment (n=86)

Average	Precision at 90% Confidence
9.2	±17%

Source: HVAC Tune-Up Survey, D5.

Despite the average age of equipment, 49% of all respondents believed they had high-efficiency cooling equipment (e.g., ENERGY STAR qualified). While this may have been true at the time of purchase, 60% of 86 respondents providing an estimate on equipment age indicated their equipment was manufactured prior to the 2006 federal minimum increase in central air conditioner efficiency levels from 10 SEER to 13 SEER.

Current cooling equipment installed in more than half (59) of respondents' homes existed before they moved in. Further, 12 respondents (20%) indicated existing equipment also had an existing maintenance contract.

The market characterization survey included a demographic battery of questions. Demographic findings from the participant survey are provided in Appendix J.

Recommendations

Based on the preceding findings, Cadmus offers the following recommendations:

- Due to the limited participation and lower than anticipated verifiable energy savings in past program years, the program has not been cost effective. The 2012 proposed changes are likely to take the program closer to cost effectiveness. We strongly believe

that services targeted at high use customers will help cost effectiveness significantly. While individual programs do not need to be cost-effective (just the portfolio of programs), DP&L should continue to closely monitor the program benefits. As this program aspires to transform the HVAC tune up and installation market, its benefits extend beyond the immediate participants. As such, its short term cost effectiveness understates its long term impacts.

RESIDENTIAL BE3 SMART (ENERGY EDUCATION) PROGRAM

This chapter describes the evaluation approach, detailed evaluation findings, and conclusions and recommendations for the Be E^3 Smart Energy Education Program, which was administered in 2010 and 2011.

Evaluation Overview and Methodology

For our 2011 evaluation of the program, we followed researchable questions and evaluation activities outlined in DP&L's 2010–2012 Evaluation, Measurement, and Verification Plan. Table 65 identifies key researchable evaluation issues outlined in the original plan.

Table 65. Key Researchable Questions

Researchable Question	Discussion	Activity to Support Question
How many schools, teachers, and students participated in the program?	The magnitude of program participation will be closely tied to the achieved program savings.	• Review of program database and documentation
What are the gross energy and demand impacts of the Be E^3 Smart program?	The amount of gross electric savings and demand reductions will help create a business case to continue running the program, and will be useful for planning future program designs.	• Analysis of student-returned surveys • Engineering calculations
What program kit measures were useful? What measures were not as useful?	Understanding which kit measures are installed and which are not can help understand how to best support customers and make use of funding.	• Stakeholder interviews • Analysis of student/parent surveys
What barriers are there to school and teacher participation? How effectively does the program overcome those barriers?	Schools and teachers are highly tapped resources across the country. The program relies exclusively on these resources for successful program delivery. In the evaluation, we will seek to determine if additional services and resources could be provided to enhance program uptake across DP&L's service territory.	• Stakeholder interviews

Detailed Evaluation Findings

The impact analysis and interviews with program stakeholders produced the following key findings:

- As shown in Table 66, the program had total adjusted gross annual kWh savings of 1,171,055 and 120.9 gross kW reduction, resulting in a 100% kWh realization rate and a 88% kW realization rate against *ex ante* estimates.

Table 66. Be E^3 Smart Program Evaluation Results

Measure	*Ex Ante* Claimed Savings		Verified Gross Savings		Adjusted Gross Savings		
	Gross kWh	Gross kW	Gross kWh	Gross kW	Gross kWh	Gross kW	Precision at 90% Confidence
13-watt CFL	393,906	47.1	393,906	47.1	393,906	41.7	±1%
23-watt CFL	748,833	89.6	748,833	89.6	748,833	79.2	±1%
LED Night-lights	28,317	-	28,317	-	28,317	-	±2%
TOTAL	1,171,055	136.7	1,171,055	136.7	1,171,055	120.9	±1%

- Completed surveys were received from 72% (4,661) of students—slightly higher than the 69% response rate in 2010. Ninety-three percent of students said they installed at least one measure from the provided kits, compared to 75% in 2010.

  Eighty-four teachers participated in the 2011 program, compared to 86 in 2010. Only four of the 84 teachers, with classrooms accounting for 201 of the 6,464 participating students, did not return any evaluation materials to Ohio Energy Project (OEP).

- Overall CFL installation rates were lower than other, comparable programs across the country, with the program realizing a 67% CFL installation rate, compared to 70% to 89% among comparable programs. This likely reflects the larger number of CFLs provided in the kit, and the time students had to install the measure before completing the Family Home Installation Survey. Implementing a follow-up survey could help DP&L understand how many CFLs eventually become installed as well as optimal numbers of CFLs per kit.

- Compared to similar programs, fewer participants reported adjusting heating and cooling temperature settings. This could reflect moderate spring temperatures—the season in which the students completed the Family Home Installation Survey. A follow-up survey implemented during Dayton's heating and/or cooling seasons could determine if participants changed temperature settings (and if the behavior persists).

- Manual entry of Family Home Installation survey data diverted OEPs resources away from curriculum development and other planning activities. A data entry and storage system must balance efficiency and data quality. While the new system greatly improved data quality (compared to the 2010 program year), OEP found it inefficient. For the 2011–2012 school year, OEP has implemented an online survey to streamline collection and entry of data.

- From 2010 to 2011, teachers' ratings of individual lessons' effectiveness decreased for five of seven lessons. While a small decrease for most lessons, additional feedback from teachers may be required to understand this perceived decrease in effectiveness.

Data Collection Methods

The program relied on responses from a student take-home survey (the Family Home Installation Survey) to estimate the number of measures installed from kits provided through OEP. After presenting the energy education lesson, teachers provided students with a paper take-home survey to complete within one or two weeks. On the survey, students reported if and how many

measures they installed from the kit, and if they adopted recommended behavioral changes (such as adjusting thermostat settings) after receiving the kits. The survey also collected basic household and demographic information, such as heating and cooling system types, family size, and type of home (e.g., single-family or multifamily).

Teachers returned completed surveys to OEP, and OEP staff entered data into a Microsoft Excel file. OEP reported that teachers provided kits and take-home surveys to 6,464 participating students.

Impact Methodology and Findings

Ex ante gross saving estimates were derived by taking total count of measures distributed, applying adjustments for participation and measure installation (provided by Cadmus), and then multiplying total measure quantities by per-unit saving estimates provided in the draft Ohio TRM.

Cadmus calculated verified gross savings the same way. We did not adjust savings calculations or assumptions. Specific adjustments are provided in the impact methodology section.

No differences occurred in evaluated savings due to DP&L adopting the evaluated measure savings values and methods for its *ex ante* estimates.

CFLs

Our methodology for determining CFL adjusted gross savings involved use of savings calculations outlined in the draft Ohio TRM.

Energy:

$$\Delta kWh = \frac{\Delta Watts * ISR * HOURS * WHFe}{1{,}000}$$

Demand:

$$\Delta kW = \frac{\Delta Watts * ISR * HOURS * WHFd * CF}{1{,}000}$$

Table 67 details input assumptions used to calculate savings for 13-watt and 23-watt CFLs.

Table 67. CFL Energy and Demand Savings Calculations Assumptions

Input	Assumption		Source / Notes
	13-watt CFL	23-watt CFL	
Δ Watts	42.3	74.8	Draft Ohio TRM. Calculated as bulb wattage multiplied by a delta watts multiplier of 3.25
In-Service Rate (ISR)	65%	70%	Be E3 Family Installation Survey
HOURS	1,040	1,040	Draft Ohio TRM
Waste Heat Factor for Energy (WHFe)*	1.07	1.07	Draft Ohio TRM
Waste Heat Factor for Demand (WHFd)*	1.07	1.07	Draft Ohio TRM, draft Ohio TRM Joint Objections and Comments
Summer Peak Coincidence Factor (CF)*	0.11	0.11	Draft Ohio TRM

* Only used in demand calculation.

Calculating an in-service rate required corrections for bias inherent in the student survey. Specifically, the unadjusted student survey installation rate was prone to the following two bias sources:

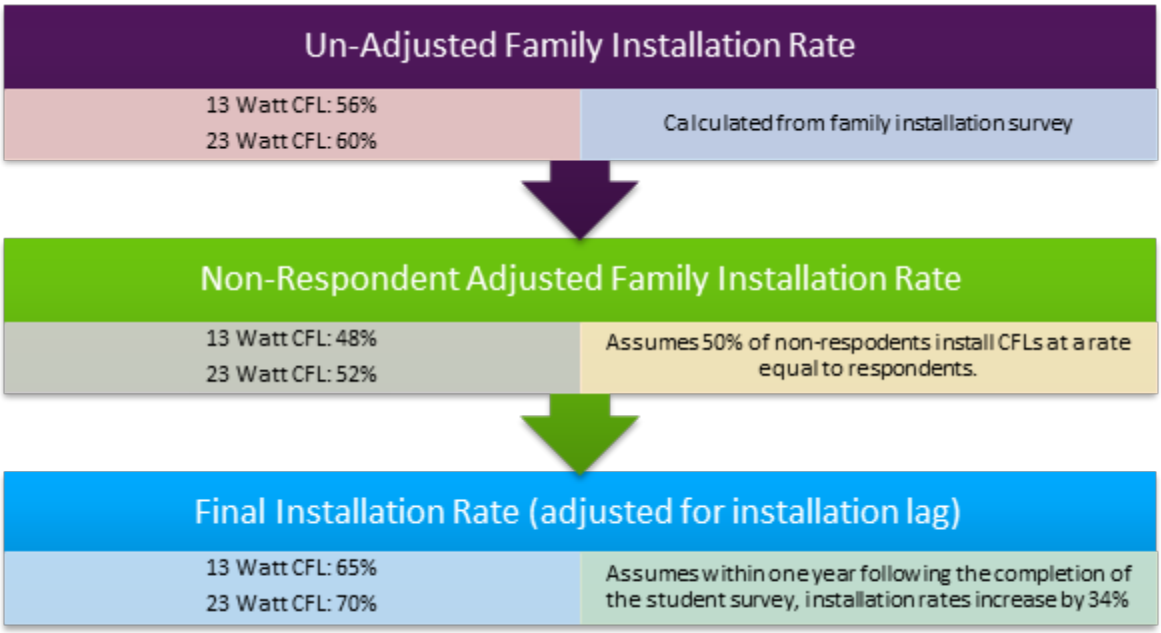
1. Students completing and returning the survey were more likely to install CFLs than those failing to complete the survey. Further, it was not possible to verify non-respondents received or installed the measure.
2. Students completed the survey within one to two weeks of receiving the kit, and may have had insufficient time to install the CFLs.

We assumed non-respondents installed kit measures at rate 50% of respondents. In other words, we assumed one-half of non-respondents did not install the measures, and the other half of non-respondents installed the measures at a rate equal to that of respondents.

Regarding the second bias source, for an evaluation of a large Midwestern utility's energy education program, Cadmus researched how installation rates following program participation compared to installation rates from a student survey. For two consecutive years, Cadmus called participants, and asked them if they had installed kit measures from the prior year. We compared installation rates from the follow-up survey to the student survey, and found, overall, CFL installation rates were 34% higher than student survey installation rates, after completing the survey.

Figure 48 provides the various steps and assumptions used in calculating the CFL installation rate.

Figure 48. CFL Installation Rate Calculation



Cadmus estimated installation of 8,378, 13-watt CFLs and 9,002, 23-watt CFLs, leading to savings of 393,906 kWh and 748,833 kWh, respectively.

LED Night-lights

The LED night-light savings calculation used the following algorithm, provided in an outdated version of the draft Ohio TRM:[16]

$$\Delta kWh = \frac{ISR * (Demand_{base} - Demand_{LED}) * HOURS}{1{,}000}$$

Table 68 shows inputs and assumptions into the LED night-light savings calculation

Table 68. LED Night-light Savings Calculation Assumptions

Input	Assumption	Source / Notes
$Demand_{base}$ (watts)	5	Draft Ohio TRM, typical C7 lamp
$Demand_{LED}$ (watts)	0.33	Draft Ohio TRM
In-Service Rate (ISR)	32.1%	Family Installation Survey
Hours	2,920	Draft Ohio TRM, on 8hrs/day 365 days/yr

To calculate LED night-light installation rates, we used an approach similar that used with CFLs, with an exception: for LED night-lights, participants indicated whether the measure replaced an existing night-light or was newly installed. As DP&L only realizes energy savings from replacement night-lights, we did not count non-replacements.

[16] Ohio Electric Utilities. 2009. *Technical Reference Manual for Ohio Senate Bill 221 Energy Efficiency and Conservation Program and 09-512-GE-UNC.*

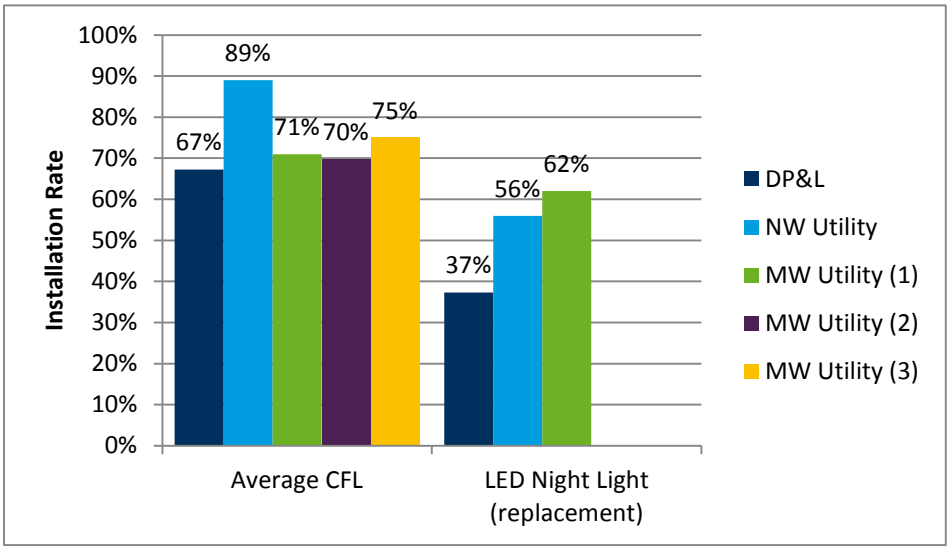
Table 69. LED Night Installations

	LED Night-light
Total distributed (A)	6,464
Distributed from survey (B)	4,661
Replacements from survey (C)	1,740
Installation rate from survey (D = C/B)	37%
Non-respondent night-lights (E = A-B)	1,803
Final Quantity Installed (F = C + 0.5*D*E)	2,077
Final Installation Rate (G = F/A)	32%

We calculated a 32% final installation rate, representing 2,077 LED night-lights, and contributing 28,317 kWh in savings.

As shown in Figure 49, final CFL and LED night-light installation rates for DP&L's Be E^3 Smart program ran somewhat lower than for similar programs at other utilities.

Figure 49. Installation Rate Benchmarking



Generally, programs providing a higher number of CFLs experience lower installation rates. For Be E^3 Smart, students received four CFLs—more than any program in the comparison group. Both the Northwest Utility and Midwest Utility 1, presented in Figure 49, provided one CFL. Midwest Utility 2 provided three CFLs, and Midwest Utility 3 provided two CFLs. Midwestern Utility 2 saw 90% installation rates for the first CFL, 68% for the second, and 51% for the third.[17]

[17] CFL installation rates for Midwest Utility 2 were calculated from a follow-up parent survey, six months after students received a kit. Installation rates from the family installation survey (which was returned shortly after students received the kit) were: 65%, 50%, and 45%.

Home Characteristics and Behavioral Changes

Home Characteristics

From each student survey, OEP collected data on home types, family sizes, heating and cooling system types, and water heating fuel types. While Cadmus did not calculate (and DP&L does not claim) savings for behavioral changes promoted by the program, understanding these household characteristics can help inform possible savings from behavioral changes; all of these characteristics could be used as inputs into behavioral change savings algorithms.

Table 70 summarizes characteristics of participating families' homes.

Table 70. Home Characteristics

Home Type	
Single-family Home	91%
Apartment/Condo	9%
Other	0%
Family Size	
1-2	5%
3-5	74%
More Than 5	21%
Primary Heating System Type	
Gas Furnace	42%
Electric Furnace	29%
Propane	10%
Heat Pump	4%
Other	4%
Wood Stove	4%
Baseboard/In-Wall Unit	4%
Geothermal	2%
Oil Furnace	2%
Primary Cooling System Type	
Central AC	76%
Window AC	13%
Room Fans	5%
Heat Pump	3%
Other	2%
Attic Fans	0%
Swamp Cooler	0%
Water Heater Type	
Electric	45%
Natural Gas	40%
Propane	8%
Heat Pump	4%
Other	3%

Given over one-third of participants had electric heat and 89% had air conditioning, potential savings could be achieved if families followed Be E^3 thermostat settings adjustment recommendations.

The Be E^3 Smart curriculum included a "Measuring the Temperature of My Home" activity, which instructs students to read a section on heating and cooling efficiency in an "Energy Savers" book, published by the DOE. After reading the section, students and their parents filled out a worksheet that awards points for energy-efficient behaviors.

The module recommended students adjust heating temperatures to 68 degrees Fahrenheit and cooling temperatures to 78 degrees Fahrenheit. In the Family Installation Survey, OEP asked students if they adjusted their thermostats, and what their before and after temperature settings were. Table 71 shows the percent of participants who said they adopted a recommended energy-saving behavior.

Table 71. Behavioral Changes

Behavior	n	Participants
Decreased heating temp	4,137	26%
Increased cooling temp	1,621	24%
Decreased water heating temp	4,480	40%
Decreased refrigerator temp	4,563	49%
Decreased freezer temp	4,559	49%
Purchased additional CFLs	4,583	30%

Table 72 shows average before and after heating and cooling temperature settings reported for families adopting energy-saving behaviors.

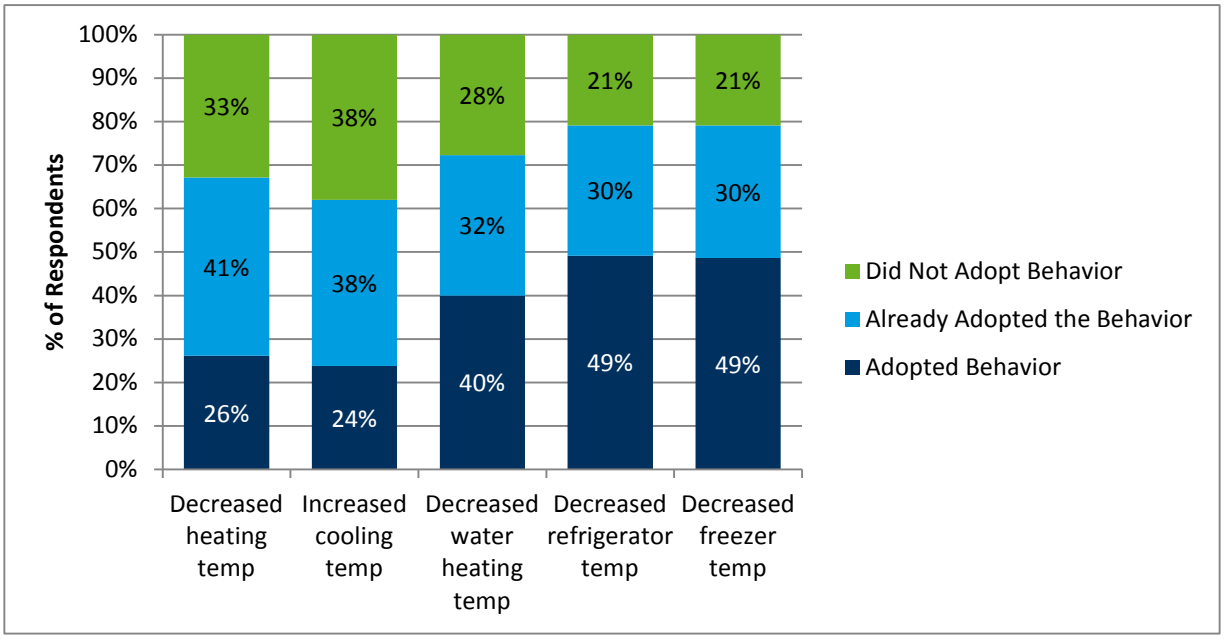
Table 72. Average Before and After Heating and Cooling Temperature Settings

	Average Before	Average After	Change
Heating Temperature (°F)	72	68	-4
Cooling Temperature (°F)	68	72	4

The 26% of families who lowered their heating temperatures, dropped it to the recommended 68 degree setting. The 24% of families who increased their cooling temperature raised it to about 72 degrees —six degrees lower than the recommended 78 degrees Fahrenheit setting.

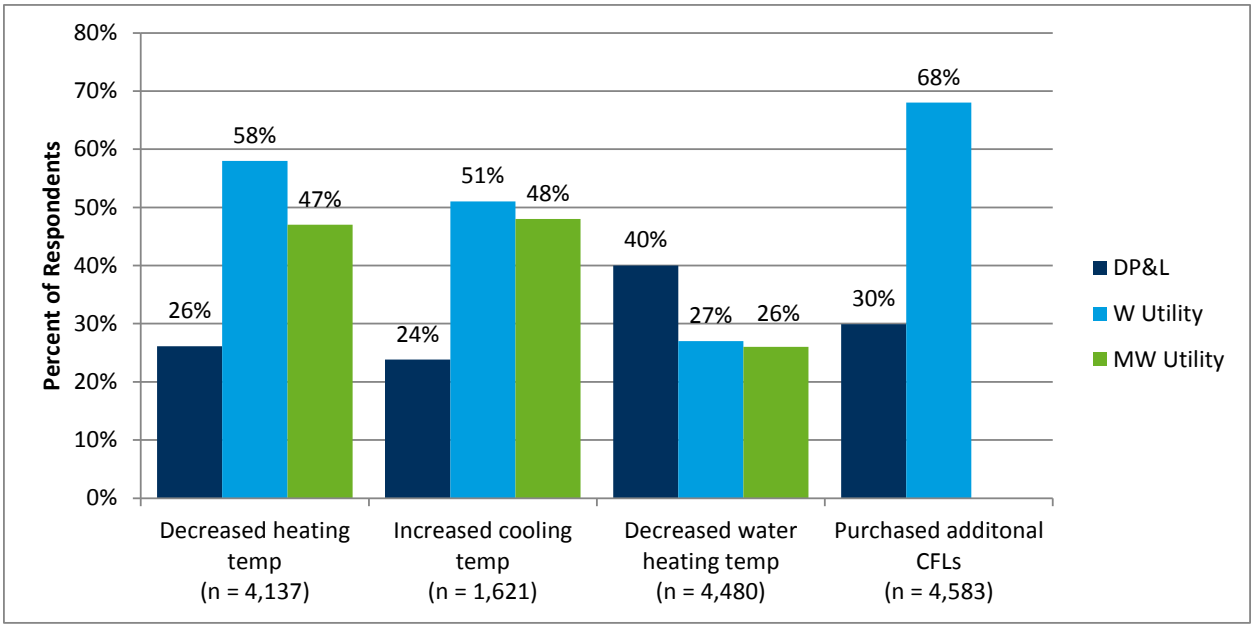
Many participants indicated they already set their thermostats to the recommended temperatures. Figure 50 shows the percent of respondents who adopted energy savings behavior before participating in the program.

Figure 50. Energy Saving Behavior Adoption



The large proportion of participants who had already adopted an energy-saving behavior may explain why the percent of participants adopting the behavior due to the program averaged lower than rates for similar programs. Figure 51 compares the percent of participants saying they made a behavioral change to participants in comparable energy education programs, for one Midwestern and one Western utility.

Figure 51. Behavioral Change Benchmarking*



* Purchased additional CFLs" data not available for MW Utility

The proportion of participants who decreased their heating temperatures and/or increased their cooling temperatures was roughly half that of participants from similar programs. As shown in Figure 50, many participants indicated they had already set their thermostats to the recommended temperature. The relatively low percentage of participants adjusting their thermostats may reflect the season in which students and parents completed the survey: if they completed the activity (and survey) in a season when Dayton experiences moderate temperatures, they may not have adjusted settings because they were not heating or cooling their home.

Process Findings

Stakeholder Interviews

For the process evaluation, Cadmus conducted interviews with program implementation staff from OEP and DP&L. Interviews covered the following program topics: design; implementation; training; reporting and auditing; marketing; achievements; and evaluation.

Program Design and Implementation

DP&L and OEP identified the following three program objectives:

- **Promote energy education**. This addresses educating students and parents about energy issues, including energy efficiency. DP&L and OEP seek to develop students' fundamental understanding of energy, including: how it is generated, how it is used, and how it can be conserved. They also teach students how energy generation can impact the environment. OEP also wishes students to understand energy's role in science and technology.
- **Save energy**. DP&L funds approximately 6,500 energy-efficiency kits to be distributed to students.
  Kits include:
  - Four CFLs; one LED night-light;
  - One hot water gauge;
  - One refrigerator thermometer;
  - One thermostat temperature guide;
  - A DP&L "$ave @ Home" residential program flyer;
  - A home energy savers booklet; and
  - A CFL recycling brochure.
- **Customer satisfaction**. DP&L cited additional public relations benefits offered by the program, such as improving customer satisfaction, and promoting corporate social responsibility.

Each fall, OEP recruits and trains teachers in the DP&L service territory to deliver an energy education curriculum to their students. The curriculum covers the following seven lessons:

1. Intro to Energy
2. Light Bulbs and Energy

3. Insulation and Air Leaks
4. Heating and Cooling
5. Saving Water and Energy
6. Appliances and Energy
7. Energy Synopsis

Each lesson has in-class and take-home activities, which not only teach students about fundamental energy concepts, but inform them how their families can conserve energy, and why this is important. These activities not only help students understand fundamental energy units, but help them understand possible cost savings tied to using appliances with lower wattages and reducing HOUs.

OEP emphasized the program utilizes a "school-to-home" model, which seeks to engage parents as well as students. Students must complete a number of take-home activities with their parents, such measuring heating and cooling temperature settings, and reading about the energy impacts from adjusting these settings. OEP reports some teachers have found it challenging to engage parents.

In addition to encouraging energy-saving behaviors, teachers distribute energy-conservation kits. When determining kit contents, OEP solicits feedback from DP&L, and uses recommendations from the kit manufacturer, Niagara Conservation, for product selection. Teachers deliver lessons around kit contents, and send them home with students to install as part of a take-home lesson. OEP tracks measure installation through the Family Home Installation Survey, provided to each student.

DP&L uses the energy education program to improve customer satisfaction, and to promote other energy-efficiency programs. Each student kit includes: DP&L's "$ave @ Home" residential program flyer. In addition, DP&L sponsors OEP's spring energy fair, where high-school students run a fair for elementary school students. DP&L provides a press release about the fair, and, in the past, has received media attention.

Reporting and Auditing

OEP tracks measure installations and self-reported behavioral changes from completed Family Home Installation Surveys.

For the 2010–2011 school year, OEP entered Family Installation Survey data for each returned survey into a Microsoft Excel spreadsheet. From a program-tracking standpoint, this improved upon the previous program year, as it allowed OEP to track measure installations and behavioral changes at the student level; during the 2009–2010 school year, OEP tracked measure installations at a teacher level. OEP also redesigned the student survey to include questions about heating, cooling, and water heating equipment, and fuel types.

While the new tracking system allowed more accurate estimates of program participation and measure installations, entering data proved to be a drain on OEP's resources. OEP said hand-entering student survey data into a tracking spreadsheet proved time consuming and seemed inefficient. For the 2011–2012 school year, OEP has implemented an online survey, eliminating

the need to hand-enter Family Home Installation Survey data. The online survey has built-in logic and data validation to ensure quality data.

OEP also administers a teacher survey, which it uses to track parts of the curriculum teachers find useful, along with the following indicators:

- Clarity of instruction;
- Ease of using activities;
- Age-appropriateness of energy content;
- Interest and motivation of students;
- Support and participation of families;
- Academic standards met;
- Effectiveness of home-to-school approach;
- Ability to positively affect attitudes about energy, including the importance of conservation and efficiency;
- Students' overall evaluation of the unit; and
- Teachers' overall evaluation of the unit.

OEP reviews Family Home Installation survey data and teacher survey data each year, and incorporates any findings when reevaluating the curriculum at the end of each school year. The section below incorporates results of the 2010 and 2011 teacher surveys (administered by OEP).

Promoting Participation

OEP identified multiple strategies for identifying and recruiting teachers to the program. These included:

- E-mailing teachers and administrators directly;
- Developing connections through trade shows and professional conferences; and
- Working with school superintendents.

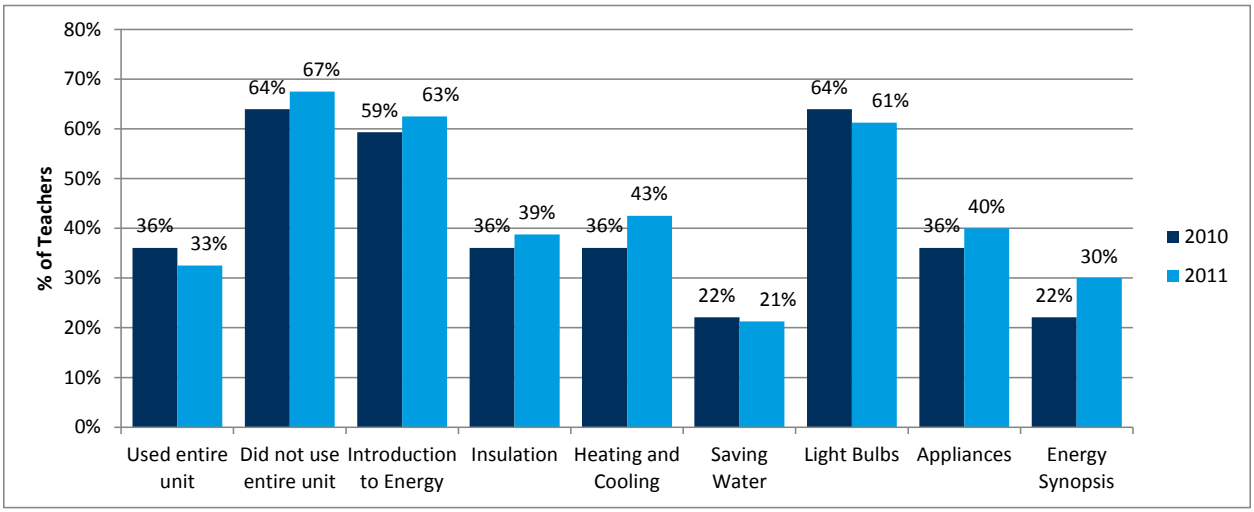
Through these activities, OEP has developed a database of eligible teachers. OEP also noted that, since the program's inception, word-of-mouth has helped bring in new teachers

OEP acknowledged participation barriers, saying teachers' assignments often change: they may move to a school outside DP&L's service territory, or they may teach a grade or subject where the curriculum no longer applies. Sometimes, teachers have been reluctant to participate due to uncertainty around their assignments. OEP reported seeing less participation in rural areas. They said if teachers could not attend teacher training sessions, held in August, they have conducted one-on-one training.

OEP emphasized satisfaction proved paramount to retaining and recruiting teachers. OEP gauged satisfaction informally, by regularly checking-in with teachers, and formally, through an end-of-

unit teacher survey. As noted, the survey asked teachers which units they used and found most effective. Figure 52 shows the percent of teachers who reported using a given lesson.

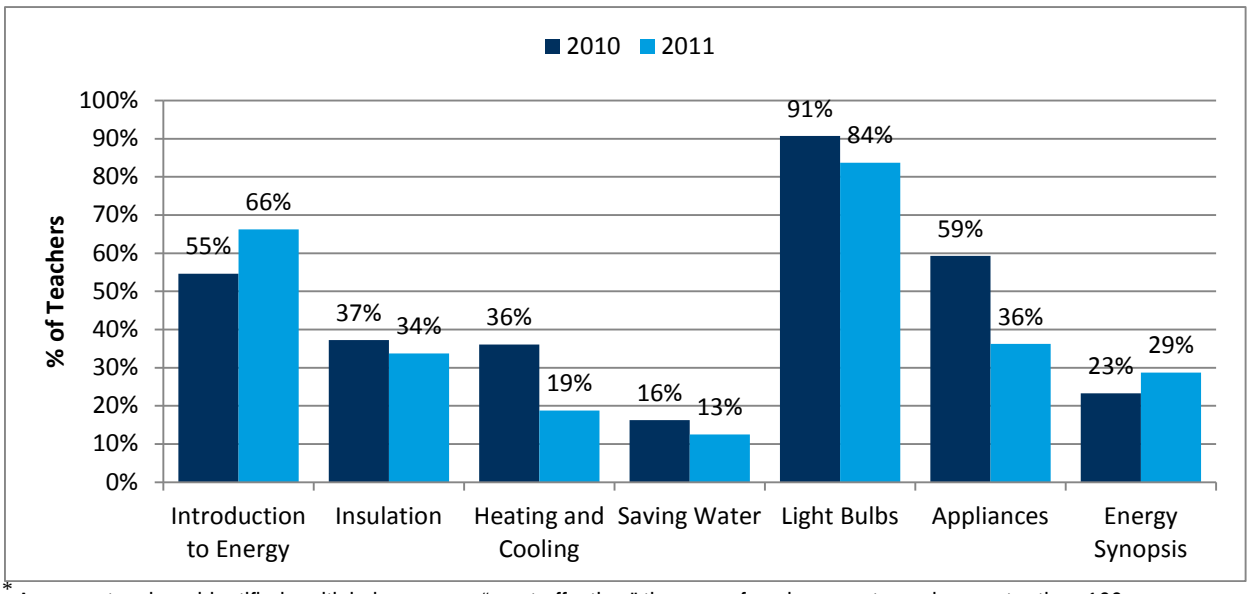
Figure 52. Teachers' Use of Individual Lessons



Roughly one-third of teachers reported using all seven lessons. Teachers used the light bulb lesson more than any other unit (61%).

OEP also asked teachers which units they found most effective.

Figure 53.Teacher Survey: Which lesson did you find most effective?*

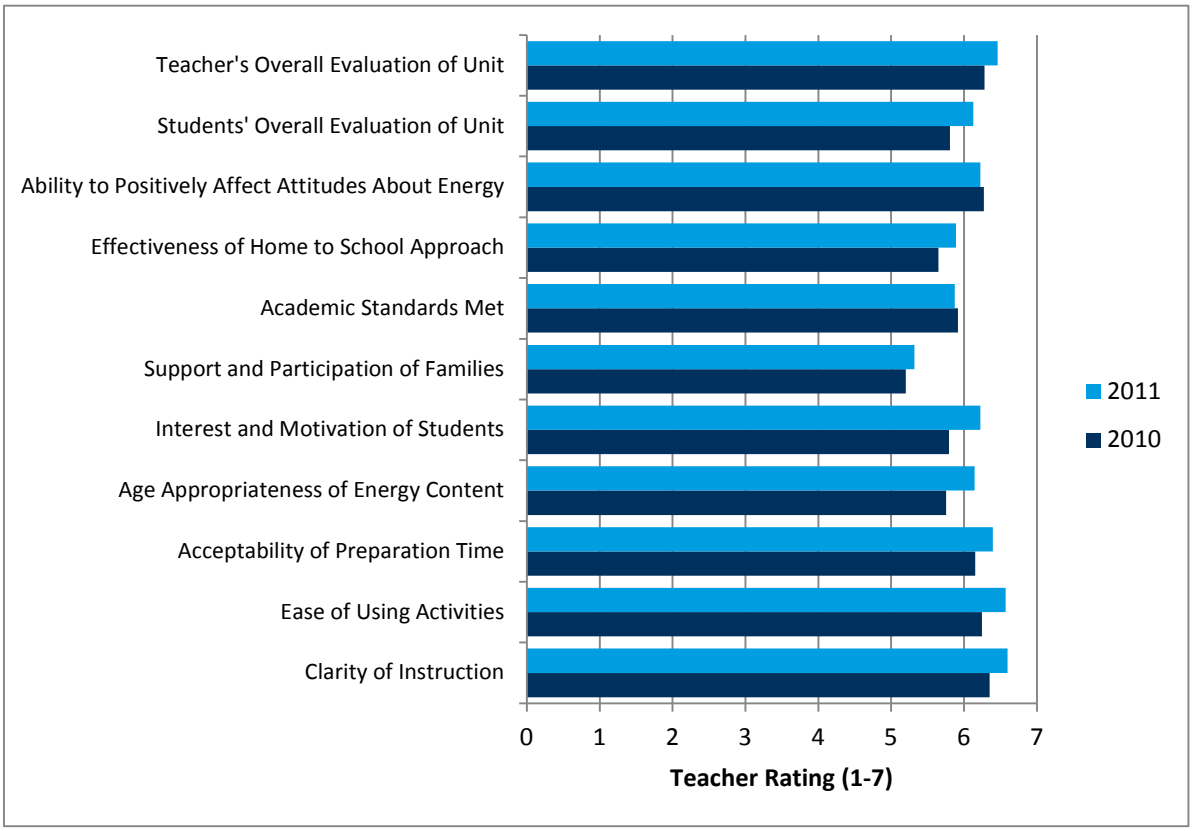


* As some teachers identified multiple lessons as "most effective," the sum of each percent may be greater than 100.

Except for the introduction to energy and energy synopsis lessons, teachers were less likely to rate other lessons as "most effective" in program year 2011 than in 2010. Light bulbs continued to be the most popular lesson among teachers—84% found it the most effective.

OEP asked teachers to rate the program (on a scale of 1 to 7) on 11 indicators. As shown in Figure 54, teachers' evaluation of nearly all the indicators improved from 2010 to 2011.

Figure 54. Teachers' Evaluation of Program



Similarly to 2010, teachers cited support and participation of families as the greatest challenge to implementing the program. Program elements teachers rated with the lowest effectiveness included: the home-to-school approach, and the applicability to academic standards. For all other indicators, teachers provided an average rating of 6 (out of 7) or higher.

Recommendations

Based on the preceding findings, Cadmus offers the following recommendations:

- The Family Home Installation Survey yielded CFL installation rates lower than comparable programs. This could reflect the number of CFLs included in the kit (four for Be E^3 smart, compared to one, two, or three in other programs). This could also reflect the amount of time students have to install CFLs before returning the student survey. We recommend conducting a follow-up survey to measure eventual CFL installations and persistence. Additional research could identify an optimal mix of kit measures.
- The percent of families who adjusted heating and cooling system temperatures was lower than proportions observed in other programs. Many families indicated they already had their thermostats set to the recommended setting, though this could reflect the season in which families completed the Family Home Installation Survey. We recommend

conducting a follow-up survey, held during Dayton's heating and/or cooling season, to measure:

1. Behavior changes during the applicable season; and
2. If these behavioral changes persist.

- Manual entry of Family Home Installation Survey data diverted OEP's resources from curriculum development and planning. We support OEP's decision to move the student survey from paper to online. Doing so will streamline data collection and entry, while ensuring data quality.
- DP&L would like to explore opportunities for additional promotion of their sponsorship of the Be E3 Smart Program. We recommend DP&L implement a survey tying program participation and awareness to customer satisfaction. Such a survey could help DP&L understand additional corporate (non-energy) benefits derived from funding the program.

NON-RESIDENTIAL PRESCRIPTIVE REBATE PROGRAM

The following sections describe the evaluation approach, detailed findings, and conclusions and recommendations for the Non-Residential Prescriptive Rebate program.

Methodology

The 2011 evaluation followed researchable questions and evaluation activities, outlined in the DP&L 2010–2012 Evaluation, Measurement, and Verification Plan. Table 73 identifies key researchable evaluation issues.

Table 73. Key Researchable Questions

Researchable Question	Discussion	Activity to Support Question
What is customer satisfaction with the program?	It is important to assess customer satisfaction with the various program components.	• Participant surveys
How do draft Ohio TRM deemed savings compare with validated program savings?	DP&L staff may be required to apply draft Ohio TRM deemed values to future reported savings, which may differ from actual savings achieved. The impact evaluation should characterize any differences and inform future revisions to the draft Ohio TRM.	• Site visits • Savings validation
How did customers learn about the program?	DP&L has expressed interest in learning which marketing channels have been most effective in encouraging participation.	• Participant surveys
What were the gross electric savings and demand reductions?	The amount of gross electric savings and demand reductions will help create a business case to continue running the program, and will prove useful for planning future program designs.	• Engineering analysis • Data verification • Site visits

Detailed Evaluation Findings

The following key findings relate to telephone surveys, site visits, and desk reviews:

- The program had total claimed *ex ante* gross kWh savings of 34,494,782 kWh, and Cadmus-adjusted gross kWh savings of 34,537,857 kWh, for a 100.12% program realization rate.

Table 74. Non-Residential Prescriptive Reported and Achieved Energy Savings

Measure	*Ex Ante* Claimed Savings		Verified Gross Savings		Adjusted Gross Savings		Adjusted Gross kWh Savings	
	Gross kWh	Gross kW	Gross kWh	Gross kW	Gross kWh	Gross kW	Realization Rate	Precision at 90% Confidence
HVAC	1,638,180	456.0	1,629,421	452.9	3,260,110	352.5	199.01%	±37%
Lighting	29,741,377	5,178.0	28,984,017	5,267.5	28,079,664	5,269.1	94.41%	±10%
Motors	2,984,246	486.7	2,994,895	473.6	3,053,244	477.5	102.31%	±64%
Other	130,980	23.4	157,308	24.1	144,839	24.9	110.58%	±155%
TOTAL	34,494,782	6,144.1	33,765,640	6,218.1	34,537,857	6,124.0	100.12%	±11%

- We attribute realization rate differences to the following:
  - Lighting measures represented 81% of total adjusted gross kWh savings. Measure-level realization rates varied, based on differences noted between reported and evaluated fixture types, quantities, and operating hours.
  - Cadmus identified discrepancies in energy calculations and assumptions for some projects. The most notable discrepancies occurred in HVAC and VFD motor projects.
- Annual kWh realization rates were near 100%, which indicates the measure application and process work well. Compared to other utilities nationally, DP&L ranks on the higher end of C&I prescriptive realization rates.
- The program exceeded DP&L's 2011 energy savings goals by 122%, but only met 80% of demand reduction filing goals.
- DP&L customer satisfaction was high. Also, compared to other utilities nationally, overall satisfaction with DP&L ranked the highest of any of program we reviewed.
- Overall, Cadmus found minimal discrepancies during the site visits. Notable discrepancies primarily occurred among a few projects, highlighted below.
- Project participation increased throughout 2009, 2010, and 2011 program years: 331, 622, and 736, respectively. Participants indicated the program administrative processes functioned well for them.

Data Collection Methods

Cadmus designed the impact evaluation to verify reported program participation and to estimate gross energy and demand reduction. We collected the impact evaluation data using the following:

- The program tracking database;
- Online application forms;
- DP&L pre-and post-audit inspection reports;
- On-site visits; and

- Applicable deemed values developed for the draft Ohio TRM.

Draft Ohio TRM Joint Objections and Comments regarding the draft Ohio TRM were also reviewed and referenced as part of the evaluation.

Participant Survey

As outlined in the evaluation plan, our analysis of the program included surveys of participants. We stratified survey sampling by major measure type (HVAC, lighting, motors, and other). The participant population was based on unique customer contacts, as contacts may oversee multiple projects and different facilities. As this evaluation spans multiple years, and to maintain a low burden on DP&L customers, the participant survey did not include customers receiving a site visit in 2011. Remaining program participants were selected at random. The survey asked respondents about the following:

- Their program awareness and participation;
- What the on-line application process was like;
- Satisfaction with their program participation experiences; and
- General questions regarding their businesses.

Table 75 details the breakdown of planned and achieved survey participants by major measure types.

Table 75. Planned and Achieved Survey Participants

Measure Category	Program Population*	Survey Target	Surveys Achieved**
Lighting	222	40	44
HVAC	53	20	20
Motors	46	20	20
Other	16	10	6
TOTAL	337	90	90

* Based on 2011 program year participants listed in the DP&L tracking database, dated November 1, 2011.
** Not a straight 90/10 on measure population, as participants may have received an incentive for more than one measure.

Project and Site Review

Cadmus proposed to evaluate a statistically valid sample of projects, based on a 90% confidence interval with a 10% precision level through on-site visits. All site visits included a thorough desk review of a selected project.

We performed two rounds of site visits (July and December 2011), obtaining the total sample from participants through November 1, 2011. The first round consisted of 16 unique (by account number) site visits, and the second consisted of 48 unique site visits. Several sites fit multiple measure categories. Table 76 shows total projects evaluated through site visits, by project category, for each round.

Table 76. Prescriptive 2011 Site Visit Breakdown by Measure Category

Measure Category	Site Visit Project Count Round 1	Site Visit Project Count Round 2	Total 2011 Site Visits	2011 DP&L Total Number of Projects (n)
Large Lighting	3	4	7	9
Medium Lighting	5	15	20	50
Small Lighting	2	24	26	487
HVAC	5	0	5	79
Motors	4	3	7	89
Other	0	2	2	22
TOTAL	19	48	67	736

To account for the wide range of project scales, lighting projects were divided into large, medium, and small subcategories, based on *ex ante* savings. For example, large lighting projects (above 500,000 kWh *ex ante* savings) comprised over 20 percent of the program's overall savings. We included all these large lighting projects in the site visit sample and achieved visiting seven of the nine large projects Cadmus prioritized analysis of large, high-impact projects due to their disproportionate effect on overall program savings. For the smaller projects, we randomly selected a sample of projects to visit.

Baseline Assumptions

Baseline assumptions typically involved data obtained on site, and included replaced fixture types and quantities as well as parameters such as original operation hours and temperature set points. Where data could not be obtained on site (such as HVAC equivalent full-load hours or baseline motor efficiency), we used assumptions in the draft Ohio TRM.

Impact Methodology

Cadmus collected baseline data through interviews with facility staff at each site, and utilized program implementation and tracking data. We used the on-site visits to verify installations and to determine any changes to operating parameters occurring since measures were first installed. These on-site data were collected to inform the savings impact calculations.

Site Verification Visits and Document Review

After selecting samples of sites to visit, Cadmus downloaded project documentation from DP&L's administrative Website. In preparation for each site, Cadmus reviewed documentation and other program materials relevant to inform the evaluation, paying particular attention to calculation procedures and documentation for savings estimates.

Cadmus reviewed the DP&L tracking spreadsheet and online application data for consistency and accuracy.

On-site visits enabled us to accomplish two primary tasks:

1. Verify the implementation status of all measures for which customers received an incentive. On-site visits allowed us to verify energy-efficiency measures had been installed correctly and functioned properly. The audit also captured characteristics of installed equipment.

2. Collect data (such as ballast factors) needed to calculate energy savings.

Appendix F provides detailed site-visit findings.

Database Tracking Review

In addition to reviewing each on-site project file, we conducted a thorough review of DP&L's entire final tracking database. This consisted of examining two tracking spreadsheets of reported project savings through January 31, 2012, which included:

- 2010 customers submitting their applications in 2010, but not completing the project until 2011; and
- All 2011 applications and completed projects.

Part of the review involved combining workbooks into a master spreadsheet, which included the following steps:

- Checking DP&L's calculation methodology with the 2010 draft Ohio TRM; and
- Checking DP&L's project savings calculations by verifying cell references, cell links, and input assumptions.

After review completion and based on our feedback, DP&L revised its tracking database to incorporate some recommendations. DP&L finalized the year-ending 2011 tracking database, and provided Cadmus with the final reported database.

Engineering Analysis and Savings Verification

For each project in the site visit sample, Cadmus performed an engineering analysis using data verified on site, supplemented by project documentation, to validate energy and demand savings.

The procedures used to validate savings depended on the measure type analyzed. Major measure groups included:

- Lighting measures;
- HVAC measures;
- Motors and VFDs; and
- Other.

In general, the review methodology used industry-standard algorithms, the draft Ohio TRM, secondary research, and engineering experience. The following sections describe procedures used to validate savings from the first three measure categories. Calculations for the "other" category typically followed algorithms, outlined in the draft Ohio TRM.

Lighting Measures

Lighting measures include retrofits of existing fixtures, lamps, and/or ballasts with energy-efficient models as well as lighting control strategies. We typically assumed fixtures operated the same for pre- and post-retrofits.

Analyzing lighting fixture measure savings required fixture data, including:

1. Wattage before and after the retrofit.
2. Hours of operation before and after the retrofit.
3. Number of fixtures affected by the measure.

Cadmus analyzed savings for occupancy sensors using data that included:

1. Total connected lighting load.
2. Type of space.
3. Facility operating hours.
4. Any operational characteristics identified through the on-site survey.

For calculations, we used wattages reported on applications, unless they deviated significantly from published databases or manufacturers' claims. We evaluated hours of operation by types of facilities and by locations directly impacted by occupancy sensors. We adjusted hours of operation, as necessary.

We verified the above parameters during on-site visits, conducting interviews with facility personnel to verify operating hours and determine locations where measures were applied. The field engineer collected lamp information (such as actual fixture and ballast details), and performed a count of fixtures.

As the draft Ohio TRM provided a specific baseline for fixtures, based on the high-efficiency replacement for lighting measures, where applicable, we used baseline wattages found in the draft Ohio TRM for our savings calculations.

HVAC Measures

HVAC measures represent a variety of technologies, including:

- Unitary air conditioners;
- Chillers;
- Ground source heat pumps;
- Programmable thermostats;
- VFDs; and
- HVAC occupancy sensors.

We analyzed each measure listed in the draft Ohio TRM, using the appropriate methodology. Cadmus verified HVAC savings through site verification results and through a review of application documentation, supplied by the customer through DP&L.

For this evaluation, Cadmus assumed values to quantify loads controlled by the devices. We based these assumed values on the draft Ohio TRM and on our engineering experience. For this

analysis, we accepted the draft Ohio TRM values for equivalent full-load hours (EFLH), as they had been reviewed by the various evaluation contractors supporting development of the draft Ohio TRM.

Motors and HVAC Variable Frequency Drives

Motor measures include:

- Premium-efficiency motors;
- Air compressors less than 100 HP; and
- VFDs[18] less than 250 HP.

We analyzed each measure using the methodology defined in the draft Ohio TRM. Cadmus verified motor and VFD gross savings through site-verification results and through a review of application documentation, supplied by the customer through DP&L.

For high-efficiency motor replacements, these parameters included:

- Efficiency of the old and new motors;
- Load factors; and
- Usage factors.

When conducting a site visit of a motor project, we collected information such as nameplates and motor applications (e.g., pump, fan, process). We verified motor operating hours by interviewing the facility contact, where applicable. When data were not available, Cadmus estimated these parameters, based on Internet equipment specification data, professional experience, and deemed values from the draft Ohio TRM.

A critical parameter for air compressor and VFD installations is the load factor, often determined through pre- and post-installation metering. Due to the time and cost involved, however, metering often is not feasible in prescriptive programs. Therefore, we calculated savings using load factor estimates, based on draft Ohio TRM values and Cadmus' engineering experience.

Other Measures

Other measures represent a variety of technologies, including:

- Injection barrel wraps;
- Vending equipment controllers; and
- Window film.

We analyzed each measure listed in the draft Ohio TRM, using the appropriate methodology. Cadmus verified the savings through site visit results and review of application documentation, supplied by the customer through DP&L.

[18] In some cases HVAC VFDs were included in this category.

Calculating Realization Rates

We derived program-level savings through realization rates calculated for each major measure type (HVAC, lighting, motors, and other). Similar to our sample selection process, lighting measure types were broken out in three categories: large, medium, and small lighting projects. This method included:

- Calculating adjusted gross savings for the sample of site visit projects.
- Calculating a realization rate, based on the claimed *ex ante* and adjusted gross savings, for the total sample within each measure group.
- Applying sample realization rates to the program population for each measure group to calculate total program verified and adjusted gross savings. For lighting, we divided lighting into the following kWh strata: small (0–125,000); medium (125,000–500,000) and large (500,000 plus). Realization rates, developed for each stratum, were then applied across that population subgroup.

Cadmus acknowledges several limitations resulting from this approach. All measure types except lighting involved a small sample. In addition, it was not ideal to apply a realization rate for a specific project, such as a variable speed chiller, to a larger and more diverse population, featuring different measures, such as heat pumps and programmable thermostats. However, lighting measures dominated both reported sample savings (94%) and reported program savings (86%). Cadmus determined the size, diversity, confidence, and precision associated with the lighting sample provided the most significant influence on overall realization rates, reducing the impacts of small sample sizes in other measure groups.

In addition, we identified the reported savings calculations for VFDs were different between project applications that applied in 2010 that were completed in 2011, versus project applications that applied in 2011. The differences occurred in DP&L's two tracking databases where the savings assumptions were significantly different. Due to this difference, we evaluated VFD projects from both tracking databases and determined the realization rates for each database independently. The realization rates were then applied across that population of 2010 VFDs project and 2011 projects separately.

Billing Analysis

The evaluation plan Cadmus submitted to the state evaluator proposed conducting a billing analysis to support the savings analysis. A preliminary analysis was performed to assess the feasibility of conducting a billing analysis, based on billing data from 2009 and 2010 participants. We reviewed smaller commercial (non-industrial) buildings (defined as 125,000 kWh or less) with a lighting end-use category, which tended to be more homogenous. Very large sites with small expected savings were undetectable by billing analysis. This resulted in less than 50% of participants with reasonable expected savings with over 5%. While a billing analysis was theoretically feasible, reducing the sample by 50% would have made it difficult to develop average savings that could be applied to the group without large error bounds.

Due to limited participant data availability and data attrition, we did not recommend conducting the billing analysis, the results of which would likely contain high error bounds. Rather, Cadmus proposed increasing the number of small commercial lighting site visits to provide a statistically

valid sample, representative of the entire participant group. This method was enacted, providing a reasonable solution to billing analysis issues.

Detailed Impact Findings

Gross Savings Results

Table 77 and Table 78 summarize sample verified and adjusted results by major measure group. The 67 projects that were sampled within the program that consisted of 11,796,696 kWh and 1,586 kW *ex ante* savings. The adjusted energy and demand savings resulted in 11,316,160 kWh and 1,621 kW respectively.

Table 77. Sample Reported Gross *Ex Ante* and Adjusted Gross *Ex Post* Energy Savings*

Measure	Number of Projects	*Ex Ante* Gross Energy Savings (kWh)	Verified Energy Savings (kWh)	Adjusted Energy Savings (kWh)	Realization Rate
Large Lighting	7	6,215,227	5,421,949	5,421,949	87%
Medium Lighting	20	3,701,479	3,650,714	3,650,714	99%
Small Lighting	26	1,114,648	1,061,424	1,061,424	95%
HVAC	5	300,667	598,351	598,351	199%
Motors	7	361,714	469,867	469,867	130%
Other	2	102,960	113,855	113,855	111%
TOTAL	67	11,796,696	11,316,160	11,316,160	N/A**

* May not sum properly due to rounding.
** Program level realization rates are in Table 74 weighted by total program sizes.

Table 78. Sample Reported Gross *Ex Ante* and Adjusted Gross *Ex Post* Demand Savings*

Measure	Number of Projects	*Ex Ante* Gross Demand Savings (kW)	Verified Demand Savings (kW)	Adjusted Demand Savings (kW)	Realization Rate
Large Lighting	7	606.6	670.0	670.0	110%
Medium Lighting	20	605.4	594.3	594.3	98%
Small Lighting	26	163.0	168.6	168.6	103%
HVAC	5	126.2	97.6	97.6	77%
Motors	7	73.3	78.6	78.6	107%
Other	2	11.3	12.0	12.0	106%
TOTAL	67	1,585.8	1,621.1	1,621.1	N/A**

* May not sum properly due to rounding.
** The program level realization rates are in Table 74 weighted by total program sizes.

A summary of the major differences, by measure category, between reported savings and adjusted savings are shown below.

Lighting Savings

Lighting projects represented the overwhelming majority of DP&L Non-Residential Prescriptive Rebate program savings. Cadmus validated a lower-than-reported realization rate for energy savings, and a higher-than-reported realization rate for demand savings.

For many projects, Cadmus found minimal to no discrepancies. The main differences between reported and adjusted values occurred due to differences in fixture quantities, fixture types, operating hours, or fixture wattages, verified from manufacturer's specification sheets. In some larger projects, facility operating hours were reduced, having the greatest impacts on energy savings. More significant discrepancies included:

- Verified savings decreased primarily due to one large lighting project we visited. This project reported the facility operated 24 hours a day, seven days a week in both the office and warehouse areas. Upon our site visit verification, the facility contact confirmed facility hours were closer to 11 hours per day, five days a week for both areas.
- Wall- and fixture-mounted occupancy sensor measures represented another variation source. DP&L reported savings based on an estimate for controlled wattages of sensors. While this represented a reasonable estimate overall for occupancy sensor applications, cases occurred where this estimate did not represent site-specific, controlled wattages very well. For several projects, realization rates ranged significantly, either much lower or higher than claimed.
- One site had a fire in a shed storing new fixtures for the facility. Some new equipment was destroyed, and most installations were not completed as expected. Occupancy sensors were not installed, except in a few isolated cases. Due to the unusual circumstances, evaluated results for this project will not be included in the overall lighting realization rate, and evaluation results will only be applied to this specific project.
- In one project, efficient lighting was installed inside a refrigerated space. Energy and demand savings were updated to account for the refrigeration system. Waste heat interaction factors used in the savings calculations referenced the LED case lighting measure assumption, found in the draft Ohio TRM.
- We increased demand savings for several projects due to incorrect allocations of summer coincident peak assumption. The draft Ohio TRM provides coincident peak factors by building type. DP&L assumes an average coincident peak factor for all buildings. As this average did not represent some larger lighting projects, we increased peak demand savings using the appropriate factor from the draft Ohio TRM.

HVAC Savings

HVAC projects resulted in the highest realization rates sampled. For most prescriptive HVAC projects, Cadmus applied the EFLH proposed in the draft Ohio TRM, as these represented the most accurate, modeled estimates of usage for the region.

Cadmus found no differences in measure quantity from the site visits. However, performance specifications found on site and through our site visit savings analysis identified differences between *ex ante* and adjusted gross savings with each of five sampled projects, outlined below:

- Three of the five projects sampled were air-source chillers. DP&L employed a prescriptive calculation to determine savings, and projects appeared to be based on the draft Ohio TRM, but calculation methods varied by project. In several cases, DP&L applied a measure efficiency matching the minimum program requirements and not actual performance specifications found in project documentation. Given these differences in efficiency values, Cadmus used the rated efficiencies found in the field and calculated savings (applying the draft Ohio TRM methodology) twice those claimed.
- One project was a 25-ton, packaged, rooftop air conditioner. Similar to air source chiller projects, we found DP&L applied a measure efficiency matching the minimum program requirements, and not the actual efficiency found in project documentation. Cadmus calculated savings based on project data, resulting in savings more than double than what was reported.
- The last project consisted of multiple water source heat pumps. Upon review of project documentation, we found the calculations assumed the baseline efficiency referenced air-source heat pumps, while the draft Ohio TRM assumed a standard, water-source heat pump as the baseline. In the draft Ohio TRM, baseline equipment was assumed to be a standard-efficiency, water-source heat pump system, meeting the energy-efficiency requirements of the International Energy Conservation Code 2006, Table 503.2.3(2). According to the draft Ohio TRM, rating conditions for the baseline and efficient equipment efficiencies must be equivalent. In adhering to the draft Ohio TRM, Cadmus recalculated the savings, using the appropriate baseline, and savings for the project reduced.

Motors and HVAC Variable Frequency Drive Savings

Motor savings represent the second-largest measure type, comprising roughly 10% of the Non-residential Prescriptive Rebate program. Cadmus validated a higher-than-reported realization rate for energy savings, and a slightly higher-than-reported realization rate for demand savings. Cadmus noted the following differences, related to calculation methodologies and specific projects:

- One project installed multiple VFDs of varying horsepower (HP). During our site visit, we verified the VFD application served for HVAC cooling of the facility's process loads. The prototypical HVAC operating hours and savings assumptions were inappropriate here. Based on site-visit data collected, such as annual hours of operation, Cadmus recalculated project *ex ante* savings, and overall project savings increased by more than 50%.
- During our site visits at two projects, we found discrepancies in rated VFD HPs in applications compared to actual field equipment. Each project had multiple VFDs installed. More than 50% of the VFDs were rated as claimed; however, remaining VFDs were rated one HP size lower than reported. *Ex ante* savings were adjusted downward, accordingly.
- Cadmus performed a custom analysis for one prescriptive VFD compressed air project. This custom analysis was based on collected field data and Cadmus' experience with air compressor projects. This resulted in reduced *ex ante* savings.

Other Savings

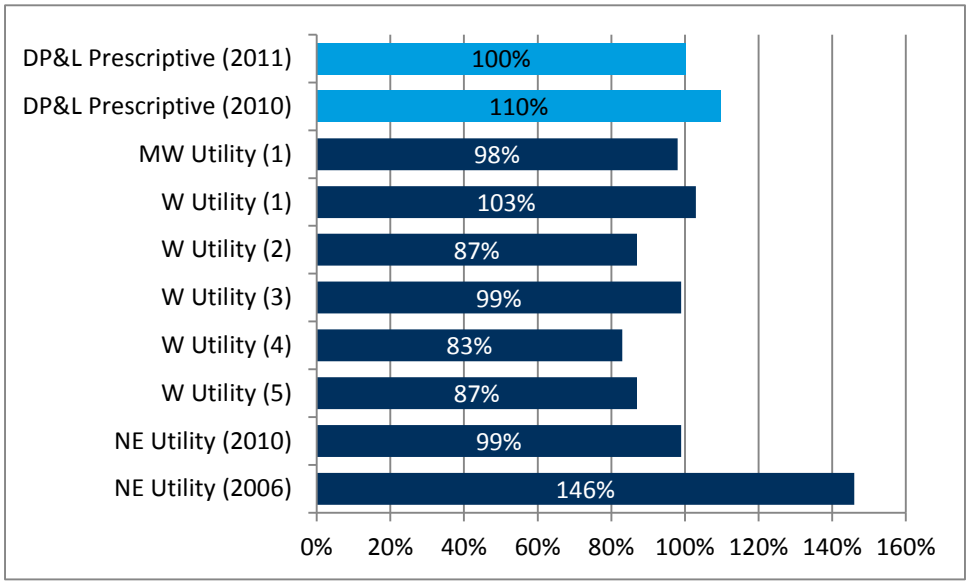
Cadmus visited two "other" savings projects: vending machine controllers, and barrel wraps. At the first site, a little more than 50% of vending controllers were actually installed at the facility. This variance in quantity lowered the project *ex ante* savings.

The second site we visited, the measure was for an injection barrel wrap application.[19] Data collected at the facility, such as operating hours and operating temperatures, resulted in higher *ex post* savings for the project.

Realization Rate Comparison

Figure 55 compares evaluated energy realization rates for the prescriptive program to other utilities nationally. DP&L ranks on the higher end within utility variations. DP&L's 100.1% overall realization rate is notable, and indicates the measure application process and analysis works well. When looking at the realization rate by measure category, lighting achieved 94.4% realization rate while HVAC, motors, and other measure categories all resulted in realization rates greater than 100%. HVAC and motor projects were the main drivers that increased the overall realization rate. As mentioned before, the realization rates for VFDs were applied separately across that population of 2010 VFDs project and 2011 projects. This VFD adjustment reduced the overall realization rate from 102.5% to 100.1%.

Figure 55. Commercial Prescriptive Program Realization Rate Comparison to Other Utilities*



* Western Utility 5 evaluation realization rates were taken from its overall commercial programs, including custom and prescriptive programs.

Realization rates tend to be driven by how accurate a utility's engineering assumptions are for their programs. A 100% realization rate is considered the best scenario for a program because it indicates energy savings estimates neither overstate nor understate achievements, making

[19] In the 2010 evaluation, DP&L moved barrel wraps for extrusion applications to be covered by the Custom Rebates program. Barrel wraps for injection applications remained eligible as a prescriptive measure.

planning for future program years less burdensome for program staff. Realization rates deviating from 100% tend to occur for two reasons:

- Newer programs often have not developed best practices for estimating energy savings, and, as the program matures, staff more accurately assesses how much a given project should produce in terms of energy savings.
- A realization rate may deviate from the 100% goal as the utility has used deemed value assumptions. These tend to be more general in approach, and cannot account for every variable that may affect energy savings for a particular measure. Deemed values allow utilities to implement their programs more efficiently, but those deemed values must be updated on a regular basis, based on evaluation results.

Excluding DP&L results, the average deviation for prescriptive commercial and industrial program realization rates was plus or minus 12% from 100%. DP&L falls well within this range.

Process Findings

Overview

The process evaluation tasks Cadmus performed for the 2011 program evaluation included surveying commercial and industrial participants as part of the DP&L's prescriptive program. Cadmus also leveraged interview results with DP&L staff to further inform the process evaluation findings.

Program Design

As shown in Table 79, program participation increased throughout the 2009, 2010, and 2011 program years. Table 80 provides further details on the frequency of installed measure types.

Table 79. Program Participation by Year

Program Year	Number of Individual Customer Projects
2009	331
2010	622
2011	736

Table 80. Frequency of Major Measure Types Installed

Measure Type	2009 Frequency	2010 Frequency	2011 Frequency
Lighting	231	458	539
HVAC	42	68	79
Motors	43	82	88
Other	15	14	23

Historically, DP&L prescriptive program measure offerings have remained somewhat consistent.

DP&L made a number of other revisions to program design in 2011, including:

- Incentives for premium efficiency motors essentially doubled, with:
  - Motor sizes from 1 to 5 HP increasing to $25 per HP;
  - Motor sizes from 7.5 to 20 HP increasing to $15 per HP; and
  - Motor sizes from 25 to 250 HP increasing to $10 per HP. Program participation in 2011 for premium efficiency motors increased slightly from 2010.
- Pulse-start, high-intensity discharge lamps were removed from prescriptive program offerings.
- DP&L added sale performance contractor incentives, with a 5% kickback for participating contractors.

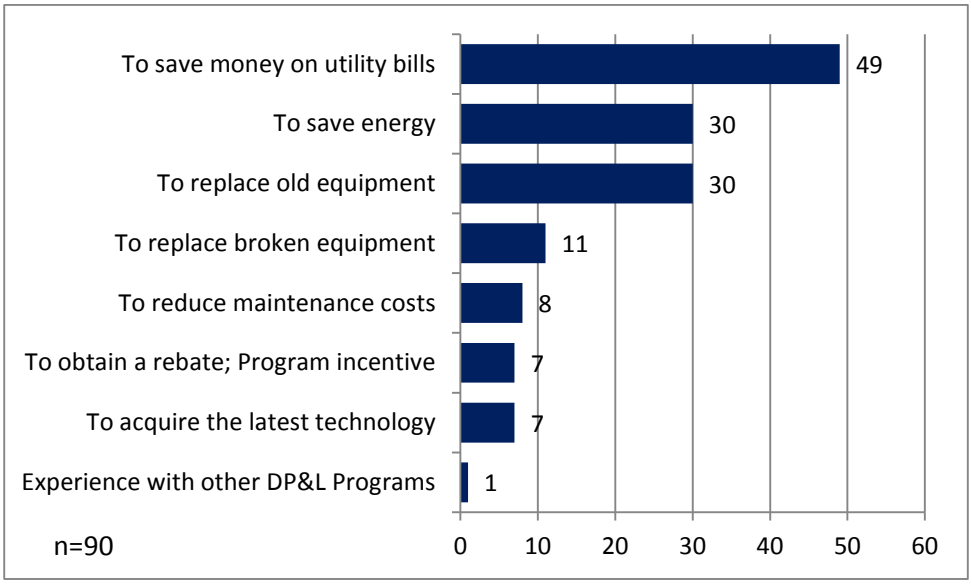
The 2011 program design generally was well-received by participants and contractors.

Program Participants

Program participants represented a variety of non-residential customers, expressing high satisfaction levels with the program. The majority (roughly 42%) of participants stated they represented the commercial sector, while an almost equal numbers of participants (roughly 38%) stated they were industrial customers. The remaining (20%) were: government customers (state, local, or federal); community centers; churches; and miscellaneous buildings.

Over two-thirds of all customers reported participating in the DP&L prescriptive program to reduce energy costs. The remaining one-third replaced old but functional equipment, replaced existing equipment with new units, or replaced broken or worn-out equipment (Figure 56).

Figure 56. Customer Reasons for Participation*



* The question includes multiple responses.

Satisfaction

Overall, participants were highly satisfied with their program experience, rating it an average of 4.7 out of 5, with 5 representing being "very satisfied." Table 81 shows participant satisfaction by measure category for different program aspects.

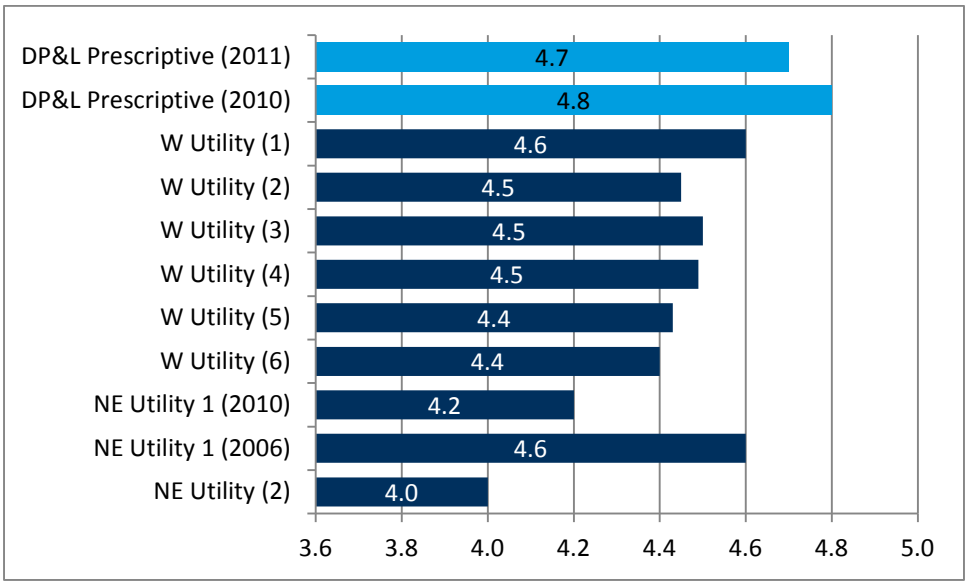
Table 81. Program Participant Satisfaction

Participant Satisfaction	HVAC	Lighting	Motor	Other	Overall
Ease of filling out online application	5.0 n = (15)	4.7 n = (20)	4.8 n = (12)	4 n = (4)	4.7 n = (51)
Rebate amount	4.6 n = (20)	4.6 n = (44)	4.8 n = (20)	4.2 n = (6)	4.6 n = (90)
Communication with DP&L staff	4.9 n = (9)	4.9 n = (19)	4.9 n = (14)	3.5 n = (2)	4.9 n = (44)
Length of time to receive rebate	4.7 n = (20)	4.6 n = (44)	4.6 n = (20)	4.2 n = (6)	4.6 n = (90)
Satisfaction with inspection	5.0 n = (4)	4.2 n = (9)	4.6 n = (7)	- n = (0)	4.5 n = (20)
Overall satisfaction	4.7 n = (20)	4.7 n = (44)	4.8 n = (20)	4.2 n = (6)	4.7 n = (90)

Customers contacting DP&L directly expressed the highest satisfaction with their corresponding DP&L staff. Ninety-seven percent were "satisfied" or "very satisfied," with an emphasis on "very satisfied" (39 out of 44). The "other" category consisted of six respondents, all with window film measure applications. Although having few respondents, window film applicants seem to express the greatest dissatisfaction. One of the window film participants indicated that the application process was complicated and not worth the effort for such a small rebate. One other participant was not satisfied with the overall process, but did not elaborate why.

In the 2010 evaluation, participants, overall, were highly satisfied with their program experiences, rating it an average of 4.8 out of 5 (96%). For 2011, overall program experience was almost identical with an average score of 4.7 (93%). Figure 57, benchmarks DP&L program satisfaction with other utilities across the country.

Figure 57. Comparison to Overall Program Satisfaction of Utility Commercial and Industrial Prescriptive Programs*



* Western Utility 1 and Northeastern 1 Utility evaluations satisfaction levels were for overall commercial portfolios, including prescriptive and custom programs.

The lowest recorded program satisfaction level was 4.0, with an average satisfaction level of 4.41 for the prescriptive programs (excluding DP&L). Satisfaction tended to be driven by customer service-related functions, including communications with staff and assistance in completing projects. These satisfaction aspects tended to provide participants with better overall experiences, even if they expressed less satisfaction with certain program elements (such as the length of time required to receive rebate or inspections).

Program Administration—Customers

Participants indicated program administrative processes functioned well for them. Participants were "satisfied" or "very satisfied" with the application process. Fifty-two percent (46 of 90) did not need to contact DP&L after submitting the online rebate application. Of those that did correspond directly with DP&L, an overwhelming number of participants were "satisfied" or "very satisfied" (43 of 44).

A small number of participants experienced minor inconveniences with program administration. Participants experiencing difficulty with the application process cited the following reasons:

- One participant reported the process was too difficult, and required too much effort to receive a small incentive.
- One participant felt the inspection process too invasive. The auditor inspected more than one project while at the facility.

- Two participants expressed dissatisfaction, but did not elaborate why. One was dissatisfied with the rebate amount, and other was dissatisfied with entire process.

Twelve respondents had participated in energy-efficiency programs sponsored by other utilities. Three of those participants said DP&L's program was an easier process, and one said it was a harder process, while the remaining participants found the program roughly the same as those of other utilities.[20] Participants who experienced an easier time with the DP&L application process described the following reasons:

- One respondent said the process was very simple and not complex. In addition, completing the application online proved to be of great benefit and saved time.
- Another respondent stated the overall process was easier to understand and follow.
- The last participant indicated DP&L required submission of less documentation.

Program Communication and Marketing

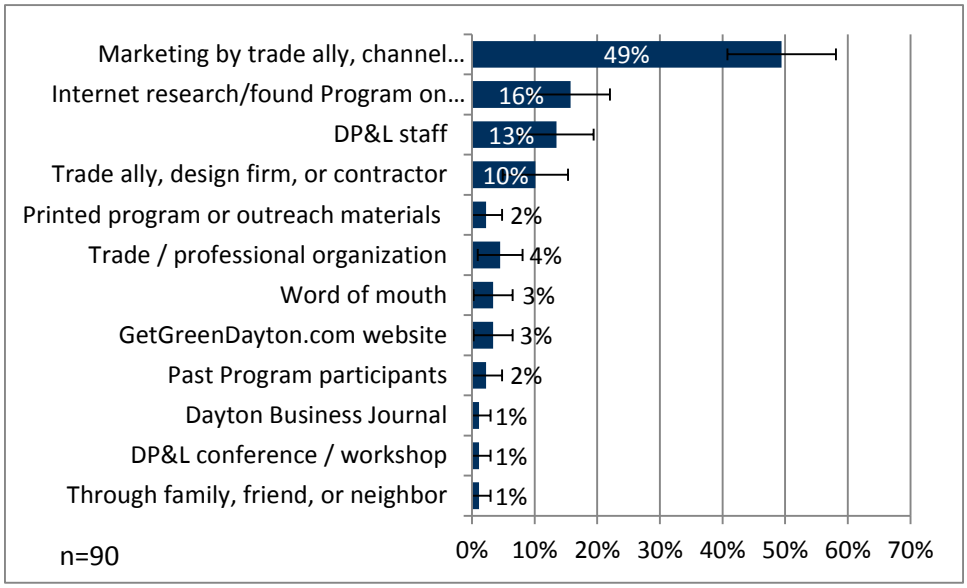
DP&L employs a comprehensive marketing plan, which includes its own efforts as well as leveraging the support of trade allies and the regional business community. DP&L actively promotes its programs through a variety of mechanisms, such as:

- DP&L's Website;
- Bill inserts;
- Inserts in the Dayton Business Journal;
- Presentations to various community and business groups; and
- Major account representatives working directly with customers.

Channel partners have direct access to DP&L staff, serving as an important program marketing outlet. DP&L staff communicates with channel partners through annual workshops, quarterly newsletters, and phone calls, as necessary. The program also provides channel partners with marketing materials and case studies to assist their marketing efforts. Figure 58 shows sources informing program participants.

[20] The participant who indicated the process was harder did not elaborate.

Figure 58. How Participants Learned About Program*



* There are multiple responses possible.

Similarly to 2010, DP&L Website/staff and channel partners/contractors remain the primary information sources. It appears, however, that more information was provided through channel partners and contractors in 2011 than in the past.

Program Participant Demographics

Demographic findings from the participant survey are provided in Appendix J.

Program Tracking Database

DP&L utilizes two primary methods to track program participation and savings. The first is a Web-based database, where customers or contractors complete applications. Documents such as invoices, audits, and specification sheets can be attached to this electronic application.

As they are received, data from online applications are manually transposed into a Microsoft Excel spreadsheet, with each program year tracked in a separate spreadsheet. Cadmus understands DP&L currently is working with their online database vendor to modify the tracking spreadsheet; this was initially planned for late 2011, but will be in place sometime in 2012.

Other Activities Influencing the Program

Lighting Code Changes

EISA, which Congress passed in December 2007, calls for a gradual phase-out of inefficient lighting. Lighting code changes could significantly impact eligible measure savings in the near future by reducing baseline wattages. As of July 1, 2010, federal law prohibits the manufacture of magnetic ballasts for T12 lighting fixtures. Starting July, 14, 2012, a new federal regulation takes effect, addressing general service fluorescent lighting, and requiring stricter lumen-per-watt specifications. This will eliminate most T12 lamps on the market. As this date nears, we have been identifying new T12 products that meet the new efficiency requirements by increasing the

lamps' lumen output while maintaining the same wattage. This may have programmatic implications for DP&L, if these products become popular.

In addition, federal law will effectively phase out high-wattage incandescent bulbs. Starting in 2012, all light bulbs will be required to use 25% to 30% less energy than current lighting, with even more aggressive targeting through 2020. The phase-in will begin with 100-watt bulbs in January 2012, and end with 40-watt bulbs in January 2014. By 2020, bulbs will have to be 70% more efficient. As with T12 magnetic ballasts, incandescent bulbs represent a relatively high baseline against which CFLs can report significant savings. After incandescent bulb inventories can be considered depleted, the baseline wattage will likely equal CFLs. This change will primarily affect residential lighting programs, where incandescent bulbs are more prevalent. However, many commercial facilities use incandescent bulbs for a variety of applications.

Motor Code Changes

EISA 2007 amended standards, effective December 2010, for general-purpose electric motors (subtype I) of 1 to 200 HP require subtype I motors meet "NEMA Premium" levels.[21] Motor manufacturers seem to have sufficient stock of "NEMA Premium" motors, and most have not updated their product literature; motor manufacturers apparently have been slow to implement the new-efficiency products. Nonetheless, the Consortium for Energy Efficiency has published an available, enhanced, premium-efficiency motors product list, which includes efficiencies greater than standard "NEMA Premium" levels. DP&L's program currently has relatively low participation in motors rebates, and should consider updating program requirements for 2012.

Recommendations

Given the preceding evaluation findings, Cadmus offers the following recommendations for program improvements:

- In 2012, DP&L is migrating their tracking spreadsheet from Microsoft Excel to an online database. We agree with this change as it is suitable for referencing materials across multiple program years. Cadmus recommends a thorough review of the new online tracking system's inputs and outputs as part of their 2012 evaluation.
- This year's evaluation found that DP&L was using a standardized efficiency level when calculating impacts for HVAC equipment. This standardization of efficiency resulted in lower claimed savings than would have if the rated equipment efficiencies were used from the application documentation. Consider using rated efficiencies, found in the submitted application documentation, to inform the energy savings for HVAC equipment.
- New federal standards for general-purpose electric motors went into effect December 2010. Consortium for Energy Efficiency published an available motors product list that exceeds the new standard. Consider updating the motor efficiencies and/or rebates for 2012 to account for new federal standard.

[21] In addition, general-purpose electric motors (subtype II), fire pump motors, and NEMA Design B general purpose electric motors must meet "NEMA Energy Efficient" levels. "NEMA Premium" motors are more efficient than "NEMA Energy Efficient" motors. While these motors are not part of DP&L's prescriptive program, they may impact some motors projects in the Custom Rebate program.

- As the new lighting requirements come into effect, there may be programmatic implications for DP&L if new T12 products meet the new efficiency requirements. It is too early to tell what the implications are, but we recommend keeping watch of these products.
- Satisfaction continues to be high and DP&L is well received by customers. Contractors are having a growing role in promoting this program. To maintain this level, continue the same interactions with the customers and contractors.

NON-RESIDENTIAL CUSTOM REBATE PROGRAM

The following sections describe the evaluation approach, detailed findings, and conclusions and recommendations for the Non-Residential Custom program.

Methodology

The 2011 evaluation followed researchable questions and evaluation activities outlined in DP&L's 2010–2012 Evaluation, Measurement, and Verification Plan. Table 82 identifies key researchable evaluation questions.

Table 82. Key Researchable Questions

Researchable Question	Discussion	Activity to Support Question
What is customer satisfaction with the program?	It is important to assess customer satisfaction, addressing the various program components.	• Participant surveys
How did customers learn about the program?	DP&L has expressed interest in learning which marketing channels most effectively encouraged participation.	• Participant surveys
What were the gross electric savings, and demand reductions?	Gross electric savings and demand reductions will help create a business case to continue running the program, and will be useful for planning future program designs.	• Engineering analysis • Data verification • Telephone surveys

In the 2011 evaluation's initial stages, Cadmus conducted interviews with program staff; these interviews as well as other program staff meetings were considered necessary to help inform the program evaluation.

Detailed Evaluation Findings

Summary of Key Findings

Evaluation activities produced the following key findings:

- The program achieved DP&L's energy and demand savings goals. As shown in Table 83, the program *ex ante* gross savings is 20,513,721 kWh and 3,222 kW with the achieved adjusted annual gross savings of 19,612,273 kWh and demand savings of 3,070 0 kW. The program achieved an energy savings realization rate of 96% for energy savings.

Table 83. C&I Custom Reported and Achieved Energy Savings

Measure	*Ex Ante* Claimed Savings		Verified Gross Savings		Adjusted Gross Savings		Adjusted Gross kWh Savings	
	Gross kWh	Gross kW	Gross kWh	Gross kW	Gross kWh	Gross kW	Realization Rate	Precision at 90% Confidence
Custom	18,916,658	2,741.0	18,254,895	2,666.3	17,931,578	2,591.7	95%	±4%
Custom NC-LPD	1,597,063	481.1	1,638,639	480.4	1,680,696	478.7	105%	±2%
Total	20,513,721	3,222.1	19,893,535	3,146.7	19,612,273	3,070.4	96%	±3%

- Site audits generally found minor discrepancies, involving lighting fixture quantities and types. Changes in operating hours presented the primary discrepancies for lighting projects.
- Air compressor projects in the Custom Rebate program comprised a large and growing portion of the overall program.
- Annual kWh realization rate is 96%, which indicates the measure application and process work well. Compared to other utilities nationally, DP&L ranks in the middle of C&I program realization rates.
- DP&L customer satisfaction was high. Also, compared to other utilities nationally, overall satisfaction with DP&L ranked the highest of any of program we reviewed.
- Participants indicated program administrative processes functioned well for them. Eleven of 14 participants surveyed claimed to be "very satisfied" overall with the program.
- Cadmus reviewed various air compressor projects and found areas to improve DP&L's independent energy consulting firms post-inspection and data logging practices. Apart from air compressors, we found these firms provided thorough and well-documented installed equipment, spot meter readings, and data logging information.

Data Collection Methods

We based survey and on-site samples on the DP&L database. The following sections provide our sampling methodology, and various attributes regarding the method and end result. The custom projects have been broken into two group populations: Custom Rebate and New Construction Rebate. New construction projects evaluated were lighting power density (LPD)[22] reduction projects. Due to the small number of Government Energy Audit projects, and no savings being credited, we did not evaluate these projects in 2011.

Participant Survey

As outlined in the evaluation plan, analysis of the program included surveys of up to 35 participants. However, the participant population was based on unique customer contacts, as contacts may oversee multiple projects as well as different facilities, and a new target was established before survey calls began.

Table 84 shows various surveys conducted, group populations, completion goals, and actual surveys completed.

[22] LPD is expressed in watts per square foot and represents the amount of electrical power (watts) used to provide lighting to an area (square foot).

Table 84. Process Evaluation Surveys Completed

Measure Category	Program Population*	Survey Target	Surveys Achieved**
Custom	14	14	11
Custom NC-LPD	6	6	3
Custom Total	20	20	14

* Based on 2011 program-year participants, listed in the DP&L tracking database, dated November 1, 2011.
** Not a straight 90/10 on measure population, as participants may have received an incentive for more than one measure.

As this is a multiple-year evaluation, and to maintain a low impact on DP&L customers, we did not include customers in the participant survey if they received a site visit in 2011. We contacted new construction projects twice: once for the site visit, and once for the participant survey. We felt it was worth investigating this new program's process for DP&L. Though Cadmus attempted to perform surveys for a census of these participants, surveys were achieved for only 14 participants. The survey asked respondents about the following:

- Their program awareness and participation;
- Descriptions of the enrollment process experience;
- Satisfaction with program participation; and
- General questions regarding their business.

Cadmus staff conducted the custom telephone surveys, with interviewers surveying the business' key decision makers regarding their equipment purchases.

Site Verification Visits and Document Review

Cadmus evaluated a statistically valid sample of projects, based on a 90% confidence interval with a 10% precision level through 24 on-site visits. All site visits included a thorough desk review of selected projects. Cadmus selected the site visit sample to achieve the targeted confidence level. The 24 projects visited consisted of 68 percent of the overall reported savings from the program.

We performed two rounds of site visits (July and December 2011), obtaining the total sample from participants through November 1, 2011.

Cadmus identified 12 projects to represent relatively large savings levels (greater than 300,000 kWh per year). We included a majority of these projects in the site visit sample, and completed site visits with seven of them. We prioritized analysis of large, high-impact projects due to their disproportionate effect on the precision of overall program savings. Cadmus evaluated over 68% of reported savings through on-site visits, and performed a desk review of all projects visited. Documentation consisted of a third-party audit report, which was used to evaluate energy savings for the sites.

Table 85 shows total projects evaluated through site visits, by project category for each round.

Table 85. Custom 2011 Site Visit Breakdown by Measure Category

Measure Category	Site Visit Project Count Round 1	Site Visit Project Count Round 2	Total 2011 Site Visits	2011 DP&L Total Number of Projects (n)
Custom	12	7	19	79
Custom NC-LPD	0	5	5	14
Total	12	12	24	93

Baseline Assumptions

Baseline assumptions typically involved data obtained on site, and included replaced fixture types and quantities as well as parameters such as original operation hours, pressure settings, and baseline equipment power draws. We used assumptions in the draft Ohio TRM when data could not be obtained on site (such as baseline motor efficiencies or fixture wattages).

Database Tracking Review

In addition to reviewing on-site project files, we conducted a thorough review of DP&L's entire final tracking database. The review addressed two tracking spreadsheets of reported project savings, through January 31, 2012, including:

- Customers submitting their applications in 2010, but not completing projects until 2011; and
- All 2011 applications and completed projects.

Part of the review combined workbooks into a master spreadsheet. The review required two steps:

- Checking DP&L's calculation methodology with the draft 2010 Ohio Technical Reference Manual; and
- Checking DP&L's project savings calculations by verifying cell references, cell links, and input assumptions.

After review completion, and based on our feedback, DP&L revised its tracking database to incorporate some of our recommendations. DP&L finalized the year-ending 2011 tracking database, which was provided to Cadmus as the final reported database.

Impact Methodology

Cadmus designed the impact evaluation to verify reported program participation and to estimate gross energy and demand savings. For the impact evaluation, we used data collected through the program tracking database, online application forms, and calculations supplied by third-party vendors.

Cadmus collected baseline data from the program tracking system. We reviewed available documentation for all completed projects (e.g., audit reports, application forms, and invoices), paying particular attention to the calculation procedures. We reviewed the original analyses used to calculate expected savings, and verified the operating and structural parameters of measures to

the extent possible, based on documentation. Specific engineering analysis and saving verification methods we applied are noted below.

Detailed Impact Findings

Table 86 and Table 87 summarize verified and adjusted results for the sample by major measure group.

Table 86. Reported Gross *Ex Ante* and Adjusted Gross *Ex Post* Savings for Sampled Projects*

Measure	Number of Projects	*Ex Ante Gross* Energy Savings (kWh)	Verified Energy Savings (kWh)	Adjusted Energy Savings (kWh)	Realization Rate
Air Compressor	7	6,628,134	5,919,454	6,300,642	95%
Custom Lighting	8	598,591	599,200	561,002	94%
Custom NC-LPD	5	793,948	835,525	835,525	105%
HVAC	1	4,392,861	4,392,861	4,175,812	95%
Motor	1	749,010	749,010	712,002	95%
Other	2	862,695	909,003	820,070	95%
Total Savings	24	14,025,239	13,405,053	13,405,053	N/A**

* May not sum properly due to rounding.
** The program level realization rates are in Table 83 weighted by total program sizes.

Table 87. Reported Gross *Ex Ante* and Adjusted Gross *Ex Post* Demand Savings for Sampled Projects*

Measure	Number of Projects	*Ex Ante Gross* Demand Savings (kW)	Verified Demand Savings (kW)	Adjusted Demand Savings (kW)	Realization Rate
Air Compressor	7	724.4	661.8	691.3	95%
Custom Lighting	8	134.3	82.3	123.5	92%
Custom NC-LPD	5	155.5	154.7	154.7	99%
HVAC	1	523.7	523.7	499.8	95%
Motor	1	91.9	91.9	87.7	95%
Other	2	57.4	97.4	54.8	95%
Total Savings	24	1,687.2	1,611.8	1,611.8	N/A**

* May not sum properly due to rounding.
** The program level realization rates are in Table 83 weighted by total program sizes.

Air Compressor Savings

Projects included replacements of air compressor equipment and installations of flow controllers. Typically, applications were industrial. Parameters were collected in the field to inform the savings analysis. In addition, pre- and post-metered data in the project document proved very valuable in confirming baseline and measure conditions. Based on metered data, site visit data, and Cadmus' experience with compressed air systems, project savings were reduced slightly.

Notable discrepancies include:

- In one project, we found pre-metered data calculations used 8,760 hours for the yearly operation calculations. During the post-metering period, DP&L's independent energy consulting firm discovered the plant did not run production yearly, but compressors ran, even though the plant was not in production. Savings were derated an average 26% to account for this shutdown period. The calculated baseline was derated by this amount, even though the compressors ran. Cadmus reviewed this project thoroughly, concluding this derated percent should not be applied, as it would have been unlikely the facility would have changed its operating practices without installing a new air compressor. Cadmus discussed this project with DP&L, and savings were updated prior to entry in the final tracking database.
- One project received a precision flow controller to regulate the discharge plant pressure at a prescribed pressure, lower than stored pressure in the tanks. At the time of the site visit, the controller was not working. Facility staff had multiple issues with the controller, and kept failing to fix it, after several attempts. They planned to replace the pneumatic controller with a digital control system. Cadmus determined zero savings for this project.

Custom Lighting (Non-Prescriptive Lighting) Savings

Measures included retrofits of existing fixtures, lamps, and ballasts with energy-efficient models. Typically, these retrofits reduced demand, and we assumed fixture operating hours to be the same pre- and post-retrofit. Measures involved a variety of project types, including those in which:

- Baseline fixtures differed from the deemed approach;
- The number of removed and installed fixtures differed; or
- Measures were not addressed by the prescriptive program (such as LEDs).

We reviewed each project's approved online application for:

- Wattage levels before and after the retrofit;
- Hours of operation before and after the retrofit; and
- Number of fixtures affected by the retrofit.

Field personnel verified the number of fixtures, and adjusted savings based on operating hours and actual fixture types. These projects provided little, if any, documentation beyond the application and invoice. Cadmus determined appropriate wattage levels through manufacturer specification sheets, draft Ohio TRM lighting wattage tables, and other published databases.[23]

During our site audits, we found minor to no discrepancies in fixture quantities and types, with changes in operating hours the main discrepancy for lighting projects. Site visit discrepancies varied by project, and could increase or decrease project savings. On average, project savings were slightly reduced.

[23] See: Including the California *2009 Table of Standard Fixture Wattages*: http://www.sce.com/business/ems/customized-solutions/procedures-manual-archives.htm

Notable discrepancies included:

- One project included installation of exterior fixtures, with lighting operating hours only during nighttime. Demand savings for the project were set at zero.
- During a site audit, we found significantly fewer LED bulbs had been installed than claimed. Cadmus found over 100 LED bulbs not installed. The site contact said they planned to install them when contractor returned to replace dimmer switches. At the time of the site visit, appointments had not been scheduled with contactor to install the LED bulbs.

New Construction Lighting Power Density Savings

The LPD Reduction for Interior Lighting projects required thorough, room-by-room audits of lighting systems. The watts-reduced value, deriving from LPD in watts per square foot, was calculated as savings for new lighting, as obtained from baseline LPD values listed in ASHRAE 90.1-2007, Space-by-Space Method, for various building types. For each room type, lamp wattage and room square footage were collected. If certain rooms presented limited access, a collected sample of rooms was compared to project documentation. Of five projects, only small variances occurred, excepting some operating hours slightly higher than reported.

Motors

For the 2009 impact evaluation, Cadmus recommended DP&L employ pre- and post-installation metering to validate energy savings, which DP&L successfully applied in 2010. In 2011, Cadmus performed a verification site visit for only one VFD project. We reviewed pre- and post-installation metered data and audit reports. No notable discrepancies were found.

HVAC

Cadmus evaluated one non-prescriptive HVAC project: a 500-ton cooling tower offsetting an existing air-cooled chiller system. DP&L contracted with a third-party engineering firm to audit the measure. The audit included: on-site verification, data logging, and calibration to typical meteorological data. Cadmus's audit report and program documentation review did not find discrepancies.

Other

"Other" project measures included barrel wraps and process heat exchangers. In addition to collecting on-site data, Cadmus evaluated these projects by reviewing audit reports and metering data found in the project documentation.

In 2010, Cadmus evaluated a project for modification of a silicon crystal growing furnace. An existing furnace was expanded to allow the crystal diameter to increase from 22 inches to 24 inches. The participant also increased the system insulation, reducing power consumption. DP&L contracted with a third-party engineering firm to perform short-term power metering on existing 22-inch and the modified 24-inch crystal growers. The third-party engineering audit included: on-site verification, data logging, and calibration to production cycle times.

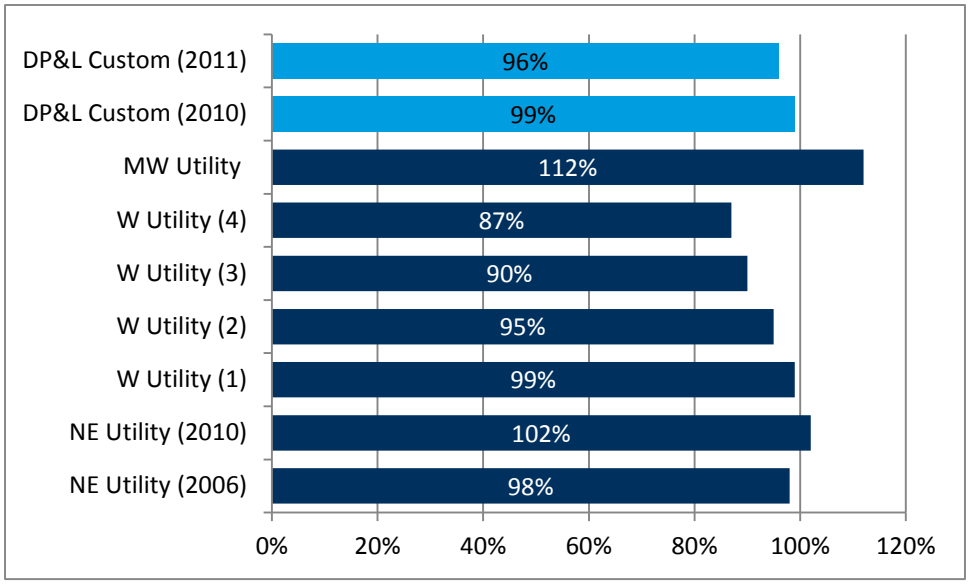
Cadmus' audit report and program documentation review did not find discrepancies that would reduce savings. In 2011, the same customer repeated the identical measure in its second

production line. The 2011 evaluation did not include a site visit. Cadmus assumed 100% realization rate for the project.

Realization Rate Comparison

Evaluated energy realization rates for the custom program were compared to those from other utilities across the country. DP&L ranks within utility variations, as shown in Figure 59.

Figure 59. Commercial Custom Program Realization Rate Comparison to Other Utilities



* Western Utility 5 evaluation realization rates were derived from its overall commercial programs, including custom and prescriptive programs.

DP&L's program realization rate is 96%. When compared to other programs, realizations rates ranged from 87% to 112% with an average of 98%. Realization rates tend to be driven by the accuracy of a utility's engineering assumptions for its programs. A 100% realization rate is considered the best scenario for any one program, as it indicates energy savings estimates neither overstate nor understate achievements made, reducing program staff's burdens for future program year planning. The 2011 DP&L evaluation results fell within this range.

Process Findings

The process evaluation tasks Cadmus performed for the 2011 program evaluation included surveys with participants and leveraged interview results with DP&L staff, further informing process evaluation findings.

Program Design

As shown in Table 88, program participation increased from 2009 through 2011. Table 89 provides greater detail regarding the frequency of measure types installed.

Table 88. Program Participation by Year

Program Year	Number of Individual Customer Projects
2009	20
2010	65
2011	93

Table 89. Frequency of Custom Measures

Measure Type	Frequency
Custom	79
Custom NC-LPD	14

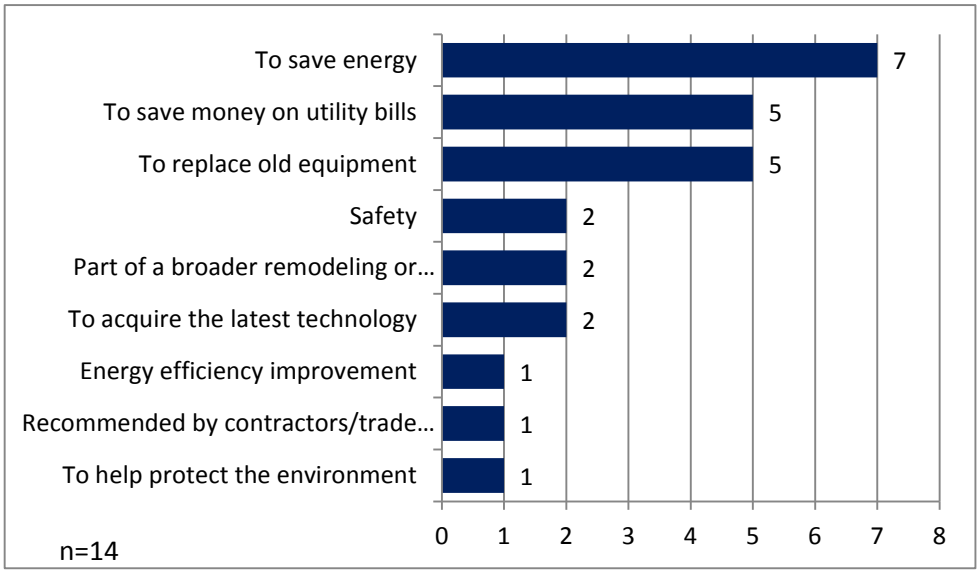
For the most part, 2011 program measure offerings remained consistent with 2009 and 2010 offerings. DP&L made a number of revisions to the program design in late 2010, which did not become active until 2011. These revisions included:

- Starting in September 2010, the Custom Rebate removed minimum payback requirements. Originally, the program required a one- to seven-year payback period. Currently, the one-year payback has been removed.
- In fall 2010, DP&L added a New Construction Rebates program, paid out of the Custom Rebate program budget. The program provides incentives based on LPD reductions and whole building improvements over a code baseline.
- DP&L added a Government Energy Audit program, also paid out of the Custom Rebate program. DP&L reimburses 50% of audit costs, and will pay the remaining 50% of audit costs if the customer implements identified electricity-saving projects within one year of the audit. Though this program did not contribute energy savings, identified measures may be eligible for incentives through DP&L's prescriptive or custom programs. Seen as a pilot, this program and may be expanded to a larger customer base.
- As part the 2010 recommendation, DP&L began investigating adding new measures, such as Energy Management System (EMS) controls, which will be part of the 2012 program portfolio.

Program Participants

Of the 14 responses in our survey, roughly 50% reported participating in DP&L's Custom Rebate program to reduce energy costs (Figure 60). One-quarter of participants said they wanted to replace old, functional equipment with new equipment, or sought to acquire the latest technology. The remaining participants had various responses, ranging from the environment to safety.

Figure 60. Reasons for Participation in the Non-Residential Custom Program*



* The question had multiple responses.

Satisfaction

Overall, participants rated the program an average 4.8 out of 5, with 5 representing being "very satisfied," indicating program participant satisfaction levels very similar to 2010 results.

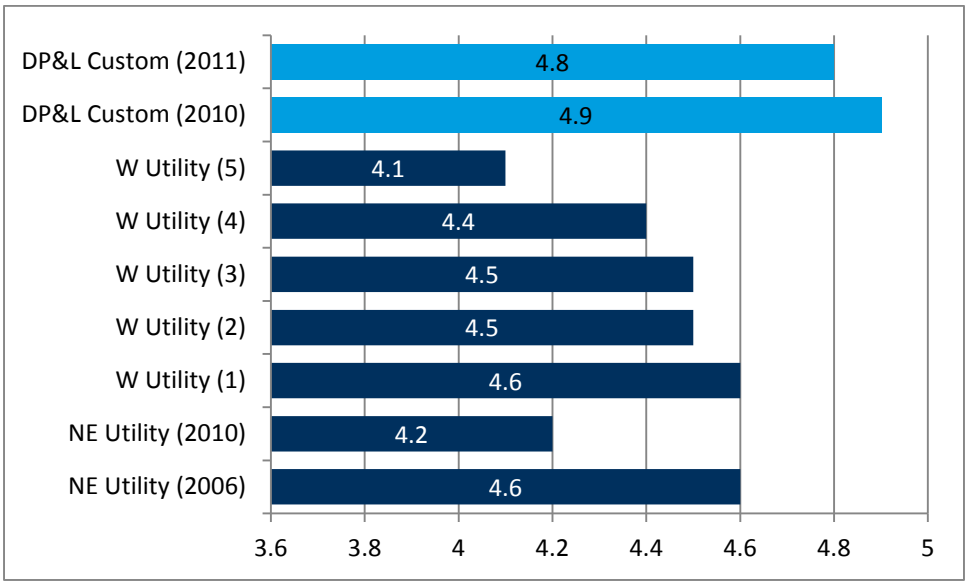
Table 90. Custom Rebate Participant Satisfaction

Participant Satisfaction	DP&L 2011	DP&L 2010*
Ease of filling out online application (n = 8)	4.6	4.8
Rebate amount (n = 14)	4.8	-
Communication with DP&L staff (n = 6)	5.0	4.9
Length of time to receive rebate (n = 13)	4.7	-
Satisfaction with inspection (n= 6)	4.7	-
Overall satisfaction (n = 14)	4.8	4.9

* Applicable questions from 2010 participant satisfaction survey (n = 8)

When comparing DP&L's customer satisfaction with other utilities, DP&L ranks very high, with DP&L custom programs levels the highest of any other program reviewed, as shown in Figure 61.

Figure 61. Comparison to Overall Program Satisfaction of Utility Commercial and Industrial Custom Programs*



* Western Utility 1 and Northeastern 1 Utility evaluations satisfaction levels represent overall commercial portfolios, including prescriptive and custom programs.

The lowest program satisfaction level recorded level was 4.1, with the average for the prescriptive programs at 4.41 (excluding DP&L). Customer service-related functions tended to drive satisfaction, including communication with staff and assistance in completing projects, which generally provided participants with a better experience overall, even if they were less satisfied with program elements such as length of time to receive rebates or inspections.

Program Administration

The program promotes purchases of high-efficiency equipment not covered by the prescriptive Rapid Rebates program. As with the prescriptive program, participants fill out an application and submit it online. DP&L notifies the participant when an application has been approved. After project completion, the participant must submit invoices and other program documentation for final verification. DP&L conducts audits or hires third-party vendors to perform measurement and verification on relatively large projects (with incentives greater than $10,000) and on a random sample (between 3% and 15% of remaining projects).

Unlike the prescriptive program, custom measures must have a maximum payback, based on electricity cost savings over seven years. Measures must also demonstrate permanency or sustainability of savings over the payback period, or over a five-year period, whichever is longer.

Program Administration—Customers

Participants indicated program administrative processes functioned well for them. One hundred percent of respondents (14 of 14) said DP&L program met their expectations. Seven of eight participants were “very satisfied” or “somewhat satisfied” with the online application process.

All three new construction participants surveyed were “very satisfied” with the rebate amount offered by DP&L. Regarding the ease of filling out the online application, new construction

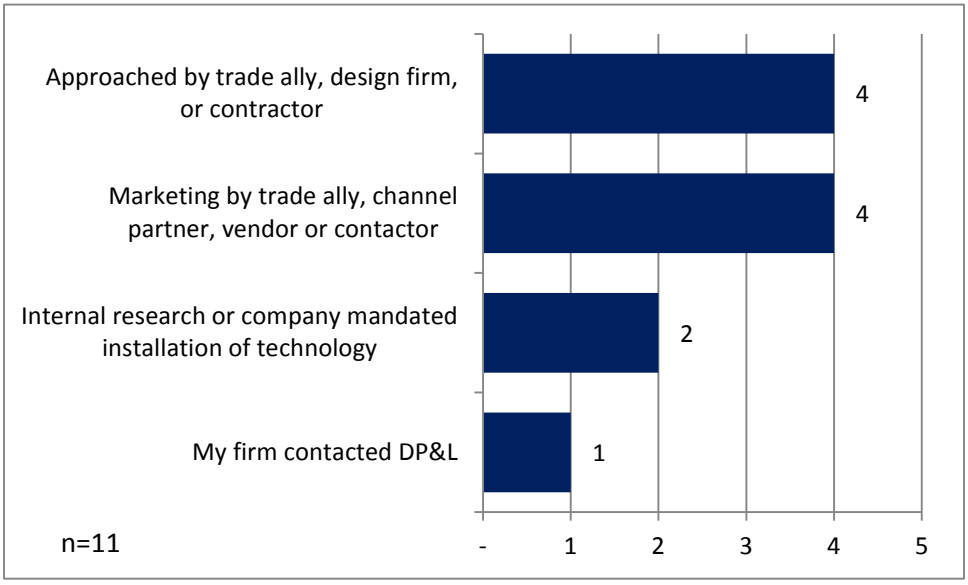
participants (two of two)[24] were very satisfied with the ease of filling out the online application. In addition, all three new construction participants were "very satisfied" or "somewhat satisfied" with time required to receive the rebate and with the post-inspection process. As part of the DP&L's application process, new construction applicants had to submit an initial application before building plans could be finalized. All three participants acknowledged they became involved early in the design phase before drawings were finalized.

No suggestions of program dissatisfaction were reported, though one non-prescriptive lighting project participant indicated parts of the application were confusing, and seemed to differ between the Website and application. This participant did not seem dissatisfied, but expressed concerns regarding the apparent discrepancies. After reviewing the application and Website, Cadmus provided feedback to DP&L.

Program Communication and Marketing

Figure 62 shows sources informing program participants about the program.

Figure 62. How Custom Participants Learned About Program



Similarly to 2010, DP&L channel partners/contractors remained the main information sources. For 2011, however, it appears channel partners and contractors have provided increased information. Channel partners provided secondary marketing support.

DP&L employs a comprehensive marketing plan, which includes its efforts, and leverages the support of trade allies and the regional business community. DP&L actively promotes its programs through a variety of mechanisms, such as:

- Bill inserts;
- Inserts in the Dayton Business Journal;

[24] Only two of three new construction participants responded to the question.

- Presentations to various community and business groups; and
- Major account representatives working directly with customers.

Channel partners can directly access DP&L staff, and provide an important program marketing outlet. DP&L staff communicates with channel partners through annual workshops, quarterly newsletters, and phone calls, as necessary. The program also provides channel partners with marketing materials and case studies to assist their marketing efforts.

Recommendations

Based on the preceding findings, Cadmus offers the following recommendations for program improvements:

- In general, we found documentation and analysis to be sufficient with DP&L's independent energy firms. Their site visit reports and impact analysis of site specific savings were typically well documented. We visited and reviewed analysis of several air compressor projects which included data from DP&L's independent energy firms. Since air compressors are a high impact measure, consider providing training and review of best practices for air compressors savings and data logging.
- Similar to the prescriptive program, satisfaction continues to be high for the custom program. This program is well received by customers. Contractors are having a growing role in promoting this program. To maintain this level, continue the same interactions with the customers and contractors.
- As the new lighting requirements come into effect, there may be programmatic implications for DP&L if new T12 products meet the new efficiency requirements. It is too early to tell what the implications are, but recommend keeping watch of these products.

COST-EFFECTIVENESS

Benefit-Cost Scenarios

The primary method used to determine program and portfolio cost-effectiveness is the TRC test. The TRC derives from the ratio of lifecycle benefits of the portfolio over lifecycle incremental costs. The TRC determines whether energy efficiency proves more cost-effective overall than supplying energy. The TRC does not provide the necessary information to determine whether the portfolio or program is cost-effective from the perspective of an individual program participant, DP&L, or ratepayers. Therefore, Cadmus calculated additional tests, based on the California Standard Practice Manual for the portfolio of programs and for each individual program implemented in 2011. Those tests, in addition to the TRC, are: the Societal Test (SCT), the Utility Cost Test (UCT), the Ratepayer Impact Measure (RIM), and the Participant Cost Test (PCT).

We did not include non-energy benefits in the present analysis; therefore, the SCT is only differentiated from the TRC by the discount rate.

The SCT uses a 10-year Treasury bill (T-bill) rate of 3.56% to discount future benefits.[25] The 10-year T-bill rate used as a discount rate for the SCT recognizes benefits accrue to society in general rather than solely to a utility or participants. Generally, utilities experience high weighted capital costs, reflecting the cost of borrowing money and the associated risk. For society as a whole, the risk level is low or almost nonexistent, making the T-bill rate more appropriate for a total resource perspective.

The UCT is a valuation of the costs and benefits directly accrued by the utility. In some ways, the UCT provides for a more even comparison between demand and supply side resources as they both include the utility cost only.

The RIM, a valuation of program net benefits as perceived by ratepayers, is measured by: electric avoided costs; incentive costs (i.e., utility measure costs); administrative costs associated with the program; and lost revenues (equal to participant energy savings benefits).

Table 91 shows discount rate applied to each benefit-cost test.

Table 91. Discount Rates

Benefit-Cost Test	Discount Rate
TRC	8.77%
SCT	3.56%
UTC	8.77%
RIM	8.77%
PCT	10.00%

[25] The SCT discount rate was updated for program year three's analysis. A 3.5% discount rate was used in previous years.

Program Benefit Components

Benefits counted through the TRC, UTC, RIM, and SCT include:

- The full value of time and seasonally differentiated generation;
- Transmission and distribution; and
- Capacity costs.

They also account for avoided line losses. For each energy-efficiency measure included in a program, Cadmus adjusted the hourly (8,760) system-avoided costs by the hourly load shape of the end use affected by the measure, capturing the full value of time and seasonally differentiated impacts of the measure.[26]

Table 92 summarizes estimates of avoided costs for program year three through program year seven.[27]

Table 92. Summary of Avoided Costs

Program Year	Average Hourly Energy Cost ($/MWh)	Capacity ($/kW)
Program Year 3 (2011)	$26.53	$49.93
Program Year 4 (2012)	$26.21	$20.24
Program Year 5 (2013)	$28.40	$8.41
Program Year 6 (2014)	$29.38	$31.04
Program Year 7 (2015)	$30.65	$54.70

Cadmus used adjusted gross energy and demand savings to perform the benefit-cost calculations. We did not factor non-energy benefits, such as water savings, into the calculation. We did apply line loss—the percentage of energy lost during transmission and distribution—to measure level savings that reflect total savings from the point of generation. Table 93 specifies line-loss assumptions.

Table 93. Line Loss Assumptions Used in Cost-Effectiveness Calculations

Sector	Energy Line Losses	Demand Line Losses
Residential	7.95%	9.14%
Commercial/Industrial	6.33%	7.68%

Program Cost Components

For the analysis' cost component, we considered incremental measure costs or project costs depending on the data available and direct utility costs.

[26] As hourly end-use load shapes were unavailable for the DP&L service area, we developed them using available data from similar regions, adjusting for weather conditions in DP&L's service territory.

[27] Appendix H includes a detailed review of the cost-effectiveness analysis inputs.

Incremental measure costs are incremental expenses associated with installation of energy-efficiency measures, and ongoing operation and maintenance costs, where applicable. These costs include the incentive as well as the customer contribution. Cadmus used data provided by DP&L as well as secondary sources to calculate the incremental cost for each measure within each program.

For the commercial and industrial programs total project costs, not incremental costs, were included in utility tracking databases. Therefore Cadmus made adjustments to the total project costs for all three programs. Although the methods described below create reliable estimates for incremental costs, it would be beneficial for DP&L to collect incremental cost data for their commercial and industrial programs in future years.

For the Prescriptive program, Cadmus relied on the draft Ohio TRM and the Database for Energy Efficient Resources (DEER) database, and other secondary sources to calculate the incremental cost for several measures such as lighting, HVAC units and motors. For the Custom program, many new construction projects had missing cost data, so Cadmus calculated the ratio of incentives to project costs for the projects that had data, applied this ratio to the projects with missing cost data and determined the total project costs.

For the Self-Directed Mercantile program Cadmus used the total project costs in the cost-effectiveness calculations for the retrofit projects – overall a conservative approach. For the new construction projects within the Self-Directed Mercantile program, which were all LEED certified schools, Cadmus relied on secondary research which calculated the incremental cost of LEED construction for schools to be 1.65% of total project costs[28]. Cadmus applied this 1.65% to the total project costs provided by DP&L to create a proxy for the incremental costs for the new construction projects.

Utility costs include any customer payments, and expenses associated with: program development; marketing; delivery; operation; and evaluation, monitoring, and verification (EM&V). Table 94 summarizes DP&L's implementation and administrative costs. All utility costs were provided by DP&L.

[28] Kats, Gregory. "Greening America's Schools – Costs and Benefits." October 6, 2006. http://www.usgbc.org/ShowFile.aspx?DocumentID=2908

Table 94. Implementation and Administrative Costs

Cost Category	Level	Description
Implementation Vendor and Marketing Costs	Program Level	Incremental costs associated with performing program implementation tasks, including customer service, application processing, marketing, customer outreach, etc.
Incentive Costs	Program Level	Rebates and incentives paid to customers by DP&L.
Direct Measure Costs	Program Level	Costs associated with paying for program measures, including measures installed through the Low Income Weatherization program.
DP&L Staff Costs	Program Level/ Portfolio Level	Costs to administer energy-efficiency programs, including DP&L's fully-loaded incremental personnel costs. Activities associated with market research outside of EM&V.
External Vendor Evaluations	Portfolio Level	Activities associated with the determination and evaluation of current and potential energy-efficiency programs. Activities include: benefit-cost ratio analysis, impact and process analysis, cost per kWh analysis, customer research, and all other analyses necessary for program evaluation.
Education, Awareness, and Building and Market Transformation	Portfolio Level	Cost to increase awareness of energy efficiency.

Overall Portfolio Cost-Effectiveness Results

Full Portfolio Results

Table 95 summarizes energy savings, demand impacts, and costs for DP&L's entire energy-efficiency portfolio, utilizing adjusted gross savings. The portfolio includes:

- DP&L's six residential sector programs: Lighting, HVAC Tune-Up, HVAC Rebate, Appliance Recycling, Low Income and School Education;
- DP&L's three commercial and industrial programs: Prescriptive Rebates, Custom Rebates, and Self-Directed Mercantile;
- Portfolio costs for education and awareness; and
- EM&V.

The portfolio passes the TRC test with a benefit-cost ratio of 1.71. All other tests have a benefit-cost ratio above 1.0, except for the RIM test. Table 95 shows benefits, costs, and benefit/cost ratios for each test.

Table 95. DP&L Portfolio

Benefit/Cost Component	2011 Values
Gross Savings (MWh)	177,387
Capacity Savings (kW)	25,965
Total TRC Costs	$40,184,442
Direct Participant Costs	$35,078,680
Direct Utility Costs	$14,001,934
Incentives	$8,896,172
Direct Measure Costs	$802,582
DP&L Staff Costs	$809,666
Implementation Vendor & Marketing	$2,274,934
External Vendor Evaluations	$546,854
Education, Awareness Building & Market Transformation	$671,726

	TRC	*Utility*	*Participant*	*RIM*	*Societal*
Present Value Benefits	$68,915,439	$68,915,439	$164,725,541	$68,915,439	$88,885,292
Present Value Costs	$40,184,442	$14,001,934	$35,078,680	$177,031,153	$40,184,442
Benefit-Cost Ratio	**1.71**	**4.92**	**4.70**	**0.39**	**2.21**

Residential Portfolio Results

Table 96 summarizes energy savings, demand impacts, and costs for DP&L's residential programs. The residential portfolio proves cost-effective overall, with a TRC of 2.22. The Residential Lighting program is the most cost-effective program in the portfolio, with a benefit/cost ratio of 4.88. The Residential HVAC Tune-Up program and the Residential Heating and Cooling Rebate program did not pass the TRC test as stand-alone programs. Additionally, the Residential Low-income Weatherization program did not pass the TRC test; however, this program provides numerous non-energy benefits, such as better health and safety for low-income customers.

Table 96. Residential Portfolio

	Program Year 2011						
Benefit/Cost Component	**Lighting - CFL Discount**	**HVAC Tune-up**	**HVAC Rebate**	**Appliance Recycling - Refrigerator / Freezer Pick-up**	**Low Income**	**School Education**	**Total**
Gross Savings (MWh)	92,843	107	7,792	4,702	1,072	1,171	107,687
Capacity Savings (kW)	9,820	40	2,461	749	134	121	13,325
Total TRC Costs	$6,068,398	$209,940	$8,021,370	$659,308	$989,692	$233,508	$16,182,216
Direct Participant Costs	$5,487,020	$27,745	$7,615,811	$111,200	$0	$0	$13,241,776
Direct Utility Costs	$3,155,537	$215,435	$2,218,359	$733,733	$989,692	$233,508	$7,546,264
Incentives	$2,574,159	$33,240	$1,812,800	$185,625	$0	$0	$4,605,824
Direct Measure Costs	$0	$0	$0	$0	$802,582	$0	$802,582
DP&L Staff Costs	$53,998	$38,149	$38,028	$37,899	$37,096	$7,346	$212,516
Implementation Vendor & Marketing	$527,380	$144,046	$367,531	$510,209	$150,014	$226,162	$1,925,342
TRC							
Present Value Benefits	$29,595,159	$25,795	$3,952,287	$1,419,878	$475,107	$409,004	$35,877,230
Present Value Costs	$6,068,398	$209,940	$8,021,370	$659,308	$989,692	$233,508	$16,182,216
Benefit-Cost Ratio	**4.88**	**0.12**	**0.49**	**2.15**	**0.48**	**1.75**	**2.22**
Utility							
Present Value Benefits	$29,595,159	$25,795	$3,952,287	$1,419,878	$475,107	$409,004	$35,877,230
Present Value Costs	$3,155,537	$215,435	$2,218,359	$733,733	$989,692	$233,508	$7,546,264
Benefit-Cost Ratio	**9.38**	**0.12**	**1.78**	**1.94**	**0.48**	**1.75**	**4.75**
Participant							
Present Value Benefits	$88,028,513	$97,884	$8,893,983	$4,195,010	$1,167,533	$1,157,596	$103,540,519
Present Value Costs	$5,487,020	$27,745	$7,615,811	$111,200	$0	$0	$13,241,776
Benefit-Cost Ratio	**16.04**	**3.53**	**1.17**	**37.72**	**-**	**-**	**7.82**
RIM							
Present Value Benefits	$29,595,159	$25,795	$3,952,287	$1,419,878	$475,107	$409,004	$35,877,230
Present Value Costs	$91,948,834	$281,416	$9,671,359	$4,882,228	$2,217,155	$1,442,025	$110,443,017
Benefit-Cost Ratio	**0.32**	**0.09**	**0.41**	**0.29**	**0.21**	**0.28**	**0.32**
Societal							
Present Value Benefits	$35,929,714	$28,316	$5,626,362	$1,686,687	$615,457	$509,974	$44,396,511
Present Value Costs	$6,068,398	$209,940	$8,021,370	$659,308	$989,692	$233,508	$16,182,216
Benefit-Cost Ratio	**5.92**	**0.13**	**0.70**	**2.56**	**0.62**	**2.18**	**2.74**

Commercial Portfolio Results

A summary of the energy savings, demand impacts, and costs for DP&L's commercial and industrial programs are reported in Table 97. Costs and benefits for mercantile customers are included under the custom program.

The commercial portfolio is cost-effective overall, with a TRC of 1.46. Both programs are cost-effective as well, with each program having a benefit/cost ratio larger than 1.0 for all except the RIM test.

Table 97. Commercial Portfolio

	Program Year 2011		
Benefit/Cost Component	**Non-Residential Prescriptive Rebates**	**Non-Residential Custom and Self-Directed Mercantile Rebates**	**Total**
Gross Savings (MWh)	34,538	35,162	69,700
Capacity Savings (kW)	6,124	6,516	12,640
Total TRC Costs	$9,638,563	$13,005,948	$22,644,511
Direct Participant Costs	$9,284,891	$12,552,013	$21,836,904
Direct Utility Costs	$2,162,402	$2,935,553	$5,097,955
Incentives	$1,808,730	$2,481,618	$4,290,348
Direct Measure Costs	$0	$0	$0
DP&L Staff Costs	$238,483	$219,532	$458,015
Implementation Vendor & Marketing	$115,189	$234,403	$349,592
TRC			
Present Value Benefits	$16,321,600	$16,716,609	$33,038,209
Present Value Costs	$9,638,563	$13,005,948	$22,644,511
Benefit-Cost Ratio	**1.69**	**1.29**	**1.46**
Utility			
Present Value Benefits	$16,321,600	$16,716,609	$33,038,209
Present Value Costs	$2,162,402	$2,935,553	$5,097,955
Benefit-Cost Ratio	**7.55**	**5.69**	**6.48**
Participant			
Present Value Benefits	$30,424,812	$30,760,210	$61,185,021
Present Value Costs	$9,284,891	$12,552,013	$21,836,904
Benefit-Cost Ratio	**3.28**	**2.45**	**2.80**
RIM			
Present Value Benefits	$16,321,600	$16,716,609	$33,038,209
Present Value Costs	$32,402,779	$32,827,642	$65,230,421
Benefit-Cost Ratio	**0.50**	**0.51**	**0.51**
Societal			
Present Value Benefits	$21,940,081	$22,548,699	$44,488,781
Present Value Costs	$9,638,563	$13,005,948	$22,644,511
Benefit-Cost Ratio	**2.28**	**1.73**	**1.96**

APPENDIX A: MEASURE-LEVEL SAVINGS TABLE

Program	Measure	Verified Gross Savings		Adjusted Gross Savings	
		Gross kWh	Gross kW	Gross kWh	Gross kW
Residential Lighting	CFL	92,842,547	11,104.7	92,842,547	9,819.9
Residential Appliance Recycling	Recycled Refrigerator	4,455,488	712.4	3,667,339	584.5
	Recycled Freezer	1,505,240	242.0	1,034,968	165.0
Residential Low-income	Compact Fluorescent Light Bulbs	347,327	41.2	347,327	41.2
	Photo Cell for Light	703	0.0	703	0.0
	Refrigerator Replacement	297,680	45.5	381,555	66.8
	Freezer Replacement	70,568	10.6	70,568	10.6
	Insulation (Attic, Wall, and Foundation)	202,379	0.9	202,379	0.9
	Air Sealing / CFM Reduction	19,911	0.1	19,911	0.1
	Energy-efficient Showerhead	10,710	1.2	3,270	0.4
	Faucet Aerator	2,437	0.3	273	0.0
	Water Heater Wrap	395	0.0	705	0.1
	Central AC Replacement	524	0.4	524	0.4
	Heat Pump Replacement	0	0.0	0	0.0
	Dryer Replacement	130	4.3	130	4.3
	Dishwasher Replacement	51	1.7	51	1.7
	Ductless Mini-Split	96,600	3.2	44,736	7.5
Residential HVAC Rebate	AC Early Retirement 14/15 SEER	1,623,820	892.4	1,509,656	848.6
	AC Early Retirement 16+ SEER	1,184,986	685.2	1,117,167	674.6
	AC New Construction 14/15 SEER	19,090	18.4	15,738	15.6
	AC New Construction 16+ SEER	16,848	13.2	15,871	12.4
	AC Std Replacement 14/15 SEER	12,880	12.4	13,968	12.8
	AC Std Replacement 16+ SEER	11,232	8.8	11,325	8.9
	GSHP Early Retirement 13/15 EER	27,612	4.0	31,361	2.1
	GSHP Early Retirement 16+ EER	1,070,289	131.8	1,127,496	136.7
	GSHP New Construction 13/15 EER	6,798	1.1	8,662	0.5
	GSHP New Construction 16+ EER	208,296	26.4	221,227	17.9
	GSHP Std Replacement 13/15 EER	3,399	0.6	3,030	0.2
	GSHP Std Replacement 16+ EER	47,340	6.0	45,581	3.8
	HP Early Retirement 14/15 SEER	2,176,250	381.9	2,024,604	373.6
	HP Early Retirement 16+ SEER	1,344,096	328.2	1,390,088	305.8
	HP New Construction 14/15 SEER	52,332	13.4	47,169	12.9
	HP New Construction 16+ SEER	35,650	9.6	35,530	9.6
	HP Std Replacement 14/15 SEER	36,312	9.3	33,035	9.1
	HP Std Replacement 16+ SEER	22,816	6.1	24,739	6.4

Program	Measure	Verified Gross Savings		Adjusted Gross Savings	
		Gross kWh	Gross kW	Gross kWh	Gross kW
	Mini-Split A/C New Construction 16+ SEER	504	0.5	324	0.3
	Mini-Split HP New Construction 14/15 SEER	4,184	0.2	4,184	0.2
	Mini-Split HP New Construction 16+ SEER	109,344	8.2	109,322	8.2
	Mini-Split HP Replacement 16+ SEER	2,278	0.2	2,278	0.2
Residential HVAC Tune-Up	Central AC Equipment Tune-Up	26,780	21.7	88,389	36.5
	Air-Source Heat Pump Equipment Tune-Up	7,942	2.6	18,310	3.7
Be E^3 Smart	CFL (two 13W and two 23W)	1,142,738	136.7	1,142,738	120.9
	LED Night Light	28,317	-	28,317	-
Non-Residential Prescriptive	HVAC	1,629,421	452.9	3,260,110	352.5
	Lighting	28,984,017	5,267.5	28,079,664	5,269.1
	Motors	2,994,895	473.6	3,053,244	477.5
	Other	157,308	24.1	144,839	24.9
Non-Residential Custom	Custom	19,893,535	3,146.7	19,612,273	3,070.4

*Values in table may not sum exactly to tables in report due to rounding differences

APPENDIX B: *EX ANTE* MEASURE-LEVEL SAVINGS

Measure	Participation Count	Ex Ante Per Unit kWh Impact	Ex Ante Per Unit kW Impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings
Residential Lighting Program					
CFL	n/a	50	0.0	92,841,910	11104.7
Appliance Recycling Program					
Refrigerator Replacement	3,238	1,376	0.2	4,455,488	712.4
Freezer Replacement	1,210	1,244	0.2	1,505,240	242.0
				5,960,728	954.4
Low Income Program					
CFL 11 W	672	32	0.0	21,660	2.6
CFL 15 W	3,669	44	0.0	161,261	19.3
CFL 20 W	238	59	0.0	13,948	1.7
CFL 24 W	507	70	0.0	35,654	4.3
CFL 7 W Candelabra	288	21	0.0	5,907	0.7
CFL 9 W Candelabra	47	26	0.0	1,239	0.1
CFL 15 W Globe	488	44	0.0	21,449	2.6
CFL 15 W Outdoor	120	44	0.0	5,274	0.6
CFL 23 W Outdoor	112	67	0.0	7,548	0.9
CFL 12-23-29w Three-Way	305	67	0.0	20,555	2.5
CFL 13 W Dimmable Torchiere	4	129	0.0	516	0.1
CFL Night Light	184	11	0.0	2,079	0.0
CFL Flood Light	49	46	0.0	2,274	0.3
Photo Cell for Light	1	703	0.0	703	0.0
Refrigerator Replacement	305	976	0.1	297,680	45.5
Freezer Replacement	88	802	0.1	70,568	10.6
Insulation (Attic, Wall, Foundation)	185	1,094	0.0	202,379	0.9
CFM Reduction	85	234	0.0	19,911	0.1
Energy-efficient Showerhead	21	510	0.1	10,710	1.2
Faucet Aerator	39	62	0.0	2,437	0.3
Water Heater Wrap	5	79	0.0	395	0.0
Central AC Replacement	1	524	0.4	524	0.4
Heat Pump Replacement	1	0	0.0	0	0.0
Dryer Replacement	1	130	4.3	130	4.3
Dishwasher Replacement	1	51	1.7	51	1.7
Ductless Mini-Split	25	3,864	0.1	96,600	3.2
				1,001,451	103.9
HVAC Rebate Program					
AC Early Retirement 14/15 SEER	1,342	1,210	0.7	1,623,820	892.4

Measure	Participation Count	Ex Ante Per Unit kWh Impact	Ex Ante Per Unit kW Impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings
AC Early Retirement 16+ SEER	883	1,342	0.8	1,184,986	685.2
AC New Construction 14/15 SEER	83	230	0.2	19,090	18.4
AC New Construction 16+ SEER	39	432	0.3	16,848	13.2
AC Std Replacement 14/15 SEER	56	230	0.2	12,880	12.4
AC Std Replacement 16+ SEER	26	432	0.3	11,232	8.8
GSHP Early Retirement 13/15 EER	6	4,602	0.7	27,612	4.0
GSHP Early Retirement 16+ EER	171	6,259	0.8	1,070,289	131.8
GSHP New Construction 13/15 EER	2	3,399	0.6	6,798	1.1
GSHP New Construction 16+ EER	44	4,734	0.6	208,296	26.4
GSHP Std Replacement 13/15 EER	1	3,399	0.6	3,399	0.6
GSHP Std Replacement 16+ EER	10	4,734	0.6	47,340	6.0
HP Early Retirement 14/15 SEER	625	3,482	0.6	2,176,250	381.9
HP Early Retirement 16+ SEER	416	3,231	0.8	1,344,096	328.2
HP New Construction 14/15 SEER	49	1,068	0.3	52,332	13.4
HP New Construction 16+ SEER	25	1,426	0.4	35,650	9.6
HP Std Replacement 14/15 SEER	34	1,068	0.3	36,312	9.3
HP Std Replacement 16+ SEER	16	1,426	0.4	22,816	6.1
Mini-Split A/C New Construction 16+ SEER	3	168	0.2	504	0.5
Mini-Split HP New Construction 14/15 SEER	2	2,092	0.1	4,184	0.2
Mini-Split HP New Construction 16+ SEER	48	2,278	0.2	109,344	8.2
Mini-Split HP Replacement 16+ SEER	1	2,278	0.2	2,278	0.2
				8,016,356	2558.1
HVAC Tune-up Program					
Central AC Equipment Tune-Up	191	187	0.0	35,672	7.1
Air-Source Heat Pump Equipment Tune-Up	18			3,362	0.7
				39,034	7.7
School Education Program					
13W CFLs (2 Bulbs in each kit)	8,378	47	0.0	393,906	47.1
23W CFLs (2 Bulbs in each kit)	9,002	83	0.0	748,833	89.6
Nightlights (1 in each kit)	2,077	14	-	28,317	-
				1,171,055	136.7
Non-Residential Prescriptive					
HVAC					
Air cooled chiller - any size	7	70,505	24.4	493,535	170.6
Air source heat pump < 65,000 BTUH (single package)	6	676	0.3	4,055	1.8
Air source heat pump < 65,000 BTUH (split)	8	673	0.2	5,386	1.6
Air source heat pump 65,000 - 135,000 BTUH	1	3,694	2.2	3,694	2.2
Ground Water-Source Heat Pumps (Open Loop) < 135,000 BTUH	6	8,882	2.4	53,290	14.3

Measure	Participation Count	Ex Ante Per Unit kWh Impact	Ex Ante Per Unit kW Impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings
Ground-Coupled Heat Pumps (Closed Loop) < 135,000 BTUH	5	4,737	2.2	23,684	11.1
Outside air economizer with two enthalpy sensors	1	1,090	0.0	1,090	0.0
Packaged terminal air conditioning and heat pumps	8	11,392	2.2	91,137	17.3
Programmable setback thermostat	8	46	0.0	369	0.2
Thermal Storage Unit / kW Shifted	1	0	39.8	0	39.8
Unitary and split system A/C 241,000 - 760,000 BTUH (20-63.33 tons)	3	2,479	1.9	7,437	5.8
Unitary and split system A/C 65,000 - 135,000 BTUH (5.4-11.25 tons)	11	1,772	1.4	19,497	14.9
Unitary and split system A/C < 65,000 BTUH (<5.4 tons)	23	347	0.3	7,984	6.9
Unitary and split system A/C > 760,000 BTUH (>63.33 tons)	2	13,990	11.0	27,979	22.0
Unitary and split system A/C 136,000 - 240,000 BTUH (11.33-20 tons)	2	1,836	1.4	3,672	2.9
Unitary and split system A/C 241,000 - 760,000 BTUH (20-63.33 tons)	6	7,370	5.8	44,223	34.7
Variable frequency drive 10HP	1	7,846	2.1	7,846	2.1
Variable frequency drive 15HP	1	11,445	3.1	11,445	3.1
Variable frequency drive 20HP	1	15,260	4.2	15,260	4.2
Variable frequency drive up to 250 HP	12	23,894	6.9	286,725	82.6
Water cooled chiller > 300 tons	1	529,875	18.0	529,875	18.0
				1,638,180	456.0
Lighting					
Central lighting control	5	20,855	0.0	104,275	0.0
CFL pin-based fixture	5	9,948	1.7	49,742	8.6
CFL screw-in bulb > 32W replacing incandescent	4	10,481	3.0	41,925	12.0
CFL screw-in bulb up to 32W replacing incandescent	52	34,252	5.1	1,781,091	267.5
Delamping HID	22	39,244	6.3	863,374	139.4
Delamping T12 (# linear feet)	71	33,954	7.5	2,410,703	533.2
Delamping T8 (# linear feet)	14	19,088	3.6	267,228	49.7
Dimmable ballast for use with daylight sensors	1	2,895	1.2	2,895	1.2
Fixture-mounted daylight sensor	1	34,636	3.9	34,636	3.9
Fixture-mounted occupancy sensor	35	24,134	0.7	844,704	25.0
LED exit sign	21	1,331	1.6	27,954	34.6
LED lighting in reach-in freezer/cooler case	1	17,351	2.7	17,351	2.7
LED or electroluminescent exit sign	39	717	0.1	27,954	3.5
LED or Induction (8,760 operating hours) replacing 175 W or less	5	108,687	12.7	543,434	63.6
LED or Induction (8,760 operating hours) replacing 176W to 250W	1	26,762	3.1	26,762	3.1
LED or Induction (operating hours < 8,760) replacing 175W or less	12	2,303	0.0	27,636	0.0
LED or Induction (operating hours < 8,760) replacing 176W to 250W	2	2,398	0.0	4,796	0.0

Measure	Participation Count	Ex Ante Per Unit kWh Impact	Ex Ante Per Unit kW Impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings
LED or Induction (operating hours < 8,760) replacing 251W to 400W	12	25,747	0.0	308,970	0.0
LED pedestrian walk/don't walk sign	1	22,706	1.2	22,706	1.2
LED recessed downlight luminaires up to 18 watts or screw-in base lamps	48	17,493	4.1	839,687	194.9
LED traffic signal - green	1	14,917	1.7	14,917	1.7
LED traffic signal - red	1	26,306	3.2	26,306	3.2
Light Tube (21")	1	0	0.0	0	0.0
Low-watt T8 4-foot 1 lamp fixture replacing T12	16	2,740	0.4	43,841	6.0
Low-watt T8 4-foot 1 lamp fixture replacing T8	2	384	0.1	769	0.2
Low-watt T8 4-foot 2 lamp fixture replacing T12	76	7,924	1.6	602,209	123.4
Low-watt T8 4-foot 2 lamp fixture replacing T8	12	2,871	0.7	34,451	7.9
Low-watt T8 4-foot 3 lamp fixture replacing T12	24	13,612	3.9	326,700	92.5
Low-watt T8 4-foot 3 lamp fixture replacing T8	12	26,164	6.7	313,970	80.6
Low-watt T8 4-foot 4 lamp fixture replacing T12	120	10,882	2.3	1,305,879	277.4
Low-watt T8 4-foot 4 lamp fixture replacing T8	13	4,381	0.6	56,954	7.4
Pulse-start or ceramic metal halide fixture > 250W	1	19,979	2.6	19,979	2.6
Pulse-start or ceramic metal halide fixture 100-250W	2	1,117	0.6	2,235	1.3
Relamping 25 watt or less	21	18,115	5.0	380,417	105.4
Relamping 28 watt	36	13,492	2.7	485,709	96.4
Remote-mounted daylight dimming sensor	2	6,982	3.7	13,963	7.5
Remote-mounted daylight sensor	4	2,023	0.3	8,093	1.1
Switching controls for multilevel lighting	2	7,954	0.9	15,908	1.8
T5 1 lamp fixture replacing T12	1	316	0.1	316	0.1
T5 2 lamp fixture replacing T12	2	776	0.1	1,553	0.2
T5 high-output 2 lamp fixture replacing T12	4	1,643	0.3	6,571	1.2
T5 high-output 4 lamp fixture replacing T12	1	2,175	0.6	2,175	0.6
T5 high-output high-bay 2 lamp fixture replacing HID	12	2,491	0.6	29,890	7.5
T5 high-output high-bay 3 lamp fixture replacing HID	2	4,052	1.3	8,104	2.5
T5 high-output high-bay 4 lamp fixture replacing HID	37	117,788	13.9	4,358,146	512.7
T5 high-output high-bay 6 lamp fixture replacing HID	42	22,763	3.7	956,042	153.3
T5 high-output high-bay 8 lamp fixture replacing HID	1	50,180	12.9	50,180	12.9
T8 (BF < 0.78) 4-foot 1 lamp fixture replacing T12	5	6,158	0.9	30,789	4.4
T8 (BF < 0.78) 4-foot 2 lamp fixture replacing T12	58	7,704	1.4	446,849	82.1
T8 (BF < 0.78) 4-foot 2 lamp fixture replacing T8	3	658	0.1	1,973	0.4
T8 (BF < 0.78) 4-foot 3 lamp fixture replacing T12	3	7,614	2.6	22,842	7.9
T8 (BF < 0.78) 4-foot 3 lamp fixture replacing T8	1	927	0.3	927	0.3
T8 (BF < 0.78) 4-foot 4 lamp fixture replacing T12	64	6,930	1.5	443,493	94.6
T8 (BF < 0.78) 4-foot 4 lamp fixture replacing T8	2	528	0.2	1,055	0.3

Measure	Participation Count	Ex Ante Per Unit kWh Impact	Ex Ante Per Unit kW Impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings
T8 4 foot 2 lamp replacing T12 HO only	7	6,228	1.8	43,597	12.7
T8 4 foot 4 lamp replacing T12 HO only	35	19,507	5.1	682,730	178.5
T8 4-foot 1 lamp fixture replacing T12	4	865	0.2	3,461	0.8
T8 4-foot 2 lamp fixture replacing T12	35	2,073	0.5	72,558	16.3
T8 4-foot 3 lamp fixture replacing T12	18	2,710	0.9	48,779	15.3
T8 4-foot 4 lamp fixture replacing T12	23	9,456	1.7	217,492	38.4
T8 high-bay 4-foot 2 lamp fixture replacing HID	5	48,561	8.8	242,806	44.0
T8 high-bay 4-foot 3 lamp fixture replacing HID	4	47,486	6.8	189,942	27.1
T8 high-bay 4-foot 4 lamp fixture replacing HID	13	20,397	3.8	265,166	49.2
T8 high-bay 4-foot 6 lamp fixture replacing HID	131	60,912	12.3	7,979,455	1614.2
T8 high-bay 4-foot 8 lamp fixture replacing HID	7	60,512	8.4	423,587	59.1
T8 high-output 8-foot 2 lamp fixture replacing T12 HO only	9	17,775	4.1	159,974	36.8
Vending equipment controller	1	9,671	0.0	9,671	0.0
Wall or ceiling-mounted occupancy sensor	103	11,079	0.4	1,141,134	44.2
				29,741,377	5178.0
Motors, Drives & Compressed Air					
Additional primary storage required	6	0	0.0	0	0.0
Air compressor 1 - 100 HP Load/No Load	14	8,442	0.6	118,191	7.8
Air compressor 1 - 100 HP Variable Speed	10	46,128	3.0	461,280	29.9
Air compressor 1-100HP variable speed	3	10,912	1.4	32,736	4.1
NEMA premium efficiency motor 10 HP	1	1,314	0.1	1,314	0.1
NEMA premium efficiency motor 100 HP	1	2,431	0.3	2,431	0.3
NEMA premium efficiency motor 10HP	3	724	0.1	2,172	0.2
NEMA premium efficiency motor 125 HP	1	3,631	0.3	3,631	0.3
NEMA premium efficiency motor 150HP	1	12,889	0.6	12,889	0.6
NEMA premium efficiency motor 15HP	1	1,737	0.1	1,737	0.1
NEMA premium efficiency motor 200HP	1	3,935	0.4	3,935	0.4
NEMA premium efficiency motor 20HP	3	4,623	0.3	13,868	1.0
NEMA premium efficiency motor 3HP	2	137	0.0	273	0.0
NEMA premium efficiency motor 40HP	1	1,969	0.1	1,969	0.1
NEMA premium efficiency motor 50 HP	1	5,959	0.7	5,959	0.7
NEMA premium efficiency motor 5HP	2	514	0.0	1,029	0.1
NEMA premium efficiency motor 60 HP	1	951	0.2	951	0.2
NEMA premium efficiency motor 60HP	1	18,520	0.8	18,520	0.8
NEMA premium efficiency motor 7.5 HP	1	1,141	0.0	1,141	0.0
NEMA premium efficiency motor 75HP	1	634	0.2	634	0.2
Variable frequency drive 1 - 50 HP	7	10,096	2.8	70,672	19.3
Variable frequency drive 10HP	2	15,692	4.3	31,384	8.6

Measure	Participation Count	Ex Ante Per Unit kWh Impact	Ex Ante Per Unit kW Impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings
Variable frequency drive 125 - 250 HP	1	111,990	30.7	111,990	30.7
Variable frequency drive 15HP	1	1,653	0.5	1,653	0.5
Variable frequency drive 3.0HP	1	2,408	0.7	2,408	0.7
Variable frequency drive 40HP	2	5,985	1.6	11,970	3.3
Variable frequency drive 5.0HP	1	74,660	20.5	74,660	20.5
Variable frequency drive 50HP	1	44,796	12.3	44,796	12.3
Variable frequency drive 60 - 100 HP	4	22,194	6.1	88,775	24.3
Variable frequency drive 7.5HP	1	5,884	1.6	5,884	1.6
Variable frequency drive up to 250 HP	30	54,117	9.9	1,623,504	297.8
VFDs on Air Compressors 1-100 HP	5	46,378	4.1	231,890	20.5
				2,984,246	486.7
Other					
Barrel wraps	1	67,500	11.3	67,500	11.3
Vending equipment controller	3	10,746	0.0	32,237	0.0
Window film	18	1,736	0.7	31,243	12.2
				130,980	23.4
Total Prescriptive				34,494,782	6144.1
Custom:	# applications				
Custom	79	2,156,766	319.4	18,916,658	2,741.0
New Construction	14	114,076	34.4	1,597,063	481.1
Total Custom				20,513,721	3,222.2

**Values in table may not sum exactly to tables in report due to rounding differences

APPENDIX C: PROGRAM-MEASURES TABLE

Program	Measure	Incentive
Residential Lighting	Non-specialty CFLs	$0.56 - $2.25
Residential Lighting	Specialty CFLs	$1.00 - $3.00
Residential Appliance Recycling	Recycled Freezer	$25
Residential Appliance Recycling	Recycled Refrigerator	$25
Residential Low-income	Compact Fluorescent Light Bulbs	Cap of $5,000 in measure costs per home. In addition, agencies can charge 15 percent of the admin cost for total installations.
	Photo Cell for Light	
	Refrigerator Replacement	
	Freezer Replacement	
	Insulation (Attic, Wall, and Foundation)	
	Air Sealing / CFM Reduction	
	Energy-efficient Showerhead	
	Faucet Aerator	
	Water Heater Wrap	
	Central AC Replacement	
	Heat Pump Replacement	
	Dryer Replacement	
	Dishwasher Replacement	
	Ductless Mini-Split	
Residential HVAC Rebate*	AC Early Retirement 14/15 SEER	$400
	AC Early Retirement 16+ SEER	$600
	AC New Construction 14/15 SEER	$200
	AC New Construction 16+ SEER	$300
	AC Std Replacement 14/15 SEER	$200
	AC Std Replacement 16+ SEER	$300
	GSHP Early Retirement 13/15 EER	$400
	GSHP Early Retirement 16+ EER	$600
	GSHP New Construction 13/15 EER	$200
	GSHP New Construction 16+ EER	$300
	GSHP Std Replacement 13/15 EER	$200
	GSHP Std Replacement 16+ EER	$300
	HP Early Retirement 14/15 SEER	$400
	HP Early Retirement 16+ SEER	$600
	HP New Construction 14/15 SEER	$200
	HP New Construction 16+ SEER	$300
	HP Std Replacement 14/15 SEER	$200
	HP Std Replacement 16+ SEER	$300
	Mini-Split A/C New Construction 16+ SEER	$300

Program	Measure	Incentive
	Mini-Split HP New Construction 14/15 SEER	$200
	Mini-Split HP New Construction 16+ SEER	$300
	Mini-Split HP Replacement 16+ SEER	$300
Residential HVAC Tune-Up**	Central AC Equipment Tune-Up	$40-$110
	Air-Source Heat Pump Equipment Tune-Up	$40-$110
Be E^3 Smart	CFLs	Provided at no cost to customer
Be E^3 Smart	LED Night Light	Provided at no cost to customer
Non-Residential Prescriptive	Low Watt Fluorescent Lighting	$4.50-$30 per fixture
Non-Residential Prescriptive	High Performance Fluorescent Lighting	$1.50-$27 per fixture
Non-Residential Prescriptive	T5 Lighting Replacing T12	$7.50-$19.50 per fixture
Non-Residential Prescriptive	High-Bay and High Output Lighting Replacing HID	$25-$80 per fixture
Non-Residential Prescriptive	T8 Replacing T12 HO	$12-$21 per fixture
Non-Residential Prescriptive	Permanent Lamp Removal (De-lamping)	$1.20-$2.25 per linear foot (Fluorescent) or $0.05 per watt (HID)
Non-Residential Prescriptive	Re-lamping	$1-$1.50 per bulb
Non-Residential Prescriptive	CFL Lighting	$1.50-$4 per bulb (screw in) or $20 per fixture (pin based)
Non-Residential Prescriptive	Sensors and Controls	$15-$60 per sensor or $0.04 per connected watt
Non-Residential Prescriptive	Exterior or Garage HID to LED/Induction Lighting	$50-$200 per fixture
Non-Residential Prescriptive	LED Exit Signs	$10 per sign
Non-Residential Prescriptive	LED Pedestrian Walk/Don't Walk Sign	$50 per sign
Non-Residential Prescriptive	LED Lighting in Reach-in freezer or cooler case	$50 per door
Non-Residential Prescriptive	LED case lighting sensor controls	$10 per sensor
Non-Residential Prescriptive	LED recessed down light luminaries up to 18 watts or screw-in base lamps	$10 per lamp
Non-Residential Prescriptive	LED Traffic Signal — Red or Green	$25 per sign
Non-Residential Prescriptive	Light Tube	$35 per sign
Non-Residential Prescriptive	Packaged Terminal Air Conditioning and Heat Pumps	$50 per unit
Non-Residential Prescriptive	Unitary and Split System Air Conditioning	$200 per unit or $40 per ton
Non-Residential Prescriptive	Air Source Heat Pumps	$400 per unit or $40 per ton
Non-Residential Prescriptive	Ground Water-Source Heat Pumps (Open Loop)	$80 per ton
Non-Residential Prescriptive	Ground-Coupled Heat Pumps (Closed Loop)	$60 per ton
Non-Residential Prescriptive	Air Cooled Chillers	$40 per ton
Non-Residential Prescriptive	Water Cooled Chillers	$40 per ton
Non-Residential Prescriptive	Heat Pump Water Heaters	$1,000-$2,500 per unit

Program	Measure	Incentive
Non-Residential Prescriptive	Thermal Storage	$100.00 per kW shifted
Non-Residential Prescriptive	Variable frequency drives up to 250 HP	$40 per hp
Non-Residential Prescriptive	Outside air economizer using two enthalpy sensors	$250 per unit
Non-Residential Prescriptive	Energy recovery ventilation (ERV) with a minimum of 450 CFM and as part of an electric-powered system	$1 per CFM
Non-Residential Prescriptive	Programmable setback thermostat	$20 per unit
Non-Residential Prescriptive	HVAC occupancy sensor	$30 per unit
Non-Residential Prescriptive	Premium Motors	$10-$25 per hp
Non-Residential Prescriptive	Variable Frequency Drives	$40 per hp
Non-Residential Prescriptive	Air Compressors	$45-$125 per hp
Non-Residential Prescriptive	Air Compressor Storage Requirements	$1.50 per gallon
Non-Residential Prescriptive	Variable Frequency Drives on Air Compressors	$40 per hp
Non-Residential Prescriptive	Window Film	$2 per square foot
Non-Residential Prescriptive	Vending Equipment Controller	$50 per unit
Non-Residential Prescriptive	Prescriptive Clothes Washer and Electric Dryer	$50 per unit
Non-Residential Prescriptive	Barrel Wraps (for injection molding and extruding applications)	$1 per ton
Non-Residential Prescriptive	Engineered Nozzle	$20 per nozzle
Non-Residential Prescriptive	Plug Load Occupancy Sensor	$20 per sensor
Non-Residential Custom	Lighting	$0.05 per kWh and $50 per kW
Non-Residential Custom	HVAC	$0.10 per kWh and $100 per kW
Non-Residential Custom	Other	$0.08 per kWh and $100 per kW

* During PY2011, less than the full incentive amount was paid out for some measures if customers/contractors did not request the full rebate amount.

** Final amount based on the tune-up effort's final outcome.

APPENDIX D: ENERGY-SAVINGS CALCULATION SOURCES

Program	Measure	Source
Residential Lighting	CFLs	Draft Ohio TRM
Residential Appliance Recycling	Refrigerator	Regression model.
	Freezer	Regression model.
Residential Low-income Weatherization	Compact Fluorescent Light Bulbs	Draft Ohio TRM, updated with ISR from participant surveys for verified gross calculations. Night light ex ante savings were calculated based on internal engineering algorithms from other evaluations but updated with DP&L wattage and hours of use assumptions.
	Photo Cell for Light	Draft Ohio TRM.
	Refrigerator Replacement	The Joint Utility Comments on the Draft Ohio TRM presented alternative unit energy consumption measures for the existing unit part-use factor and for Energy Star refrigerators. The main assumption they make is that for low-income families, these refrigerators are primary units that are being replaced so they should be modeled as running full time. The adjusted gross calculations use these alternative inputs in the TRM deemed savings formula.
	Freezer Replacement	The calculation for freezer replacement savings is not included in the draft Ohio TRM. The TRM provided an algorithm for freezer early retirement, from which we took the baseline assumption for usage (1,244 kWh). We matched consumption estimates for the efficient freezer by size and type, assuming replacement with an ENERGY STAR® unit. We calculated a weighted average usage estimate for the efficient unit based on the distribution of installations through the program.
	Insulation (Attic, Wall, and Foundation)	Draft Ohio TRM. Foundation insulation savings were calculated based on internal engineering algorithms for basement wall and band joist savings used in other evaluations.
	Air Sealing / CFM Reduction	Draft Ohio TRM.
	Energy-efficient Showerhead	Ex ante calculations used the per-unit savings estimates from the school education program. Adjusted gross calculations used the TRM's deemed calculation for energy savings.
	Faucet Aerator	Ex ante calculations used the per-unit savings estimates from the school education program. Adjusted gross calculations used the TRM's deemed calculation for energy savings.
	Water Heater Wrap	Draft Ohio TRM. Adjusted gross savings were calculated based on internal engineering algorithms from other evaluations. See comment 3 below.
	Central AC Replacement	Draft Ohio TRM.
	Heat Pump Replacement	Draft Ohio TRM.
	Dryer Replacement	Savings were calculated based on assumptions included in the 2010 DP&L potentials assessment.
	Dishwasher Replacement	The calculation for dishwasher replacement savings is not included in the draft Ohio TRM. Energy savings were calculated as the difference between old and new unit energy usage (from old unit product label and new unit description in the Energy Star dishwasher list.) Demand savings were calculated by multiplying energy savings by the draft Ohio TRM's

Program	Measure	Source
		coincidence factor for clothes washers.
	Ductless Mini-Split	Ex ante savings were calculated based on internal engineering algorithms used in last year's evaluation. Adjusted gross savings were calculated using the Pennsylvania TRM. See comment 4 below.
Residential HVAC Rebate	AC Early Retirement (all SEERs)	Participant billing analysis, kW calculated using draft Ohio TRM. See comment 5 below.
	AC Std Replacement SEER 14/15	Participant billing analysis, kW calculated using draft Ohio TRM. See comment 5 below.
	AC Std Replacement SEER 16+	kWh and kW calculated using draft Ohio TRM. See comment 5 below.
	AC New Construction (all SEERs)	kWh and kW calculated using draft Ohio TRM. See comment 5 below.
	GSHP Early Retirement/Std/New Construction (all EERs)	kWh and kW calculated using draft Ohio TRM. See comment 5 below.
	HP Early Retirement 14/15 SEER	Participant billing analysis, kW calculated using draft Ohio TRM. See comment 5 below.
	HP Early Retirement 16+ SEER	kWh and kW calculated using draft Ohio TRM. See comment 5 below.
	HP New Construction and Std Replacement (all SEERs)	kWh and kW calculated using draft Ohio TRM. See comment 5 below.
	Mini-split AC and HP New Construction (all SEERs)	kWh and kW calculated using NSTAR and BPA studies. See comment 6 below.
Residential HVAC Tune-Up	AC and HP Tune-up	Participant billing analysis, kW calculated using draft Ohio TRM.
Be E^3 Smart	CFLs	Draft Ohio TRM, ISR from OEP's Family Home Installation Survey
	LED night lights	Draft Ohio TRM dated October 15, 2009. This was the utility-defined TRM. ISR from OEP's Family Home Installation Survey
Non-Residential Prescriptive	HVAC	See comment 7 below.
	Lighting	See comment 7 below.
	Motors	See comment 7 below.
	Other	See comment 7 below.
Non-Residential Custom	Lighting	See comment 8 below.
	Other	See comment 9 below.

Comments:

1. We calculated the CFL installation rate based on the telephone survey results (0.80), which we used in place of the draft Ohio TRM's in-service rate input (0.81) in the savings calculation.
2. The calculation for freezer replacement savings is not included in the draft Ohio TRM. The TRM provided an algorithm for freezer early retirement, from which we took the baseline assumption for usage (1,244 kWh). We matched consumption estimates for the efficient freezer by size and type, assuming replacement with an ENERGY STAR® unit. We calculated a weighted average usage estimate for the efficient unit based on the distribution of installations through the program. We explored a second approach that considered scaling the baseline usage estimate to correspond with the size and type of

installation (using ENERGY STAR® calculator vintage usage data). The difference in program savings between these methods was negligible (less than 0.1 percent), and we ultimately employed the first method.

3. The adjusted gross savings calculation was based on Cadmus engineering calculations. In addition to general water heater efficiency standards, the algorithm accounted for the number of people per household (based on results from the participant survey) and for local weather, resulting in a slightly higher estimated savings than the TRM.
4. The ex ante calculation was based on a Cadmus engineering algorithm used in the 2010 DP&L Residential HVAC evaluation. This algorithm was based on a metering study of single-family homes, reflecting slightly higher square footage assumptions than appropriate for low-income program participants. Adjusted gross savings calculations were based on a more conservative algorithm from the Pennsylvania TRM, using an equipment capacity more suitable for smaller homes
5. Minor adjustments were made to TRM equations and assumptions. See report section for details.
6. Mini-split savings based on the following reports:
   http://www.bpa.gov/energy/n/pdf/Monmouth_year_2_FINAL_1007_1019.pdf and
   http://www.env.state.ma.us/dpu/docs/electric/09-64/12409nstrd2ac.pdf
7. We based our calculations on algorithms outlined in the draft Ohio TRM. We based our baseline conditions on the draft Ohio TRM, except when the site visit indicated a different baseline than deemed by measure type. Cadmus calculated the retrofit equipment wattage and operating parameters through site visit results and product specification sheets.
8. Cadmus calculated baseline and retrofit equipment wattage and operating parameters through site visit results and product specification sheets.
9. DP&L contracted with a third-party engineering firm to conduct pre and post installation metering to calculate energy savings. Cadmus reviewed the engineering reports and made revisions as necessary to evaluate savings.

APPENDIX E: BILLING ANALYSIS SPECIFICATIONS AND MODEL OUTPUT

Residential Heating and Cooling Rebate Program

We used the following model specification to estimate savings for each separate Residential Heating and Cooling Rebate measure category:

$$\mathbf{ADC_{it} = \alpha_i + \beta_1 AVGCDD_{it} + \beta_2 AVGHDD_{it} + \beta_3 POST_t * AVGCDD_{it} + \beta_4 POST_t * AVGHDD_{it} + \varepsilon_{it}}$$

Where, for each participant 'i' and monthly billing period 't,'

α_i	=	the separate average daily kWh base load for each participant.
ADC_{it}	=	the average daily kWh consumption during the pre- and post-program periods.
$AVGCDD_{it}$,	=	the average daily cooling degree days (base 65), based on home location.
$AVGHDD_{it}$,	=	the average daily heating degree days (base 65), based on home location. This term is only used in the heat pump models.
$POST_t$	=	a dummy variable that is 1 in the post period, and 0 otherwise.
$POST_t * AVGCDD_{it}$	=	an interaction of $POST_t$ and $AVGCDD_{it}$.
$POST_t * AVGHDD_{it}$	=	an interaction of $POST_t$ and $AVGHDD_{it}$. This term is used in the heat pump models.
β_1	=	the average daily kWh usage per cooling degree day in the pre-program period.
β_2	=	the average daily kWh usage per heating degree day in the pre-program period.
β_3	=	the kWh cooling savings per cooling degree day for efficient A/C or heat pump measures.[29]
β_4	=	the kWh heating savings per heating degree day for heat pump measures.
ε_{it}	=	the modeling estimation error.

Inclusion of the interaction of cooling degree days and heating degree days, along with the post-variable, allows for the possibility of obtaining weather-normalized savings for any geographic area by simply entering the associated normal cooling or heating degree days for that geographic area.

[29] For heat pump models, we estimated for participants replacing an existing heat pump. Whenever models were attempted and the existing equipment was an air conditioner, no heating savings occurred; however, cooling savings were almost identical.

The model above directly estimates cooling and heating early replacement savings (β_3 and β_4) (i.e., actual savings achieved by replacing an existing A/C system with a new, high-efficiency A/C system).

Rationale for Not Including Nonparticipants

We did not use a nonparticipant group for this analysis. The most appropriate control group for equipment replacement programs consists of customers replacing their air conditioners or heat pumps with a standard, base-code efficiency air conditioner or heat pump. Finding this subgroup requires calling numerous customers, and can be costly.

A standard billing analysis typically uses a nonparticipant group, with approximately four times more nonparticipants than participants, and requires numerous screening survey calls. Even if a group of matching nonparticipants can be identified, their pre-period usages must fall within the quartiles of participant pre-period usages to ensure the two groups appropriately match by consumption level. This would lead to some selected nonparticipants having to be discarded.

Neither does the general DP&L customer population provide the appropriate nonparticipant group, as it is possible customers did not change their air conditioning/heat pump systems at all, or they installed high-efficiency units outside the program.

Model Outputs

The following tables summarize model result outputs[30] from the billing analysis of 2009–2011 program participants.

Table 98. SEER 14/15 A/C Early Replacement Regression Model

	Analysis of Variance				
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	1572582	524194	4129.48	<.0001
Error	33186	4212610	126.93939		
Corrected Total	33189	5785192			
Root MSE	11.26674		R-Square	0.2718	
Dependent Mean	7.84E-17		Adj R-Square	0.2718	
Coeff Variance	1.44E+19				
	Parameter Estimates				
Source	DF	Parameter Estimates	Standard Error	t value	Prob. t
Avghdd	1	0.31724	0.0061	52.00	<.0001
Avgcdd	1	2.98481	0.03025	98.68	<.0001
Postcdd	1	-1.04397	0.02699	-38.67	<.0001

[30] We ran all models with a fixed-effects specification: a separate intercept for each participant. Due to the large output, resulting from showing the model coefficients of each intercept, we only present the average intercept across all separate intercepts in the output.

Table 99. SEER 16+ A/C Early Replacement Regression Model

Source	Analysis of Variance				
	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	1559288	519763	5417.49	<.0001
Error	28735	2756881	95.94157		
Corrected Total	28738	4316169			
Root MSE	9.79498		R-Square	0.3613	
Dependent Mean	9.25E-17		Adj R-Square	0.3612	
Coeff Variance	1.06E+19				
Source	Parameter Estimates				
	DF	Parameter Estimates	Standard Error	t value	Prob. t
Avghdd	1	0.29791	0.00567	52.5	<.0001
Avgcdd	1	3.04898	0.02636	115.66	<.0001
Postcdd	1	-1.20481	0.02405	-50.09	<.0001

Table 100. SEER 14/15 Heat Pumps Early Replacement Regression Model

Source	Analysis of Variance				
	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	10877124	2719281	7009.41	<.0001
Error	15454	5995333	387.94699		
Corrected Total	15458	16872457			
Root MSE	19.69637		R-Square	0.6447	
Dependent Mean	-1.35E-16		Adj R-Square	0.6446	
Coeff Variance	-1.46E+19				
Source	Parameter Estimates				
	DF	Parameter Estimates	Standard Error	t value	Prob. t
Avghdd	1	2.5229	0.01736	145.36	<.0001
Avgcdd	1	3.87883	0.07596	51.06	<.0001
Postcdd	1	-1.06231	0.06849	-15.51	<.0001
Posthdd	1	-0.38596	0.0151	-25.56	<.0001

Table 101. SEER 16+ Heat Pumps Early Replacement Regression Model

Source	Analysis of Variance				
	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	6585587	1646397	4410.44	<.0001
Error	8989	3355551	373.29522		
Corrected Total	8993	9941138			
Root MSE	19.32085		R-Square	0.6625	
Dependent Mean	7.35E-16		Adj R-Square	0.6623	
Coeff Variance	2.63E+18				
Source	Parameter Estimates				
	DF	Parameter Estimates	Standard Error	t value	Prob. t
Avghdd	1	2.59566	0.02237	116.04	<.0001
Avgcdd	1	4.13407	0.09614	43	<.0001
Postcdd	1	-1.17399	0.08712	-13.48	<.0001
Posthdd	1	-0.38977	0.01942	-20.07	<.0001

Table 102. SEER 14/15 A/C Replace on Burnout Regression Model

Source	Analysis of Variance				
	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	56445	18815	238.89	<.0001
Error	879	69228	78.75808		
Corrected Total	882	125673			
Root MSE	8.87457		R-Square	0.4491	
Dependent Mean	4.19E-16		Adj R-Square	0.4473	
Coeff Variance	2.12E+18				
Source	Parameter Estimates				
	DF	Parameter Estimates	Standard Error	t value	Prob. t
Avghdd	1	0.29224	0.02977	9.82	<.0001
Avgcdd	1	3.4209	0.14697	23.28	<.0001
Postcdd	1	-1.33068*	0.13002	-10.23	<.0001

* The model provides the early replacement savings (i.e., the savings from converting an old SEER 9 unit to an efficient SEER 14/15 unit). We developed the replace on burnout savings by applying an 18% adjustment that, in effect, accounts for the difference between the actual replaced efficiency of SEER 9 and the much higher code value of SEER 13. We thus reduced early replacement savings to estimate savings based on the SEER 13.

Residential HVAC Tune-up Program

We used the following model specification to estimate savings for the Residential Tune-up Rebates that: passed the initial test; received a full rebate of $110; and did not participate in the HVAC Rebate program:

$$\mathbf{ADC_{it} = \alpha_i + \beta_1 AVGCDD_{it} + \beta_2 AVGHDD_{it} + \beta_3 POST_t * AVGCDD_{it} + \beta_4 POST_t * AVGHDD_{it} + \varepsilon_{it}}$$

Where, for each participant 'i' and monthly billing period 't,'

α_i	=	the separate average daily kWh base load for each participant.
ADC_{it}	=	the average daily kWh consumption during the pre- and post-program periods.
$AVGCDD_{it}$,	=	the average daily cooling degree days (base 65), based on home location.
$AVGHDD_{it}$,	=	the average daily heating degree days (base 65), based on home location.
$POST_t$	=	a dummy variable that is 1 in the post period, and 0 otherwise.
$POST_t * AVGCDD_{it}$	=	an interaction of $POST_t$ and $AVGCDD_{it}$.
$POST_t * AVGHDD_{it}$	=	an interaction of $POST_t$ and $AVGHDD_{it}$.
β_1	=	the average daily kWh usage per cooling degree day in the pre-program period.
β_2	=	the average daily kWh usage per heating degree day in the pre-program period.
β_3	=	the kWh cooling savings per cooling degree day for efficient A/C or heat pump tune-ups.
β_4	=	the kWh heating savings per heating degree day for heat pump tune-ups.
ε_{it}	=	the modeling estimation error.

Inclusion of the interaction of the cooling degree days and heating degree days, along with the post-variable, allow for the possibility of obtaining weather-normalized savings for any geographic area by simply entering the associated normal cooling or heating degree days for that geographic area.

The above model directly estimates the tune-up cooling and heating early replacement savings (β_3 and β_4) (i.e., actual savings achieved from tune-ups of AC/heat pump units).

Rationale for Not Including Nonparticipants

We did not use a nonparticipant group for this analysis. The most appropriate control group for equipment replacement programs consists of customers replacing their air conditioners or heat

pumps with standard, base-code efficiency air conditioners or heat pumps. Finding this subgroup requires calling numerous customers, and can be costly.

A standard billing analysis typically uses a nonparticipant group, with approximately four times more nonparticipants than participants, requiring numerous screening survey calls. Even if a group of matching nonparticipants can be identified, their pre-period usages must fall within the quartiles of the participant pre-period usages to ensure the two groups match appropriately by consumption level. This would lead to some selected nonparticipants having to be discarded.

Neither does the general DP&L customer population provide the appropriate nonparticipant group, as it is possible customers did not change their air conditioning/heat pump systems at all, or they installed high-efficiency units outside the program.

Model Outputs

The below table summarizes model result outputs[31] from the billing analysis of 2009–2011 program participants.

Table 103. AC and Heat Pump Tune-up Regression Model

	Analysis of Variance				
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	295774	73944	389.39	<.0001
Error	5032	955559	189.89649		
Corrected Total	5036	1251333			
Root MSE	13.78029		R-Square	0.2364	
Dependent Mean	3.53437E-16		Adj R-Square	0.2358	
Coeff Variance	3.898937E18				
	Parameter Estimates				
Source	DF	Parameter Estimates	Standard Error	t value	Prob. t
Avghdd	1	0.68247	0.02136	31.95	<.0001
Avgcdd	1	2.82259	0.09002	31.36	<.0001
Postcdd	1	-0.35811	0.08153	-4.39	<.0001
Posthdd	1	-0.04357	0.01843	-2.36	0.0181

[31] We ran all models with a fixed effects specification: a separate intercept for each participant. Due to the large amount of output resulting from showing model coefficients of each intercept, we only present the average intercept across all of separate intercepts in the output.

APPENDIX F: SUMMARY OF COMMERCIAL PROGRAM SITE VISIT FINDINGS

This appendix represents findings from 88[32] site visits performed by Cadmus for the Non-Residential Prescriptive Rebate and Non- Residential Custom programs. Cadmus found that most measures were installed correctly and matched the reported quantities in the program database. However, Cadmus did find discrepancies in reported quantities than what was found in the field.

Cadmus completed the two rounds of site visits for 2011; the first round in July, which consisted of 28 unique (by account number) site visits, and the second round in December consisted of 60 unique site visits. In the site visit findings tables, "P" represents prescriptive projects. Custom projects are broken out into two categories; custom (non-new construction) and custom-nc (new construction) projects. There were several sites with multiple measure categories.

The table below provides the call disposition summary.

Table 104. July 2011 and December 2011 Site Visit Call Disposition Summary

DP&L Call Disposition Summary	July Count	December Count	2011 Total
Scheduled and Completed*	28	60	88
Left Voice Message	14	12	26
Refused – Unable/Unwilling	2	1	3
Did Not Call (due to distance and/or time frame)	4	13	17
Total Call Disposition	48	87	135

* There were several sites with than one project that was verified.

July 2011 Site Visits Findings

The following sections provide site specific findings relating to verified quantities and comments regarding discrepancies in reported values, as well as measure operation observations.

Table 105. (Project Number: F225206D, 84E69083, and 32666BEB)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	143	143	0
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	113	113	0
P-Lighting	Delamping HID	8,280	Could not verify	NA
P-Lighting	Delamping HID	820	Could not verify	NA
Custom	CUSTOM-Cooper Lighting - Lumark WPL2A	7	7	0

Notes: Cadmus verified all lighting types were installed. The onsite contact reported the delamped HIDs were 400 watt metal halides, but could not provide an estimate of how many were removed.

[32] 88 unique site visits were completed. Some sites included more than project across different measure categories.

Table 106. (Project Number: 8D112A6E)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	100	100	0
P-Lighting	Delamping T12 (# linear feet)	224	224	0

Notes: Cadmus verified reported quantity is correct. Cadmus found more lighting being installed additionally; site contact said they are replacing fixtures in other sections.

Table 107. (Project Number: 026E1FFC)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM-Replacing T12 HO's with 2x2 fixtures	28	28	0

Notes: Cadmus found (28) 3-lamp 2x2 fixtures installed in the showroom of the dealership.

Table 108. (Project Number: DCBF118E)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM-replace 307 40w incandescent w/ 2w LED	307	138	-169

Notes: Cadmus walked through the entire nursing home and found just less than half of the candelabra lighting had not been replaced with the new LED bulbs. Site contact said that they could not be installed because the fixtures were on dimmer switches. Site contact reported the contractor was supposed to replace the switches, but was unaware when that was going to be done. Cadmus counted 104 LED bulbs still in original packaging

.

Table 109. (Project Number: 0764E08B)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	CFL screw-in bulb up to 32W replacing incandescent	1,519	1,519	0
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T12	371	265	-106
P-Lighting	LED exit sign	68	68	0
P-Lighting	Low-watt T8 4-foot 2 lamp fixture replacing T12	98	250	152

Notes: Cadmus was unable to inspect individual nursing home rooms, but did count fixtures in the hallways. Cadmus was shown one unoccupied room and found five CFLs installed and two 2 Lamp T8 fixtures installed. Site contact informed Cadmus that not all resident rooms had 2 Lamp fixtures, but some of the larger rooms had 4 Lamp fixtures. With the assistance of a map of the facility we counted the number of rooms that have each lighting type. There was a discrepancy in the number of 2-lamp and 4-lamp fixtures as original reported. A follow up call to the site contact was made to clarify the variance in the number of lamps.

Table 110. (Project Number: 0DB31FC2)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	T8 4 foot 4 lamp replacing T12 HO only	259	259	0
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	15	15	0
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	9	0	-9

Notes: Cadmus inspected all spaces were new lighting was installed. Cadmus and site contact walked the entire facility and could not find additional high-bay lighting that was in the reported quantity. The additional high bay lighting is listed as a separate line item indicating different installation location, but Cadmus could not find the additional high bay fixtures.

Table 111. (Project Number: A88040BC)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	CFL screw-in bulb up to 32W replacing incandescent	311	311	0
P-Lighting	Delamping HID (Watt reduction)	9,675	10,250	575
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	29	29	0
P-Lighting	LED or electroluminescent exit sign	33	33	0
P-Lighting	Fixture-mounted occupancy sensor	5	0	-5

Notes: Cadmus verified all lighting types were installed. The number of delamped fixtures was verified from speaking with the customer. Cadmus verified from site contact that (41) 250 mercury vapor fixtures were delamped. Cadmus did not find any occupancy sensors installed in the facility. Site contact reported they were originally installed, but were removed because they did not work properly. The site contact was unsure if they are going to reinstall the occupancy sensors.

Table 112. (Project Number: 015F47CBE)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Motors	Variable frequency drive up to 250 HP	12	12	0

Notes: Twelve 7.5 HP variable frequency drives were reported to be installed on supply fans inside twelve roof top HVAC units. Cadmus verified that of those twelve VFDs, only seven were controlling 7.5 HP motors, the other five were installed on 5 HP motors. Since smaller motors were found than originally reported, verified savings will be lower than first reported.

Table 113. (Project Number: DA2B5596)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Motors	Variable frequency drive up to 250 HP	10	10	0

Notes: Ten 7.5 HP Variable frequency drives were reported to be installed on supply fans inside ten roof top HVAC units. Cadmus verified that of those ten VFDs, seven were controlling 7.5 HP motors and the other three were installed on 5 HP motors. Since smaller motors were found than originally reported, verified savings will be lower than first reported.

Table 114. (Project Number: 241BC46E)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Motors	Air compressor 1-100HP variable speed	1	1	0

Notes: Cadmus verified one 5 HP variable frequency drive installed on a well pump. This pump feeds ground water to the water cooled AC units. Reported measure lists an air compressor VFD, which is not what the application documentation shows.

Table 115. (Project Number: AC5F14EB)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-HVAC	Air cooled chiller - any size	1	1	0

Notes: Cadmus verified one 160-Ton screw chiller installed at facility.

Table 116. (Project Number: B0B4D11F, and 334B6742)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Delamping T12 (# linear feet)	2,120	2,096	-24
P-Lighting	Delamping HID (Watt reduction)	5,760	4,580	-1,180
P-Lighting	T8 4-foot 2 lamp fixture replacing T12	224	224	0
P-Lighting	T8 high-bay 4-foot 4 lamp fixture replacing HID	18	18	0
P-Lighting	T8 4-foot 3 lamp fixture replacing T12	12	12	0
P-Lighting	T8 4-foot 2 lamp fixture replacing T12	12	12	0
P-Lighting	T8 4-foot 2 lamp fixture replacing T12	8	8	0
P-HVAC	Air cooled chiller - any size	1	1	0

Notes: Cadmus verified all lighting measures and one 180-Ton screw chiller installed at facility. The delamping verified quantity is from onsite contact. The verified quantity of delamped T12, is derived based on the total verified new fixture count and assuming the previous fixture was 8 foot T12 with the same amount of lamps. Cadmus verified that ten 458w metal halide lamps were removed in addition to what was replaced by high-day T8 fixtures.

Table 117. (Project Number: F7D24202)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	109	109	0
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	72	72	0
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	29	29	0
P-Lighting	T8 high-bay 4-foot 2 lamp fixture replacing HID	26	26	0
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	11	11	0
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	9	9	0
P-Lighting	Fixture-mounted occupancy sensor	148	148	0
P-Lighting	T8 4-foot 4 lamp fixture replacing T12	46	46	0
P-Lighting	T8 (BF < 0.78) 4-foot 2 lamp fixture replacing T12	63	63	0
P-Lighting	LED exit sign	6	6	0
P-Lighting	T8 high-bay 4-foot 2 lamp fixture replacing HID	5	5	0
P-Lighting	T8 (BF < 0.78) 4-foot 2 lamp fixture replacing T12	16	16	0
P-Lighting	T8 4-foot 2 lamp fixture replacing T12	1	1	0

Notes: Cadmus verified all lighting measures.

Table 118. (Project Number: 4FAE27E1)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	197	197	0
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	52	52	0
P-Lighting	T5 high-output high-bay 6 lamp fixture replacing HID	67	67	0
P-Lighting	T8 4 foot 4 lamp replacing T12 HO only	24	24	0
P-Lighting	T8 4-foot 4 lamp fixture replacing T12	21	21	0
P-Lighting	Fixture-mounted occupancy sensor	52	52	0
P-Lighting	Relamping 25 watt or less	176	144	-32
P-Lighting	Wall or ceiling-mounted occupancy sensor	13	13	0

Notes: Cadmus verified all lighting types were installed at this distribution facility. To calculate the relamping quantity, Cadmus counted a total of (57) 4-Lamp 25W T8 fixtures installed at the facility. Of those 57 fixtures, (21) are new fixtures, thus (36) 4-Lamp fixtures were relamped from 32w to 25w bulbs.

Table 119. (Project #68816460)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-HVAC	Unitary and split system A/C 241,000 - 760,000 BTUH (20-63.33 tons)	1	1	0

Notes: Cadmus verified the unit was installed, and model number matched the invoice.

Table 120. (Project # 77B8E5C6)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Motors	Variable frequency drive 5.0HP	10	10	0

Notes: Site installed VFDs on 10 chilled water pumps. All pumps were in the production area and were confirmed by site contact to have an operating schedule of 24/7/365.

Table 121. (Project # 7F6743A0)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-HVAC	Air cooled chiller - any size	1	1	0

Notes: The 280-Ton air cooled chiller was verified and installed.

Table 122. (Project # B9F34109)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM-Flow Controller	1	0	-1

Notes: Although the flow controller was installed at time of visit, the piece was not working; this was the second time the site has had issues with the equipment, and they were waiting for a technician to come out. The site contact stated the company would likely install a digital controller and uninstall the pneumatic one for which it got a rebate.

Table 123. (Project # EDC082D6)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM-200hp VFD	1	1	0

Notes: Cadmus verified that the 200 HP VFD was installed as reported. The system was operating as predicted.

Table 124. (Project # A21E4B95)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM-replace (40) 1000w with (54) 6lamp	54	54	0

Notes: Fixtures were installed as reported.

Table 125. (Project # 755523BF)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM - New flow controller on air compressor	1	1	0

Notes: Verified operational settings on air compressor.

Table 126. (Project # F618F94D)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Motors	NEMA premium efficiency motor 125 HP	1	1	0

Notes: Cadmus verified that the 125 HP motor was installed and operating as indented.

Table 127. (Project # 8B632CF9)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM-HID to fluorescent retrofit	40	40	0

Notes: Verified fixture types, counts and operating hours.

Table 128. (Project # 4DB7D910 & 898B2C4B)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-HVAC	Ground Water-Source Heat Pumps (Open Loop) <135,000 BTUH	21	21	0
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	48	48	0
P-Lighting	Wall or ceiling-mounted occupancy sensor	60	60	0
P-Lighting	T8 4-foot 3 lamp fixture replacing T12	63	63	0
P-Lighting	T8 4-foot 2 lamp fixture replacing T12	113	113	0
P-Lighting	CFL screw-in bulb up to 32W replacing incandescent	8	8	0
P-Lighting	LED or electroluminescent exit sign	17	16	-1

Notes: Cadmus found a discrepancy in the number of installed fixtures. The reported quantity of 8 CFLs (CFL screw-in bulb up to 32W replacing incandescent) but we found 50 CFLs installed. In addition, we found 25 more T8s (T8 4-foot 3 lamp fixture replacing T12) and 4 more T8s (T8 4-foot 2 lamp fixture replacing T12) than reported. Quantities in two rooms could not be verified because we were not allowed access. However, based on size and lay out of the facility we estimated (10) T8 were fixtures installed in those two rooms. Since, we found more than reported and savings is based on rebated number of fixtures, the verified quantity is equal to the reported quantity for the project.

Table 129. (Project # 2DC1E48A)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM-relamp T-5 to 51w and delamp	84	84	0

Notes: Verified fixture types, counts and operating hours.

Table 130. (Project # 5B817CBF)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM-relamp T-5 to 49w and delamp	90	92	+2

Notes: Verified fixture types, counts and operating hours; site installed two more fixtures than reported.

Table 131. (Project # B6B64136)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM-Remove 3300CFM compressor replace w 1300CFM	1	1	0

Notes: Verified air compressor installation and operating conditions.

Table 132. **(Project Number BB5789AE)**

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM-Air compressor replacement	1	1	0

Notes: Verified air compressor installation and operating conditions.

December 2011 Site Visit Findings

The following sections provide site specific findings relating to verified quantities and comments regarding discrepancies in reported values, as well as measure operation observations. The following projects findings are for the December 2011 (Round 2) site visits.

Table 133. (Project Number: 0E7C9F76)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Motors	VFDs on Air Compressors 1-100 HP	1	1	0

Notes: Cadmus verified one Allen Bradley Power Flex 400 VFD was installed on a Comp Air 30hp air compressor. At time of site visit Compressor was running at 30 hz, which implies the VFD was also operating.

Table 134. (Project Number: A901084F)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	CFL screw-in bulb up to 32W replacing incandescent	1,117	1,117	0
P-Lighting	LED or electroluminescent exit sign	3	3	0

Notes: Cadmus verified CFL screw-in bulbs ranging from 14w-23w installed in the hallways, outside, and in each room. Cadmus was unable to gain access to each room, but spot checked rooms to verify bulbs were installed. Cadmus verified all LED exit sign retrofit kits were installed.

Table 135. (Project Number: 013CC9A9)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Fixture-mounted occupancy sensor	54	54	0
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	49	49	0

Notes: Cadmus verified all lighting types were installed and currently operating.

Table 136. (Project Number: 17136FEF)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Low-watt T8 4-foot 2 lamp fixture replacing T12	22	22	0
P-Lighting	Low-watt T8 4-foot 3 lamp fixture replacing T12	12	12	0

Notes: Cadmus verified all lighting types were installed and currently operating.

Table 137. (Project Number: 5458CB9E)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Low-watt T8 4-foot 2 lamp fixture replacing T12	20	20	0
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T12	17	17	0

Notes: Cadmus verified all lighting types were installed and currently operating.

Table 138. (Project Number: FAAC7432)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	T5 high-bay 4-foot 6 lamp fixture replacing HID	54	54	0
P-Lighting	T5 high-bay 4-foot 4 lamp fixture replacing HID	314	313	-1
P-Lighting	Fixture Mounted Occupancy Sensor	217	217	0

Notes: Invoiced fixtures were documented to have been installed. There was a single fixture difference with the 4 lamp T5's. The invoiced number of fixtures was 313. All of the following fixtures replaced fixture for fixture from 458W metal halide lamps.

Table 139. (Project Number: 84FF63EC)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	LED parking lot lighting	32	32	0
P-Lighting	Daylight Sensors	2	2	0
P-Lighting	Central Lighting Controls	1	1	0

Notes: Cadmus found the all equipment installed and operating. One of the LED fixtures was not controlled by the daylight sensors and was operating during the daytime. It was presumed to be operating 24/7. The daylight sensors assure that the fixtures will not operate during the daylight hours. An adjustment will need to be made when calculating the evaluated energy savings. A central lighting controls also setback the hours even further so they do not operate between 1am and 6:15am and not at all on weekend. In addition, the lighting control system was connected to the lower floors of the structure that were lit by T-8 lighting.

Table 140. (Project Number: 1798024D)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	T5 HO HB 6L Fixtures Replacing HID	12	12	0

Notes: The fixtures were verified to be installed in the school gym. The fixtures were also controlled by infrared occupancy sensors, but were not part of this project.

Table 141. (Project Number: B79802DD)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Motors	VFD's on Air-Compressors 1-100HP	1-20hp	1-20hp	0

Notes: Cadmus confirmed that the 15kW (20 HP) VFD drive is operating and installed. Operating hours of the shop that draws air from the compressor is 2,600 hours annually. This VFD drive was installed replacing an older VFD, which had failed.

Table 142. (Project Number: F9532D98)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	CFL screw-in bulb up to 32W replacing incandescent	15	13	-2

Notes: Cadmus inspected the store and found 13 lamps installed and 2 sitting in their original package. The staff onsite mentioned that they would probably get around to installing them eventually. Store hours were verified.

Table 143. (Project Number: B7DA6B3B)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Low-watt T8 4-foot 2 lamp fixture replacing T12	18	18	0
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T12	425	425	0
P-Lighting	T8 (BF < 0.78) 4-foot 2 lamp fixture replacing T12	28	28	0

Notes: Cadmus was able to inspect most of the areas where the new lighting was installed and found everything operating correctly. The layout of the hospital and the lack of access to all areas made it all but impossible to perform an accurate count of fixtures. Invoices were used to verify fixture count. Operating hours vary throughout the hospital from 3,100 to 8,760.

Table 144. (Project Number: 9C651541)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Low-watt T8 4-foot 2 lamp fixture replacing T12	31	31	0
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T12	459	459	0
P-Lighting	T8 (BF < 0.78) 4-foot 2 lamp fixture replacing T12	83	83	0

Notes: Cadmus inspected most of the areas where the new lighting was installed and found everything operating correctly. The layout of the hospital and the lack of access to all areas made it impossible to perform an accurate count of fixtures. Operating hours vary throughout the hospital from 3,100 to 8,760.

Table 145. (Project Number: A28E9B6D)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Delamping HID	920	920	0
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	42	42	0

Notes: Fixture count for this facility was verified to be installed and operating as excepted. Operating hours were verified as accurate.

Table 146. (Project Number: 601009C4)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Fixture-mounted occupancy sensor	253	253	0
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	253	253	0

Notes: Fixture count for this facility was verified to be installed and operating as intended. Operating hours were verified as accurate.

Table 147. (Project Number: 8321826B)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	LED or electroluminescent exit sign	3	3	0
P-Lighting	T8 4 foot 2 lamp replacing T12 HO only	46	44	-2
P-Lighting	T8 high-output 8-foot 2 lamp fixture replacing T12 HO only	59	61	2

Notes: Cadmus visually verified the fixtures were installed and operating at the time of the site visit. The lamps and ballasts for all fixtures in the building were of one type. In the warehouse area of the building, the reported fixtures stated to be 8 foot - 2 lamp fixtures suggesting that each fixture contained 2 – 8 foot lamps or 976 linear feet of lamps. However, the actual installed light fixture was a 2 lamp 4 foot fixture and ballast that was end to end or 488 linear feet of lamps. This miss-classification will impact energy savings for this measure. The retrofitted lamps and ballasts information was collected and will be used to determine the energy savings.

Table 148. (Project Number: E456204)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Delamping T12 (# linear feet)	8	8	0
P-Lighting	Fixture-mounted daylight sensor	59	59	0
P-Lighting	Fixture-mounted occupancy sensor	20	20	0
P-Lighting	T8 (BF < 0.78) 4-foot 2 lamp fixture replacing T12	4	4	0
P-Lighting	T8 4 foot 4 lamp replacing T12 HO only	27	27	0
P-Lighting	T8 high-bay 4-foot 2 lamp fixture replacing HID	5	5	0
P-Lighting	T8 high-bay 4-foot 4 lamp fixture replacing HID	6	6	0
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	37	37	0
P-Lighting	Wall or ceiling-mounted occupancy sensor	1	1	0

Notes: Fixture count could not be verified visually. This facility had multiple rounds of the retrofit projects, which made it very difficult to determine when and where measures were installed. Fixture types and baseline types were verified and invoicing was used to verify count.

Table 149. (Project Number: 89DDA278)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Low-watt T8 4-foot 1 lamp fixture replacing T12	1	1	0
P-Lighting	Low-watt T8 4-foot 2 lamp fixture replacing T12	14	14	0
P-Lighting	Low-watt T8 4-foot 2 lamp fixture replacing T8	62	64	0
P-Lighting	Low-watt T8 4-foot 3 lamp fixture replacing T8	75	75	0
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T12	7	7	0
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T8	1	1	0
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T8	6	6	0

Notes: Cadmus verified that all lamps and ballast's replaced in several office areas conference rooms and hall ways. All lamps found to be 25 watt (low wattage) lamps powered by 0.78 BF ballasts.

Table 150. (Project Number: 0E2E153C)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Delamping T12 (# linear feet)	320	320	0

Notes: Cadmus verified lamps had been removed. The amount of de-lamping that was verified matched the reported quantity.

Table 151. (Project Number: 7E6AD343)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	LED pedestrian walk/don't walk sign	24	24	0
P-Lighting	LED traffic signal - green	40	40	0
P-Lighting	LED traffic signal – red	56	56	0

Notes: Cadmus verified that the lamps were installed around the City of Troy. This was confirmed by the city's maintenance manager. Of the 40 green lamps, 8 were 12" and 32 were 8", and of the 56 red lamps 16 were 12" and 40 were 8".

Table 152. (Project #9DD7F4D2)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T12	17	17	0

Notes: Cadmus verified all fixtures and operating hours.

Table 153. (Project # 5E425521)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	T5 high-output high-bay 6 lamp fixture replacing HID	20	20	0
P-Lighting	T8 high-bay 4-foot 4 lamp fixture replacing HID	15	15	0
P-Lighting	Wall or ceiling-mounted occupancy sensor	6	6	0
P-Lighting	Wall or ceiling-mounted occupancy sensor	13	13	0

Notes: All fixtures and occupancy sensors were verified to have been installed and were operating. Operating hours for each measure matched the reported hours.

Table 154. (Project # E6D22AF0)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Delamping T8 (# linear feet)	2,504	2,504	0
P-Lighting	Low-watt T8 4-foot 1 lamp fixture replacing T8	5	5	0
P-Lighting	Low-watt T8 4-foot 2 lamp fixture replacing T8	69	69	0
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T8	40	40	0
P-Lighting	Relamping 28 watt	626	626	0

Notes: Cadmus verified measures were installed and operating at the time of the site visit. Operating hours of the store were verified.

Table 155. (Project Number: OFE339E0)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM-Replace existing air compressors w/5 200 hp units	1	1	0

Notes: Cadmus verified that all five new air compressors are installed and operating. Operational parameters including pressures, air flows, plant operating schedule, and more were gathered, which will be used in the final energy calculation review. Some additional process loads have come online and the plant pressure has increased correspondingly, which increases plant energy usage.

Table 156. (Project Number: FF6BDFFA)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom Lighting	CUSTOM - Non-Prescriptive Lighting retrofits	1	1	0

Notes: Cadmus verified that reported quantity was for the most part consistent, but we did identify slight fixture counts and operating hours differences in some areas.

Table 157. (Project Number: EC314DF2)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM-Remove 300HP compressor & install 200HP VSD compressor	1	1	0

Notes: Cadmus verified that the new air compressors were installed and operating. Operational parameters including pressures, air flows, plant operating schedule, and more were gathered, which will be used in the final energy calculation review. The data logging performed by Go Sustainable Engineering included a period of relatively low air usage before the project was installed and a period of higher air usage after the project was installed (due to production fluctuations), which resulted in a low savings estimate. The customer is happy with the equipment and they report savings have proven to be higher than forecasted.

Table 158. (Project Number: 4539D0B0, 5916D8DF)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Delamping T12 (# linear feet)	504	744	240
P-Lighting	Low-watt T8 4-foot 2 lamp fixture replacing T12	89	159	70
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T12	83	60	-23
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	18	18	0
P-Lighting	T8 (BF < 0.78) 4-foot 2 lamp fixture replacing T12	7	0	-7
P-Lighting	Wall or ceiling-mounted occupancy sensor	30	3	-27

Notes: Cadmus walked through the entire complex and counted all light fixtures. There was a fire in the shed storing the new fixtures and some installations were not completed as expected. Occupancy sensors were not installed except in a few isolated

cases. All bulbs are 28W. Some fixtures have not yet been replaced in the gymnasium building and 12 fixtures were installed then removed due to a remodel in an office building. Site contact maintained that all new installed fixtures have same ballast type and was not aware of any low-ballast-factor fixtures. Hours of operation for most fixtures are only during summer months when facility is used as a summer camp.

Due to the unusual set of circumstances, the evaluated results of this project will not be included in the overall lighting realization rate. Evaluation results will only be applied to this specific project.

Table 159. (Project Number: [NC-LPD])

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom NC-LPD	NEW CONSTRUCTION - Crown Solutions (20,000 SF office + 50,000 SF manuf)	1	1	0

Notes: Cadmus verified the installation of onsite lighting. Some very minor discrepancies in lighting counts were found: corridor lighting quantities were slightly different than reported. A slight adjustment will be made to the savings analysis. The hours of operation were recorded.

Table 160. (Project Number: B448471D)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	CFL screw-in bulb up to 32W replacing incandescent	32	30	-2
P-Lighting	LED exit sign	9	9	0
P-Lighting	T8 4 foot 2 lamp replacing T12 HO only	36	36	0
P-Lighting	T8 4-foot 2 lamp fixture replacing T12	38	38	0
P-Lighting	Wall or ceiling-mounted occupancy sensor	23	23	0

Notes: Cadmus inspected all spaces were new lighting was installed. Cadmus verified the installation of all lighting types. All CFLs were pin-based rather than screw-based and some CFLs were higher-wattage fixtures than claimed. A total of 12 CFL cans are 32W single-lamp fixtures and a total of 18 CFL cans are 26W two-lamp fixtures.

Table 161. (Project Number: DBF6023A)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM-Plate and frame heat exchanger	1	1	0

Notes: Cadmus verified the installation and operation of the flat-plate heat exchanger. The site contact was able to provide chiller operation trend data showing the operation of the heat exchanger and proving that the system is providing free cooling as designed. Operational information including plant characteristics and operational parameters was gathered.

Table 162. (Project Number: [NC-LPD])

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom NC-LPD	NEW CONSTRUCTION - 17,921 SF Warehouse addition	1	1	0

Notes: Cadmus verified the installation and operation of the lighting systems as claimed. Hours of operation were recorded and are lower than reported due to installation of occupancy sensors and aggressive energy conservation efforts by facility management.

Table 163. (Project Number: 769AAAB1)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	CFL screw-in bulb up to 32W replacing incandescent	72	72	0

Notes: Cadmus verified the installation of the lights to be as claimed. Hours of operation are slightly different than claimed.

Table 164. (Project Number: 50E4E4C6)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	CFL screw-in bulb up to 32W replacing incandescent	13	11	-2
P-Lighting	Relamping 28 watt	1,770	932	-838

Notes: Cadmus verified the installation of CFL and 28W linear T8 lamps. Some fixtures are T12s and were not retrofitted as part of this project. The total lighting count above represents number of lamps switched to 28W T8 lamps. The hours of operations were determined to be correct.

Table 165. (Project Number: AA29FFA3)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Other	Vending equipment controller	22	14	-8

Notes: Cadmus verified the installation of some of the claimed vending misers. A total of 14, or all but two machines, in the high school were retrofitted with vending misers. One outdoor vending machine at the high school had been removed at the time of the site visit. None of the seven vending machines in the middle school were retrofitted. The machines in the middle school are still present and operational but vending misers were not installed.

Table 166. (Project Number: 621C26BD)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom	CUSTOM-Plate and frame heat exchanger	1	1	0

Notes: Cadmus verified all barrel wraps on extrusion feed tubes. The plant has 14 lines and typically operates 9-10 lines at a time. Operational parameter data including temperature of operation, hours of operation, and size of barrels and wraps were gathered. Some of wraps were found to be left unfastened at the bottom to allow access by an IR gun for thermocouple testing;

this will reduce savings somewhat as heat can still escape from the bottom of the extrusion feed tubes. Upon review of Go Sustainable Energy documentation of the facility, they photographed similar findings of unfastened wraps. Savings will not be impacted by this finding.

Table 167. (Project Number: 3EA91C32, DAB1AC44)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Central lighting control	1	1	0
P-Lighting	Delamping HID	1,380	1,380	0
P-Lighting	Fixture-mounted occupancy sensor	44	43	-1
P-Lighting	Light Tube (21")	12	12	0
P-Lighting	Remote-mounted daylight sensor	1	1	0
P-Lighting	Switching controls for multilevel lighting	1	1	0
P-Lighting	T8 high-bay 4-foot 4 lamp fixture replacing HID	33	32	-1
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	11	11	0
Custom	CUSTOM-replace compressed air dryer with heater and blower	1	1	0

Notes: Cadmus verified all lighting types were installed at Eurand facility. Some minor quantity differences were observed. The compressed air upgrade (replacing a refrigerated cycling dryer with a heater/blower system) was installed as claimed. Operational parameters including pressures, air flows, plant operating schedule, and as well as other data points were gathered, which will be used in the final energy saving calculations.

Table 168. (Project Number: 7BB7608B)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Delamping T12 (# linear feet)	1,608	1,304	-304
P-Lighting	LED or electroluminescent exit sign	12	12	0
P-Lighting	Low-watt T8 4-foot 3 lamp fixture replacing T12	402	379	-23
P-Lighting	Relamping 25 watt or less	206	206	0
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	52	52	0
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T12	0	16	16
P-Lighting	Low-watt T8 4-foot 2 lamp fixture replacing T12	0	20	20
P-Lighting	Low-watt T8 4-foot 1 lamp fixture replacing T12	0	33	33

Notes: Cadmus verified that the lighting upgrade was performed in the school. The lighting counts were verified based on on-site observation and project documentation provided by school staff, including the scope of work from the contractor and the post-installation audit performed by DP&L. The project included some other light fixture types that were not included in the summary and do not have associated savings. These are the 4-lamp, 2-lamp, and 1-lamp low-watt 4-foot T8 fixtures replacing T12 fixtures. The savings associated with these fixtures should be included with this project because the fixtures were installed as part of the same project. Savings from these fixtures will tend to increase the overall project savings, but the reduced savings from the lower-than-claimed number of delamped T12 lamps and 3-lamp T8 fixtures will offset this savings, resulting in a relatively small savings adjustment. However, the hours of operation were determined to be lower than claimed for classroom space types and higher than claimed for the gymnasium lighting. Overall this will reduce savings from this project.

Table 169. (Project Number: [NC-LPD])

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom NC-LPD	NEW CONSTRUCTION - 45,500 SF manufacturing and warehouse	1	1	0

Notes: Cadmus confirmed the lighting was installed as claimed. The calculated LPD was slightly different than the claimed LPD. Hours of operation were confirmed to be as claimed.

Table 170. (Project Number: A4A9595B)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Fixture-mounted occupancy sensor	72	72	0
P-Lighting	Pulse-start or ceramic metal halide fixture > 250W	34	34	0
P-Lighting	T5 high-output high-bay 6 lamp fixture replacing HID	21	21	0
P-Lighting	T5 high-output high-bay 6 lamp fixture replacing HID	145	145	0
P-Lighting	T8 4 foot 4 lamp replacing T12 HO only	39	39	0

Notes: Cadmus walked through the building where the lighting installation was completed and gathered information about the lighting project. All fixtures were observed to be in place as claimed. The hours of operation were as claimed for production areas of the facility but were higher for shipping areas of the facility, and the savings calculations will be adjusted due to this difference.

Table 171. (Project Number: E0C54759)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Delamping HID	87,400	87,400	0
P-Lighting	Fixture-mounted occupancy sensor	84	84	0
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	460	460	0

Notes: Cadmus determined that the new lighting was installed as claimed. The project consisted of replacing 276 1,000W metal halide fixtures with 460 T5 4-lamp linear fluorescent fixtures. The delamping savings will be rolled into the total savings and evaluated energy savings will be based on the performance of the overall project. Hours of operation were determined to be lower than claimed, which will affect the savings for the project.

Table 172. (Project Number: 848D8C08)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	T8 (BF < 0.78) 4-foot 4 lamp fixture replacing T12	57	57	0

Notes: Cadmus determined that all fixtures were installed as claimed. Hours of operation were determined to be lower than claimed, which will affect the savings for the project.

Table 173. (Project Number: 89F9D48B, E24AF489, [NC-LPD])

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom NC-LPD	NEW CONSTRUCTION - 72,000 SF warehouse	1	1	0
P-Other	Window film	931 (sqft)	931 (sqft)	0
P-Other	Barrel wraps	1	1	0

Notes: Cadmus verified the installation of the lighting in the new warehouse areas. Fewer light fixtures were installed than claimed, which will increase lighting savings due to a lower lighting power density. The window film was installed as claimed and the area of window film was found to be correct. The film is present on 26 windows, 2 doors, and 2 transoms, all of which are east-facing. The barrel wraps were found to be installed on one machine as claimed. Barrel wrap savings may be adjusted based on operating hours, operating temperature, insulation thickness, and other parameters.

Table 174. (Project Number: 49E8FE77)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Low-watt T8 4-foot 2 lamp fixture replacing T12	200	193	-7
P-Lighting	Low-watt T8 4-foot 3 lamp fixture replacing T12	150	38	-112
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T12	200	341	141

Notes: Cadmus walked through as much of the building as feasible where the lighting installation was completed and gathered information about the lighting project. Some spaces were not visited because classes were in session and so the actual number of fixtures counted involves some extrapolation based on building plans. The actual number of lamps installed was somewhat different than claimed. However, the total number of fixtures observed (572) is only slightly greater than the invoice states (550). All lamps were observed to be 25W lamps, as claimed. All fixtures were retrofitted with the same number of lamps (e.g. all 4-lamp T12 fixtures were converted to 4-lamp T8 fixtures) and no delamping occurred. Hours of operation are relatively high for a school building (5,840 hours/year, or 16 hours per day, 7 days per week, year-round) due to the fact that many building occupants tend to leave lights on all the time.

Table 175. (Project Number: 52B45358 & 75E719D6)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	LED exit sign	6	6	0
P-Lighting	Low-watt T8 4-foot 2 lamp fixture replacing T12	14	14	0
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T12	77	77	0
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	6	6	0
P-Lighting	T8 4 foot 4 lamp replacing T12 HO only	18	18	0

Notes: Cadmus toured the entire facility and verified the operation of all fixtures that were claimed. Cadmus found the operating hours to be slightly greater for three of the measures (rows 2,3,4) located in the offices and primary use areas of the church based on the site visit contact. The operating hours for row measure 5, located in the kitchen, were found to be slightly less than claimed, based on the site visit contact.

Table 176. (Project Number: E9EEFF57)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	T8 high-bay 4-foot 6 lamp fixtures replacing HID	221	221	0

Notes: Cadmus verified reported quantity is correct. Cadmus found the hours of operation to be higher (4910 hrs) than the reported value (2340 hrs). Site contact verified two shifts at 16 hours per day, six days per week and these hours have been consistent over time.

Table 177. (Project Number: DA8EFFFE)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	T8 high-bay 4-foot 6 lamp fixtures replacing HID	192	191	1

Notes: Cadmus (291) of the (292) claimed fixtures. The facility had two separate businesses operating within the same area, which was divided by a chain link fence. Cadmus verified the hours of operation to be slightly higher in the majority of the facility that operates two shifts, 16 hours per day, six days per week. The other business, which was a smaller portion of the warehouse, operated only one shift, 8 hours per day, six days per week.

Table 178. (Project Number: 2240F211 & C6516ECB & DD60B590)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Wall or ceiling-mounted occupancy sensor	18	18	0
P-Lighting	Wall or ceiling-mounted occupancy sensor	59	52	-7
P-Lighting	LED exit sign	24	30	6

Notes: Cadmus verified all lighting types were installed. An additional 6 LED exit signs were found to be installed. Cadmus found 70 of the 77 claimed wall mounted occupancy sensors that were located throughout the building in individual offices. On site, Cadmus verified that offices are generally occupied 8:30-5:30 M-F and closed on holidays. These savings will be adjusted based on the reduced number of occupancy sensors.

Table 179. (Project Number: OB4203B8 & 1E4A64BD)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	T8 high-bay 4-foot 6 lamp fixture replacing HID	169	166	-3
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	19	19	0

Notes: Cadmus confirmed most (166) of the installed T8 high bay fixtures. The hours of operation for both measures were found to be greater than the claimed value. Although the facility doesn't currently operate three shifts 7-days a week, the lights are never turned off.

Table 180. (Project Number: 742AA028)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Fixture-mounted occupancy sensor	45	86	41
P-Lighting	T5 high-output high-bay 2 lamp fixture replacing HID	89	89	0

Notes: Cadmus inspected all the fixtures. A total of 86 fixtures were found to have fixture-mounted occupancy sensors. Each fixture is equipped with an occupancy sensor to turn off the fixture during periods of inactivity. The fixtures are left on 24/7, except for the reduction due to occupancy sensor controls. Of the 89 fixtures, (3) are left on 24/7 and are not controlled by occupancy sensors.

Table 181. (Project Number: 26ADF2BD)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Delamping HID	215	215	0
P-Lighting	T5 high-output high-bay 2 lamp fixture replacing HID	6	6	0
P-Lighting	Wall or ceiling-mounted occupancy sensor	2	2	0

Notes: Cadmus confirmed the installation of (6) 2-lamp F54T5HO fixtures and the ceiling mounted occupancy sensors. Each sensor controls (2) 2-lamp F54T5HO fixtures. There were two metal halide fixtures delamped and replaced with CFL bulbs.

Table 182. (Project Number: 015F47CBE)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Delamping T8 (# linear feet)	3,136	3,052	84
P-Lighting	Low-watt T8 4-foot 2 lamp fixture replacing T8	46	0	-46
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T8	40	42	2
P-Lighting	Relamping 28 watt	720	711	-9
P-Lighting	T8 (BF < 0.78) 4-foot 2 lamp fixture replacing T8	26	26	0

Notes: Cadmus conducted an entire lighting audit of the facility and confirmed the lighting hours of operation. In addition, Cadmus verified the majority of the fixtures installed, but was unable to find a group of (46) 2-lamp fixtures.

Table 183. (Project Number: 013A1F5F&2168C8C9&B1AE9D74& DA67A9D5&A96C490B)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Delamping HID	916	916	0
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	12	12	0
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	8	8	0
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	19	19	0
P-Lighting	T5 high-output high-bay 6 lamp fixture replacing HID	2	2	0
P-Lighting	T5 high-output high-bay 6 lamp fixture replacing HID	4	4	0
P-Lighting	Delamping HID	1,374	1,374	0
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	36	36	0
P-Lighting	T5 high-output high-bay 6 lamp fixture replacing HID	28	28	0
P-Lighting	Delamping HID	8	8	0
P-Lighting	T5 high-output high-bay 6 lamp fixture replacing HID	60	60	0
P-Lighting	T5 high-output high-bay 6 lamp fixture replacing HID	89	89	0
P-Lighting	T5 high-output high-bay 6 lamp fixture replacing HID	67	67	0
P-Lighting	Delamping HID	3,206	3,206	0
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	6	6	0
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	14	14	0
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	14	14	0
P-Lighting	T5 high-output high-bay 6 lamp fixture replacing HID	1	1	0
P-Lighting	T5 high-output high-bay 6 lamp fixture replacing HID	1	1	0

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	T5 high-output high-bay 6 lamp fixture replacing HID	45	45	0

Notes: Cadmus conducted a comprehensive lighting audit with the company's facility manager. The hours of operation for lighting are 24/7 for days per week and then approximately 10% of all lights on the 7th day. All T5 fixtures had replaced 400W MH fixtures on a 1-for-1 basis. Cadmus also found that 110 occupancy sensors had been installed on fixtures in low traffic areas, which were not part of any of the original savings projects.

Table 184. (Project Number: Custom NC-LPD)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
Custom-NC	Reduced LPD	1	1	0

Notes: Teradata installed lighting equipment that was below the state requirements and resulting in a lower LPD for their new construction building. Cadmus took several LPD measurements in the various room types (bathrooms, conferences, lobby, and offices) and compared these values to the claimed values Go Sustainable Energy report. Cadmus found the claimed and verified LPD measurements to be extremely close in all areas, and thus a change in energy savings estimates is not likely.

Table 185. (Project Number: 776FC527)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Delamping HID	6,960	6,960	0
P-Lighting	Fixture-mounted occupancy sensor	4	4	0
P-Lighting	Low-watt T8 4-foot 2 lamp fixture replacing T12	16	16	0
P-Lighting	Low-watt T8 4-foot 4 lamp fixture replacing T12	126	126	0
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	298	298	0
P-Lighting	T5 high-output high-bay 6 lamp fixture replacing HID	28	28	0

Notes: Cadmus verified all lighting measures installed as part of the project.

Table 186. (Project Number: 31B6B6AF)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Delamping HID	1,392	1,392	0
P-Lighting	Fixture-mounted occupancy sensor	362	359	-3
P-Lighting	T5 high-output high-bay 4 lamp fixture replacing HID	362	359	-3

Notes: Cadmus verified all lighting measures and fixture mounted occupancy sensors, except 3 were not found.

Table 187. (Project Number: CBA37991)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	LED lighting in reach-in freezer/cooler case	39	39	0

Notes: Cadmus verified a total of 54 LED fixtures installed in both the reach-in freezers and open meat display case. Cadmus verified a total 39 reach-in freezer doors and (28) linear feet of open display cases. Both the open and the closed cases had fixtures installed. Documentation also indicates that 54 fixtures were installed but post audit verification indicated 55 fixtures (as invoiced) and 39 doors. The refrigeration case lights are on approximately 17.5 hours per day, for a total of 6,388 hours per year.

Table 188. (Project Number: C70B0C2D)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Lighting	Low-watt T8 4-foot 2 lamp replacing T12	327	328	1
P-Lighting	Low-watt T8 4-foot 3 lamp replacing T12	14	17	3

Notes: Cadmus verified all fixtures installed on site. The claimed hours of operation were 8,760, which is significantly more than the actual operating hours. The hours of operation were found to be closer to 2,500 hours per year. Additional fixtures were found in both measures.

Table 189. (Project #2F33B177)

Measure Type	Reported Measure	Reported Quantity	Verified Quantity	Difference
P-Motor	Variable frequency drive 60-100 HP (60 HP)	2	2	0
P-Motor	Variable frequency drive 60-100 HP (100 HP)	2	2	0

Notes: Cadmus verified both measures and all (4) motors on site with VFD's. The 100HP motors were connected to the cooling tower chilled water supply pumps. The two 60HP motors were connected to the cooling tower fans.

APPENDIX H: COST-EFFECTIVENESS ANALYSIS INPUTS

Utility Assumptions

Utility assumptions apply to all programs and measures, including the assumptions that follow.

Avoided Costs are the full value of time and seasonally differentiated generation, transmission and distribution, and capacity costs. For each energy-efficiency measure included in a program, hourly (8760) system-avoided costs are adjusted by the hourly load shape of the end use affected by the measure, capturing the full value of time and seasonally-differentiated impacts of the measure. Avoided costs, provided by DP&L, are updated as needed.

Line Loss is the percentage of energy lost during transmission and distribution. In DSM Portfolio Pro, both energy and capacity line losses are applied to measure-level savings to reflect total savings from the point of generation. Table 190 presents line loss assumptions for the 2011 Evaluation Measurement and Verification Report.

Table 190. Line Loss Assumptions Used in Cost-Effectiveness Calculations

Sector	Energy Line Losses	Demand Line Losses
Residential	7.95%	9.14%
Commercial/Industrial	6.33%	7.68%

Retail Rates, provided by DP&L, include electric rates for all customer classes eligible for DSM programs. Table 191 provides line loss assumptions for the 2011 Evaluation Measurement and Verification Report.

Table 191. Line Loss Assumptions Used in Cost-Effectiveness Calculations

Sector	Retail Rate	Escalator
Residential	$0.15	0%
Residential Heating	$0.13	0%
Commercial	$0.11	0%
Industrial	$0.10	0%

Load Shapes show hourly energy use over a year for each end use included in DSM Portfolio Pro. Hourly end-use load shapes were not available for the 2011 cost-effectiveness tests. Therefore, Cadmus developed load shapes using available data from similar regions, and adjusting for weather conditions in DP&L's service territory.

Discount Rates are used to determine the net present value of benefits for each program. Table 192 shows the discount rates used in 2011. The TRC, UTC, and RIM test discount rates are based on DP&L's weighted cost of capital; SCT discount rate is based on a 10-year T-bill rate; and the PCT rate represents a hurdle rate. Cadmus will update discount rates in subsequent years, as new data are provided.

Table 192. Discount Rates

Tests	Discount Rates
TRC	8.77%
SCT	3.56%
UTC	8.77%
RIM	8.77%
PCT	10.00%

Peak Definitions are used to determine any time or seasonal differentiation between rates and avoided costs. Additionally, to calculate peak load impacts from energy-efficiency measures, end-use load shapes are used to identify the average reduction in demand over the DP&L system's top 100 peak demand hours.

Externalities and Indirect Benefits are additional, non-energy benefits associated with installing energy-efficiency measures. For the 2011 analysis, we did not include non-energy benefits. Unless otherwise requested, we do not plan to include any non-energy benefits for future cost-effectiveness tests.

Program Assumptions

Sectors/Segments identify the customer class to which participants from each program belong. Sectors for DP&L include: residential, commercial, and industrial. Examples of segments used in DSM Portfolio Pro include: single-family, multifamily, small office, large retail, and schools (these are tailored to DP&L's service territory). Sectors and segments dictate which retail rates and load shapes are used during analysis.

Utility Administrative Costs include any expenses associated with: program development; marketing; delivery; operation; and EM&V. These costs are not measure-specific, and are assessed at the program or portfolio level. Costs categories used in the 2011 Evaluation Measurement and Verification Report are shown in Table 193 and will be updated in subsequent cycles.

Table 193. Implementation and Administrative Costs

Cost Category	Level	Description
Implementation Vendor and Marketing Costs	Program Level	Incremental costs associated with performing program implementation tasks, including customer service, application processing, marketing, customer outreach, etc.
Incentive Costs	Program Level	Rebates and incentives paid to customers by DP&L.
Direct Measure Costs	Program Level	Costs associated with paying for program measures, including measures installed through the Low Income Weatherization program.
DP&L Staff Costs	Program Level/ Portfolio Level	Costs to administer energy-efficiency programs, including DP&L's fully-loaded incremental personnel costs. Activities associated with market research outside of EM&V.
External Vendor Evaluations	Portfolio Level	Activities associated with the determination and evaluation of current and potential energy-efficiency programs. These activities include: benefit-cost ratio analysis, impact and process analysis, cost per kWh analysis, customer research, and all other analyses necessary for program evaluation.
Education, Awareness, and Building and Market Transformation	Portfolio Level	Cost to increase awareness of energy efficiency. Campaigns include a school education program, a mass marketing campaign for CFLs, and a monitoring and research project.

Measure Assumptions

Measure Life is used during the calculation of total lifetime benefits for each measure. The life of each measure is based on information from the draft Ohio TRM, program-supported documentation, and secondary research.

End Use is used to assign each measure to a specific load shape. Examples of end uses in DSM Portfolio Pro include water heating, HVAC, and lighting.

Savings are annual kWh savings associated with installation of each energy-efficiency measure. Savings used in DSM Portfolio Pro are the adjusted gross savings.

Incremental Cost is the expense associated with the installation of energy-efficiency measures and ongoing operation and maintenance costs, where applicable. These costs include the entire cost of installing the measure, and do not net out incentive payments to the customer. The incremental cost is based on information from the draft Ohio TRM, program-supported documentation, and secondary research.

Incentive Level is the dollar amount of the rebate paid to a customer by DP&L. The incentive amount for each measure is provided by DP&L.

Freeridership is the percent of participants who would have taken the same action/installed the same measure in the program's absence. Cadmus assumed a net-to-gross ratio of 1.0 for the 2011 analysis.

Spillover is the percent of participants who installed additional energy-savings measures without incentives due to their participation in the program. Spillover was not calculated for the 2011 analysis.

Participation is the number of customers who participated in the program or quantity of measures verified by Cadmus.

APPENDIX I: DISTRIBUTION OF GENERAL POPULATION TELEPHONE SURVEY CALL RESULTS

Table 194. Residential Lighting RDD Telephone Survey Diagnostics

Category	Count
Number of Dialings	4,903
Number of Contacts	3,811
Unusable Numbers	43
Not Contacted	6
DISCONNECT	1
COMPUTER TONE/FAX	5
Contacted	37
BUSINESS/GOVERNMENT	23
NON-BUSINESS NUMBER	0
WRONG NUMBER	10
LANGUAGE PROBLEMS	4
Non-Final Dispositions	1,716
NO ANSWER	42
BUSY	0
ANSWERING MACHINE	1,042
PRIVACY MANAGER	2
RESPONDENT NOT AVAILABLE	511
SCHEDULED CALLBACK WITH NO TIME GIVEN	95
CALLBACK	22
MID INTERVIEW SUSPEND	2
Refusals	343
SOFT REFUSAL	131
HARD REFUSAL	35
TAKE ME OFF YOUR CALL LIST	30
HUDI	147
SCREENER TERMINATE	0
DNC NUMBER	0
Ineligible	47
Eligible, but Over Quota	0
Eligible, but Incomplete	29
TERMINATED DURING INTERVIEW	0
MID INTERVIEW TERMINATE	29
Complete	301

Table 195. Residential Heating and Cooling Rebate Full Participant Telephone Survey Diagnostics

Category	Count
Number of Dialings	2,075
Number of Contacts	1,462
Unusable Numbers	23
Not Contacted	12
DISCONNECT	8
COMPUTER TONE/FAX	4
Contacted	11
BUSINESS/GOVERNMENT	8
NON-BUSINESS NUMBER	0
WRONG NUMBER	3
LANGUAGE PROBLEMS	0
Non-Final Dispositions	801
NO ANSWER	78
BUSY	0
ANSWERING MACHINE	523
PRIVACY MANAGER	0
RESPONDENT NOT AVAILABLE	49
SCHEDULED CALLBACK WITH NO TIME GIVEN	18
CALLBACK	110
MID INTERVIEW SUSPEND	23
Refusals	175
SOFT REFUSAL	99
HARD REFUSAL	16
TAKE ME OFF YOUR CALL LIST	15
HUDI	33
SCREENER TERMINATE	12
DNC NUMBER	0
Ineligible	11
Eligible, but Over Quota	0
Eligible, but Incomplete	2
TERMINATED DURING INTERVIEW	0
MID INTERVIEW TERMINATE	2
Complete	226

Table 196. Residential Heating and Cooling Rebate Mini-Split Participant Telephone Survey Diagnostics

Category	Count
Number of Dialings	140
Number of Contacts	31
Unusable Numbers	7
Not Contacted	4
DISCONNECT	4
COMPUTER TONE/FAX	0
Contacted	3
BUSINESS/GOVERNMENT	1
NON-BUSINESS NUMBER	0
WRONG NUMBER	2
LANGUAGE PROBLEMS	0
Non-Final Dispositions	108
NO ANSWER	9
BUSY	0
ANSWERING MACHINE	96
PRIVACY MANAGER	0
RESPONDENT NOT AVAILABLE	0
SCHEDULED CALLBACK WITH NO TIME GIVEN	0
CALLBACK	3
MID INTERVIEW SUSPEND	0
Refusals	3
SOFT REFUSAL	3
HARD REFUSAL	0
TAKE ME OFF YOUR CALL LIST	0
HUDI	0
SCREENER TERMINATE	0
DNC NUMBER	0
Ineligible	1
Eligible, but Over Quota	0
Eligible, but Incomplete	3
TERMINATED DURING INTERVIEW	0
MID INTERVIEW TERMINATE	3
Complete	10

Table 197. Residential Certified HVAC Tune-Up Market Characterization Telephone Survey Diagnostics

Category	Count
Number of Dialings	2,812
Number of Contacts	1,700
Unusable Numbers	111
Not Contacted	89
DISCONNECT	85
COMPUTER TONE/FAX	4
Contacted	22
BUSINESS/GOVERNMENT	21
NON-BUSINESS NUMBER	0
WRONG NUMBER	1
DIALER DISCONNECTED	0
LANGUAGE PROBLEMS	0
Non-Final Dispositions	1,206
NO ANSWER	103
BUSY	12
ANSWERING MACHINE	897
PRIVACY MANAGER	11
RESPONDENT NOT AVAILABLE	50
SCHEDULED CALLBACK WITH NO TIME GIVEN	16
CALLBACK	102
MID INTERVIEW SUSPEND	15
Refusals	302
SOFT REFUSAL	136
HARD REFUSAL	6
TAKE ME OFF YOUR CALL LIST	14
HUDI	146
SCREENER TERMINATE	0
DNC NUMBER	0
Ineligible	98
Eligible, but Over Quota	1
Eligible, but Incomplete	5
TERMINATED DURING INTERVIEW	0
MID INTERVIEW TERMINATE	5
Complete	100

Table 198. Residential Low-Income Participant Telephone Survey Diagnostics

Category	Count
Number of Dialings	1,244
Number of Contacts	1,010
Unusable Numbers	12
Not Contacted	7
DISCONNECT	2
COMPUTER TONE/FAX	5
Contacted	5
BUSINESS/GOVERNMENT	2
NON-BUSINESS NUMBER	0
WRONG NUMBER	0
LANGUAGE PROBLEMS	3
Non-Final Dispositions	299
NO ANSWER	17
BUSY	0
ANSWERING MACHINE	210
PRIVACY MANAGER	0
RESPONDENT NOT AVAILABLE	24
SCHEDULED CALLBACK WITH NO TIME GIVEN	13
CALLBACK	26
MID INTERVIEW SUSPEND	9
Refusals	123
SOFT REFUSAL	56
HARD REFUSAL	2
TAKE ME OFF YOUR CALL LIST	2
HUDI	50
SCREENER TERMINATE	13
DNC NUMBER	0
Ineligible	0
Eligible, but Over Quota	1
Eligible, but Incomplete	0
TERMINATED DURING INTERVIEW	0
MID INTERVIEW TERMINATE	0
Complete	119

Table 199. Commercial Prescriptive Participant Telephone Survey Diagnostics

Category	Count
Number of Dialings	608
Number of Contacts	403
Unusable Numbers	8
Not Contacted	5
DISCONNECT	3
COMPUTER TONE/FAX	2
Contacted	3
BUSINESS/GOVERNMENT	2
NON-BUSINESS NUMBER	0
WRONG NUMBER	1
LANGUAGE PROBLEMS	0
Non-Final Dispositions	473
NO ANSWER	19
BUSY	0
DIALER NO ANSWER	25
DIALER ANSWERING MACHINE	0
PUT TO GET SPECIFIC ONLY STACK	0
ANSWERING MACHINE	156
PRIVACY MANAGER	0
RESPONDENT NOT AVAILABLE	99
SCHEDULED CALLBACK WITH NO TIME GIVEN	1
CALLBACK	171
MID INTERVIEW SUSPEND	2
Refusals	16
SOFT REFUSAL	14
HARD REFUSAL	1
TAKE ME OFF YOUR CALL LIST	0
HUDI	1
SCREENER TERMINATE	0
DNC NUMBER	0
Ineligible	4
Eligible, but Over Quota	7
Eligible, but Incomplete	3
TERMINATED DURING INTERVIEW	0
MID INTERVIEW TERMINATE	3
Complete	90

APPENDIX J: GENERAL POPULATION SURVEY DEMOGRAPHICS

The following two tables provide demographic results for 5 general population surveys:

- Low Income program participant;
- Residential Rebate general program participant survey;
- Residential Rebate Mini-Split Heat Pump program participant survey;
- Certified HVAC Tune-Up market characterization; and
- Commercial Prescriptive program participant.

Survey responses for the Residential Upstream Lighting RDD survey were weighted by demographics and therefore, the demographic section for this survey are provided in the Residential Upstream Lighting section.

Table 200. Residential Survey Demographics

Home Characteristics	Low Income (n=120)	Standard HVAC (n=226)	Mini-Split HVAC (n=10)	HVAC Tune-Up (n=15)
Dwelling Type				
Single-family home, detached	73%	93%	90%	87%
Single family home, factory manufactured/modular	9%	1%	0%	7%
Single family, mobile home	3%	0%	0%	0%
Row House	9%	0%	0%	0%
Two or Three family attached residence—traditional structure	1%	1%	0%	0%
Condominium---traditional structure	0%	4%	0%	7%
Square Footage of Dwelling				
Less than 1,000 square feet	1%	5%	0%	10%
1,001-2,000 square feet	8%	41%	75%	70%
2,001-3,000 square feet	17%	38%	25%	20%
3,001-4,000 square feet	8%	10%	0%	0%
4,001-5,000 square feet	1%	4%	0%	0%
Greater than 5,000 square feet	2%	3%	0%	0%
Years Home was Constructed				
Before 1960	5%	21%	30%	20%
1960-1969	33%	11%	0%	20%
1970-1979	12%	29%	50%	13%
1980-1989	7%	14%	10%	7%
1990-1999	10%	17%	0%	13%
2000-2005	3%	4%	0%	13%
2006 or later	2%	1%	0%	0%
Ownership Type				
Own	73%	-	-	-
Rent	23%	-	-	-

Table 201. C&I Prescriptive Survey Demographics

Facility Characteristics	HVAC Measures (n=20)	Lighting Measures (n=44)	Motors Measures (n=20)	Other Measures (n=6)
Role or Title of Respondent				
Facilities Manager	5%	14%	15%	17%
Building Manager	0%	2%	5%	0%
Energy Manager	5%	0%	5%	0%
Other facilities management / maintenance position	15%	16%	35%	17%
Chief Financial Officer	5%	0%	5%	0%
Other financial / administrative position	35%	16%	10%	33%
Proprietor / Owner	10%	18%	10%	17%
President / CEO	25%	11%	5%	0%
Other	0%	20%	10%	17%
Facility Ownership of Space				
Own	85%	75%	75%	50%
Lease/Rent	10%	20%	20%	50%
Size of Facility (sqft)				
Less than 9,999	35%	37%	22%	50%
10,000-24,999	18%	17%	33%	0%
25,000-49,999	35%	26%	22%	0%
50,000-74,999	0%	0%	11%	0%
75,000-99,999	0%	0%	0%	0%
100,000-199,999	0%	9%	0%	0%
200,000+	12%	11%	11%	50%
Total FTE at Facility				
Less than 10	35%	48%	25%	50%
11 to 25	20%	20%	25%	0%
26 to 40	10%	9%	15%	0%
41 to 75	5%	2%	5%	0%
76 to 100	5%	2%	5%	0%
100+	15%	16%	25%	33%

APPENDIX K: ENERGY-SAVING CONFIDENCE AND PRECISION

Residential

A multifaceted approach was taken to construct error bounds for final savings estimates due to methods varying across programs, and, in some cases, within individual programs. To determine the uncertainty level, two types of error were considered: measurement (or modeling) error; and sampling error. Measurement error refers to the uncertainty level around engineering parameters that derived from either simulation or professional judgment. Sampling error refers to uncertainty introduced by the use of sampled data to infer characteristics of the overall population.

For engineering calculations using either simulated or assumed parameters, measurement error was assumed to have a relative precision of ±10%. This accuracy level is regarded as a minimum for results in the evaluation industry, and any results taken from outside evaluations or based on engineering analysis would likely be reliable within these bounds.

An example of this would be the effective full-load hours (EFLH) used in many of the HVAC calculations. These values come from simulations conducted by the EPA and, as such, have no sampling error. They aren't, however, deterministic (presumably average EFLH deviates from these values). Absent documentation on this level of uncertainty, we assume that they are accurate within what the industry regards as a standard threshold: ±10% relative precision with 90% confidence.

Sampling error was calculated for parameters estimated through some sort of sampling. These data included: survey results, meter data, and those from secondary sources. Sampled data were used in the evaluation of several programs to estimate parameters to be used in per-unit savings calculations (such as installation rates), or in the consumption of specific equipment types (such as in billing analysis).

In some cases, uncertainty of estimates derived from multiple sources. For example, for summed estimates, such as those for total program savings, the root of the sum of the squared standard errors was calculated to estimate the confidence interval:[33]

$$Confidence\ Interval_{\bar{X}+\bar{Y}} = (\bar{X} + \bar{Y}) \pm 1.645 * \sqrt{\left(\frac{s^2{}_{\bar{X}}}{n_{\bar{X}}}\right) + \left(\frac{s^2{}_{\bar{Y}}}{n_{\bar{Y}}}\right)}$$

In some cases, Cadmus multiplied estimates. For example, evaluating the ARP gross per-unit savings calculations involved combining full-year gross estimates from a regression-based metering analysis, with average annual running times estimated from participant surveys. For

[33] This approach to aggregation errors follows methods outlined in Appendix D from Schiller, Steven et. al. "National Action Plan for Energy Efficiency". Model Energy Efficiency Program Impact Evaluation Guide. 2007. www.epa.gov/eeactionplan.

these results, Cadmus calculated combined standard errors for the final estimates. In cases where the relationship was multiplicative, Cadmus used the following formula:[34]

$$Confidence\ Interval_{\bar{X}*\bar{Y}} = \bar{X} * \bar{Y} \pm 1.645 * \sqrt{\bar{Y}^2\left(\frac{s^2{}_{\bar{X}}}{n_{\bar{X}}}\right) + \bar{X}^2\left(\frac{s^2{}_{\bar{Y}}}{n_{\bar{Y}}}\right) + \left(\frac{s^2{}_{\bar{X}}}{n_{\bar{X}}}\right)\left(\frac{s^2{}_{\bar{Y}}}{n_{\bar{Y}}}\right)}$$

Table 202. Residential Energy Savings Precision

Program	Precision at 90% Confidence	Sources of Uncertainty
Residential Lighting	±6%	Participant survey, draft Ohio TRM values
Residential Appliance Recycling	±5%	Secondary meter data, participant survey
Residential Low-income	±5%	Participant survey, draft Ohio TRM values
Residential HVAC Rebate	±3%	Billing analysis, draft Ohio TRM values
Residential HVAC Tune-Up	±25%	Billing analysis, draft Ohio TRM values
Residential Energy Education	±1%	Family Home Installation survey, draft Ohio TRM values

Non-residential

For commercial and industrial programs, DP&L provided Cadmus with a project database that included calculated and deemed (*ex ante*) savings values for each nonresidential project. Cadmus performed site visits and engineering desk reviews to calculate *ex post* savings for a sample of projects. We used these desk reviews to estimate realization rates, which we applied to non-sampled projects to obtain estimates of realized savings. We divided desk review samples into custom and prescriptive programs, and performed the analyses separately.

For the prescriptive program, we first estimated savings, standard errors, and precision levels by measure type, and then rolled up these results into the overall prescriptive savings estimate, standard error, and precision level. In addition, since lighting projects spanned an especially wide range of *ex ante* savings values (from 30 KWh to over 0.8 million KWh), we analyzed prescriptive lighting savings by strata, as indicated in the following table.

Table 203. Prescriptive Lighting Stratification

	Small	Medium	Large
kWh Range	0 to 125,000	125,000 to 500,000	Over 500,000
Number of Projects	487	50	9
Total *ex ante* kWh	11,470,685	10,818,125	7,452,567

[34] Derived from Goodman, Leo, "The Variance of the Product of K Random Variables," Journal of the American Statistical Association. 1962.

We also separated custom projects into three strata: large custom, small custom, and new construction.

Table 204. Custom Stratification

	New Construction	Small	Large
kWh Range	NA	0 to 50,000	Over 50,000
Number of Projects	14	57	22
Total *ex ante* kWh	1,597,063	620,748	18,295,910

The remaining project types were prescriptive HVAC, prescriptive motors, and prescriptive other, and we treated each of these groups as a single stratum.

We sampled projects from the large strata heavily for verification. This emphasis reduced uncertainty in overall savings estimates by directly verifying a large proportion of savings. We obtained total savings estimates and precision levels with 90% confidence, as shown in the table below.

Table 205. Nonresidential Gross Energy Savings, Custom and Prescriptive

Prescriptive Program Savings		Custom Program Savings	
Total Estimated Savings (KWh)	Precision at 90% Confidence	Total Estimated Savings (KWh)	Precision at 90% Confidence
34,537,857	±11%	19,612,273	±3%

Energy savings estimates for individual measure categories are shown below. For each estimate, we provided precision at the 90% levels. Categories with large kWh savings totals have tighter precision than those with small savings totals. This is because we allocated evaluation resources with the goal of producing efficient program-level estimates.

Table 206. Nonresidential Summary of Energy Savings Precision Estimates

Measure Type	Reported Savings (kWh)	Estimated Savings (KWh)	Realization Rate	Precision at 90% Confidence
Prescriptive HVAC	1,638,180	3,260,110	199.00%	±37%
Prescriptive Lighting	29,741,377	28,079,664	94.40%	±10%
Prescriptive Motors	2,984,246	3,053,244	102.30%	±64%
Prescriptive Other	130,980	144,839	110.60%	±155%
Custom	20,513,721	19,612,273	95.60%	±3%

EXHIBIT 2

BEFORE
THE PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of The Dayton Power and Light Company's Portfolio Status Report.	))))	Case No. 12-1420-EL-POR

Affidavit of Bryce Nickel

State of Ohio)
) SS:
County of Montgomery)

I, Bryce Nickel, being first duly cautioned and sworn, do hereby swear and affirm the following to the best of my knowledge and belief:

1. I have attained the age of eighteen and have personal knowledge of the matters set forth herein.

2. I am the Vice President of Service Operations for the Dayton Power and Light Company ("DP&L"). As part of my overall responsibilities, I am responsible for ensuring DP&L's compliance with statutorily imposed energy efficiency and peak demand reduction requirements.

3. DP&L has met its statutory benchmarks for energy efficiency and peak demand reduction as set forth in the Portfolio Status Report being filed contemporaneously with this Affidavit.

FURTHER AFFIANT SAYETH NAUGHT.

Bryce Nickel

Sworn to and subscribed in my presence on this 2nd day of May, 2012.

Notary Public

EDWARD N. RIZER, Attorney at Law
Notary Public, State of Ohio
My Commission has no expiration date
Section 147.03 O. R. C.

This foregoing document was electronically filed with the Public Utilities

Commission of Ohio Docketing Information System on

5/15/2012 2:58:16 PM

in

Case No(s). 12-1420-EL-POR, 11-4627-EL-WVR

Summary: Notice of the Dayton Power and Light Company's Portfolio Status Report electronically filed by Mrs. Jessica E Kellie on behalf of The Dayton Power and Light Company