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**VOLUME 1:
2015 TO 2019
ENERGY EFFICIENCY/
PEAK DEMAND REDUCTION
(EE/PDR) ACTION PLAN**

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E EXECUTIVE SUMMARY

E.1 AEP Ohio's Commitment and Strategic Plan Goals

AEP Ohio is committed to helping customers use energy more efficiently and productively by delivering cost-effective programs that provide value to all stakeholders.

The strategic goals of this 2015-2019 Energy Efficiency and Peak Demand Reduction (EE/PDR) Action Plan (Plan) are to:

- Deliver a comprehensive and cost-effective Plan providing the opportunity for participation by all customer rate classes and every major customer segment in every region of AEP Ohio's service territory.
- Reduce inefficient uses of electricity while improving customer productivity, comfort and safety, and increasing satisfaction.
- Provide additional customer financial resources through energy savings for other important needs and to offset rising costs.
- Help delay the need for new electricity generation and future related rate impacts.
- Continue to provide the lowest cost alternative to new generation.
- Reduce the environmental impacts of fossil fuel generation facilities and the cost of compliance with environmental regulations.
- Help provide sustainable jobs for Ohio.
- Increase economic development in Ohio.
- Meet or exceed Ohio Senate Bill (SB) 221 energy efficiency and peak demand reduction requirements.¹
- Comply with Ohio Revised Code 4901:1-39 for Plan content.²

E.2 Summary of 2015-2019 EE/PDR Plan

This Plan is the third plan developed and submitted for approval to the Public Utilities Commission of Ohio (PUCO) by AEP Ohio, following the current approved 2012-2014 EE/PDR Action Plan.³ The Plan is modeled based on the current market potential study, baseline analyses and actual results from programs delivered through the current Plan.

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

² See <http://codes.ohio.gov/oac/4901%3A1-39>

³ See PUCO dockets 11-5568-EL-POR and 11-5569-EL-POR for the 2012-2014 EE/PDR Action Plan

This Plan has been lengthened from three years to five years for several reasons:

- A market potential study has been completed for this Plan and AEP Ohio agrees with PUCO staff's recommendation in the revised green rules to increase the length of time from three to five years for market potential study updates⁴. The current rules do not require Plans to be completed on a three year basis; however, Plans have been filed every three years to coincide with the three year market potential study update time frame. AEP Ohio intends to file for an exception to the three year potential study update requirement in this Plan filing.
- A five year Plan reduces administrative burden on the part of AEP Ohio, stakeholders and the PUCO, while maintaining adequate oversight and review through ongoing annual filings of Plan status reports and EE/PDR rider true ups, as well as regular reporting and stakeholder input through the AEP Ohio Collaborative of stakeholders.
- The increase in Plan length will reduce costs for all customers. Plan and market potential study development is a significant cost and increasing the Plan length by two years is expected to save customers nearly \$250,000 in Plan development without reducing planning quality or alignment with market conditions.
- Moving to a five year Plan at this time also reflects an experienced AEP Ohio EE/PDR staff with the capability to manage the longer-term Plan effectively based on their proven track record of cost effective goal achievement.
- AEP Ohio has a history of working collaboratively with stakeholders through its Collaborative and with other interested parties and plans to continue that effort in an open, transparent and flexible manner throughout this Plan period.
- The period from 2015 through 2018 represents a stable period of 1 percent incremental energy benchmarks and the conclusion of the cumulative peak demand reduction requirements in 2018. Costs are more predictable as well.
- For 2019, AEP Ohio has sufficient banked savings available prior to the implementation of the 2015-2019 Plan to pledge a minimum of 1 percent in 2019 so that this Plan can be designed to meet or exceed 1 percent in that year, reducing costs for all customers.
- AEP Ohio's position at this time is that 2020 represents a critical year of review to determine if then implemented federal codes and standards will diminish the ability of utilities in Ohio to reach the mandated 2 percent goals past 2019 in a cost effective manner, without significantly increasing costs for all customers.
- AEP Ohio and interested stakeholders need more time leading up to 2020 to develop the future planning necessary to address this challenge and a five year

⁴ See PUCO Docket 13-0651-EL-ORD

plan implementation and approval provides that opportunity. Lower statutory goals and/or Plan cost caps may need to be considered in order to continue cost effective programs at reasonable costs for all customers.

- Whether the legislative mandates for energy efficiency and peak demand reduction remain the same, change or are eliminated, this Plan is provided for approval to the Commission for the full term of the Plan. The Plan benefits for all customers and the state of Ohio are significantly higher than the cost.

The Plan reflects the continuance of successful existing programs and modifications to improve program success. In addition, new programs have been added to the Plan to encourage greater participation by customers. Collaborative stakeholder input has been instrumental in identifying and adding new programs and modifications to existing ones. Segmentation continues to be enhanced, enabling targeted marketing to continue increasing customer participation. Ongoing Plan viability, customer acceptance, customer satisfaction and cost effectiveness are critically important; therefore, the Plan continues a rigorous research and development function, to ensure ongoing effective energy efficiency programs that deliver strong performance. The research and development function will also allow new program opportunities identified over the Plan life to be tested, measured and integrated into the program offerings after passing AEP Ohio's screening process.

Significant effort was made to design the Plan at a lower cost on an annual basis than the 2012-2014 approved EE/PDR Action Plan, even though the benchmark requirements are higher. The Plan is designed to meet or exceed the benchmark energy efficiency and peak demand reduction requirements in Ohio law, while capping Plan costs at the 2013 approved levels on average for the 2015-2019 Plan.

This Plan allows the flexibility to adjust and shift incentives between programs to maximize cost effectiveness and increase customer participation as conditions change over the five year period. Any shifting of incentives between residential and commercial/industrial customer classes would require separate PUCO approval and is not expected at this time. AEP Ohio proposes to develop separate residential and business pools of incentive dollars, allocating those incentive dollars to the programs that are the most cost effective and have the highest customer participation each year. Further, AEP Ohio intends to utilize competitive bidding for business incentive dollars through its Bid to Win program in the fall of each year to provide competitive intelligence that can be used to set business program incentives in the following year.

Cost management and overall improvement strategies for the 2015-2019 Plan include:

- Provide program opportunities to improve cost effectiveness while also increasing customer participation and satisfaction.

- Continue and enhance the successful programs currently being delivered; however, focus on adjusting incentives for all programs based on market conditions through competitive bidding and ongoing market analyses.
- Pool some incentive dollars into residential and business buckets to be delivered to customers through approved programs based on cost effectiveness and program participation. Identify methods of reducing the cost of managing and delivering incentives.
- Increase multifamily opportunities for new construction and home retrofit programs.
- Investigate building code compliance educational opportunities and attribute appropriate savings.
- Focus on total electric residential customer opportunities to increase savings per home, including manufactured housing.
- Improve target marketing in all sectors.
- Increase customer awareness of AEP Ohio programs with research and segmentation, to increase opportunities for all customers to participate.
- Add Combined Heat and Power and Waste Energy Recovery (CHP/WER) program and deliver performance based and highly cost effective customer projects to help offset cost effectiveness losses by other programs to codes and standards changes.
- Enhance Continuous Energy Improvement (CEI) program to increase customer productivity and reduce energy density for large scale energy savings at lower cost.
- Provide AEP Ohio side of the meter customer energy efficiency programs such as Volt Var and investigate light-emitting diode (LED) street lighting and LED outdoor lighting programs.
- Continue to investigate upstream and midstream approaches as well as direct opportunities to deliver cost effective energy efficiency measures.

EE/PDR is an important resource for the state of Ohio, AEP Ohio and its customers, continuing to be important as future fuel and commodity prices remain volatile and environmental regulation becomes more stringent. EE/PDR may become an effective resource to help state compliance with potential future federal greenhouse gas regulations. Estimates of EE/PDR potential are a key input to the integrated resource planning process, which considers the load forecast and both supply-side and demand-side resources. The market potential study that informs this Plan is the result of a current analysis of the EE/PDR market potential in AEP Ohio's service territory by Navigant Consulting, Inc. (Navigant), an experienced EE/PDR consultant, under the direct supervision and guidance of AEP Ohio. The market potential study included the results of a recent baseline study completed in AEP Ohio's service territory and the

direct experience of AEP Ohio in its current program Plan performance, as well as benchmarking and best practices program analyses from other utility programs.

Ohio law in SB 221 requires investor-owned electric utilities to achieve incremental energy savings each year through EE/PDR programs, with a cumulative 22.2 percent by the end of 2025. Utilities also must implement programs designed to reduce peak energy demand one percent beginning in 2009, and an additional 0.75 percent per year, for a total 7.75 percent through 2018.

Table 1 presents SB 221 EE/PDR percentage requirements and associated energy and summer peak demand requirements for 2015 through 2019, which is the focus of this EE/PDR Action Plan.

Table 1. SB 221 Savings Requirements (at Meter) – 2015 to 2019

SB 221 Requirements				
At Meter	Energy Savings (GWh)			
Year	Incremental		Cumulative (2009 Through)	
2015	1.0%	420.8	5.2%	2,295.7
2016	1.0%	424.9	6.2%	2,720.6
2017	1.0%	425.6	7.2%	3,146.2
2018	1.0%	426.3	8.2%	3,572.5
2019	2.0%	854.5	10.2%	4,427.0
At Meter	Peak Demand Savings (MW)			
Year	Incremental		Cumulative (2009 through)	
2015	0.75%	49	5.50%	479.0
2016	0.75%	55	6.25%	533.9
2017	0.75%	54	7.00%	587.8
2018	0.75%	63	7.75%	650.5
2019	NA	NA	NA	NA

AEP Ohio plans to meet or exceed the SB 221 savings requirements for 2015 to 2019, ensuring that all customer classes have energy saving opportunities. The Plan presents detailed information on the approach, energy efficiency and demand response measures and proposed incentive levels. AEP Ohio anticipates that portions of the Plan will need to be adjusted during implementation in response to better information or changing market conditions. AEP Ohio will update the PUCO in accordance with the rules, and advise the AEP Ohio Collaborative regarding the need for any substantive revisions to this Plan.

E.3 Summary of EE/PDR Program Results

Table 2 presents the actual savings results submitted to the PUCO for 2011 and 2012 programs.

Table 2. EE/PDR Plan Savings Results (at Meter) – 2011 to 2012

EE/PDR Plan Savings Results 2011 to 2012						
At Meter	Energy Savings (GWh)					
Year	Incremental			Cumulative (2009 through)		
	SB 221 Requirement	GWh Achieved	Achievement as Percent of Sales	SB 221 Requirement	GWh Achieved	Achievement as Percent of Sales
2011	0.7%	502	1.04%	1.5%	1,117	0.79%
2012	0.8%	571	1.22%	2.3%	1,688	0.90%
At Meter	Peak Demand Savings (MW)					
Year	Incremental			Cumulative (2009 through)		
	SB 221 Requirement	MW Achieved	Achievement as Percent of Sales	SB 221 Requirement	MW Achieved	Achievement as Percent of Sales
2011	0.75%	128	1.26%	2.50%	270	0.94%
2012	0.75%	82	0.86%	3.25%	352	0.92%

E.4 EE/PDR Plan Summary

AEP Ohio proposes to invest up to \$441.4 million over five years on energy efficiency and demand response programs and projects full year savings of 2,705 GWh and 433 MW cumulative annual savings at the meter over a five-year period during calendar years 2015 through 2019. The total customer bill savings from this investment estimated over the life of the installed EE/PDR measures are projected at approximately \$1.5 billion, using Participant Cost Test (PCT) net benefit results less program administrative costs. Further, the total net benefits based on the Total Resource Cost (TRC) test are projected to be about \$615 million, including reparticipation over the 20-year planning horizon, excluding Combined Heat and Power/Waste Energy Recovery (CHP/WER). With every dollar of program investment yielding over 1.6 dollars in benefits, using the TRC test net benefit results.

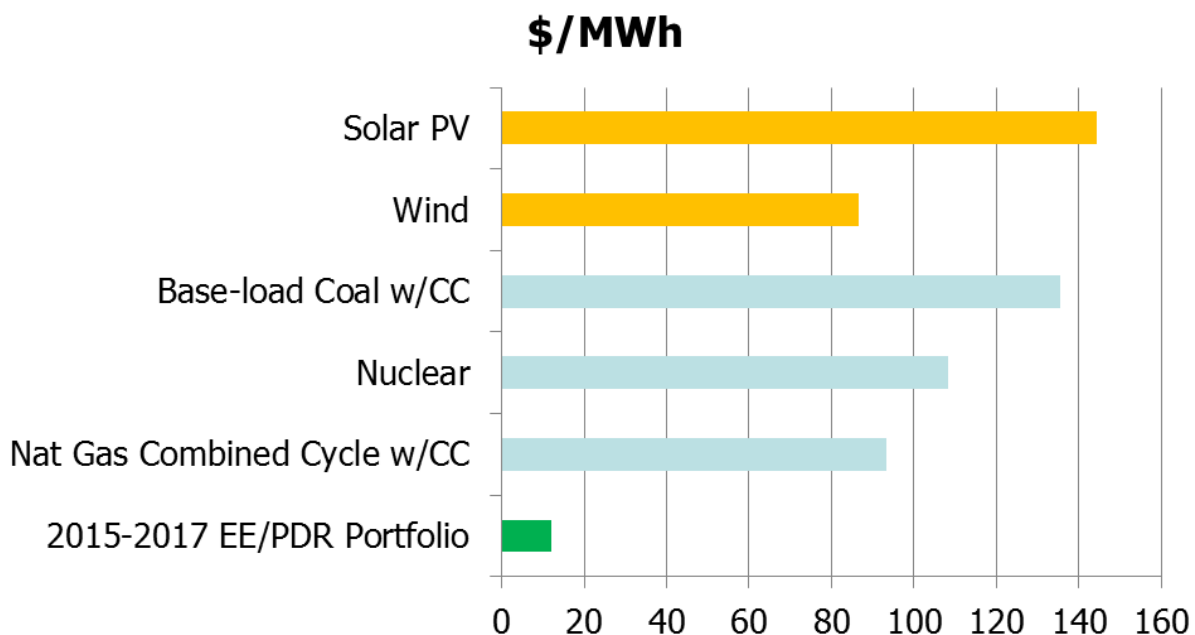
The overall Plan projected first year annual cost per kWh saved is \$0.16/kWh (note that this cost is not comparable to a supply-side investment and is only used to compare programs and Plans at a high level for reasonableness of cost.) This Plan continues the previous Plan's anticipation that the lower cost lighting opportunities are going to be significantly less available over time; however, growing commercial and industrial

measures are expected to make up for some of those losses. Large institutional or industrial combined heat and power projects can be highly cost effective in the right applications and may provide significant opportunities to help offset the loss of low cost lighting applications. Another opportunity reflected in this Plan is the shift to LED lighting. While incremental annual savings will be lower, LED lighting measure life will help improve cost effectiveness.

This Plan reflects an ongoing reduction in lighting savings resulting from changes in baselines due to federal lighting standards and projected deeper savings from higher cost, but still cost effective, measures and measure combinations. AEP Ohio’s actual program experience with costs has been factored into the 2015-2019 Plan cost projections.

The lifetime cost of saved energy is estimated to be \$0.013/kWh for the 2015 to 2019 EE/PDR Plan. The lifetime cost of saved energy is more comparable to a supply-side generation investment alternative. At current supply-side generation investment alternatives including non-dispatchable technologies such as wind and solar, the EE/PDR Plan cost compares favorably and is the lowest cost alternative, as shown in Figure 1.

Figure 1. EE/PDR vs. Supply-Side Investments



Supply-side investments source: Energy Information Administration, Annual Energy Outlook 2013, January 2013, DOE/EIA-0383 (2012).

The division of EE/PDR program investment between residential and business customers is commensurate with each sector’s relative cost-effectiveness and contribution to the Plan. Table 3 provides the projected savings, associated funding for

AEP Ohio's 2015 through 2019 program Plan, and projected net present value net benefits.

Table 3. Savings Goals and Efficiency Plan Investment – 2015 to 2019

Consumer Sector (Incremental Annual Savings at Meter)	2015	2016	2017	2018	2019	2015-2019 Total (Cumulative)	NPV Net Benefits (Million \$ 2015\$)
Energy Savings (GWh)	130	128	133	138	141	591	\$136
% Savings of Sector Sales	0.95%	0.95%	0.99%	1.02%	1.05%	4.41%	-
Note: Behavior Change program savings are not cumulative. Combined Heat and Power / Waste Energy Recovery savings are presented in 2015-2019 Total (Cumulative) only; and are not presented in 2015 to 2019 Incremental Annual Savings.							
Demand Savings (MW)	21	20	20	20	21	90	-
% Savings of Sector Sales	0.61%	0.59%	0.60%	0.60%	0.62%		-
Note: Demand savings goals are not cumulative. Behavior Change program savings are not cumulative. Combined Heat and Power / Waste Energy Recovery savings are not presented in 2015 to 2019 Incremental Annual Savings.							
Total Cost (million \$)	\$30.2	\$30.6	\$34.0	\$36.5	\$37.1	\$168.4	-
Business Sector (Incremental Annual Savings at Meter)	2015	2016	2017	2018	2019	2015-2019 Total (Cumulative)	NPV Net Benefits (Million\$ 2015\$)
Energy Savings (GWh)	299	309	317	321	326	2,114	\$511
% Savings of Sector Sales	1.09%	1.12%	1.15%	1.16%	1.18%	7.70%	-
Note: Combined Heat and Power / Waste Energy Recovery savings are presented in 2015-2019 Total (Cumulative) only, and are not presented in 2015 to 2019 Incremental Annual Savings.							
Demand Savings (MW)	53	54	54	54	55	343	-
% Savings of Sector Sales	1.12%	1.13%	1.14%	1.14%	1.15%		-
Demand savings goals are not cumulative. Behavior Change program savings are not cumulative. Combined Heat and Power / Waste Energy Recovery savings are not presented in 2015 to 2019 Incremental Annual Savings.							
Total Cost (million \$)	\$44.2	\$46.2	\$47.0	\$47.5	\$48.0	\$233.0	-

Total All Sectors (Incremental Annual Savings at Meter)	2015	2016	2017	2018	2019	2015-2019 Total (Cumulative)	NPV Net Benefits (Million \$ 2015\$)
Energy Savings (GWh)	429	438	450	459	468	2,705	\$615
% Savings of Sector Sales	1.04%	1.06%	1.10%	1.12%	1.14%	6.60%	-
Note: Behavior Change program savings are not cumulative. Combined Heat and Power / Waste Energy Recovery savings are presented in 2015-2019 Total (Cumulative) only; and are not presented in 2015 to 2019 Incremental Annual Savings.							
Demand Savings (MW)	74	74	75	74	75	433	-
% Savings of Sector Sales	0.91%	0.91%	0.92%	0.92%	0.93%		-
Note: Demand savings goals are not cumulative. Behavior Change program savings are not cumulative. Combined Heat and Power / Waste Energy Recovery savings are not presented in 2015 to 2019 Incremental Annual Savings.							
Total Cost (million \$)	\$74.4	\$76.8	\$81.0	\$84.0	\$85.1	\$401.4	-
Other Costs (million \$)	\$8.0	\$8.0	\$8.0	\$8.0	\$8.0	\$40.0	
Portfolio Total Investment (million \$)	\$82.4	\$84.8	\$89.0	\$92.0	\$93.1	\$441.4	-

(1) Savings are not projected for Research and Development, Transmission and Distribution (T&D) System Efficiency Improvements, Customer Power System Efficiency or Demand Response. AEP Ohio also will conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables, and Plan cost-benefit analysis.

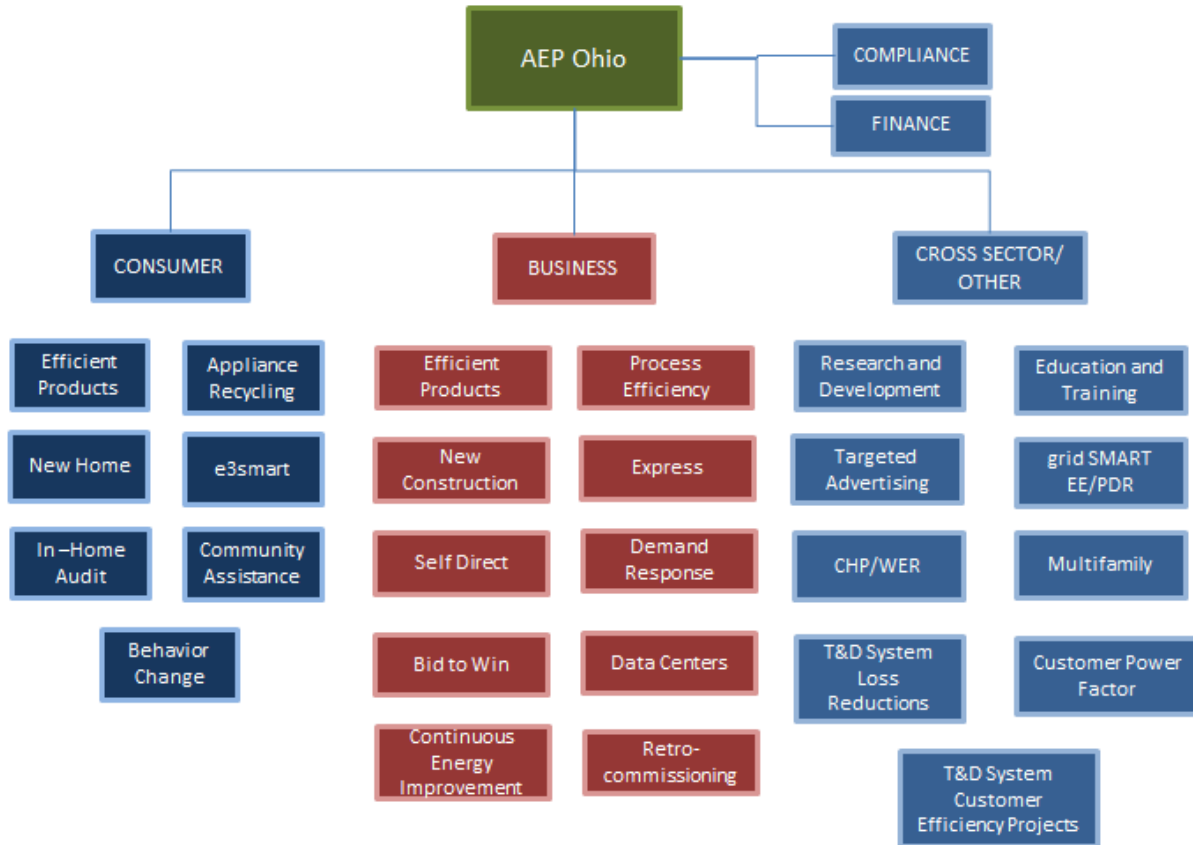
(2) Other Costs include support and other services, including Research and Development, General Education and Training, Targeted Advertising, and Demand Response, etc.

Incentive levels and other program elements will be reviewed and adjusted to reflect changes in market conditions or implementation processes in order to maximize cost-effective savings.

Plan Structure

Figure 2 presents the proposed Plan structure, including seven consumer sector and ten business sector programs, as well as nine cross-sector programs and other activities. AEP Ohio also will conduct program evaluation and other essential program support functions, such as compliance and reporting, financials, database management, contracting and payables and Plan benefit-cost analysis. The new programs are Multifamily, Combined Heat and Power / Waste Energy Recovery (CHP/WER), Customer Power Factor and transmission and distribution (T&D) Customer Efficiency Projects.

Figure 2. EE/PDR Action Plan Structure – 2015 to 2019



E.5 Energy, Demand and Emissions Savings

Table 4 presents the projected incremental annual GWh energy savings for each year as well as 2015 to 2019 cumulative total, TRC test results, net present value net benefits in 2015 million dollars, lifetime energy saved in thousand MWh, and lifetime cost of saved energy in 2015 dollars per kWh over the five-year period from 2015 to 2019.

Table 4. Incremental Annual Energy (GWh) Savings at Meter – 2015 to 2019

Consumer Sector	'15	'16	'17	'18	'19	'15- '19 Total (cumulative)	% of Plan Total	Total Resource Cost Test (TRC)	NPV Net Benefits (million 2015\$)	Lifetime Energy Saved (thousand MWh)	Lifetime Cost of Saved Energy (2015\$ / kWh)
Appliance Recycling	17	15	15	15	15	76	2.8%	2.3	\$14.9	609	\$0.019
Behavior Change	9	9	9	9	9	9	0.3%	1.2	\$0.4	9	\$0.207
Community Assistance	8	9	9	10	9	43	1.6%	0.8	-\$5.5	560	\$0.060
e3smart	5	5	5	5	5	24	0.9%	3.0	\$9.8	216	\$0.011
Efficient Products	74	74	78	81	84	353	13.1%	1.7	\$100.9	3,605	\$0.018
In-Home Energy	10	10	10	11	12	51	1.9%	1.2	\$4.4	577	\$0.032
New Home	6	7	7	7	7	34	1.3%	1.4	\$10.7	671	\$0.015
Consumer Sector Total	130	128	133	138	141	591	21.8%	1.6	\$135.7	6,246	\$0.023
% Total of Consumer Sector Sales	0.95%	0.95%	0.99%	1.02%	1.05%	Note: Behavior Change savings are not cumulative.					

Business Sector	'15	'16	'17	'18	'19	'15- '19 Total (cumulative)	% of Plan Total	Total Resource Cost Test (TRC)	NPV Net Benefits (million 2015\$)	Lifetime Energy Saved (thousand MWh)	Lifetime Cost of Saved Energy (2015\$ / kWh)
New Construction and Major Renovation	32	36	36	36	36	173	6.4%	2.6	\$63.5	1,757	\$0.010
Continuous Energy Improvement	14	16	17	15	14	74	2.7%	1.2	\$8.3	369	\$0.037
Process Efficiency	65	63	67	65	65	325	12.0%	2.8	\$155.7	4,685	\$0.007
Data Center	8	7	7	6	6	34	1.3%	1.2	\$3.7	169	\$0.041
Bid to Win	43	45	45	44	45	222	8.2%	1.2	\$26.2	2,216	\$0.006
Express	20	22	21	21	21	104	3.8%	1.5	\$23.4	790	\$0.025
Efficient Products for Business	99	100	105	111	118	515	19.1%	1.7	\$150.2	4,732	\$0.014
Retro-Commissioning	3	4	4	4	5	20	0.7%	1.2	\$2.2	99	\$0.028
Self-Direct	11	11	12	13	13	26	1.0%	3.3	\$25.4	258	\$0.021
Multifamily	4	5	5	4	4	22	0.8%	1.2	\$2.4	187	\$0.049
Combined Heat and Power/Waste Energy Recovery	-	-	-	-	-	600	22.2%	1.2	\$50.0	9,600	\$0.002
Business Sector Total	299	309	317	321	326	2,114	78.2%	1.6	\$510.9	24,863	\$0.008
% Total of Business Sector Sales	1.09%	1.12%	1.15%	1.16%	1.18%	Note: CHP/WER annual savings are not presented.					
PLAN TOTAL (includes Other Costs)	429	437	450	459	467	2,705	100%	1.6	\$615.2	31,109	\$0.013
% Total of Total Sales	1.04%	1.08%	1.10%	1.12%	1.14%	Note: CHP/WER annual savings are not presented.					

Table 5 presents the projected incremental annual summer peak demand MW savings levels as well as the cumulative total over the five-year period from 2015 to 2019.

Table 5. Incremental Annual Summer Peak Demand (MW) Savings at Meter – 2015 to 2019

Consumer Sector	2015	2016	2017	2018	2019	2015-2019 Total (cumulative)	Percent of Plan Total
Appliance Recycling	2.3	2.1	2.1	2.1	2.1	10.8	2.5%
Behavior Change	1.2	1.2	1.2	1.2	1.2	1.2	0.3%
Community Assistance	1.1	1.2	1.2	1.3	1.2	5.6	1.3%
e3smart	0.5	0.6	0.5	0.5	0.5	2.6	0.6%
Efficient Products	11.1	10.0	9.7	9.3	9.8	44.7	10.3%
In-Home Energy	1.9	1.9	2.1	2.3	2.5	10.0	2.3%
New Home	2.8	2.8	3.4	3.3	3.2	15.4	3.6%
Consumer Sector Total	21.0	19.8	20.2	20.1	20.6	90.4	20.9%
Percent Total of Sector Sales	0.61%	0.59%	0.60%	0.60%	0.62%	-	-
Business Sector	2015	2016	2017	2018	2019	2015-2019 Total (cumulative)	Percent of Plan Total
New Construction and Major Renovation	2.9	3.2	3.2	3.2	3.3	15.7	3.6%
Continuous Energy Improvement	2.9	3.5	3.5	3.2	2.9	15.7	3.6%
Process Efficiency	14.3	13.6	13.9	13.1	12.8	66.8	15.4%
Data Center	0.8	0.7	0.6	0.6	0.6	3.1	0.7%
Bid to Win	7.2	7.5	7.4	7.4	7.5	36.9	8.5%
Express	4.0	4.2	3.9	3.7	3.6	18.9	4.4%
Efficient Products for Business	18.4	18.3	18.7	19.5	20.4	92.9	21.4%
Retro-Commissioning	0.5	0.6	0.7	0.7	0.8	3.3	0.8%
Self-Direct	1.3	1.2	1.3	1.4	1.4	2.7	0.6%
Multifamily	1.0	1.2	1.1	1.0	0.9	5.1	1.2%
CHP/WER	-	-	-	-	-	81.9	18.9%
Business Sector Total	53.3	55.0	54.0	53.8	54.2	343.0	79.1%
Percent Total of Sector Sales	1.12%	1.13%	1.14%	1.14%	1.15%	-	-
Plan Total	74.3	74.8	74.2	73.9	74.8	433.3	-
Percent of Total Sales	0.91%	0.91%	0.92%	0.92%	0.93%	-	-

Table 6 presents the estimated total emissions reductions based on the projected cumulative annual energy savings at meter over the five-year period from 2015 to 2019.⁵

Table 6. Total Emissions Reductions – 2015 to 2019

Consumer Sector	NOx (metric tons)	SO₂ (metric tons)	CO₂ (metric tons)	H_g (lbs.)
Appliance Recycling	50	151	40,435	2.5
Behavior Change	6	19	4,976	0.3
Community Assistance	29	88	23,694	1.5
e ³ smart SM	16	49	13,146	0.8
Efficient Products	255	775	207,747	12.8
In-Home Energy	34	104	28,028	1.7
New Home	22	68	18,123	1.1
Consumer Sector Total	413	1,253	336,148	20.6
Business Sector	NOx (metric tons)	SO₂ (metric tons)	CO₂ (metric tons)	H_g (lbs.)
New Construction & Major Renovation	114	346	92,768	5.7
Continuous Energy Improvement	49	149	39,993	2.5
Process Efficiency	213	645	172,987	10.6
Data Center	23	70	18,768	1.2
Bid to Win	145	439	117,714	7.2
Express	69	210	56,230	3.5
Efficient Products for Business	348	1,056	283,339	17.4
Retro-Commissioning	13	40	10,795	0.7
Self-Direct	39	117	31,476	1.9
Multifamily	15	45	11,941	0.7
CHP/WER	1,176	3,564	956,081	58.7
Business Sector Total	2,204	6,681	1,792,092	110.0
PLAN TOTAL	2,617	7,934	2,128,241	130.6

E.6 EE/PDRs Investment and Potential Job Creation

The estimated investment for these programs is approximately \$88.3 million in each year from 2015-2019, for a total \$441.4 million, as shown in Table 7.

⁵ Emissions factors from PJM.

Table 7. Estimated Annual Total Investments by Program (million \$)

Consumer Sector	2015	2016	2017	2018	2019	2015-2019 Total (cumulative)	Percent of Plan Total
Efficient Products	\$13.2	\$13.0	\$15.4	\$17.6	\$18.0	\$77.3	17.5%
Community Assistance	\$7.4	\$8.0	\$8.1	\$7.9	\$7.9	\$39.4	8.9%
In-Home Energy	\$3.9	\$3.8	\$4.3	\$4.7	\$5.1	\$21.9	5.0%
Appliance Recycling	\$2.9	\$2.6	\$2.6	\$2.6	\$2.6	\$13.2	3.0%
New Home	\$1.9	\$2.0	\$2.5	\$2.6	\$2.6	\$11.7	2.7%
Behavior Change	\$0.4	\$0.4	\$0.4	\$0.4	\$0.4	\$2.2	0.5%
e3smart SM	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6	\$2.8	0.6%
Consumer Sector Total	\$30.2	\$30.6	\$34.0	\$36.5	\$37.1	\$168.4	38.2%
Business Sector	2015	2016	2017	2018	2019	2015-2019 Total (cumulative)	Percent of Plan Total
Efficient Products for Business	\$14.5	\$14.6	\$15.2	\$16.1	\$16.9	\$77.3	17.5%
Process Efficiency	\$7.9	\$7.5	\$7.5	\$7.1	\$6.8	\$36.8	8.3%
Express	\$4.5	\$4.9	\$4.7	\$4.6	\$4.6	\$23.3	5.3%
New Construction and Major Renovation	\$3.8	\$4.3	\$4.3	\$4.3	\$4.3	\$21.0	4.8%
Continuous Energy Improvement	\$2.9	\$3.5	\$3.5	\$3.2	\$2.9	\$16.0	3.6%
Bid to Win	\$3.2	\$3.4	\$3.3	\$3.3	\$3.3	\$16.5	3.7%
CHP/WER	\$1.7	\$2.1	\$2.6	\$3.1	\$3.5	\$13.0	2.9%
Multifamily	\$1.9	\$2.5	\$2.3	\$2.1	\$2.0	\$10.7	2.4%
Self-Direct	\$1.1	\$1.1	\$1.3	\$1.5	\$1.4	\$6.5	1.5%
Data Center	\$1.9	\$1.7	\$1.5	\$1.5	\$1.4	\$8.0	1.8%
Retro-Commissioning	\$0.5	\$0.6	\$0.6	\$0.7	\$0.8	\$3.3	0.7%
Demand Response	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.5	0.1%
Business Sector Total	\$44.2	\$46.2	\$47.0	\$47.5	\$48.0	\$233.0	52.8%
Other Costs	2015	2016	2017	2018	2019	Total	Percent of Plan Total
Targeted Advertising & Outreach	\$5.3	\$5.3	\$5.3	\$5.3	\$5.3	\$26.5	6.0%
Research and Development	\$2.0	\$2.0	\$2.0	\$2.0	\$2.0	\$10.0	2.3%
Education and Training	\$0.7	\$0.7	\$0.7	\$0.7	\$0.7	\$3.5	0.8%
Other Costs Total	\$8.0	\$8.0	\$8.0	\$8.0	\$8.0	\$40.0	9.1%
PLAN TOTAL	\$82.4	\$84.8	\$89.0	\$92.0	\$93.1	\$441.4	-

(1) Savings are not projected for Research and Development, Education and Training, Targeted Advertising or Demand Response. AEP Ohio also will conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables, and Plan cost-benefit analysis.

(2) Other Costs include support and other services, including Research and Development, General Education and Training, Targeted Advertising, and Demand Response, etc.

To firm up cost estimates and make any necessary budget and schedule changes, AEP Ohio may re-negotiate existing contracts for ongoing programs or issue Requests for Proposals (RFPs) for implementation contractors to bid on the work, and require

them to submit detailed budgets along with estimated savings and implementation schedules. All new programs will be competitively bid through an RFP process. The cost for incremental internal management and third party evaluation, measurement and verification activities, and future plan development is included in the cost of the Plan. It is anticipated that these costs will not exceed ten percent of the total costs for the Plan.

Potential Job Creation

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

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

Table 8 shows the total number of potential jobs—direct, indirect, and induced—that are estimated would be created from investing \$441.4 million in electric energy efficiency and peak demand reduction in AEP Ohio customer homes and businesses in 2015 through 2019. AEP Ohio estimates the number of jobs in Table 8.⁶ On average, based on this analysis, one job potentially will be created for approximately \$100,000 in spending.

⁶ Job creation estimates based on data from Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy, pages 9 and 27, Political Economy Research Institute, University of Massachusetts at Amherst, http://www.americanprogress.org/issues/2008/09/pdf/green_recovery.pdf

Table 8. Number of Jobs Created (2015 through 2019)

2015 to 2019	Direct	Indirect	Induced	Total
Jobs Created	1,950	1,450	975	4,375

E.7 Benefit-Cost Analysis, Net Benefits and Bill Impacts

Energy efficiency measures were evaluated with respect to each of the four standard benefit-cost tests:⁷

- **Participant Test (PCT):** Measures are cost effective from this perspective if the reduced electric costs to the participating customer from the measure exceed the after-incentive cost of the measure to the customer.
- **Utility (or program administrator) (UCT) Cost Test:** Measures are cost effective from this perspective if the costs avoided by the measures' energy and demand savings are greater than the utility's EE/PDR program costs to promote the measure, including customer incentives.
- **Ratepayer Impact Measure (RIM) Test:** Measures are cost effective from this perspective if their avoided costs are greater than the sum of the EE/PDR program costs and the "lost revenues" caused by the measure.
- **Total Resource Cost (TRC) Test:** Measures are cost effective from this perspective if their avoided costs are greater than the sum of the measure costs and the EE/PDR program administrative costs.

In line with standard industry practice and PUCO rule, AEP Ohio used the TRC test to guide which EE/PDR programs to include in the Plan. Most measures passed the TRC test. The Plan of EE/PDR programs in the Plan are cost effective by industry standards.

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

Table 9 presents the overall benefit cost ratios for the consumer sector, the business sector, and the overall Plan including all costs from cross-sector and other activities.

Table 9. Cost-effectiveness Ratios – 2015 to 2019

Consumer Sector	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Rate Impact Measure Test (RIM)
Appliance Recycling	2.3	2.3	7.7	0.4
Behavior Change	1.2	1.2	0.0	0.3
Community Assistance	0.8	0.6	3.0	0.3
e3smart	3.0	6.1	8.0	0.5
Efficient Products	1.7	3.8	4.0	0.5
In-Home Energy	1.2	1.5	3.4	0.4
New Home	1.4	3.6	3.0	0.5
Consumer Sector Total	1.6	2.6	4.0	0.4
Business Sector	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Rate Impact Measure Test (RIM)
New Construction and Major Renovation	2.6	5.8	4.4	0.7
Continuous Energy Improvement	1.2	3.7	2.3	0.5
Process Efficiency	2.8	7.6	3.6	0.9
Data Center	1.2	2.8	2.8	0.5
Bid to Win	1.2	10.6	1.5	0.8
Express	1.5	3.5	3.3	0.5
Efficient Products for Business	1.7	5.4	2.6	0.7
Retro-Commissioning	1.2	4.5	1.7	0.7
Self-Direct	3.3	6.7	5.1	0.8
Multifamily	1.2	1.7	4.4	0.4
CHP/WER	1.2	18.1	1.2	1.0
Business Sector Total	1.6	6.6	2.2	0.8
Plan Total (includes Other Costs)	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Rate Impact Measure Test (RIM)
	1.6	4.6	2.6	0.7

Projected Net Benefits

The formulas used to determine the net benefits for each benefit-cost test are provided in Table 10. After all tests are evaluated by calculating the net present values over the lifetimes of the measures covered by the 20-year planning horizon. The total net

benefits for each benefit-cost test for the 2015-2019 EE/PDR Plan are calculated by subtracting the value(s) in the denominator of each formula from the value(s) in the numerator. For example, subtracting both Administrative Costs (B) and Incentive Costs (C) from the Avoided Costs (A) results in the the UCT net benefits.

Table 11 presents the present value costs for the 2015-2019 EE/PDR Plan. The Avoided Costs (A) and Bill Reductions (E) result from energy savings and are valued as benefits. The Administrative Costs (B), Incentive Costs (C), and Technology Costs (D) are valued as costs.

Table 10. Benefit-Cost Test Formulas

Cost Test	Formula	Key of Terms	
Utility Cost Test (UCT)	$UCT = A / (B + C)$	A = PV Avoided Costs	D = PV Technology Costs
Participant Cost Test (PCT)	$PCT = (C + E) / D$	B = PV Administrative Costs	E = PV Bill Reductions
Rate Impact Measure Cost Test (RIM)	$RIM = A / (B + C + E)$	C = PV Incentive Costs	PV = Present Value
Total Resource Cost Test (TRC)	$TRC = A / (B + D)$		

Table 11. Present Value Costs – 2015 to 2019 (2015\$)

PV Avoided Costs (A)	PV Administrative Costs (B)	PV Incentive Costs (C)	PV Technology Costs (D)	PV Bill Reductions (E)
\$1,711,817,207	\$137,105,377	\$240,154,491	\$959,552,030	\$2,245,373,773

Utility Cost Test (UCT) indicates how much utility costs will decrease due to the projected EE/PDR programs. The UCT examines the EE/PDR costs and benefits from the AEP Ohio’s perspective. The UCT allows AEP Ohio to evaluate EE/PDR benefits and costs on a comparable basis with supply-side investments. A positive UCT indicates the total EE/PDR costs to save energy are less than the AEP Ohio’s costs to deliver the same amount of power through new supply side resources. The net benefits from the UCT is the reduction in supply costs to AEP Ohio due to reduced energy consumption.

Participant Cost Test (PCT) examines the costs and benefits from the perspective of the customer installing the EE/PDR measures. The PCT shows how much the EE/PDR program participants are projected to save over the life of the measures installed.

Rate Impact Measure Test (RIM) indicates how much AEP Ohio’s rates are projected to increase or decrease over the long term as a result of the EE/PDR

measures installed. Unlike typical supply-side investments, EE/PDR programs reduce energy sales. It is also important to consider whether rates overall will increase more or less by installing EE/PDR measures than new supply side resources over the long term.

Total Resource Cost Test (TRC) shows how much more or less energy efficiency resources cost compared to new supply-side electricity resources in the AEP Ohio service area. Unlike other cost tests, the TRC does not take the view of a class of stakeholders. The TRC test is essentially the “all ratepayer” test. The TRC is similar to the UCT except that the TRC considers the full cost of the measure itself rather than only the portion covered by the incentive paid by AEP Ohio.

Table 12 presents the cost test results in terms of net present value (NPV) net benefits based on the projected 2015 to 2019 EE/PDR programs. A positive value indicates cost savings, while a negative value indicates increased costs.

Table 12. Costs Tests – Net Present Value Net Benefits – 2015-2019 (2015 \$million)

Consumer Sector	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Rate Impact Measure Test (RIM)
Efficient Products	\$100.9	\$179.3	\$384.4	(\$283.5)
In-Home Energy	\$4.4	\$9.3	\$39.9	(\$35.4)
Appliance Recycling	\$14.9	\$14.9	\$53.4	(\$38.5)
Behavior Change	\$0.4	\$0.4	\$5.2	(\$4.8)
New Home	\$10.7	\$25.7	\$41.7	(\$31.0)
E3smart™	\$9.8	\$12.4	\$26.2	(\$16.4)
Community Assistance	(\$5.5)	(\$12.9)	\$43.9	(\$49.4)
Consumer Sector Total	\$135.7	\$229.1	\$594.7	(\$459.0)
Business Sector	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Rate Impact Measure Test (RIM)
Efficient Products for Business	\$150.2	\$288.3	\$295.1	(\$144.9)
Process Efficiency	\$155.7	\$208.5	\$179.5	(\$23.8)
New Construction and Major Renovation	\$63.5	\$85.0	\$116.5	(\$53.0)
Express	\$23.4	\$49.3	\$89.4	(\$66.0)
Self Direct	\$25.4	\$30.8	\$35.8	(\$10.4)

Retro-Commissioning	\$2.2	\$9.6	\$7.2	(\$5.0)
Continuous Energy Improvement	\$8.3	\$36.4	\$54.1	(\$45.7)
Bid to Win	\$26.2	\$134.9	\$65.2	(\$39.1)
Data Center	\$3.7	\$12.7	\$26.1	(\$22.5)
Combined Heat and Power and Waste Energy Recovery	\$50.0	\$275.2	\$40.5	\$9.5
Multifamily	\$2.4	\$6.6	\$21.5	(\$19.1)
Business Sector Total	\$510.9	\$1,137.3	\$930.9	(\$420.0)
Plan Total (includes Other Costs)	TRC	UCT	PCT	RIM
	\$615.2	\$1,334.6	\$1,525.2	(\$910.8)

Table 13 shows the projected UCT results by program by year for 2015 to 2019.

Table 13. Utility Cost Test (UCT) – Net Present Value Net Benefits (2015 \$million)

Consumer Sector	2015	2016	2017	2018	2019	2015-2019 Total
Efficient Products	\$39.7	\$37.7	\$35.7	\$33.7	\$32.5	\$179.3
In-Home Energy	\$1.9	\$1.8	\$1.9	\$1.9	\$1.9	\$9.3
Appliance Recycling	\$3.3	\$3.0	\$2.9	\$2.9	\$2.8	\$14.9
Behavior Change	\$0.0	\$0.1	\$0.1	\$0.1	\$0.1	\$0.4
New Home	\$5.3	\$5.2	\$5.8	\$5.3	\$4.2	\$25.7
e3smart SM	\$2.7	\$2.6	\$2.4	\$2.4	\$2.3	\$12.4
Community Assistance	(\$3.1)	(\$2.9)	(\$2.9)	(\$1.9)	(\$2.1)	(\$12.9)
Consumer Sector Total	\$49.8	\$47.4	\$45.9	\$44.3	\$41.7	\$229.1

Business Sector	2015	2016	2017	2018	2019	2015-2019 Total
Efficient Products for Business	\$60.3	\$58.2	\$57.3	\$57.5	\$55.0	\$288.3
Process Efficiency	\$46.2	\$42.9	\$42.9	\$39.7	\$36.8	\$208.5
New Construction and Major Renovation	\$17.2	\$18.5	\$17.6	\$16.6	\$15.0	\$85.0
Express	\$10.5	\$11.0	\$10.1	\$9.3	\$8.4	\$49.3
Self-Direct	\$6.7	\$6.0	\$6.4	\$6.4	\$5.2	\$30.8
Retro-Commissioning	\$1.8	\$1.9	\$2.0	\$2.1	\$1.9	\$9.6
Continuous Energy Improvement	\$7.2	\$8.4	\$8.2	\$7.2	\$5.4	\$36.4
Bid to Win	\$29.8	\$29.5	\$27.8	\$26.2	\$21.5	\$134.9
Data Center	\$3.3	\$2.8	\$2.5	\$2.3	\$1.8	\$12.7
Combined Heat and Power and Waste Energy Recovery	Not presented.					\$275.2
Multifamily	\$1.2	\$1.6	\$1.4	\$1.3	\$1.1	\$6.6
Business Sector Total	\$184.3	\$180.9	\$176.1	\$168.5	\$152.3	\$1,137.3
Plan Total (includes Other Costs)	2015	2016	2017	2018	2019	2015-2019 Total
	\$226.0	\$220.2	\$213.9	\$204.8	\$185.9	\$1,334.6

Projected Electric Bill Reductions

The projected reductions in electric bills for participants in each consumer and business sector program over the life of the measures installed during 2015 to 2019 is approximately \$1.5 billion. This amount includes the Plan cost of the programs.

The next section discusses the approach to estimating EE/PDR potential, along with an overview of EE/PDR Potential results for 2015 to 2034, and then program plans are presented, followed by conclusions and recommendations.

E.8 2015 to 2034 EE/PDR Savings Potential Analysis

AEP Ohio’s program Plan was developed by incorporating elements of the most successful energy efficiency and peak demand reduction programs across North America many of which are already being delivered by AEP Ohio, into program plans designed for the Ohio market and AEP Ohio customers in particular. AEP Ohio used a benchmarking process to review the selected programs, with a focus on successful AEP Ohio and other programs in the Midwest to help shape this Plan.

As detailed in Figure 3 there are four major types of EE/PDR potential:

1. *Technical* potential for all technologies.
2. *Economic* potential, the amount of EE/PDR available that is cost effective.
3. *Achievable* potential, the amount of EE/PDR available under current market conditions and available investments.
4. *Program* potential, the amount of EE/PDR available given limited resources, available time and duration of the efficiency program planning period.

AEP Ohio’s EE/PDR Action Plan is focused on capturing cost-effective *program potential* in its service territory while achieving SB 221 requirements for 2015 to 2019. Most energy efficiency measures that were known not to be cost-effective were pre-screened and eliminated from all potential scenarios. Some measures not cost-effective were included as part of an overall program delivery strategy for high customer satisfaction and participation.

Figure 3. The Four Stages of Energy Efficiency Potential

Not Technically Feasible	Technical Potential			
Not Technically Feasible	Not Cost Effective	Economic Potential		
Not Technically Feasible	Not Cost Effective	Market and Adoption Barriers	Achievable Potential	
Not Technically Feasible	Not Cost Effective	Market and Adoption Barriers	Program Design, Budget, Staffing, and Time Constraints	Program Potential

Source: Reproduced from "Guide to Resource Planning with Energy Efficiency November 2007", US EPA. Figure 2-1.

AEP Ohio undertook the EE/PDR potential study with the following key tasks:

- Conduct a baseline market profile study, which included conducting telephone surveys and on-site surveys with random samples of AEP Ohio’s residential and non-residential customers. The telephone surveys collected information on customers’ awareness of AEP Ohio programs and energy efficiency measures, as well as customers’ energy efficient equipment decision making criteria. The on-site surveys conducted detailed inventories of customers’ energy using equipment, as well as building shell characteristics.
- Develop baseline consumption profiles, and develop initial building simulation model specifications.
- Characterize the EE/PDR measures.
- Conduct an EE/PDR benchmarking and best practices analysis.
- Conduct benefit-cost analysis (discussed in Section E.7).
- Estimate EE/PDR potentials.
- Develop EE/PDR program plans.

A summary of each of these tasks follows.

Baseline Market Assessments

AEP Ohio conducted a baseline study of the residential market segments in 2013 to characterize AEP Ohio’s service territory in terms of customer numbers, age and size of household and housing stock, key building characteristics, saturation of efficient technologies, and customer awareness of and decision making about efficient options. Appendix A in Plan Volume 2 includes detailed baseline survey results.

Baseline Consumption Profiles and Simulation Model Specifications

Segment-level commercial and industrial sales data delivered by AEP Ohio provide a good starting point to determine customer energy use in broad end-use categories, such as lighting, heating, and cooling. These profiles were the calibration points in developing hourly computer models of energy consumption. With building characteristics from the baseline study, the models were used to estimate savings from EE/PDR measures.

The derivation of the residential electricity market profile relied on monthly consumption data and benchmark monthly profiles of end uses to derive annual electricity consumption for seasonal and non-seasonal uses. The starting point in this exercise was

the AEP Ohio system-level residential electricity consumption by month for 2012-2013. The household total electricity consumption by month was calculated from this data. There are four seasonal end uses that were tabulated (heating, cooling, hot water, and lighting) in addition to the non-seasonal end uses (includes appliances, plug loads, and other). Results of the baseline study were used for technology saturation data.

Characterizing EE/PDR Measures

Characterization of EE/PDR measures requires:

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

In addition, the baselines must consider that different classes of buildings have different penetrations of technologies, such as existing homes compared to new construction. A combination of approaches to characterize the EE/PDR measures was used for this study. For EE/PDR measures having impacts that do not vary with climate, data was used from several different sources, including: ongoing AEP Ohio programs, the 2013 residential and baseline study, the Ohio Statewide TRM for climate-dependent measures, and engineering estimates, as well as publicly available and well-respected sources, such as the California Database on Energy-Efficiency Resources (DEER) database. The approach adjusted the DEER energy and demand impacts for AEP Ohio's customer operating parameters as necessary based on the local weather. In addition to using data from ongoing AEP Ohio programs, or the draft Ohio Statewide TRM for climate-dependent measures, the analysis used a combination of building simulation modeling and engineering estimates specifically developed for AEP Ohio to estimate EE/PDR measure per unit savings.

For EE/PDR measure costs, in addition to using data from ongoing AEP Ohio programs or the draft Ohio Statewide TRM for climate dependent data, AEP Ohio primarily used the California DEER database, adjusted by geographic multiplier factors from industry sources, such as the RS Means Mechanical Cost Data.⁸ A variety of sources were used to establish measure lifetimes, including, ongoing AEP Ohio programs, the draft Ohio Statewide TRM, manufacturer data, typical economic depreciation assumptions, and the California DEER database. Appendix C in Plan Volume 2 provides detailed measure descriptions and characterizations.

⁸ <http://rsmeans.reedconstructiondata.com/>

EE/PDR Benchmarking and Best Practices Assessment

To ensure that the demand side management (DSM) potential estimates developed are reasonable and appropriate, and to identify the best practices of DSM programs, AEP Ohio conducted a benchmarking assessment on other utilities' DSM programs, in Ohio and in neighboring states, that have similar DSM requirements and Plans and available data about them. To identify common best practices of top performers, the analysis compared detailed program results by customer sector of those utilities identified as achieving high levels of DSM savings for below-median costs.

Table 14 shows the 2012 and 2013 median EE/PDR benchmarking data for AEP Ohio and eleven other Midwest utilities, including overall spending, savings, costs, and energy costs. Appendix B in Plan Volume 2 provides more benchmarking results.

Table 14. 2012 EE/PDR Benchmarking Data

	Spending as Percent of Revenue	Energy Savings as Percent of Sales	Peak Demand Savings as Percent of Peak Demand	Retail Cost of Energy \$/kWh	Cost of First Year Savings (1)	
					\$/kWh	\$/kW
All Region Median 2012	1.2%	1.2%	0.8%	\$0.11	\$0.10	\$671
AEP Ohio 2012	1.2%	1.1%	0.7%	\$0.09	\$0.10	\$688
AEP Ohio 2013 (2)	1.7%	1.3%	1.0%	\$0.08	\$0.10	\$642

(1) Note: Cost of First Year Savings is not comparable to a supply-side investment and is only used to compare programs and Plans at a high level for reasonableness of cost.

(2) AEP Ohio 2013 results have not been evaluated.

For 2012, the utilities with the largest relative energy savings and below-median costs achieved energy savings at about 1.4 percent of annual sales. The utilities with the largest relative peak demand savings and below-median costs saved about 1.1 percent of peak demand. AEP Ohio saved more than the median amount of savings from the utilities' benchmarked in 2012 and 2013, and AEP Ohio's program costs were lower than the median program costs.

EE/PDR Program Potentials

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

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

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

1. A base case or expected EE/PDR potential estimates. These estimates assume that adequate funding is available to achieve the EE/PDR potentials and that AEP Ohio is able to achieve "best practice" EE/PDR program performance over the short term, from 2015 to 2019.
2. A high case estimate based on the experience of the best of the best utilities' EE/PDR program results, to meet the SB 221 requirements over the long term, through 2034.

The Plan's Business Sector will achieve greater energy and demand savings than the base case scenario. As a result, the overall Plan is projected to achieve energy and demand savings above the Base Case.

EE/PDR Potential Results

The cumulative annual EE/PDR potential savings (Base Case Scenario Market Potential) in 2034 is estimated to be approximately 10.3 thousand GWh at meter, about 24 percent of forecast baseline sales, and approximately 1,670 MW at meter, about 19 percent of baseline peak summer demand, as shown in Table 15. Table 15 also presents the projected savings in 2034 for the technical, economic, and high market potential scenarios.

These results assume a net-to-gross impact ratio of 1.0 whereby free ridership is assumed for this analysis to be offset by spillover impacts. The Base Case market potential meets the SB 221 savings targets over the short term, from 2015 to 2019. Note that in 2019, AEP Ohio is utilizing its banked savings to reach the 2 percent benchmark requirement, so the potential study assumes a 1 percent requirement. The high case market potential meets the SB 221 cumulative savings targets over the long term, through 2034. Unless already specified for a particular measure, the Base Case market potential includes incentives at 50 percent of incremental measure costs. The High Case market potential includes incentives at 75 percent of incremental measure

costs in most instances for each measure, unless the existing incentive was greater than 75 percent. Appendix A in Plan Volume 2 provides detailed EE/PDR potential study results.

Table 15. Projected Cumulative Annual Savings at Meter and Costs – 2034

Potential Scenario	Cumulative Annual Gross Energy Savings at Meter (2034) (1)		Cumulative Annual Gross Summer Peak Demand Savings at Meter (2034) (1)		Total Cost (Energy Efficiency Only) (2)
	GWh	Percent of 2034 Forecast Sales	MW	Percent of 2034 Forecast Sales	20 Year Cost (2015 to 2034) (million 2015\$)
Residential					
Technical	5,750	41.1%	1,409	38.5%	-
Economic	3,626	25.9%	914	25.0%	-
High Case	4,090	37.7%	723	22.4%	\$1,203
Base Case	2,549	18.2%	459	12.6%	\$694
Commercial and Industrial (does not include Agricultural or CHP/WER)					
Technical	20,232	70.3%	2,982	60.1%	-
Economic	18,656	64.8%	2,942	59.3%	-
High Case	11,825	45.6%	1,822	40.5%	\$1,847
Base Case	7,727	26.8%	1,211	24.4%	\$994
Total					
Technical (3)	28,107	65.7%	4,820	55.9%	-
Economic	22,283	52.1%	3,856	44.7%	-
High Case	15,915	37.2%	2,545	29.5%	\$3,094
Base Case	10,276	24.3%	1,670	19.4%	\$1,688

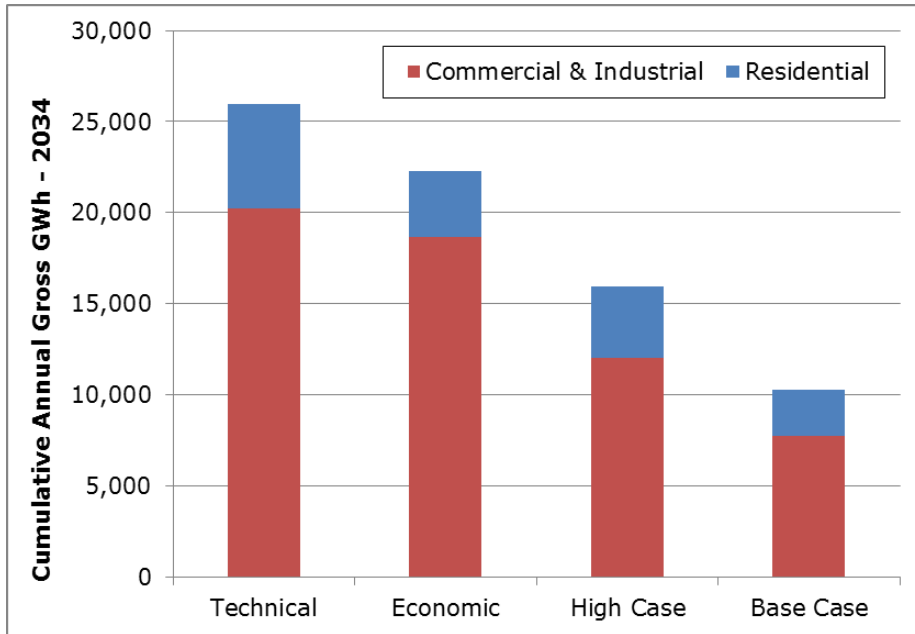
(1) Savings are not projected for Research and Development, Education and Training, Targeted Advertising, Demand Response. For comparative purposes, savings are not included for Agricultural or Combined Heat and Power / Waste Energy Recovery. AEP Ohio also will conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables, and Plan cost-benefit analysis.

(2) Other Costs include support and other services, including Research and Development, General Education and Training, Targeted Advertising, and Demand Response, etc.

(3) Total technical potential includes codes and standards.

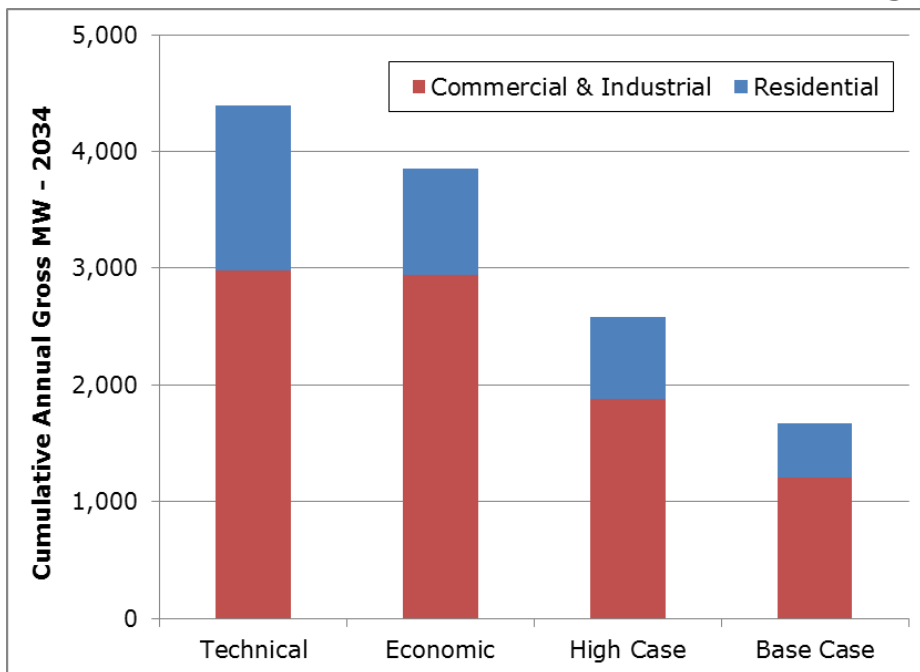
Figure 4 and Figure 5 show the cumulative annual energy and summer peak demand savings in 2034 for each of the four potential analysis scenarios.

Figure 4. Cumulative Annual GWh Energy Savings in 2034



Note: Savings are not projected for Research and Development, Education and Training, Targeted Advertising, Demand Response. For comparative purposes, savings are not included for Agricultural or Combined Heat and Power / Waste Energy Recovery. AEP Ohio also will conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables, and Plan cost-benefit analysis. Total technical potential includes codes and standards.

Figure 5. Cumulative Annual Summer Peak MW Demand Savings in 2034

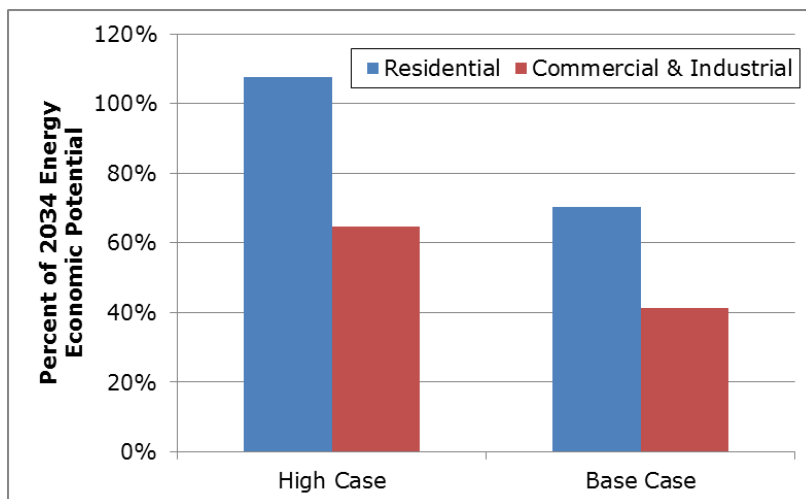


Note: Savings are not projected for Research and Development, Education and Training, Targeted Advertising, Demand Response. For comparative purposes, savings are not included for Agricultural or Combined Heat and Power / Waste Energy Recovery. AEP Ohio also will conduct program evaluation and other essential program support

functions, such as compliance and reporting, database management, contracting and payables, and Plan cost-benefit analysis. Total technical potential includes codes and standards.

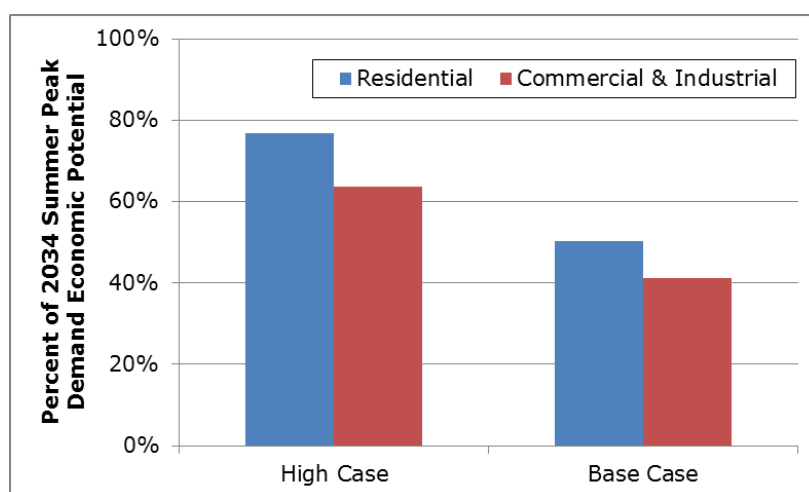
Figure 6 and Figure 7 show the cumulative Market Potential⁹ as a percent of the Economic Potential for EE/PDR.

Figure 6. Market Potential Annual Energy Savings at Meter as Percent of Economic Potential in 2034



Note: Savings are not projected for Research and Development, Education and Training, Targeted Advertising, Demand Response. For comparative purposes, savings are not included for Agricultural or Combined Heat and Power / Waste Energy Recovery. AEP Ohio also will conduct program evaluation and other essential program support functions, such as compliance and reporting, database management, contracting and payables, and Plan cost-benefit analysis. Total technical potential includes codes and standards.

Figure 7. Peak Demand Savings at Meter as Percent of Economic Potential in 2034



Note: Savings are not projected for Research and Development, Education and Training, Targeted Advertising, Demand Response. For comparative purposes, savings are not included for Agricultural or Combined Heat and Power / Waste Energy Recovery. AEP Ohio also will conduct program evaluation and other essential program support

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

functions, such as compliance and reporting, database management, contracting and payables, and Plan cost-benefit analysis. Total technical potential includes codes and standards.

E.9 Overview of Program Plans

The overview of the Plan presented here is to provide a sense of scope and scale and to convey the general schedule and resources needed to increase participation in the various markets in which AEP Ohio will operate the programs. The plans for newly-proposed programs developed are based on best-practice programs and the experience gained by AEP Ohio through its 2012-2014 Plan, with the strategic concepts outlined. These program plans are proposed as guidelines for more detailed program planning. An update is presented for ongoing programs, along with proposed program modifications that were approved in the 2012-2014 EE/PDR Action Plan.

Overall, the Plan covers a broad range of demographic, business, facility and end-use markets. AEP Ohio's Plan can be divided into consumer, business and cross-sector, with utility administrative functions providing support across all program areas. AEP Ohio will maintain as part of its functions the education and training, advertising, and research and development budgets.

Consumer Sector

AEP Ohio currently offers seven consumer (residential) sector programs:

- **Efficient Products** – This program produces long-term electric savings by increasing the market share of efficient lighting and appliances through price markdowns, coupons and rebates.
- **Appliance Recycling** – This program permanently removes operable second refrigerators and freezers and primary refrigerators and freezers that have been replaced by recycling them in an environmentally safe manner.
- **In-Home Audit** – This program provides custom, prioritized recommendations on appropriate weatherization measures and the installation of high-efficiency lighting, appliances, HVAC and other equipment based on an in-home audit (all electric only), in-home assessment or online energy survey of a customer's single family or multifamily home. Free energy saving items such as CFL light bulbs and electric water heater measures (e.g., low-flow shower head, faucet aerators, pipe wrap), are installed or provided to participating customers. Joint program delivery with other local gas utilities is under consideration.
- **Behavior Change** – This program provides tips that are relevant to a customer's home and provides an estimate on how much electricity and money they may save by implementing suggested energy efficiency measures and changing energy usage behaviors.

- **New Home** – This program produces long-term electric energy savings by affecting the construction of single family homes, duplexes and multifamily housing to meet select ENERGY STAR® efficiency standards on insulation, HVAC, water heating, appliances, lighting, windows, doors and other quality construction measures.
- **e³smartSM school** program – This energy efficiency education program is for students of schools served by AEP Ohio and the curriculum is designed to meet national and state science standards for grades 5-12. Students take home energy efficiency measures and install them as part of the learning experience.
- **Community Assistance Program or CAP** – This program generates energy savings for residential low-income customers through the installation of a wide range of weatherization upgrades and base load electric measures. Qualified customers must be at or below 200 percent of the federal poverty level. Typically these customers are eligible for an energy assistance program such as Home Energy Assistance Program (HEAP), Percentage of Income Payment Plan (PIPP) or Home Weatherization Assistance Program (HWAP).

Business Sector

AEP Ohio currently offers ten business (nonresidential) sector programs:

- **Efficient Products for Business** (previously Prescriptive) – This program is based on a menu of standardized incentives for high efficiency lighting, heating, ventilation, and air conditioning (HVAC), motors, drives and refrigeration.
- **Process Efficiency** (previously Custom) – This program provides incentives for qualifying efficiency improvements not included in the Efficient Products for Business Program or other AEP Ohio Programs.
- **New Construction** – This program provides incentives for new construction and major renovation to exceed current building energy code requirements.
- **Self-Direct** – This program is available to capture retrospective energy savings from large mercantile customers with the capability to administer internal energy management efforts of their own. It allows submittal of energy saving projects from the last three years.
- **Demand Response** – This program is used to supplement the peak demand reductions achieved from energy efficiency programs in order to ensure the peak demand reduction benchmark requirements of SB 221 are met.
- **Express** – This program provides a streamlined, one-stop, turn-key service for small business customers and is delivered through a program implementer.
- **Retro-commissioning** – This program for medium and large customers provides assessments to identify and implement low-cost, operational

adjustments that improve the efficiency of existing buildings' operating systems by optimizing the systems to meet the building's requirements, with a focus on building controls and HVAC systems.

- **Continuous Energy Improvement** (previously Continuous Improvement) – This program is for large customers that consume significant amounts of energy. It is designed to engage corporate management to create a sustainable culture and planned actions to reduce energy use long term.
- **Bid to Win** (previously Energy Efficiency Auction) – This program is for business customers in the capital planning process considering large potential energy efficiency projects, or for aggregators of customer energy efficiency projects. The program will also be an input into annual incentive level pricing for other business programs based on auction results.
- **Data Center** – This program provides for energy savings opportunities for new and existing data centers of all sizes from data closets to enterprise class centers.

Cross-Sector Activities and Other Programs

AEP Ohio currently offers five cross-sector activities/programs and proposes to continue these efforts during the Plan period:

- **Education and Training** – This program will coordinate AEP Ohio's efforts to create customer, marketer, contractor and supplier awareness for the programs and the proper installation of measures, enhance demand and educate customers on energy efficiency.
- **Targeted Advertising** – This program is designed to build customer awareness of energy efficiency in support of AEP Ohio EE/PDR programs and also to encourage market transformation in support of AEP Ohio's commitment and key goals in this Plan.
- **gridSMART Enabled EE/PDR Savings** – This activity provides energy savings achieved from this project.
- **T&D Loss Reduction Projects** (formerly T&D and Internal System Efficiency Improvements) – This activity provides energy savings from AEP Ohio T&D projects that reduce losses on its system, thereby saving energy and demand.
- **Research and Development** – The program objective is to identify and develop new energy efficient technologies, programs and marketing approaches to capture cost effective energy and demand savings.

AEP Ohio proposes four new cross-sector programs:

- **Multi-Family** – This pilot program provides both consumer (tenant) and business (common areas) customers with energy savings opportunities and implementation of cost effective measures to existing and new construction buildings.
- **Combined Heat and Power and Waste Energy Recovery or CHP/WER** – This program is primarily for large high efficiency CHP/WER projects, now allowable through the passage of SB 315. The program provides performance based funding or supports EE/PDR rider exemptions for CHP/WER projects that meet all PUCO and AEP Ohio requirements.
- **T&D Customer Efficiency Projects** – These projects provide direct energy savings through the implementation of high efficiency technologies that reduce customer energy costs. Two projects included in this Plan are Volt Var and LED Street and Outdoor Lighting.
- **Customer Power Factor** – This program provides customers with specific technology measures that can be implemented to improve power quality and to produce energy measure and demand savings within the customers’ facilities.

E.10 Plan Implementation

AEP Ohio plans to continue implementing the proposed Plan through a combination of in-house utility staff and competitively selected third-party implementation contractors. For newly-proposed programs, AEP Ohio may issue request for proposals (RFP) to qualified firms for the program delivery. Implementation contractors are eligible to respond to any or all of the RFPs. From start to finish, AEP Ohio anticipates the process of issuing RFPs, evaluating responses and negotiating contracts along with associated program start-up time will result in 2015 launch dates for most newly-proposed programs. Remaining programs needing longer preparation times will begin on an extended schedule. For existing programs, AEP Ohio may issue RFPs or re-negotiate contracts with existing implementation contractors. AEP Ohio plans to issue RFPs for all contractors that have been in place for two previous approved Plan periods.

E.11 Evaluation, Measurement and Verification

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

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

Framework for Evaluation

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

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

Approach to Evaluation

The overall evaluation approach is based on an integrated cross-disciplinary model that includes evaluators as members of “project teams” involved in the various stages of program planning, design, monitoring and evaluation. This is a very cost-effective method that has been very successful for AEP Ohio over the last six years.

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

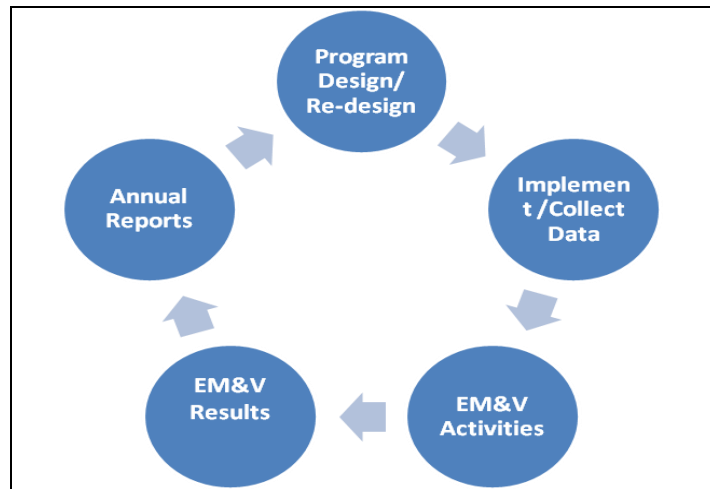
EM&V plans are designed to mitigate these problems. The process by which this is done is to integrate select data collection within the program implementation process and to provide near real-time feedback on key indicators of program progress. EM&V processes that take an “integrated data collection” (IDC) approach to planning seek out opportunities in the program implementation process where evaluation data can be collected efficiently, cost-effectively, accurately, and produce timely results. One example is program application forms, where programs can collect comparable data in standard formats across programs. Of course, this approach will be highly dependent of

the program design and the points where the program interacts with the customer or trade ally.

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

The IDC protocol garners participant feedback in near real-time to support process, market, and impact analyses. Examples include exit surveys with training participants designed by evaluation staff, but administered by program implementation staff: evaluation inputs on program application forms so key baseline data is collected before existing equipment is replaced, and regular transfer of program data to evaluators, so follow-up surveys can be implemented soon after program participation Figure 8 shows the program evaluation cycle.

Figure 8. Steps of the EM&V Process



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

- EM&V-related activities.
- Project savings verification and due diligence.
- Independent program evaluations.
- Independent assessment of annual program impacts.
- Internal quality assurance and control.

- Coordination of evaluation activities with other players, such as the PUCO statewide evaluator.

Independent Program Evaluations

Descriptions of proposed evaluations for each program are included in the program plans. The key components of the process and impact evaluations include:

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

Assessment of Annual Impacts

AEP Ohio's EM&V contractor will prepare an annual report of EE/PDR program results, which will incorporate findings from evaluation activities completed that year, changes to programs, and new programs implemented, as well as energy savings, costs and cost-effectiveness results by program and Plan. It is anticipated that the EM&V contractor's work, as well as participation in the process by the implementation contractor, will identify numerous areas where improvements and refinements to the AEP Ohio deemed measure database would be useful. As required, AEP Ohio will submit program evaluations to the PUCO statewide evaluator for its review.

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

AEP Ohio will require implementation contractors or staff to routinely contact or visit a sample of participating customers to assess the quality of program delivery and the installation of measures for which incentives were claimed. AEP Ohio intends to also track on an on-going basis incentive fulfillment time, technical services delivery times

(how long between customer request and audit completion for example), incentive documentation, and customer complaints among other metrics of program performance.

PJM Evaluation Requirements

AEP Ohio's EM&V plans will be developed to ensure that the evaluations to be conducted are done in a manner that enables AEP Ohio the ability to nominate achieved and verified energy efficiency and peak demand reduction values with a level of statistical confidence and precision that complies with PJM's Manual 18B Energy Efficiency Measurement & Verification.¹⁰

E.12 Plan Risk

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

AEP Ohio plans to use the following strategies to minimize the risks associated with its portfolio of EE/PDR programs in this Plan:

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

¹⁰ See <http://pjm.com/~media/documents/manuals/m18b.ashx>. PJM Interconnection is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia.

- Anticipating and preparing for stronger than expected market response.
- Conducting adequate market checks on standard practices and energy efficient product availability.
- Developing incentive structures that are simple to understand.
- Creating simple participation rules.
- Monitoring and responding to rapidly dropping equipment prices quickly.
- Setting appropriate qualifying efficiency levels.
- Setting appropriate incentive levels.
- Rolling out targeted marketing to contractors focusing on what is in it for them and how they participate.
- Training account managers on program rules.
- Establishing documentation, analysis methods and reporting requirements for technical studies.
- Managing the pipeline of projects and establishing decision deadlines so the response time to those waiting for decisions is reasonable.
- Expanding research and development to assist in mid-stream adjustments to current programs as needed and developing new programs for future implementation.

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

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

E.13 Conclusions and Recommendations

The EE/PDR potential (Base Case Scenario Market Potential) identified in this study represents energy reductions of approximately 28 percent for AEP Ohio residential customers and 31 percent for commercial and industrial customers below forecasted levels and known enacted energy codes and standards by 2034, or approximately 1.5 percent per year. This magnitude of savings has been achieved by best practice program portfolios in the Midwest, Northeast and Western U.S. Summer peak demand and annual energy reductions of the magnitudes found for the Base Market Potentials case are being achieved by a variety of utilities. Meeting the SB 221 targets over the long term, through 2034, will require energy reductions on the order projected in the High Case Scenario Market Potential, which have been achieved by few jurisdictions to date. Accordingly, the proposed 2015 to 2019 EE/PDR Plan includes energy savings goals above the base case scenario for the business sector.

Over time, AEP Ohio will need to increase EE/PDR activities beyond the Base Case Scenario Market Potential for 2015 to 2019 to achieve the projected long-term savings in the High Case Scenario Market Potential. Based on the results from the three-year 2012-2014 period, and considering additional program and measure offerings, in 2019, AEP Ohio will propose EE/PDR efforts beyond the five-year 2015 to 2019 period, to meet the SB 221 savings goals for 2020 to 2024.

The EE/PDR benchmarking analysis results presented in this report give AEP Ohio management confidence that a variety of utilities in the region and throughout the country are achieving large-scale results from their EE/PDR programs.

Utilities that choose to invest significantly in EE/PDR programs often make significant periodic investments to develop and update secondary best-practice and primary market research data to aid their EE/PDR program planning. AEP Ohio conducted a market assessment baseline study of the residential customer sector in 2013 that included significant on-site customer data collection. Both AEP Ohio's 2015 to 2019 EE/PDR Action Plan and the 2015 to 2034 potential study included significant customer data from the residential baseline study. In addition, AEP Ohio's significant direct experience with all customer classes in the implementation of its current Plan has aided the development of the 2015-2019 Plan.

Recommendations to consider include the following:

- Move results into operational planning with a focus on integrating newly proposed programs seamlessly and making ongoing adjustments.
- Consider both insourcing and outsourcing strategies to selectively jump-start key additions to the ongoing Plan and more cost effectively manage existing programs.

1 INTRODUCTION

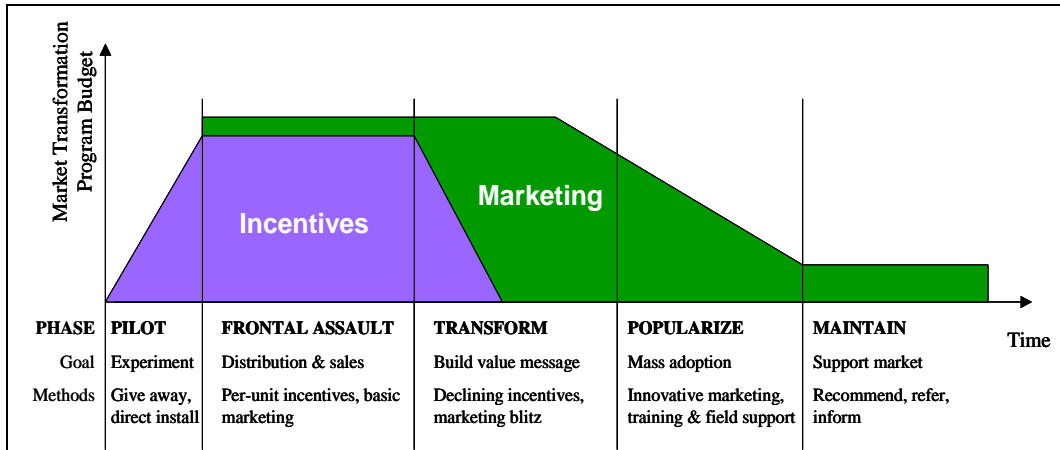
AEP Ohio or Ohio Power Company, is based in Gahanna, and is Ohio's second largest provider of electric service with a mix of 1.5 million residential, commercial and industrial customers. Pursuant to the requirements in 2008 Senate Bill (SB) 221 and Ohio Revised Code 4901:1-39, AEP Ohio submits this Plan for calendar years 2015 to 2019 for approval by the Public Utility Commission of Ohio (PUCO).

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

Together with stakeholders and the assistance of industry expert Navigant Consulting, Inc. (Navigant), AEP Ohio has designed a comprehensive EE/PDR Plan to deliver significant cost-effective electric efficiency savings. These programs include incentive and buy down approaches for energy efficient products and services, educational, marketing, and outreach approaches to raise awareness and enhance demand, and partnerships with trade allies to apply as much leverage as possible to augment the ratepayer dollars invested. Proper coordination between the programs is essential to maximizing this leverage.

As detailed in Figure 9, AEP Ohio anticipates that over time investment in energy efficiency measures will follow a predictable path of market transformation that has been experienced in other jurisdictions. With sustained levels of investment, promotion of efficient measures will in the early years focus on immediate up-front incentives to stimulate the marketplace. Over time, funds will be transitioned to marketing, training, education, and awareness to sustain program participation. Furthermore, as certain markets become transformed, and the baseline conditions become the efficient options, program resources will be transferred to new program areas and new technologies, and the process will repeat. Each series of the market transformation process will result in greater and more efficient opportunities for residential and business customers.

Figure 9. Phases of Energy Efficiency Promotion



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

Demand Side Management (DSM) is the planning and implementation of programs and services that help and encourage customers to use electricity as efficiently as possible. DSM represents an important resource for AEP Ohio, growing increasingly important as fuel and commodity prices become more volatile and greenhouse gas regulation becomes more likely. Estimates of DSM or (EE/PDR) potential are a key input to the integrated resource planning process, which considers the load forecast and both supply and demand-side resources. This study presents the results of an analysis of the EE/PDR potential in AEP Ohio’s service territory from 2015 to 2034.

1.1 AEP Ohio Overview

As described on AEP Ohio’s web site, the Company is a significant distribution utility in the Midwest. With approximately 1.5 million customers, AEP Ohio has a strong market presence. Figure 10 presents AEP Ohio’s service territory, which spans a large geographic area in Ohio. AEP Ohio provides power to more than 1,126 communities located in 61 of Ohio's 88 counties.

Figure 10. AEP Ohio’s Service Territories



Table 16 outlines key statistics for AEP Ohio.

Table 16. AEP Ohio Key Statistics¹¹

AEP Ohio's Business Profile 2012 Statistics	
Operating Information	
Total Customers	1,460,393
Residential	1,273,361
Commercial	173,948
Industrial	10,274
Other	2,810
2012 electrical sales in megawatt-hours	30,897,005
Size of service area (asset)	10,374 square miles
Communities served	1,126
Net plant in service	\$9.5 billion
Size of distribution system	45,583 miles
Size of transmission system	9,032 circuit miles
Total number of AEP Ohio employees	2,739
Financial Information	
2012 Operating Revenue	\$4.9 billion
2012 Net Income	\$343.5 million
2012 Ohio Taxes Paid	\$155.0 million
2012 Local Taxes Paid	\$210.7 million
Top 5 Customers (by revenue)	
Ormet Primary Aluminum Corporation	Republic Engineered Products Inc.
The Timken Company	The Ohio State University
Globe Metalurgical Inc.	

1.2 EE/PDR Study Goals and Approach

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

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

¹¹ https://aepohio.com/global/utilities/lib/docs/factsheets/aepohio_factsheet_1-14.pdf

AEP Ohio undertook the EE/PDR potential study with the following key tasks:

- Conduct a customer market baseline study using telephone and on-site customer surveys to profile AEP Ohio’s residential and non-residential customers.
- Develop baseline consumption profiles, and develop initial building simulation model specifications.
- Characterize the EE/PDR measures.
- Conduct an EE/PDR benchmarking and best practices analysis.
- Conduct benefit-cost analysis.
- Estimate EE/PDR potentials.
- Develop program plans.

These steps are discussed in more detail in Volumes 1 and 2 of the Plan.

1.3 2015 to 2019 EE/PDR Action Plan Report Organization

The remainder of AEP Ohio’s EE/PDR Action Plan is divided into the following sections:

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

Section 3: EE/PDR Plan Summary Results details the summary results of Plan electric savings, investment allocations and benefit-cost results.

Section 4: EE/PDR Program Plans presents detailed program plans for AEP Ohio’s proposed programs, with full descriptions for new programs.

Section 5: Glossary defines key terms used in the report.

Volume 2 Appendices include: EE/PDR Potential Study results (Appendix A); overall EE/PDR Benchmarking results (Appendix B); EE/PDR Measure Descriptions and Characterizations Results (Appendix C); and EE/PDR Methodology (Appendix D).

2 PLAN DEVELOPMENT

Based on a national review of leading EE/PDR programs, AEP Ohio is proposing a balanced Plan including EE/PDR programs that will achieve significant energy savings, while establishing trade ally and retailer partnerships resulting in lasting market transformation. AEP Ohio's programs will target all major sectors and customer classes, including low-income and small business customers.

AEP Ohio plans to continue offering a diverse Plan of "tried and true" major programs (some of which include sub-program components) across the residential, commercial and industrial sectors. Additionally, in this plan, AEP Ohio also proposes new programs, research and development activities targeting experimental opportunities, as well as broad-based education and training and targeted advertising.

2.1 Plan Tactical Objectives

In addition to AEP Ohio's strategic goals provided in the Plan Executive Summary, AEP Ohio has the following tactical objectives for the 2015-2019 Plan:

- Meet or exceed SB 221 resource acquisition goals for 2015-2019, while laying the groundwork for long-term market transformation.
- Design and implement a diverse group of programs that provide opportunities for participation by all customers.
- When feasible, maximize opportunities for program coordination with other efficiency programs to yield maximum benefits.
- Maximize program savings at a minimum cost by striving to achieve comprehensive cost-effective savings opportunities.
- Provide AEP Ohio customers with a single web site to access information on all efficiency programs (residential and business) for electricity savings opportunities.
- Expand the energy efficiency infrastructure in the state - for example, increasing the number of available qualified contractors.
- Transform the market for efficient technologies and highly qualified efficiency-oriented trade allies (such as electricians, air sealing and insulation contractors, HVAC contractors, home energy raters, builders, architects and engineers).
- Inform and educate customers and students to enable them to use energy more efficiently.

2.2 Planning Process

AEP Ohio’s Plan of programs continues its successful programs while incorporating additional elements of the most successful EE/PDR programs across North America into program plans designed for the Ohio market and AEP Ohio customers in particular. A substantial amount of information including current program performance and evaluation studies were used to develop specific programs for AEP Ohio. AEP Ohio also used a benchmarking process to review the most successful EE/PDR programs from across the country, with a focus on successful Midwest programs to help shape the Plan.

As detailed in Figure 11, there are four major types of energy efficiency potential: (1) *technical* potential for all technologies, (2) *economic* potential, the amount of energy efficiency available that is cost effective, (3) *achievable* potential, the amount of energy efficiency available under current market conditions and available investments, and (4) *program* potential, the amount of energy efficiency available given limited resources, available time and duration of the efficiency program planning period. AEP Ohio’s EE/PDR Action Plan is focused on capturing cost-effective *program potential* in its service territory while achieving SB 221 requirements for 2015 to 2019.

Figure 11. Four Stages of Energy Efficiency Potential

Not Technically Feasible	Technical Potential			
Not Technically Feasible	Not Cost Effective	Economic Potential		
Not Technically Feasible	Not Cost Effective	Market and Adoption Barriers	Achievable Potential	
Not Technically Feasible	Not Cost Effective	Market and Adoption Barriers	Program Design, Budget, Staffing, and Time Constraints	Program Potential

Reproduced from “Guide to Resource Planning with Energy Efficiency November 2007”, U.S. EPA, Figure 2-1.

2.3 Market Segmentation

Segmentation of the market in AEP Ohio is needed to have ongoing and effective outreach and participation across segments and classes of customers. In addition, AEP Ohio plans to continue measuring geographical participation for geo-targeting opportunities going forward.

Consumer Segmentation

Table 17 presents 2013 data for single-family and multifamily residential customers, including low income. Overall, 69.2 percent of the total residential sector customers are in the base residential segment that excludes all single-family and multifamily low income customer segments. Most, 89.2 percent base residential customers live in single-family homes while the remainder lives in multifamily housing.

Overall, 30.8 percent of total residential sector customers are in the low income segment. Most of these customers (90.8%) live in single-family homes, while the remainder lives in multifamily housing.

Table 17. Residential Customer Data – 2013

Customer Segment - 2013	Number of Accounts	Percent of Accounts	Percent of Consumption
Single Family	737,145	90.7%	94%
Multifamily	75,701	9.3%	5.9%
Residential (Excluding Low Income)	812,846	68.2%	69.2%
Single Family	326,500	86.1%	90.8%
Multifamily	52,570	13.9%	9.2%
Residential (Low Income Only)	379,070	31.8%	30.8%
Single Family	1,063,645	89.2%	93.1%
Multifamily	128,271	10.8%	6.9%
Total - All Residential	1,191,916	100%	100%

(1) Excludes 69,282 accounts (5.5% of total) that do not have income or dwelling type data available.

(2) Low income residential customers are defined as those having incomes less than 200% of the federal income poverty guidelines.

Table 18 presents 2013 participant data for single-family and multifamily residential customers. Results from the Efficient Products Program are not included since customer-specific data is not available for that program.

There is not a significant difference in the EE/PDR program 2013 participant savings as a percent of customer segment consumption (8.9% for low income segment vs. 8.6% for the base residential segment). Average 2013 participant savings vs. participant consumption was higher for multifamily than single-family homes, with low income customers savings more on average than for single-family homes.

Table 18. Consumer Programs Participation - 2013

Customer Segment - 2013	Program Participant Average Consumption (kWh)	Participants vs Segment Consumption (percent)	Participant Savings vs. Customer Segment Consumption (percent)	Participant Savings vs. Participant Consumption (percent)	2009-2013 Participant Savings vs All 2013 Consumption
Single Family	15,069	24.8%	2.1%	8.6%	14.5%
Multifamily	12,034	17.8%	1.7%	9.7%	8.5%
Residential (Excluding Low Income)	14,907	24.8%	2.1%	8.6%	14.1%
Single Family	15,917	25.3%	2.2%	8.8%	13.5%
Multifamily	12,208	16.3%	1.7%	10.3%	9.0%
Residential (Low Income Only)	15,627	24.5%	0.2%	8.9%	13.0%
Single Family	13,011	24.9%	2.2%	8.7%	14.2%
Multifamily	8,136	17.2%	1.7%	9.9%	8.4%
Total - All Residential	12,639	24.4%	2.1%	8.7%	13.8%

(1) Efficient Lighting calculated at a fully saturated 46 lamps per household. 50% of these household's assumed to be new participants

(2) 46 lamps per household source: <http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/2010-lmc-final-jan-2012.pdf> Page 26

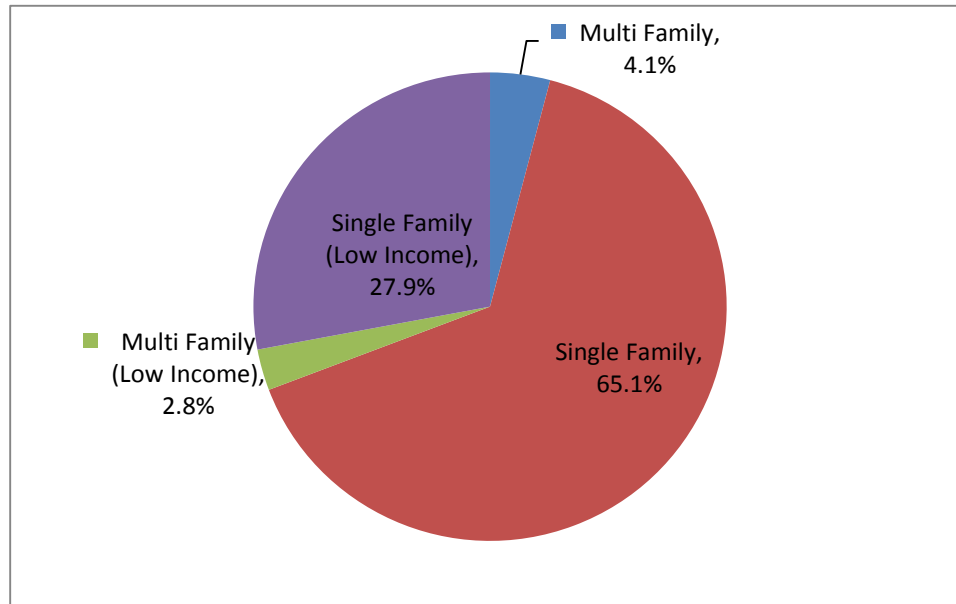
(3) Excludes 69,282 accounts (5.5% of total) that do not have income or dwelling type data available.

(4) Low income residential customers are defined as those having incomes less than 200% of the federal income poverty guidelines.

(5) Penetration Consumption adjusted for Past Energy Savings

Figure 12 shows 2013 single-family and multifamily residential energy consumption by segment. Single-family homes comprised the large majority of residential sector energy usage.

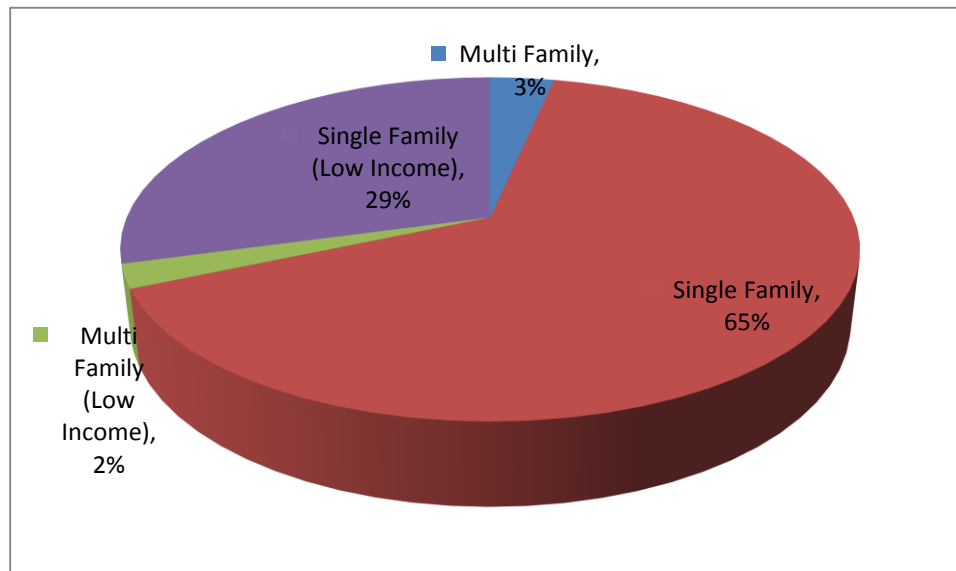
Figure 12. Residential Sector Energy Consumption – 2013



- (1) Excludes accounts that do not have income or dwelling type data available.
- (2) Low income residential customers are defined as those having incomes less than 200% of the federal income poverty level.

Figure 13 presents 2013 participant savings by segment. Single-family homes comprised the large majority of participants.

Figure 13. Consumer Programs Participant Savings – 2013



- (1) Includes Efficient Products program participation or savings.
- (2) Excludes accounts that do not have income or dwelling type data available.
- (3) Low income residential customers are defined as those having incomes less than 200 percent of the federal income poverty level.

Business Segmentation

Current programs as well as proposed programs are designed to target all segments of the business sector. There are specific target segments that recognize key activities with significant available EE/PDR opportunities.

Table 19 presents 2013 nonresidential customer data by customer type, including the number of EE/PDR participants. Small Office, Manufacturing, Small Retail, and Schools comprised over half the participants.

Table 19. Nonresidential Customer Data – 2013

Type of Customer - 2013	Number of Accounts	Percent of Accounts	Number of Participants	Penetration 2009-2013
Ag,Mine,Const.	14,345	6.69	131	2%
Assembly	17,559	8.19	233	4%
Flat Load Comm	11,820	5.51	43	1%
Grocery	2,599	1.21	200	19%
Health Srv	5,858	2.73	84	5%
Hospitals	432	0.2	21	13%
Light Industrial	196	0.09	10	15%
Manufacturing	6,436	3	377	17%
OfficeLarge	1,912	0.89	181	28%
OfficeSmall	74,824	34.91	825	3%
Other	550	0.26	7	3%
RestaurantLarge	464	0.22	24	14%
RestaurantSmall	7,546	3.52	168	5%
RetailLarge	1,388	0.65	148	31%
RetailSmall	56,893	26.54	788	3%
Schools	5,578	2.6	266	17%
Warehouse	5,931	2.77	170	7%
Total	214,331	100	3,676	5%

Table 20 presents 2013 nonresidential participant data. The average Small Office and Other building type participant saved over 28 percent of annual electricity usage. All other participants saved less than 23 percent.

Table 20. Business Programs Participant Savings – 2013

Type of Customer - (kWh)	Total Participants Consumption	Participants vs. Segment Consumption (percent)	Participants Savings vs. Segment Consumption (percent)	Participant Savings as Percent of Participant Consumption	2009-2013 Savings vs All 2013 Consumption
Ag,Mine,Const.	64,150,900	10.5%	0.6%	5%	2%
Assembly	81,341,544	8.4%	8.9%	9%	3%
Flat Load Comm	60,832,743	15.2%	3.5%	4%	1%
Grocery	231,340,000	35.8%	2.7%	3%	5%
Health Srv	20,427,762	3.6%	9.3%	9%	3%
Hospitals	247,360,000	32.9%	1.2%	1%	3%
Light Industrial	7,061,059	14.0%	10.9%	11%	9%
Manufacturing	6,336,000,000	41.3%	1.9%	2%	3%
OfficeLarge	636,860,000	21.3%	4.7%	5%	5%
OfficeSmall	52,640,484	3.6%	47.0%	47%	5%
Other	1,658,820	7.5%	2.2%	29%	7%
RestaurantLarge	22,100,160	8.3%	3.0%	3%	1%
RestaurantSmall	18,518,748	2.9%	11.9%	12%	1%
RetailLarge	228,090,000	14.2%	8.4%	8%	7%
RetailSmall	69,824,477	5.4%	22.3%	22%	4%
Schools	854,450,000	42.5%	4.2%	4%	7%
Warehouse	157,550,000	24.3%	7.0%	7%	11%
Total	9,090,206,697	-	-	-	-

Figure 14 shows 2013 nonresidential energy consumption by segment. Manufacturing facilities consume two-thirds of nonresidential customer usage.

Figure 14. Nonresidential Energy Consumption – 2013

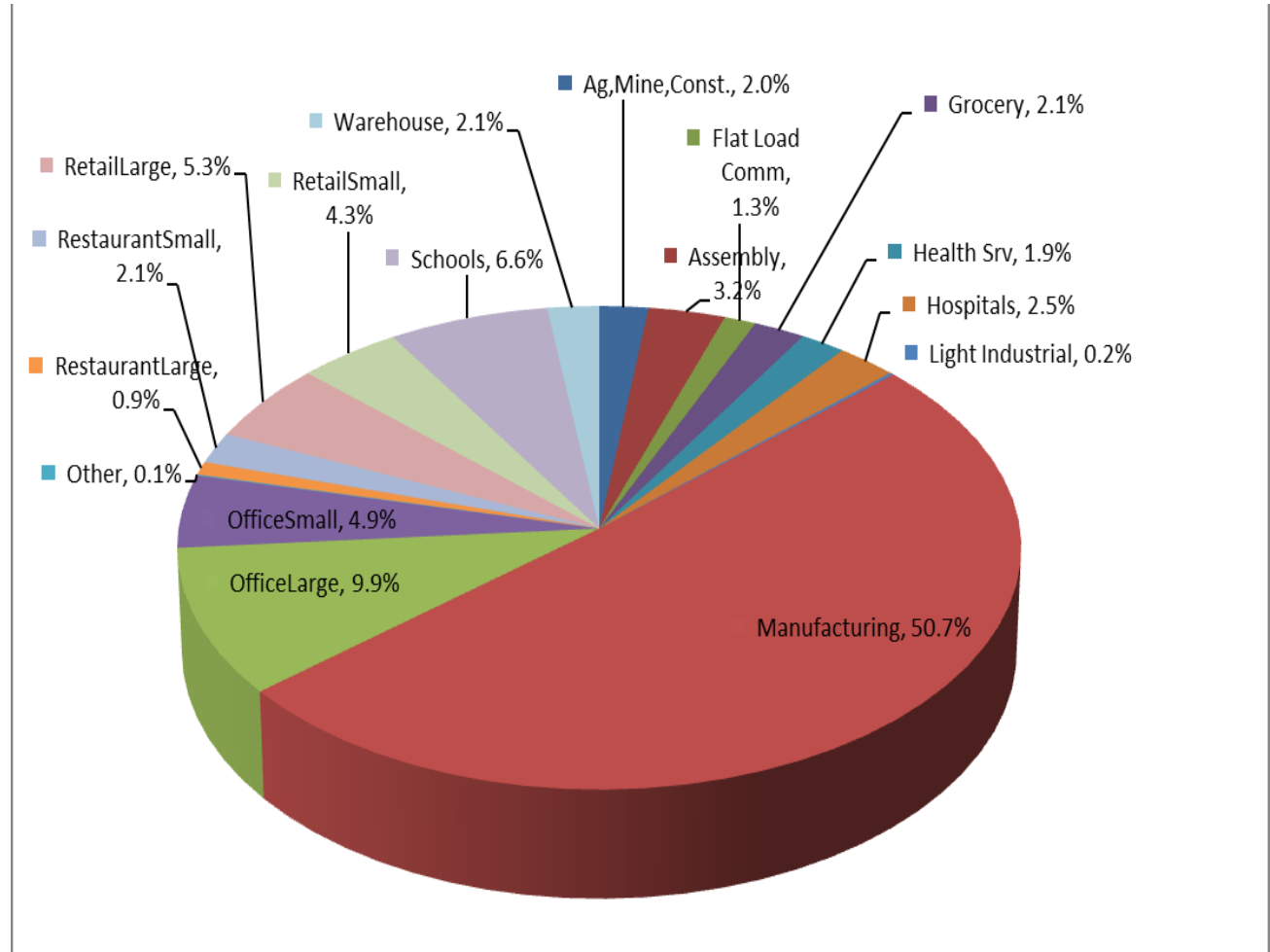
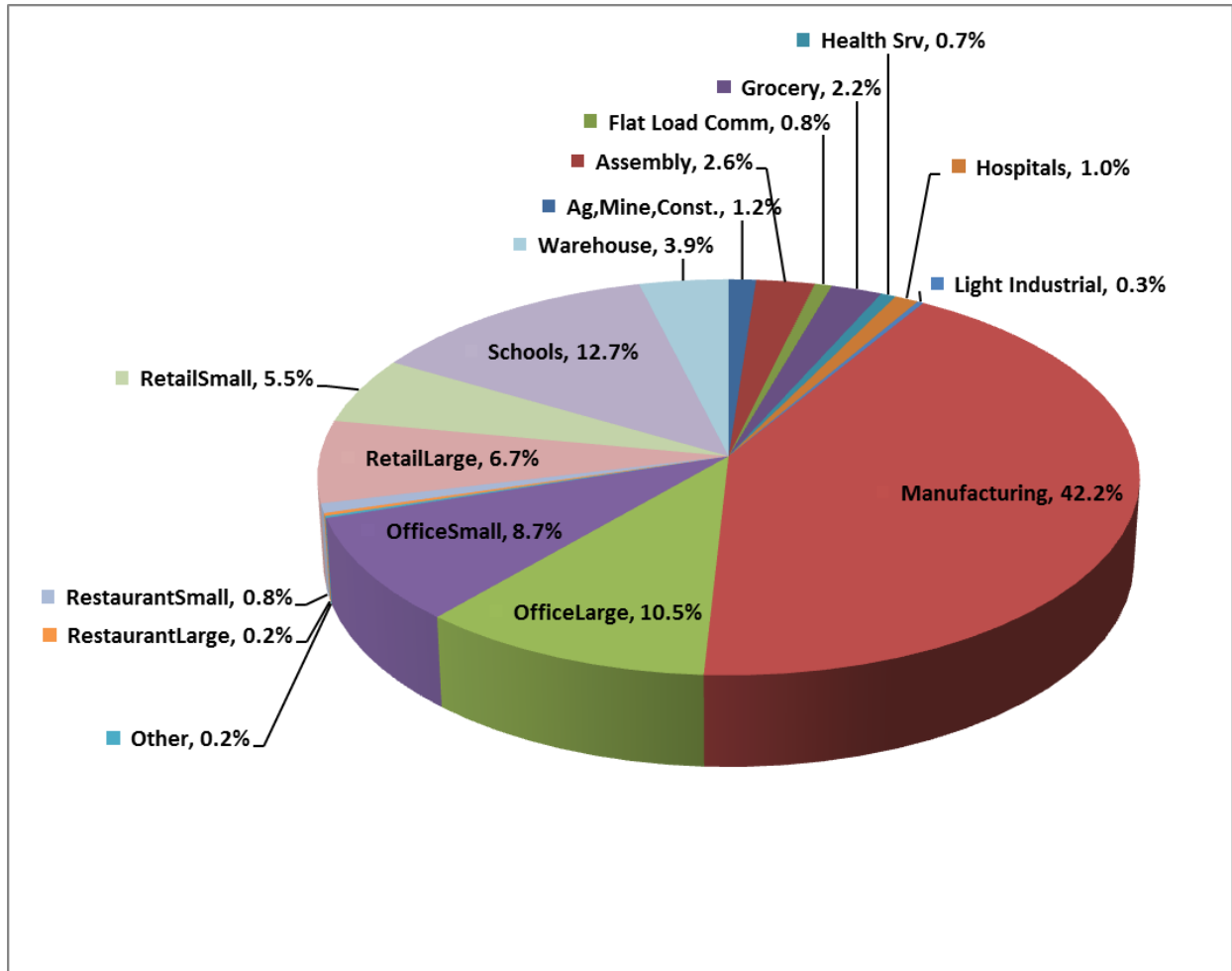


Figure 15 shows 2013 participant savings by segment. Large offices, large retail stores, and schools participated in greater numbers than their share of the AEP Ohio customer base.

Figure 15. Business Programs Participant Savings – 2013



2.4 Stakeholder Participation in the Planning Process

AEP Ohio established the AEP Ohio Collaborative in October 2008, and has met regularly since that time to gain input from its twenty-five members representing all classes of customers on program planning and to provide feedback on the current plan and its performance.

For this Plan's development, the AEP Ohio Collaborative met twelve times in 2013 and 2014 to review AEP Ohio's proposed approaches and Collaborative members had the opportunity as a group and individually to provide feedback throughout the entire process. Included in the count were individual meetings held with interested Collaborative members to provide additional time for input. In some cases, Collaborative members brought in third party EE/PDR consultants to assist AEP Ohio.

The Collaborative members include: PUCO Staff, Ohio Consumers' Counsel, Sierra Club, Natural Resources Defense Council, Ohio Environmental Council, Industrial Energy Users, Ohio Manufacturing Association, Ohio Energy Group, Ohio Hospital Association, Ohio Partners for Affordable Energy, Ohio Air Quality Development Authority, Ohio Development Services Agency (includes the Office of Energy and Office of Community Assistance), Ohio Chamber of Commerce, Ohio Board of Regents, Ohio Farm Bureau, Mid-Ohio Regional Planning Commission, Ohio Poverty Law Center, Corporation for Ohio Appalachian Development, Building Industry Association of Central Ohio, Association of Independent Colleges and Universities of Ohio, IMPACT Community Action, Ohio Energy Project, Environmental Law and Policy Center, Environmental Defense Fund, Ohio Legal Services and Ormet.

2.5 Attempts to Align and Coordinate with Other Public Utility Programs

AEP Ohio has regular communication with other utilities in the state regarding EE/PDR activities and is open to opportunities to work together and share information. AEP Ohio has met periodically with all the other utilities, electric and gas, over the last three years to share knowledge on program design and implementation. For example, AEP Ohio and Columbia Gas are currently working together to deliver New Homes, In-Home Audit, e3smart and Energy Code Support Pilot.

2.6 AEP Ohio Plan Management

AEP Ohio serves as the overall program administrator for delivery of the Plan. AEP Ohio plans to engage third-party implementation contractors when it is more cost effective than running the programs in house. Utilization of third party contractors will continue to be subject to cost effectiveness throughout the Plan period. Competitive bidding for third party work is planned for most programs that require third party contractors since many contractors have been working for AEP Ohio through two previous Plan cycles. The competitive bidding process can be lengthy and is one of the key reasons behind completing this Plan early in 2014 for filing and Commission approval.

AEP Ohio is responsible for high-level administrative, contract and program management, program design and marketing oversight of the selected implementation contractors. A Plan of this proposed size and scope requires careful management oversight. The experience gained from implementation of the 2009-2011 and 2012-

2014 Plans provides the best guidance as to the structure and size required to administer these programs. AEP Ohio will continue to have a small and dedicated group of EE/PDR program staff overseeing both AEP Ohio and third-party implemented programs including compliance and financial management activities, as well as research, development, education, training, planning and promotion of programs to increase customer awareness and participation.

AEP Ohio's Manager EE/PDR is responsible for the overall Plan and reports to the Director of Customer Services and Marketing, who reports to the President of AEP Ohio. Six functional areas report to the Manager EE/PDR and include Research & Development, Education & Training, Compliance, Finance, Consumer Programs and Business Programs. A staff of twenty two currently manages these activities, and it is projected that an additional four full-time employees (FTEs) will be needed to manage this Plan due to new programs and expansions, as well as significantly more outreach, and compliance activities. While this staffing level contemplates a continuing reliance on external third-party contractors, it is possible that in house staff may be more cost effective after third-party bidding is analyzed for the various programs. In any case, any increase in the level of in house staffing beyond the FTEs indicated above would be constrained within the overall budget proposed in this Plan, and only if it were determined that in house staffing additions were more cost effective than third party implementation.

AEP Ohio has developed a comprehensive tracking database to ensure accurate and comprehensive reporting of all program participation that will be fully launched by the end of 2014. Additionally, the database will allow AEP Ohio to research and track participation by customer class, segment and geographic area, to identify trends and untapped opportunities to advance program goals and increase first time program participation. Also, AEP Ohio staff has primary responsibility for general energy efficiency education and awareness strategies and activities, including the content of the EE/PDR web site¹², online energy audit software, mass-market media, general education, and efficiency awareness promotions. Research and Development will support in Plan adjustments and future planning intelligence for the achievement of goals.

¹² See <http://www.aepohio.com/save>

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

- High-level guidance and direction to any implementation contractors, including review and revision of proposed annual implementation plans and proposed milestones, and additionally, daily engagement with the contractor team when working through strategy and policy issues.
- Review and approval of implementation contractor invoices and ensuring program activities are within budget and on schedule.
- Assurance that implementation contractor operational databases are accurate, and data is incorporated into AEP Ohio's comprehensive Plan tracking database to be used for overall tracking, management and regulatory reporting.
- Review of measure saving estimates maintained by AEP Ohio and the implementation contractors.
- Oversight and coordination of evaluation, measurement, and verification contractors.
- Public education and outreach to customers, community groups, trade allies and trade associations.
- Guidance and direction on new initiatives or strategies.
- Communication and direction to implementation contractors regarding other AEP Ohio initiatives that may provide opportunities for cross-program promotion.
- Development, review and approval of printed materials and advertising plans.
- Evaluation of Plan and program cost effectiveness and recommendations for modifications to programs and approach as needed.
- Periodic review of program metrics, conduct investment analyses, and review evolving program designs.
- Research and development, both internal and oversight of third party providers.

3 EE/PDR PLAN SUMMARY RESULTS

3.1 Plan Framework and Summary

For this Plan, AEP Ohio is proposing to cap annual Plan spending at less than the 2013 approved level of \$91.5 million in the current 2012-2014 EE/PDR Action Plan, which was supported by a broad coalition of stakeholders and approved by the PUCO. Over the five years of the Plan, total spending is proposed at \$436.1 million (2015\$) on EE/PDR programs during calendar years 2015 to 2019. The division of EE/PDR program investment between residential and business customers is commensurate with each sector's relative contribution to the Plan overall and to the Plan's cost effectiveness.

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

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

As previously detailed in Table 2, AEP Ohio has developed this plan with the intent to meet or exceed statutory energy savings goals as percent of sales and demand savings as a percent of peak load.

3.2 Benefit-Cost Analysis Background

AEP Ohio has estimated the energy savings, costs and benefits associated with each of the programs included in the proposed Plan. The following section presents the benefit-cost results.

Types of Benefit-Cost Tests

As detailed in Table 21 there are four major benefit-cost tests commonly utilized in the energy efficiency industry, each of which addresses different perspectives. The PUCO established that the Total Resource Cost (TRC) Test be the key test to determine if EE/PDR programs should be offered to customers. Regardless of which perspective is used, benefit-cost ratios greater than or equal to 1.0 are considered beneficial. While various

perspectives are often referred to as tests, the following list of criteria demonstrates that decisions on program development go beyond a pass/fail test.

Table 21. Comparative Benefit-Cost Tests

	PARTICIPANT TEST (PCT)	RATE IMPACT MEASURE TEST (RIM)	TOTAL RESOURCE COST TEST (TRC)	UTILITY COST TEST (UCT)
Reduction in Customer's Utility Bill	X			
Incentive Paid by Utility/Program Administrator	X			
Any Tax Credit Received	X		X	
Avoided Supply Costs		X	X	X
Avoided Participant Costs			X	
Participant Payment to Utility (if any)		X		X
Utility Admin Costs		X	X	X
Participant Costs	X		X	
Incentive Costs		X		X
Lost Revenues		X		

AEP Ohio evaluated the cost-effectiveness of the measures, programs and overall Plan based on the following standard tests:

The Participant Cost Test (PCT) illustrates the relative magnitude of net benefits that go to participants compared to net benefits achieved from other perspectives. While called a “participant” perspective, it is not necessarily a perspective indicating whether customers participate. The implied discount rate can vary substantially between customers. More importantly, many customers neither understand nor make decisions based on present-value benefit-cost analysis. Consequently, a simple payback (years) net of incentive has been shown to provide further guidance on customer participation. The benefits derived from this test reflect reductions in a customer’s bill and energy costs plus any incentives received from the utility or third parties, and any tax credit. Savings are based on gross revenues. Costs are based on out-of-pocket expenses from participating in a program, plus any increases in the customer’s utility bill(s).

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

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

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

3.3 Benefit-Cost Methodology

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

The baseline estimates of building stocks and equipment saturations came from the results of the on-site assessments conducted by AEP Ohio for the 2013 residential and nonresidential baseline studies. DSM-RAM also used the electricity forecast, avoided cost forecast, and electricity prices as described below.

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

- **Technical EE/PDR potential** describes the amount of EE/PDR savings that could be achieved, not considering economic and market barriers, by customers installing EE/PDR measures. Technical potential is calculated as the product of the EE/PDR measures' savings per unit, the quantity of applicable equipment in each facility, the number of facilities in a utility's service area, and 100 percent current market saturation of the measure. Technical potential estimates include EE/PDR measures that may not be cost effective, and technical potential does not consider market barriers, such as customer's lack of awareness of EE/PDR measures. Therefore, technical EE/PDR potential estimates do not provide a realistic basis for setting EE/PDR program goals.
- **Economic EE/PDR potential** describes the amount of technical EE/PDR potential that is "cost-effective," as defined by the results of the TRC test (or other preferred cost effectiveness test). The program benefits for the TRC test include the avoided costs of generation, transmission, and distribution investments and avoided fuel costs due to the energy conserved by the EE/PDR programs. The costs for the TRC test are the EE/PDR measure costs, plus the EE/PDR program administration costs. The TRC test does not consider economic or market barriers to customers installing EE/PDR measures.
- **Achievable EE/PDR market potential** estimates the amount of EE/PDR potential that could be captured by realistic EE/PDR programs that include cost effective EE/PDR measures over the forecast period covered by this EE/PDR potential analysis. Achievable EE/PDR potential can vary with EE/PDR program parameters, such as the magnitude of rebates or incentives offered to customers for installing EE/PDR measures and, thus, many different scenarios can be modeled.

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

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

market, and implementation costs are often different due to the different technologies, either the energy efficient or base technology.

Cost Effectiveness Tests

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

Simple Customer Payback

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

EE/PDR Measure Levelized Cost/kWh

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

Discount Rate

There is a time value of money because money spent in the future does not have the same value as money spent today. This time value is represented by a discount rate (analogous to an interest rate). Economic equations use the discount rate to convert all costs and benefits to a “present value” for comparing alternative costs and benefits. AEP Ohio used a uniform discount rate of 8.6 percent for planning purposes only.

Avoided Costs and Energy Costs

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

Administration, Implementation and Direct Costs

Each program’s administration, implementation, and direct costs were allocated to the technologies delivered by the program based on the annual kWh savings per measure. The result is that individual technology benefit/cost ratios can appear low simply because administration or implementation costs have been allocated to the technology beyond the specific technology costs. On the one hand, this allocation helps ensure the overall cost-effectiveness of a program by guiding selection of technologies with sufficient benefits to

support program delivery costs. This still allows technologies with a benefit-cost ratio less than 1.0 to be included as needed to meet other goals in addition to Plan cost-effectiveness requirements. AEP Ohio support services that are not specific to individual programs are added as costs at the Plan level for all programs.

3.4 Program Development

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

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

While almost all customer sectors will pay a contribution in their utility bill towards the cost of efficiency programs, some customer sectors will not be able to participate unless a program is specifically targeted to overcome their barriers. The Residential Community Assistance Program is an example of a program where improving the ability of a specific sector to participate was a primary program design goal. Similarly the Business Express program is targeted to small businesses and without a focused effort those customers would not participate at a reasonable level.

The next section provides details on the adjustments and enhancements, projected participation, savings, budgets and benefit-cost test results for ongoing programs. Further details are provided for new programs, including:

- Objectives
- Target Markets
- Duration
- Description
- Incentive Strategy
- Eligible Measures

- Implementation Strategy
- Marketing Strategy
- Milestones
- EM&V Strategy
- AEP Ohio Administrative Requirements
- Budget
- Savings Targets
- Benefit-Cost Test Results

4 EE/PDR PROGRAM PLANS

The programs developed to achieve EE/PDR goals in this Plan are based on lessons learned from the implementation of the 2009-2011 and the 2012-2014 EE/PDR Action Plans as well as other best-practice programs from around the country, with the concepts outlined in a strategic manner. Existing program plans are not repeated from the 2012-2014 EE/PDR Action Plan; however, modifications are included. The plans are proposed as guidelines for more detailed program planning; they are not intended to be operational per se. The intent of the Plan presented here is to provide a sense of scope and scale, and convey the general schedule and resources needed to increase customer participation from previous program efforts in the various markets in which the programs will operate.

Overall, a Plan is presented that covers a broad range of demographic, business, facility, and end-use markets. AEP Ohio's Plan can be divided into consumer, business and cross-sectors with utility administrative functions providing support across all program areas. AEP Ohio will maintain as part of its functionality the advertising, education, training and research and development budgets. The following section presents a summary of the services offered in each program.

4.1 Consumer Programs

For the complete program plan for each ongoing consumer EE/PDR program, please reference the Consumer Program Plans section (pages 57-80) of *Volume 1: AEP Ohio 2012 to 2014 Energy Efficiency/Peak Demand Reduction (EE/PDR) Action Plan*, dated November 29, 2011 (PUCO Docket 11-5568-EL-POR and 11-5569-EL-POR.) Included in each program description below are material program changes shown as adjustments and enhancements, participation levels, budget, savings targets and benefit-cost test results. For the new programs, complete program descriptions are included.

4.1.1 Efficient Products (On-Going Program)

This program provides incentives and marketing support through retailers to build market share and usage of efficient lighting and efficient appliances primarily through mark down and rebate approaches. Customer incentives at the point of sale encourage increased purchases of high-efficiency products while in-store signage, sales associate training, and support make provider participation easier.

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

Lighting: AEP Ohio relies on CFL and LED sales through the over 600 retailers in place throughout its service territory.

Appliances: Funding allows incentives for a variety of cost effective appliances, including refrigerators, freezers, clothes washers, clothes dryers, dishwashers, televisions and pool pumps. AEP Ohio plans for retailer based appliance programs with mid and downstream incentive strategies, depending on the overall cost effectiveness and savings potential for each appliance.

HVAC and Domestic Hot Water: The program affects the purchase and installation of air source heat pumps and electric hot water heaters when replacing less efficient electric space heating or water heating through a combination of market push and pull strategies that stimulate demand while simultaneously increasing market provider investment in stocking and promoting high efficiency products.

The program will work through two distinct market channels – plumbing contractors and the retail Do-It-Yourself stores.

Adjustments and Enhancements

The Efficient Products program will be enhanced to allow agricultural customers on residential tariff(s) to participate in agriculture measures identified in the Efficient Products for Business Program and the savings from those measures to be counted.

Other AEP Ohio modifications to the Efficient Products Program as shown below will:

- Aggressively promote and discount LED's
- Add ENERGY STAR® dryers, smart strips, programmable thermostats to the appliance rebate program offering
- Discontinue mid-stream TV incentives and switch to customer rebate
- Offer revised electric water heater rebate through trained plumbing contractors and distributors rather than through typical DIY retailer
- Incentives not included in the measure mix from previous plan(s) have been deemed either not cost effective or had low participation.
- Customer incentives may be adjusted to increase cost effectiveness and/or program participation.
- Cost effective measures developed during Plan implementation may be added and measures currently on the list may be changed or removed depending on both cost effectiveness and customer participation.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total
							2015 - 2019
5W Chandelier LED bulb	Lamp	2,328	2,812	2,989	3,110	3,378	14,617
Air Source Heat Pump SEER 14.5, COP 2.49	Ton	1,390	1,096	1,143	1,442	2,635	7,706
Air Source Heat Pump SEER 14.5, COP 2.49	Ton	60	48	51	67	124	350
CFL >25W Screw-In Indoor	Lamp	17,669	19,514	19,817	19,681	20,381	97,063
CFL >25W Screw-In Outdoor	Lamp	254	278	282	279	288	1,381
CFL 13W Screw-In Indoor	Lamp	632,200	666,475	633,066	611,279	615,685	3,158,706
CFL 13W Screw-In Outdoor	Lamp	58,170	62,022	59,514	57,992	58,919	296,616
CFL 18W Screw-In Indoor	Lamp	37,794	37,200	36,607	35,198	35,258	182,058
CFL 18W Screw-In Outdoor	Lamp	4,126	3,990	3,894	3,711	3,684	19,404
CFL 23W Screw-In Indoor	Lamp	36,857	38,601	38,708	37,936	38,729	190,831
CFL 23W Screw-In Outdoor	Lamp	6,978	7,317	7,341	7,196	7,347	36,179
CFL 7W Screw-In Indoor	Lamp	289,581	315,359	305,415	300,019	307,110	1,517,483
CFL 7W Screw-In Outdoor	Lamp	12,324	13,522	13,157	12,981	13,342	65,327
Clothes Washer Retirement (Early Replacement)	Unit	9,125	10,125	10,272	10,190	10,524	50,235
Ductless Mini Split HP SEER 13	Ton	156	173	173	173	186	861
Ductless Mini Split HP SEER 15	Ton	156	173	173	173	186	861
ECM Fan Motor - Central A/C - EL Heat	Home	203	236	247	254	274	1,214
ECM Fan Motor - Central A/C - Non-EL Heat	Home	8,891	10,065	10,384	10,534	11,203	51,077
ECM Fan Motor - Heat Pump	Home	1,337	1,485	1,518	1,527	1,611	7,479
Efficient Refrigerator (ENERGY STAR® or Better)	Refrigerator	4,212	0	0	0	0	4,212
ENERGY STAR® 50 CFM Bathroom Ventilating Fan	Fan	6,267	7,541	7,966	8,235	8,870	38,878
ENERGY STAR® 50 CFM Bathroom Ventilating Fan	Fan	419	507	538	559	606	2,629
ENERGY STAR® Dehumidifier	Dehumidifier	3,476	4,078	4,252	4,335	4,604	20,745
ENERGY STAR® Most Efficient Television	TV	31,500	29,745	29,011	27,928	28,138	146,322
ENERGY STAR® Torchiere	Lamp	2,736	2,913	2,954	2,934	3,039	14,576
ENERGY STAR® v. 5.3 Television	TV	31,500	29,745	29,011	27,928	28,138	146,322
Hardwired Dimmer Switch	Dimmer	89,091	0	0	0	0	89,091
Heat Pump Water Heater - 2.0 EF	Unit	1,517	1,811	1,718	1,126	1,242	7,414
Heavy Duty Outdoor Timer for Pool Pump	Pump	901	1,085	1,155	1,209	1,330	5,680
Indoor Wall-mounted Motion Sensor	Sensor	73,797	0	0	0	0	73,797
LED Lighting 12W - Indoor	Lamp	24,003	24,222	24,339	23,915	24,526	121,005
LED Lighting 12W - Outdoor	Lamp	3,608	3,715	3,767	3,734	3,863	18,687
LED Lighting 8W - Outdoor	Lamp	17,066	16,582	15,229	14,223	13,847	76,947
LED Lighting 8W - Indoor	Lamp	191,558	182,887	164,575	150,649	143,593	833,262
Outdoor Motion Sensor	Sensor	0	97,643	201,051	303,816	303,227	905,737
Premium Efficiency Pool Pumps	Pump	563	681	727	762	839	3,572
Programmable Electronic Baseboard Thermostat	Thermostat	295	352	385	419	474	1,924
SEER 15 CAC - EL Heat	Ton	0	0	0	0	250	250
SEER 15 CAC - Non-EL Heat	Ton	0	0	0	0	5	5
Tier 3 GSHP, Open Loop, water to air	Ton	292	301	304	303	313	1,512
VSD Pool Pump	Pump	447	535	568	593	649	2,791
Waterbed Insulating Pad	Pad	539	623	657	685	748	3,253

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

	Incremental Annual Budget					
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$3,504,219	\$3,488,077	\$3,656,896	\$3,832,695	\$3,942,879	\$18,424,765
Incentive	\$9,699,717	\$9,544,695	\$11,764,377	\$13,794,339	\$14,105,431	\$58,908,559
Total	\$13,203,935	\$13,032,772	\$15,421,274	\$17,627,033	\$18,048,309	\$77,333,324
	Incremental Annual					
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	\$18,508,119	\$15,483,318	\$17,897,517	\$20,325,161	\$20,303,941	\$92,518,056

Savings Targets

	Incremental Annual Savings – at Meter					
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	74,272	74,092	77,673	81,245	83,840	353,460
Summer Peak Demand (kW)	11,094	10,007	9,678	9,307	9,809	44,743

Benefit-Cost Test Results

Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
Total Resource Cost (TRC)	1.7
Utility System Resource Cost (UCT)	3.8
Participant Cost (PCT)	4.0
Rate Impact Measure (RIM)	0.5

4.1.2 Appliance Recycling (On-Going Program)

Many of the refrigerators and freezers being replaced by AEP Ohio customers are still functioning, and, often end up as energy guzzling secondary appliances in basements and garages. The secondary used refrigerator/freezer market may be an additional source of energy and demand savings. This opportunity continues to be explored. The Appliance Recycling Program targets these “second” refrigerators and freezers, cutting energy consumption. It also intervenes to keep the older, less efficient appliances out of

the used appliance market. The program provides incentives to remove working units from service and fully recycle their materials. The program offers an environmentally responsible turnkey pick-up and recycling service.

Adjustments and Enhancements

AEP Ohio modifications to the Appliance Recycling Program as shown below:

- Open business customer pick-up and recycling of refrigerators/freezers to broaden participation.
- Pilot secondary market intervention with potential to add to program.
- Customer incentives may be adjusted to increase cost effectiveness and/or program participation.
- Cost effective measures developed during Plan implementation may be added and measures currently on the list may be changed or removed depending on both cost effectiveness and customer participation.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total 2015 - 2019
Refrigerator Retirement	Refrigerator	13,110	11,659	11,479	11,429	11,395	59,073
Freezer Retirement	Freezer	3,414	3,074	3,059	3,086	3,129	15,762

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience. Electricity and measure cost savings resulting from removing secondary appliances result in negative participant costs (savings.)

Incremental Annual Budget						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$827,999	\$743,956	\$739,791	\$744,216	\$750,315	\$3,806,276
Incentive	\$2,065,475	\$1,841,580	\$1,817,289	\$1,814,368	\$1,815,612	\$9,354,325
Total	\$2,893,474	\$2,585,536	\$2,557,080	\$2,558,585	\$2,565,927	\$13,160,601

	Incremental Annual					
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	\$0	\$0	\$0	\$0	\$0	\$0
Savings Targets						
	Incremental Annual Savings – at Meter					
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	16,560	14,879	14,796	14,884	15,006	76,126
Summer Peak Demand (kW)	2,342	2,106	2,095	2,110	2,129	10,782
Benefit-Cost Test Results						
Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio					
Total Resource Cost (TRC)	2.3					
Utility System Resource Cost (UCT)	2.3					
Participant Cost (PCT)	7.7					
Rate Impact Measure (RIM)	0.4					

4.1.3 In-Home Audit (On-Going Program)

This program produces long-term electric energy savings in the consumer sector by helping customers analyze and reduce their energy use from a whole house perspective through the installation of whole house cost effective measures. The customer will have three options to choose from:

Option 1: On-Line Energy Analysis – This program is free to all AEP Ohio customers. Customers who complete the online analysis will receive a kit of energy efficiency measures by mail. Savings could include customer changes in behavior informed from the completion of the energy analysis.

Option 2: In-Home Energy Assessment – This program provides a walk-through audit by pre-certified contractors and a list of recommendations. Customers will also receive direct installed energy efficiency measures and a prioritized list of recommendations. This option is available to customers that are not eligible for Option 3.

Option 3: In-Home Energy Audit (all electric only) – This program provides the customer a comprehensive energy efficiency audit. The audit is performed by a pre-qualified and certified energy auditor, either directly contracted or sub-contracted to AEP Ohio to deliver the services required. The auditors perform blower-door, infrared

camera, and combustion air tests, and utilize approved software to provide customers a detailed report of energy usage and potential savings associated with improvements. Customers will also receive the direct installed energy efficiency measures and a prioritized list of recommendations.

For any option selected, customers will be eligible for incentives and can choose from a list of pre-qualified contractors to have energy-saving improvements installed.

Adjustments and Enhancements

Retrofit Manufactured Housing:

AEP Ohio will expand the In-Home Audit Program to obtain energy savings through the identification and implementation of cost-effective measures that improve the efficiency and comfort of existing occupied manufactured housing and to serve hard-to-reach customer segments. The Retrofit Manufactured Housing measures are targeted to residential customers with all-electric mobile homes on permanent foundations in urban and rural communities.

- AEP Ohio will offer assessment services to identify retrofit opportunities and will offer financial incentives to residents and/or to contractors to assist with installation of measures:
 - A/C inspection and tune-up
 - High efficiency heat pump replacements of resistance heating
 - Ductless mini-splits
 - Duct sealing and repair
 - Mobile home belly patch
 - Mobile home roof coat
 - Mobile home roof patch
 - Attic radiant barrier
 - Mobile home insulation
 - Mobile home underneath vapor retarder
 - Mobile home rigid window
- The implementation strategy is designed to lower the cost of delivery and increase participation by:
 - Combining multiple measures in one treatment package per home.
 - Identifying and engaging other program administrators and collaborators to share costs.
 - Encouraging third party financing for energy efficiency loans.

- The marketing strategies will vary from community outreach and direct mail to reach the majority of manufactured housing that is sited in rural settings of low population density to door-to-door canvassing of more densely clustered mobile home parks and communities.
- The Manufactured Housing Retrofit implementation contractor will:
 - Market the retrofit program to customers.
 - Implement a screening process to qualify cost-effective candidates for retrofit.
 - Administer, provide quality control, and verify retrofit installations.
 - Identify and collaborate with other manufactured housing efficiency program administrators.

Other AEP Ohio modifications to the In-Home Audit Program as shown below:

- Continue to look for opportunities to partner with other utilities to lower program administration costs and increase participation.
- Targeting only all-electric customers in the 2015-2019 plan for audits.
- Revised measure mix and rebate schedules to improve cost effectiveness.
- Incentives not included in the measure mix from previous plan(s) have been deemed either not cost effective or had low participation.
- Customer incentives may be adjusted to increase cost effectiveness and/or program participation.
- Cost effective measures developed during Plan implementation may be added and measures currently on the list may be changed or removed depending on both cost effectiveness and customer participation.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total
							2015 - 2019
1W LED Night Light	Lamp	371	381	436	476	515	2,180
1W LED Night Light	Lamp	59	61	70	78	85	353
5-plug Smart Strip Power Bar	Power Strip	7,383	7,736	9,023	10,110	11,271	45,523
7-plug Smart Strip Power Bar	Power Strip	7,383	7,736	9,023	10,110	11,271	45,523
CFL >25W Screw-In Indoor	Lamp	2,681	2,524	2,759	2,877	2,961	13,803
CFL >25W Screw-In Outdoor	Lamp	38	36	39	41	42	196
CFL 13W Screw-In Indoor	Lamp	95,337	85,615	87,240	88,201	87,984	444,377
CFL 13W Screw-In Outdoor	Lamp	8,791	7,985	8,232	8,413	8,481	41,901
CFL 18W Screw-In Indoor	Lamp	5,608	4,769	5,038	5,072	5,032	25,519
CFL 18W Screw-In Outdoor	Lamp	610	510	533	531	521	2,705
CFL 23W Screw-In Indoor	Lamp	5,543	4,993	5,391	5,552	5,637	27,116
CFL 23W Screw-In Outdoor	Lamp	1,050	947	1,023	1,053	1,070	5,142
CFL 7W Screw-In Indoor	Lamp	43,993	40,777	42,493	43,843	44,612	215,718
CFL Pin-Based (<25W) Indoor	Fixture	2,806	2,823	3,235	3,550	3,862	16,275
CFL Pin-Based (<25W) Outdoor	Fixture	259	266	307	340	373	1,546
CFL Pin-Based (>=25W) Indoor	Fixture	72	73	84	92	101	422
CFL Pin-Based (>=25W) Outdoor	Fixture	1	1	1	1	2	6
DHW Pipe Insulation R-4 10 feet	10 Linear Feet	1,610	1,665	1,914	2,103	2,284	9,576
DHW Pipe Insulation R-4 10 feet	10 Linear Feet	142	147	169	186	202	847
Duct Sealing and Insulation - CAC - EL Heat	Home	2	2	3	3	3	14
Duct Sealing and Insulation - Heat Pump	Home	10	10	12	13	14	58
Efficient Refrigerator (ENERGY STAR® or Better) (DUB)	Refrigerator	1,767	1,792	2,063	2,272	2,474	10,369
ENERGY STAR® Central A/C (Early Replacement)	Ton	4,327	4,512	5,232	5,813	6,403	26,288
ENERGY STAR® Door - EL Heat	Door	88	91	105	115	126	524
Freezer Retirement	Freezer	74	78	91	103	115	460
Heat Pump Water Heater - 2.0 EF	Unit	16	0	0	0	0	16
LED Holiday Lights (300 bulb string)	300 bulb string	9,583	9,916	11,414	12,562	13,675	57,149
Low Flow (1.25 GPM) showerhead	Shower	2,956	3,012	3,409	3,688	3,946	17,012
Low Flow (1.25 GPM) showerhead	Shower	264	273	315	346	377	1,575
Low Flow Faucet Aerator, 1.5 GPM - EDHW	Faucet	3,441	3,501	3,959	4,276	4,566	19,743
Low Flow Faucet Aerator, 1.5 GPM - EDHW	Faucet	307	318	365	402	436	1,828
Reduced ACHnat 0.3 - Central A/C - EL Heat	Home	3	3	4	4	5	20
Reduced ACHnat 0.3 - Heat Pump	Home	19	19	22	24	26	111
Shower Start/Stop	Unit	1,194	1,261	1,478	1,665	1,865	7,464
Wall Insul. R-11 - Central A/C - EL Heat	1000 sqft wall area	7	7	9	10	10	43
Wall Insul. R-11 - Heat Pump	1000 sqft wall area	41	43	50	55	60	249

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience. Electricity and measure cost savings resulting from installing CFLs in lieu of incandescent bulbs result in negative participant costs (savings.)

	Incremental Annual Budget					
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$1,497,765	\$1,449,694	\$1,599,370	\$1,710,118	\$1,800,199	\$8,057,146
Incentive	\$2,381,652	\$2,396,752	\$2,738,093	\$3,010,486	\$3,278,724	\$13,805,708
Total	\$3,879,416	\$3,846,446	\$4,337,464	\$4,720,605	\$5,078,923	\$21,862,854

	Incremental Annual					
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	\$1,088,455	\$1,042,131	\$1,140,942	\$1,215,860	\$1,200,503	\$5,687,892

Savings Targets

	Incremental Annual Savings – at Meter					
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	9,815	9,506	10,463	11,162	11,821	50,563
Summer Peak Demand (kW)	1,902	1,899	2,138	2,322	2,503	9,963

Benefit-Cost Test Results

Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
Total Resource Cost (TRC)	1.2
Utility System Resource Cost (UCT)	1.5
Participant Cost (PCT)	3.4
Rate Impact Measure (RIM)	0.4

4.1.4 NEW HOME (On-Going Program)

The New Home Program increases energy efficiency in residential new construction. The program is designed to recruit and educate builders and their trades on the benefits associated with energy efficient homes. Homes become certified at different efficiency levels through a home energy rating system (HERS) rating process and incentivized base on HERS scores. Going forward, the program will provide builder incentives but also focus on helping customers select more efficient new home construction by offering more education on building at higher energy efficiency levels and creating a market demand for energy efficient crafted homes.

Adjustments and Enhancements

New Energy Efficient Manufactured Housing

AEP Ohio will expand the program to obtain energy savings by increasing the share that energy efficient manufactured housing represents of total new manufactured housing sales to AEP Ohio customers.

- AEP Ohio will offer incentives to manufacturers to outfit new manufactured homes at the plant with high efficiency equipment, appliances, lighting and electronics for homes to be sited in AEP Ohio service territory. Measures include:
 - Heat pump water heaters
 - Ductless mini-splits
 - Whole-house sealing
 - Duct sealing
- Manufacturers of housing for sale and shipment to Ohio will be recruited for New Energy Efficient Manufactured Housing participation.
- The Energy Efficient Manufactured Housing implementation contractor will:
 - Market the value of energy efficient manufactured housing to homebuyers.
 - Engage manufacturers to install high-efficiency equipment and lighting to be sited for customers served by AEP Ohio.
 - Identify and collaborate with other manufactured housing efficiency program administrators.

Additional AEP Ohio modifications to the New Homes Program as shown below:

- Include code and standards education and awareness.
- Explore energy savings opportunities that may exist from energy code support activities designed to transform the market. AEP Ohio will attribute any quantifiable energy savings based on the difference between building to the

energy code and actual market practices to the New Homes program.

- Incentives not included in the measure mix from previous plan(s) have been deemed either not cost effective or had low participation.
- Customer/builder incentives may be adjusted to increase cost effectiveness and/or program participation.
- Cost effective measures developed during Plan implementation may be added and measures currently on the list may be changed or removed depending on both cost effectiveness and customer participation.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total 2015 - 2019
ENERGY STAR® Double Pane Windows - Central A/C - EL Heat	100 sqft window area	69	69	84	83	77	383
ENERGY STAR® Double Pane Windows - Central A/C - Non-EL Heat	100 sqft window area	2,240	2,223	2,703	2,682	2,490	12,338
ENERGY STAR® Double Pane Windows - Heat Pump	100 sqft window area	290	288	350	347	322	1,596
ENERGY STAR® 2.0/2.5 Qualified Home - Central A/C - Non-EL Heat	Home	465	462	565	566	531	2,588
ENERGY STAR® 2.0/2.5 Qualified Home - Heat Pump	Home	61	61	75	75	70	342
ENERGY STAR® 3.0 Qualified Home - Central A/C - Non-EL Heat	Home	324	323	397	401	381	1,827
ENERGY STAR® 3.0 Qualified Home - Heat Pump	Home	41	41	50	51	48	231
ENERGY STAR® 50 CFM Bathroom Ventilating Fan	Fan	3,072	3,047	3,699	3,662	3,387	16,868
ENERGY STAR® Manufactured Homes - EL Heat	Home	21	21	25	25	23	115
ENERGY STAR® Manufactured Homes - Non-EL Heat	Home	0	62	128	193	179	563
Heat Pump Water Heater - 2.0 EF	Unit	612	608	673	475	409	2,777
Reduced ACHnat 0.3 - Central A/C - EL Heat	Home	4	4	6	6	7	27
Reduced ACHnat 0.3 - Heat Pump	Home	23	23	29	30	29	134
Triple Pane Windows - Central A/C - EL Heat	100 sqft window area	50	50	61	61	57	280
Triple Pane Windows - Central A/C - Non-EL Heat	100 sqft window area	1,627	1,616	1,973	1,969	1,841	9,027
Triple Pane Windows - Heat Pump	100 sqft window area	211	209	255	255	238	1,168

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

	Incremental Annual Budget					
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$741,154	\$781,121	\$874,224	\$816,455	\$881,345	\$4,094,299
Incentive	\$1,118,046	\$1,266,055	\$1,672,688	\$1,811,542	\$1,693,317	\$7,561,648
Total	\$1,859,200	\$2,047,176	\$2,546,912	\$2,627,997	\$2,574,662	\$11,655,947

	Incremental Annual					
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	\$2,977,579	\$3,114,070	\$3,922,115	\$4,024,826	\$3,770,031	\$17,808,622

Savings Targets

	Incremental Annual Savings – at Meter					
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	6,176	6,509	7,285	6,804	7,325	34,119
Summer Peak Demand (kW)	2,772	2,788	3,353	3,316	3,212	15,442

Benefit-Cost Test Results

Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
Total Resource Cost (TRC)	1.4
Utility System Resource Cost (UCT)	3.6
Participant Cost (PCT)	3.0
Rate Impact Measure (RIM)	0.5

4.1.5 BEHAVIOR CHANGE (On-Going Program)

The Behavior Change Program focuses on measuring energy savings persistence as AEP Ohio switches to a digital based home energy savings and education report on an ongoing basis. This program helps pre-selected and new customers on an opt-in basis to reduce energy use by encouraging them to alter their habits of electricity usage by providing positive reinforcement. The report is shared with the customer via email or other electronic media to provide participants with their home's respective usage and

other relevant information in a manner to motivate the customer to take action to save energy and maintain those savings through positive reinforcement. For example, the participant is provided a list of simple actions to follow to reduce electricity usage and promote other energy efficiency programs in which they can participate.

Adjustments and Enhancements

AEP Ohio will model savings from current participants to determine the persistence of savings over time and will count associated savings as long as persistence can be validated.

AEP Ohio modifications to the Home Energy Report Program as shown below:

- AEP Ohio will make reports available via email, online or other digital media.
- AEP Ohio customers may opt in to participate in the digital based communications whether they have received printed reports in the past or are new to the Behavior Change program.
- AEP Ohio may consider providing reports with internal resources if it is more cost effective.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results, and program implementation experience. Participation levels are not assumed to have a one year measure life; however, to be conservative the program design continued that assumption for plan purposes. Therefore, the total participation over the five year period from 2015 to 2019 are based on the number of participants in the fifth year, 2019.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total
							2015 - 2019
Home Energy Report	Home	24,852	24,852	24,852	24,852	24,852	124,259

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Budget						
	2015	2016	2017	2018	2019	Total
						2015 – 2019
Administrative	\$437,070	\$437,070	\$437,070	\$437,070	\$437,070	\$2,185,351
Incentive	\$0	\$0	\$0	\$0	\$0	\$0

Total	\$437,070	\$437,070	\$437,070	\$437,070	\$437,070	\$2,185,351
Incremental Annual						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	\$0	\$0	\$0	\$0	\$0	\$0

Savings Targets

Savings for this program are not cumulative due to a one year measure life.

	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	9,369	9,369	9,369	9,369	9,369	9,369
Summer Peak Demand (kW)	1,218	1,218	1,218	1,218	1,218	1,218

Benefit-Cost Test Results

Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
Total Resource Cost (TRC)	1.2
Utility System Resource Cost (UCT)	1.2
Participant Cost (PCT)	NA
Rate Impact Measure (RIM)	0.3

4.1.6 e³smartSM (On-Going Program)

This energy efficiency education program provides curriculum, teacher training, and supplies for in-class instruction about energy sources, transformation, and uses. Students learn how to use energy efficiently at home. With the permission of their parents or caregiver(s), students take home energy efficiency measures and install them as part of the learning experience. The curriculum is designed to meet national and state science standards for grades 5-12.

Adjustments and Enhancements

AEP Ohio modifications to the e3SMART Program as shown below:

- Adjust the number of student participants to approximately 24,000 per year.
- Remove the outlet gasket measure as a preventative student safety action.
- Expand curriculum from grades 5-9 to grades 5-12.
- Increase the proportion of LED measures in the student and teacher kits.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total 2015 - 2019
1W LED Night Light	Lamp	532	585	611	673	720	3,122
CFL 13W Screw-In Indoor	Lamp	117,126	116,789	108,706	110,704	109,400	562,726
CFL 23W Screw-In Indoor	Lamp	685	395	179	48	0	1,308
Hot Water Temp Gauge (Tank Temperature Turn Down)	Unit	3,462	3,806	3,971	4,372	4,686	20,296
Low Flow (1.25 GPM) showerhead	Shower	6,780	7,396	7,647	8,333	8,832	38,988
Low Flow Faucet Aerator, 1.5 GPM - EDHW	Faucet	7,888	8,597	8,879	9,661	10,217	45,243
Reduced ACHnat 0.3 - Central A/C - EL Heat	Home	8	9	9	10	12	47
Reduced ACHnat 0.3 - Heat Pump	Home	44	48	50	55	59	255

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Budget						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$296,180	\$300,728	\$288,620	\$298,574	\$299,843	\$1,483,945
Incentive	\$257,969	\$268,718	\$261,999	\$277,269	\$285,719	\$1,351,674
Total	\$554,149	\$569,445	\$550,619	\$575,843	\$585,562	\$2,835,619

Incremental Annual						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	\$606,056	\$613,886	\$586,475	\$607,068	\$601,578	\$3,015,062

Savings Targets

Incremental Annual Savings – at Meter						
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	4,949	5,018	4,809	4,969	5,004	24,169
Summer Peak Demand (kW)	549	553	526	541	541	2,643

Benefit-Cost Test Results

Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
Total Resource Cost (TRC)	3.0
Utility System Resource Cost (UCT)	6.1
Participant Cost (PCT)	8.0
Rate Impact Measure (RIM)	0.5

4.1.7 Community Assistance (On-Going Program)

The program provides energy efficiency services to AEP Ohio customers with limited income to assist them in reducing their electric energy use and managing their utility costs. AEP Ohio low income residential customers eligible to participate are any customers that have an income of 200 percent of the federal poverty income level or less. These customers are also typically approved for an energy assistance program such as PIPP (percentage of income payment plan) HEAP (home energy assistance program) or HWAP (home weatherization assistance program.) The program generates energy savings for residential low-income customers through an in-home energy audit and the installation of a wide range of base load measures such as efficient lighting, more efficient refrigerators and weatherization upgrades. The program can be delivered through community based action agencies or private contractors. While the program is not cost-effective based on standard tests, it has significant non-energy benefits, including assisting customers with limited incomes to reduce their energy costs, improving their standard of living and maintaining their service.

Adjustments and Enhancements

Retrofit Manufactured Housing:

AEP Ohio will expand the Community Assistance Program to obtain energy savings through the identification and implementation of cost-effective measures that improve the efficiency and comfort of existing occupied manufactured housing and to serve a hard-to-reach customer segment. The Retrofit Manufactured Housing measures are targeted to income-eligible residential customers with all-electric mobile homes on permanent foundations in urban and rural communities.

Other changes to the Community Assistance Program as shown below:

- Incentives not included in the measure mix from previous plan(s) have been deemed either not cost effective or had low participation.
- Customer incentives may be adjusted to increase cost effectiveness and/or program participation.
- Cost effective measures developed during Plan implementation may be added

and measures currently on the list may be changed or removed depending on both cost effectiveness and customer participation.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total 2015 - 2019
1W LED Night Light	Lamp	273	298	305	371	291	1,537
Air Source Heat Pump SEER 14.5, COP 2.49	Ton	95	102	104	125	98	525
Ceiling Ins. R-30 - Central A/C - EL Heat	1000 sqft footprint	33	36	37	45	35	187
Ceiling Ins. R-30 - Central A/C - Non-EL Heat	1000 sqft footprint	147	158	160	194	151	810
Ceiling Ins. R-30 - Heat Pump	1000 sqft footprint	190	205	208	251	195	1,048
Ceiling Insul R-45 - Central A/C - EL Heat	1000 sqft footprint	33	36	37	45	35	187
Ceiling Insul R-45 - Central A/C - Non-EL Heat	1000 sqft footprint	147	158	160	194	151	810
Ceiling Insul R-45 - Heat Pump	1000 sqft footprint	190	205	208	251	195	1,048
CFL >25W Screw-In Indoor	Lamp	1,376	1,523	1,561	1,905	1,499	7,863
CFL >25W Screw-In Outdoor	Lamp	20	22	23	28	22	114
CFL 18W Screw-In Indoor	Lamp	3,131	3,440	3,526	4,303	3,385	17,786
CFL 18W Screw-In Outdoor	Lamp	345	379	388	474	373	1,958
CFL 23W Screw-In Indoor	Lamp	2,970	3,286	3,368	4,109	3,233	16,966
CFL 23W Screw-In Outdoor	Lamp	562	622	637	778	612	3,210
DHW Pipe Insulation R-4 10 feet	10 Linear Feet	1,397	1,503	1,525	1,841	1,433	7,700
DHW Tank Wrap (R-10 Water Heater Blanket)	Unit	966	1,044	1,064	1,294	1,015	5,383
Efficient Refrigerator (ENERGY STAR® or Better) (DUB)	Refrigerator	1,883	2,026	2,055	2,481	1,931	10,375
ENERGY STAR® Window / Room AC (Early Replacement)	Unit	234	255	261	318	249	1,317
Freezer Retirement	Freezer	701	791	826	1,027	823	4,168
Heat Pump Water Heater - 2.0 EF	Unit	585	644	663	813	642	3,347
High Eff. Elec. Water Heat - Tank - .95 EF	Unit	867	966	1,002	1,241	988	5,064
Instantaneous Electric Water Heater - .99 EF	Unit	332	368	380	469	371	1,919
Low Flow (1.25 GPM) showerhead	Shower	2,897	3,117	3,163	3,823	2,980	15,980
Low Flow Faucet Aerator, 1.5 GPM - EDHW	Faucet	3,025	3,255	3,302	3,987	3,102	16,671
Reduced ACHnat 0.3 - Central A/C - EL Heat	Home	5	6	6	7	5	29
Reduced ACHnat 0.3 - Central A/C - Non-EL Heat	Home	46	49	50	60	47	251
Reduced ACHnat 0.3 - Heat Pump	Home	29	32	32	39	30	162
Refrigerator Retirement	Refrigerator	1,475	1,663	1,737	2,160	1,732	8,769
Underbelly Insulation R-19 - Central A/C - EL Heat	100 sqft floor area	533	569	574	689	534	2,899
Underbelly Insulation R-19 - Heat Pump	100 sqft floor area	1,901	2,046	2,075	2,505	1,950	10,477
Wall Insul. R-11 - Central A/C - EL Heat	1000 sqft wall area	9	10	10	12	10	51
Wall Insul. R-11 - Central A/C - Non-EL Heat	1000 sqft wall area	40	43	44	53	41	223
Wall Insul. R-11 - Heat Pump	1000 sqft wall area	52	56	57	69	54	288

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience. Participant electricity cost savings result in negative participant costs.

Incremental Annual Budget						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$899,572	\$976,970	\$914,815	\$1,009,631	\$956,232	\$4,757,221
Incentive	\$6,510,515	\$7,065,550	\$7,218,647	\$6,912,691	\$6,895,147	\$34,602,550
Total	\$7,410,086	\$8,042,520	\$8,133,462	\$7,922,322	\$7,851,379	\$39,359,770

Incremental Annual						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	-\$1,579,983	-\$1,687,211	-\$1,719,238	-\$1,850,152	-\$1,915,230	-\$8,751,815

Savings Targets

Incremental Annual Savings – at Meter						
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	8,377	9,103	8,579	9,543	9,006	42,800
Summer Peak Demand (kW)	1,087	1,191	1,154	1,325	1,181	5,559

Benefit-Cost Test Results

Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
Total Resource Cost (TRC)	0.8
Utility System Resource Cost (UCT)	0.6
Participant Cost (PCT)	3.0
Rate Impact Measure (RIM)	0.3

4.2 Business Programs

For the complete program plan for each ongoing business program, please reference the Business Program Plans section (pages 81-126) of *Volume 1: AEP Ohio 2012 to 2014 Energy Efficiency/Peak Demand Reduction (EE/PDR) Action Plan*, dated November 29, 2011 (PUCO Docket 11-5568-EL-POR and 11-5569-EL-POR.) Included in each program description below are material program changes as well as participation levels, budget, savings targets and benefit-cost test results. For the new programs, complete program descriptions are included.

4.2.1 Efficient Products for Business (Previously Prescriptive) (On-Going Program)

All business (non-residential) customers in AEP Ohio's service territory are eligible to participate in this program. The program provides a simple and easy way to help fund common energy efficiency projects in existing facilities and new construction projects. A standard menu of incentives, updated annually based on customer participation levels, competitive incentive pricing and market conditions, includes lighting, heating, ventilation, and air conditioning (HVAC), motor drives, refrigeration, and food preparation and storage equipment. Three primary objectives will focus on increasing: market share, installation rates, and operating efficiency. Incentives typically ranging from 20 percent to 50 percent of the incremental cost to purchase energy efficient products will be offered to customers.

Adjustments and Enhancements

AEP Ohio modifications to the Efficient Products for Business Program as shown below:

- Add a midstream component for specific lighting and equipment measures to make efficiency available for small projects where an application is a barrier to participation and also to encourage energy efficiency choices at the point of sale with lighting and equipment distributors.
- Deliver a motor rewind component through an Implementation Contractor that enlists motor rewind shops to be trained and certified in efficient motor rewind and enrolled in the AEP Ohio EMotor Rewind approach.
- Incentives not included in the measure mix from previous plan(s) have been deemed either not cost effective or had low participation.
- Customer incentives may be adjusted to increase cost effectiveness and/or program participation.
- Cost effective measures developed during Plan implementation may be added and measures currently on the list may be changed or removed depending on

both cost effectiveness and customer participation.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total 2015 - 2019
1L4'T5 NLO	Lamp	9,201	6,848	3,615	0	0	19,664
1L4'T8 HP	Lamp	9,201	9,928	6,998	3,713	0	29,842
1L4'T8 HP	Lamp	23,817	20,720	17,220	14,790	13,299	89,846
6L4'T5 HLO	Fixture	17,018	16,772	16,984	17,227	17,382	85,382
6L4'T8HP	Fixture	2,925	2,564	2,220	1,867	1,504	11,080
Advanced Pre-Rinse Spray Nozzle, <=1.6 GPM	Per Sprayer	3	3	4	4	4	18
Agriculture Heat Pads	Unit/swine and hatchery farm	2	3	3	3	3	14
Anti-Sweat Heat (ASH) Controls - freezer and cooler glass reach in or freezer door only are eligible	Linear foot door width	75	79	86	96	107	442
CFL: Pin-Based (13W) Indoor	Fixture	587	499	419	349	279	2,133
CFL: Pin-Based (26W) Indoor	Fixture	14	11	9	6	3	44
CFL: Pin-Based (42W) Outdoor Wall Pack	Fixture	74	78	84	91	98	424
CFL: Pin-Based (84W) Outdoor Wall Pack	Fixture	335	350	377	408	440	1,909
CFL: Screw-In (>26W) Indoor	Lamp	514	510	526	545	563	2,657
CFL: Screw-In (10-15W) Indoor	Lamp	3,126	3,065	3,080	3,138	3,204	15,612
CFL: Screw-In (16-21W) Indoor	Lamp	1,132	1,141	1,186	1,238	1,289	5,985
CFL: Screw-In (22-26W) Indoor	Lamp	138	136	141	145	150	710
Cogged (V) belts on fans 5 HP to 100 HP	Fan	7,920	8,185	8,768	9,404	10,039	44,317
Cogged (V) belts on fans 5 HP to 100 HP	Fan	1,934	1,995	2,134	2,288	2,443	10,794
Cogged (V) belts on fans 5 HP to 100 HP	Fan	968	965	1,013	1,078	1,137	5,160
Cogged (V) belts on fans 5 HP to 100 HP	Fan	1,299	1,293	1,332	1,375	1,411	6,710
Compressed Air - Air Entraining Air Nozzle, 100 psi, 0.25 kW/scfm	Nozzle	2,753	2,601	2,533	2,461	2,375	12,723
Compressed Air - Air Entraining Air Nozzle, 100 psi, 0.25 kW/scfm	Nozzle	522	506	510	519	525	2,582

Compressed Air - Air Receiver for Load/No-Load Compressors (>=5 gal/CFM storage), <=300 HP	Gallon Increased Storage	12,546	12,956	13,846	14,837	15,854	70,040
Compressed Air - Air Receiver for Load/No-Load Compressors (>=5 gal/CFM storage), <=300 HP	Gallon Increased Storage	5,570	5,883	6,532	7,364	8,259	33,608
Compressed Air - Cycling Air Dryer, <=600scfm, thermal mass	sCFM	2,214	2,286	2,443	2,618	2,797	12,359
Compressed Air - Cycling Air Dryer, <=600scfm, thermal mass	sCFM	725	732	762	796	830	3,846
Compressed Air - Cycling Air Dryer, <=600scfm, thermal mass	sCFM	368	386	427	481	538	2,200
Compressed Air - Cycling Air Dryer, <=600scfm, thermal mass	sCFM	121	123	130	138	145	658
Compressed Air - Low Pressure Drop Filter for Compressed Air Systems, 25HP to 300HP, <500CFM, mist eliminator, <1 psi new	sCFM	2,150	2,153	2,247	2,351	2,453	11,354
Compressed Air - Low Pressure Drop Filter for Compressed Air Systems, 25HP to 300HP, <500CFM, mist eliminator, <1 psi new	sCFM	2,147	2,147	2,236	2,338	2,439	11,307
Compressed Air - Low Pressure Drop Filter for Compressed Air Systems, 25HP to 300HP, <500CFM, mist eliminator, <1 psi new	sCFM	356	357	373	390	407	1,883
Compressed Air - Low Pressure Drop Filter for Compressed Air Systems, 25HP to 300HP, <500CFM, mist eliminator, <1 psi new	sCFM	356	356	371	388	404	1,875
Compressed air - no-loss condensate drains	per drain	2,960	3,072	3,305	3,562	3,826	16,725
Compressed air - no-loss condensate drains	per drain	552	573	616	665	714	3,120
Compressed Air - Variable Speed Drive Air Compressor, new, less than 150 HP	Compressor HP	1,314	1,341	1,419	1,505	1,592	7,171
Compressed Air - Variable Speed Drive Air Compressor, new, less than 150 HP	Compressor HP	438	447	473	502	531	2,390
Compressed Air - Variable Speed Drive Air Compressor, new, less than 150 HP	Compressor HP	258	247	244	242	239	1,229
Compressed Air - Variable Speed Drive Air Compressor, new, less than 150 HP	Compressor HP	86	82	81	81	80	410

Dairy Scroll Compressors (Agriculture)	Unit/1000 dairy cows	1	1	1	1	1	3
Daylighting Controls	Watts Controlled, 1 DC	2,433	1,431	632	159	0	4,656
EC Motor for HVAC - Cooling Only	Motor	127	135	148	163	180	752
EC Motor for HVAC - Heating and Cooling	Motor	506	539	591	652	719	3,007
EC Motor for HVAC - Heating Only	Motor	25	27	30	33	36	150
EC Motor: Reach-In Enclosure; blended average of coolers and freezers; no controls	Motor	329	338	360	384	411	1,822
EC Motor: Walk-In Enclosure; blended average of coolers and freezers; no controls	Motor	207	213	226	241	258	1,145
ENERGY STAR Combination Oven	Unit	63	67	74	81	89	374
ENERGY STAR Hot Food Holding Cabinet, Half Size, 8 cuft average	Unit	9	10	11	12	13	54
Energy Star Ice Making Head (501-1000lbs/day)	100lbs ice	189	200	218	240	263	1,110
ENERGY STAR Refrigerated Beverage Vending Machine with Control Software, average	Average Standard Vending	14	15	17	18	20	84
ENERGY STAR Refrigerated Beverage Vending Machine without Control Software, average	Average Standard Vending	14	15	17	18	20	84
Energy Star Remote Condensing Unit, Without Remote Compressor (1001-1500lbs/day)	100lbs ice	38	40	44	48	53	222
ENERGY STAR Solid Door Commercial Freezer	Conventional Non-Energy Star Freezer	0	0	0	24	51	75
ENERGY STAR Steam Cooker - 4 Pan - 100lbs/day	Unit	3	3	4	4	4	19
ENERGY STAR, CEE Tier 2 or CEE Tier 3 Commercial Clothes Washer	Unit	4,285	4,459	4,790	5,143	5,482	24,159
Evap Fan Controller for Cooler and Freezer Walk-ins with glass reach in - ECM	Fan	34	35	37	40	42	188
Evap Fan Controller for Cooler and Freezer Walk-ins with glass reach in - Shaded Pole	Fan	34	35	37	40	42	188
Evap Fan Controller for Cooler and Freezer Walk-ins, no glass - ECM	Fan	90	93	99	105	113	500
Evap Fan Controller for Cooler and Freezer Walk-ins, no glass - Shaded Pole	Fan	90	93	99	105	131	519
Floating Head Pressure Controls; 70F or lower, 1 HP or greater	Refrigeration HP	128	134	144	156	169	731
Heat Reclaimer Units (Agriculture)	Unit/1000 dairy cows	1	1	1	1	1	5
High Volume Low Speed Fans (Agriculture)	Unit/livestock farm	82	87	94	103	113	478
Hotel Guest Room Energy Management System (GREM), Electric Cooling, Electric Heating	Hotel Room Controller	1,392	1,448	1,559	1,687	1,825	7,912
Hotel Guest Room Energy Management System (GREM), Electric Cooling, NON-Electric Heating	Hotel Room Controller	535	557	600	649	702	3,043
LED Exit Sign	Sign	228	229	237	245	252	1,191
LED Lighting <10W - Indoor	Lamp	260	400	352	344	336	1,691
LED Lighting <10W - Indoor	Lamp	239	239	242	255	267	1,243
LED Lighting >=10W - Indoor	Lamp	31	35	0	0	0	67
LED Lighting >=10W - Indoor	Lamp	1,473	1,354	1,251	1,213	1,182	6,472

Livestock Waterers (Agriculture)	Unit/livestock farm	79	85	94	104	115	477
Milk Pre-cooler (Agriculture)	Unit/1000 dairy cows	1	1	1	1	1	5
Occupancy Sensor	Watts Controlled, 1 OC	8,882	8,415	8,313	8,462	8,805	42,878
Outdoor LED Lighting (130W), TC Control, Pole/Area Mount	Fixture	0	233	500	806	842	2,381
Outdoor LED Lighting (130W), TC Control, Pole/Area Mount	Fixture	41	90	146	156	165	597
Outdoor LED Lighting (80W), TC Control, Pole/Area Mount	Fixture	940	945	972	1,002	1,032	4,891
Outside Air Economizer for Coolers	Cooler	214	223	240	260	281	1,217
Packaged terminal air-conditioner (< 7kbtuh, minimum 12.7 EER)	Rated Tons Cooling	44	46	50	54	58	251
Photocell (Outdoor Lighting)	Watts Controlled, 1 PC	1,259	1,276	1,328	1,394	1,466	6,724
Photocell + Timeclock (Outdoor Lighting)	Watts Controlled, 1 TC, 1 PC	3,945	3,982	4,127	4,310	4,511	20,874
Refrigerated Display LED Lighting Strips	Linear foot case door	1,286	1,318	1,397	1,487	1,576	7,064
Screw-in 5W CCFL	Lamp	86	84	85	88	92	435
Specialty CFL - 16W PAR30	Lamp	4	4	4	4	4	20
Specialty CFL - 23W Dimmable R40	Lamp	4	4	4	4	4	20
Split/Package system A/C (< 5.4 tons, 14 SEER) - Direct Exp /All Heating Types	Rated Tons Cooling	949	991	1,065	1,146	1,225	5,376
Split/Packaged Air Conditioner (120 - 240 kBtu/h) 12 EER, 13 IEER - Direct Exp /All Heating Types	Rated Tons Cooling	118	123	133	143	153	670
Split/Packaged Air Conditioner (240 - 760 kBtu/h) 10.6 EER; 12.1 IEER - Direct Exp /All Heating Types	Rated Tons Cooling	304	317	341	367	392	1,721
Split/Packaged Air Conditioner (65 - 120 kBtu/h) 12 EER, 13 IEER - Direct Exp /All Heating Types	Rated Tons Cooling	671	701	754	811	867	3,804
Split/Packaged Heat Pump (<65 kBtu/h) SEER 14 - Heat Pump	Rated Tons Cooling	127	132	142	153	164	717
Split/Packaged Heat Pump (135 - 240 kBtu/h) EER 11.5 - Heat Pump	Rated Tons Cooling	273	285	306	329	352	1,545
Split/Packaged Heat Pump (240 - 760 kBtu/h) EER 10.8 - Heat Pump	Rated Tons Cooling	273	285	306	329	352	1,546
Split/Packaged Heat Pump (65 - 135 kBtu/h) EER 12 - Heat Pump	Rated Tons Cooling	698	728	783	842	900	3,952
T8 Delamping	Lamp	36,950	31,367	25,061	20,025	15,921	129,324
Time clock (Outdoor Lighting)	Watts Controlled, 1 TC	0	0	0	0	592	592
Tractor Engine Block Heater Timer (Agriculture)	Unit/farm	504	532	579	633	692	2,941
Variable Speed Drive for Milk Vacuum Pump	HP/1000 dairy cows	1	1	1	1	1	3
Vending Machine PIR Occupancy Sensor - Cold Drink	Per Machine	357	369	395	425	457	2,004
Vending Machine PIR Occupancy Sensor - Snacks	Per Machine	357	369	394	424	455	1,999
VFD on centrif load - Process or HVAC fans or pumps up to 200 HP	HP	24,059	25,040	26,966	29,190	31,583	136,838
VFD on centrif load - Process or HVAC fans or pumps up to 200 HP	HP	3,287	3,421	3,684	3,987	4,314	18,693
Water Source Heat Pump (<17 kBtu/h) EER 17 - Heat Pump	Rated Tons Cooling	139	147	161	176	193	817
Water Source Heat Pump (>17 kBtu/h and < 135 kBtu/h) EER 17 - Heat Pump	Rated Tons Cooling	139	147	161	176	193	817
Window Films on Double Pane - Non-North Facing Windows	100 sqft glazed	0	0	0	2,058	4,035	6,093
Zero Energy Door	Case Door	0	151	307	471	442	1,372

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Budget						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$4,563,376	\$4,616,148	\$4,820,158	\$5,105,582	\$5,291,578	\$24,396,842
Incentive	\$9,946,207	\$9,940,784	\$10,372,676	\$11,001,108	\$11,603,318	\$52,864,094
Total	\$14,509,583	\$14,556,932	\$15,192,834	\$16,106,690	\$16,894,896	\$77,260,935

Incremental Annual						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	\$30,333,361	\$30,806,907	\$32,040,640	\$34,628,611	\$35,064,900	\$162,874,419

Savings Targets

Incremental Annual Savings – at Meter						
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	99,158	100,349	104,975	111,265	117,691	515,534
Summer Peak Demand (kW)	18,422	18,263	18,740	19,755	20,833	92,945

Benefit-Cost Test Results

Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
Total Resource Cost (TRC)	1.7
Utility System Resource Cost (UCT)	5.4
Participant Cost (PCT)	2.6
Rate Impact Measure (RIM)	0.7

4.2.2 Process Efficiency (Previously Custom) (On-Going Program)

All business (non-residential) customers in AEP Ohio's service territory are eligible to participate. The Process Efficiency program is for cost-effective energy efficiency improvements that reduce energy consumption and peak demand not already covered by other AEP Ohio programs. All technologies are subject to eligibility and verification of

savings. Customers receive an incentive customized to the specific results of the energy savings technologies implemented. The program assists larger commercial and industrial customers with the analysis and selection of high-efficiency equipment or processes not covered under the Efficient Products program or other program offerings. This program approach identifies more complex energy savings projects, provides economic analysis and aids in the completion of the incentive application. Incentives are based on energy savings on a per kWh basis for installed measures.

Adjustments and Enhancements

AEP Ohio modifications to the Process Efficiency Program as shown below:

- Eliminate the \$100/kW demand savings incentive as ancillary to the energy incentive and not seen as a market driver for participation.
- Adjust incentive levels annually as appropriate with consideration of Bid to Win auction results.
- Incentives not included in the measure mix from previous plan(s) have been deemed either not cost effective or had low participation.
- Customer incentives may be adjusted to increase cost effectiveness and/or program participation.
- Cost effective measures developed during Plan implementation may be added and measures currently on the list may be changed or removed depending on both cost effectiveness and customer participation.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total
							2015 - 2019
Air Cooled Chiller <150 Tons, 90% of code kW/Ton (IPLV)	Rated Tons Cooling	3,054	3,304	3,903	4,259	4,701	19,222
Code minimum R-20ci or R-38 batt - Chiller / Elec Resist	1000 sqft roof	1,147	1,106	1,148	1,095	1,051	5,547
Compressed Air - Air Entraining Air Nozzle, 100 psi, 0.25 kW/scfm	Nozzle	8,128	8,492	9,682	10,185	10,827	47,314
Compressed Air - Air Entraining Air Nozzle, 100 psi, 0.25 kW/scfm	Nozzle	1,295	1,348	1,530	1,602	1,695	7,469
Compressed Air - Controls	Compressor HP	7,814	7,605	7,992	7,755	7,622	38,788
Compressed Air - Controls	Compressor HP	1,215	1,182	1,242	1,206	1,185	6,030
Compressed Air - Cycling Air Dryer, >600scfm, all types	sCFM	9,768	9,506	9,990	9,694	9,527	48,485
Compressed Air - Cycling Air Dryer, >600scfm, all types	sCFM	3,512	3,695	4,237	4,478	4,777	20,700
Compressed Air - Cycling Air Dryer, >600scfm, all types	sCFM	1,620	1,576	1,657	1,607	1,580	8,040
Compressed Air - Cycling Air Dryer, >600scfm, all types	sCFM	589	627	726	776	836	3,553
Compressed Air - Variable Speed Drive Air Compressor, new, greater than 150 HP	Compressor HP	12,692	12,051	12,370	11,793	11,466	60,372
Compressed Air - Variable Speed Drive Air Compressor, new, greater than 150 HP	Compressor HP	2,252	1,823	1,463	960	485	6,983
Compressed Air - Variable Speed Drive Air Compressor, new, greater than 150 HP	Compressor HP	2,429	2,364	2,485	2,411	2,370	12,059
Compressed Air - Variable Speed Drive Air Compressor, new, greater than 150 HP	Compressor HP	569	586	659	684	718	3,215
Daylighting Controls	Watts Controlled, 1 DC	14,981	11,283	7,771	3,806	1,228	39,068
Energy Management System	sf Conditioned Space	12,681	12,335	12,955	12,566	12,347	62,884
Energy Management System	1000sf Conditioned Space	32,381	31,498	33,080	32,088	31,528	160,575
Intra-company behavioral change re plugloads	Building	1,831	1,785	1,886	1,842	1,823	9,166
Multiplex system with oversized condenser	Tons of Refrigeration Per Networked Workstation	91	78	66	52	43	330
Network PC Management Software	Workstation	890	883	953	957	986	4,669
Screw Chillers, Water-Cooled, 150 tons to below 300 tons, 90% of code kW/Ton (IPLV)	Rated Tons Cooling	720	1,113	1,274	1,348	1,445	5,900
Screw Chillers, Water-Cooled, 75 tons to below 150 tons, 90% of code kW/Ton (IPLV)	Rated Tons Cooling	538	582	687	750	828	3,384
Screw Chillers, Water-Cooled, below 75 tons, 90% of code kW/Ton (IPLV)	Rated Tons Cooling	538	582	687	750	828	3,384

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Budget						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$3,560,626	\$3,463,556	\$3,649,464	\$3,566,800	\$3,545,691	\$17,786,136
Incentive	\$4,384,980	\$4,012,505	\$3,891,486	\$3,506,678	\$3,259,249	\$19,054,898
Total	\$7,945,606	\$7,476,061	\$7,540,950	\$7,073,478	\$6,804,940	\$36,841,034

Incremental Annual						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	\$13,512,091	\$12,604,641	\$12,614,240	\$11,660,318	\$10,925,630	\$61,316,921

Savings Targets

Incremental Annual Savings – at Meter						
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	65,016	63,308	66,787	65,351	65,218	324,711
Summer Peak Demand (kW)	14,280	13,554	13,859	13,144	12,809	66,784

Benefit-Cost Test Results

Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
Total Resource Cost (TRC)	2.8
Utility System Resource Cost (UCT)	7.6
Participant Cost (PCT)	3.6
Rate Impact Measure (RIM)	0.9

4.2.3 New Construction (On-Going Program)

All business (non-residential) customers in AEP Ohio's service territory are eligible to participate in this program. This program is for new construction and major renovation projects to encourage building owners, designers, and architects to exceed standard building practices to achieve efficiency above current building energy code requirements. The program provides interactive design assistance to the architects and engineers that are designing new buildings. The key design assistance tool is building

simulation modeling of more efficient building designs. The program provides incentives to new facility owners for the installation of high-efficiency lighting, HVAC, building envelope, refrigeration and other equipment and controls. The program provides a marketing mechanism for architects and engineers to promote energy efficient new buildings and equipment to end users. This whole building approach requires fully-executable energy models for evaluation and therefore has incentives for the design team as well as the owner. Efficient Business Products and Process Efficiency incentives are available for individual energy efficiency measures that exceed then current code requirements.

Adjustments and Enhancements

AEP Ohio modifications to the New Construction Program as shown:

- Master metered apartment buildings are metered for non-residential tariffs. As such, these facilities are eligible for this program.
- Incentives not included in the measure mix from previous plan(s) have been deemed either not cost effective or had low participation.
- Incentives may be adjusted to increase cost effectiveness and/or program participation.
- Cost effective measures developed during Plan implementation may be added and measures currently on the list may be changed or removed depending on both cost effectiveness and customer participation.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total
							2015 - 2019
Air Cooled Chiller <150 Tons, 90% of code kW/Ton (IPLV)	Rated Tons Cooling	2,588	2,933	2,963	3,007	3,071	14,563
Airside Economizer - below 33,000 Btu/h	Rated Tons Cooling	115	130	132	134	136	647
Cogged (V) belts on fans 5 HP to 100 HP	Fan	5,600	6,315	6,309	6,318	6,345	30,887
Cogged (V) belts on fans 5 HP to 100 HP	Fan	556	627	627	628	630	3,068
Compressed Air - Controls	Compressor HP	944	1,066	1,070	1,076	1,087	5,243
Compressed Air - Controls	Compressor HP	283	320	321	323	326	1,573
Daylighting Controls	Watts Controlled, 1 DC	1,207	1,361	1,357	1,357	1,360	6,643
DCV - Office	1000sf	9,956	11,227	11,217	11,232	11,280	54,911
Evap Fan Controller for Cooler and Freezer Walk-ins with glass reach in - ECM	Fan	71	80	81	82	84	397
Evap Fan Controller for Cooler and Freezer Walk-ins, no glass - ECM	Fan	112	127	128	130	132	628
Hotel Guest Room Energy Management System (GREM), Electric Cooling, Electric Heating	Hotel Room Controller	1,437	1,628	1,644	1,668	1,703	8,080
Hotel Guest Room Energy Management System (GREM), Electric Cooling, NON-Electric Heating	Hotel Room Controller	553	626	632	642	655	3,108
Improved Ceiling Insulation R45 batt - Direct Exp / Elec Resist	1000 sqft roof	1,846	2,077	2,066	2,057	2,052	10,097
Network PC Management Software	Per Networked Workstation	205	233	235	239	244	1,157
Package system A/C (>=63.3 tons, minimum 10.2 EER, 11.4 IEER) - Direct Exp / All Heating Types	Rated Tons Cooling	164	185	184	184	183	900
Packaged terminal air-conditioner (< 7kbtuh, minimum 12.7 EER)	Rated Tons Cooling	132	148	147	147	146	720
Screw Chillers, Water-Cooled, 150 tons to below 300 tons, 90% of code kW/Ton (IPLV)	Rated Tons Cooling	456	516	522	529	541	2,564
Screw Chillers, Water-Cooled, 75 tons to below 150 tons, 90% of code kW/Ton (IPLV)	Rated Tons Cooling	456	516	522	529	541	2,564
Screw Chillers, Water-Cooled, below 75 tons, 90% of code kW/Ton (IPLV)	Rated Tons Cooling	456	516	522	529	541	2,564
Split/Package system A/C (< 5.4 tons, 14 SEER) - Direct Exp /All Heating Types	Rated Tons Cooling	2,858	3,217	3,201	3,189	3,181	15,646
Split/Packaged Air Conditioner (120 - 240 kBTu/h) 12 EER, 13 IEER - Direct Exp /All Heating Types	Rated Tons Cooling	356	401	399	398	397	1,950
Split/Packaged Air Conditioner (240 - 760 kBTu/h) 10.6 EER; 12.1 IEER - Direct Exp /All Heating Types	Rated Tons Cooling	915	1,030	1,025	1,021	1,018	5,008
Split/Packaged Air Conditioner (65 - 120 kBTu/h) 12 EER, 13 IEER - Direct Exp /All Heating Types	Rated Tons Cooling	2,022	2,276	2,265	2,256	2,251	11,070
Split/Packaged Heat Pump (<65 kBTu/h) SEER 14 - Heat Pump	Rated Tons Cooling	381	429	427	426	425	2,088
Split/Packaged Heat Pump (135 - 240 kBTu/h) EER 11.5 - Heat Pump	Rated Tons Cooling	822	925	920	916	914	4,498
Split/Packaged Heat Pump (240 - 760 kBTu/h) EER 10.8 - Heat Pump	Rated Tons Cooling	822	925	920	917	914	4,498
Split/Packaged Heat Pump (65 - 135 kBTu/h) EER 12 - Heat Pump	Rated Tons Cooling	2,102	2,365	2,353	2,343	2,337	11,500
Water Source Heat Pump (<17 kBTu/h) EER 17 - Heat Pump	Rated Tons Cooling	421	478	483	490	500	2,372
Water Source Heat Pump (>17 kBTu/h and < 135 kBTu/h) EER 17 - Heat Pump	Rated Tons Cooling	421	478	483	490	500	2,372

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Budget						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$1,137,156	\$1,283,678	\$1,284,144	\$1,287,567	\$1,294,944	\$6,287,488
Incentive	\$2,665,879	\$3,006,654	\$3,005,011	\$3,010,206	\$3,024,577	\$14,712,326
Total	\$3,803,035	\$4,290,332	\$4,289,155	\$4,297,772	\$4,319,520	\$20,999,814

Incremental Annual						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	\$4,570,611	\$5,157,106	\$5,159,204	\$5,174,363	\$5,206,929	\$25,268,213

Savings Targets

Incremental Annual Savings – at Meter						
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	31,588	35,658	35,671	35,766	35,971	173,106
Summer Peak Demand (kW)	2,854	3,224	3,231	3,246	3,273	15,704

Benefit-Cost Test Results

Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
Total Resource Cost (TRC)	2.6
Utility System Resource Cost (UCT)	5.8
Participant Cost (PCT)	4.4
Rate Impact Measure (RIM)	0.7

4.2.4 Express (On-Going Program)

Program	Express Program
Objective	<p>The Express Program provides a streamlined, one-stop, turn-key energy efficiency service delivered through a program implementer. The program generates energy savings through program services and incentives to help qualifying customers reduce energy usage and lower energy costs. Incentives for energy efficiency retrofit projects are generally higher than the Efficient Products and Process Efficiency Programs, with an initial cap of 70 percent of the project costs.</p> <p>The Express Program targets small business customers, generally indicated as customers with demands of less than 100 kW or with annual energy consumption of 200,000 kWh</p>

or less, based on the last 12 months of billing history. Either the demand or energy consumption limits could be lowered during implementation to focus more on smaller customers during the Plan period. Corporate-owned national accounts are excluded from participation. Funding for large franchisee-owned national accounts customers are eligible but may be limited to ensure local small business participation. As with residential low income customers, small non-profit customers may need additional incentives to afford energy efficiency improvements, and these opportunities will be considered to remove barriers to this group's participation.

Adjustments and Enhancements

AEP Ohio modifications to the Express Program as shown below:

- The Express Program is designed to operate with marketing and installations provided by a single Implementation Contractor, but may operate with multiple trade allies providing marketing and installation services or, a hybrid of the two models as AEP Ohio deems best to increase participation and improve customer satisfaction.
- Implementation contractors or other partners may offer financing to reduce barriers to small business installation of measures.
- In the 2015-2019 Plan customers with an initial demand limit of 100 kW will also be eligible to participate. A study of customers with demands of 100 kW or less, even when energy usage is greater than 200,000 kWh showed that most shared characteristics of other small business Express participants and would benefit by participation in the program.
- Incentives not included in the measure mix from previous plan(s) have been deemed either not cost effective or had low participation.
- Incentives may be adjusted to increase cost effectiveness and/or program participation.
- Cost effective measures developed during Plan implementation may be added and measures currently on the list may be changed or removed depending on both cost effectiveness and customer participation.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total 2015 - 2019
1L4'T5 NLO	Lamp	3,347	2,476	1,019	0	0	6,842
1L4'T8 HP	Lamp	3,868	3,924	2,345	990	0	11,128
1L4'T8 HP	Lamp	10,168	9,825	7,554	6,040	5,154	38,741
6L4'T5 HLO	Fixture	10,969	11,999	11,496	11,127	10,962	56,553
6L4'T8HP	Fixture	1,249	1,224	983	773	597	4,826
Advanced Pre-Rinse Spray Nozzle, <=1.6 GPM	Per Sprayer	1	2	2	2	2	8
Anti-Sweat Heat (ASH) Controls - freezer and cooler glass reach in or freezer door only are eligible	Linear foot door width	33	36	36	35	36	176
CFL: Pin-Based (13W) Indoor	Fixture	244	230	172	132	99	876
CFL: Pin-Based (26W) Indoor	Fixture	6	5	4	2	1	19
CFL: Pin-Based (42W) Outdoor Wall Pack	Fixture	33	37	37	37	38	182
CFL: Pin-Based (84W) Outdoor Wall Pack	Fixture	147	166	165	167	172	818
CFL: Screw-In (>26W) Indoor	Lamp	223	242	230	222	219	1,136
CFL: Screw-In (10-15W) Indoor	Lamp	1,337	1,419	1,305	1,230	1,188	6,480
CFL: Screw-In (16-21W) Indoor	Lamp	487	529	506	490	484	2,496
CFL: Screw-In (22-26W) Indoor	Lamp	60	65	62	60	59	305
EC Motor: Reach-In Enclosure; blended average of coolers and freezers; no controls	Motor	144	160	158	157	160	780
EC Motor: Walk-In Enclosure; blended average of coolers and freezers; no controls	Motor	91	101	99	99	101	490
Evap Fan Controller for Cooler and Freezer Walk-ins with glass reach in - ECM	Fan	15	17	16	16	17	81
Evap Fan Controller for Cooler and Freezer Walk-ins with glass reach in - Shaded Pole	Fan	15	17	16	16	17	80
Evap Fan Controller for Cooler and Freezer Walk-ins, no glass - ECM	Fan	40	44	43	43	44	214
Evap Fan Controller for Cooler and Freezer Walk-ins, no glass - Shaded Pole	Fan	40	44	43	43	44	214
LED Exit Sign	Sign	100	109	104	101	99	512
LED Lighting <10W - Indoor	Lamp	105	113	106	104	104	533
LED Lighting >=10W - Indoor	Lamp	631	642	549	496	459	2,777
Occupancy Sensor	Watts Controlled, 1 OC	5,116	5,488	5,183	5,045	5,094	25,927
Outdoor LED Flood Light (30W), TC Control	Fixture	2,182	2,492	2,528	2,593	2,713	12,507
Outdoor LED Lighting (130W), TC Control, Pole/Area Mount	Fixture	2,109	2,408	2,442	2,505	2,620	12,084
Outdoor LED Lighting (80W), TC Control, Pole/Area Mount	Fixture	2,097	2,385	2,407	2,458	2,561	11,907
Photocell (Outdoor Lighting)	Watts Controlled, 1 PC	551	605	582	568	567	2,874
Photocell + Timeclock (Outdoor Lighting)	Watts Controlled, 1 TC, 1 PC	2,291	2,540	2,477	2,448	2,475	12,230
Screw-in 5W CCFL	Lamp	37	40	37	36	35	185
Specialty CFL - 16W PAR30	Lamp	2	2	2	2	2	8
Specialty CFL - 23W Dimmable R40	Lamp	2	2	2	2	2	8
T8 Delamping	Lamp	17,995	17,414	13,439	10,579	8,583	68,011
Vending Machine PIR Occupancy Sensor - Cold Drink	Per Machine	156	174	171	171	174	846
Vending Machine PIR Occupancy Sensor - Snacks	Per Machine	161	179	176	176	180	872

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Budget						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$1,466,072	\$1,602,879	\$1,535,021	\$1,500,296	\$1,493,335	\$7,597,604
Incentive	\$3,082,840	\$3,344,094	\$3,143,774	\$3,069,750	\$3,078,098	\$15,718,556
Total	\$4,548,913	\$4,946,973	\$4,678,795	\$4,570,046	\$4,571,434	\$23,316,160

Incremental Annual						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	\$5,889,876	\$6,444,986	\$6,191,587	\$6,019,720	\$5,801,178	\$30,347,347

Savings Targets

Incremental Annual Savings – at Meter						
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	20,315	22,248	21,371	20,923	21,008	103,680
Summer Peak Demand (kW)	3,982	4,244	3,944	3,747	3,647	18,917

Benefit-Cost Test Results

Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
Total Resource Cost (TRC)	1.5
Utility System Resource Cost (UCT)	3.5
Participant Cost (PCT)	3.3
Rate Impact Measure (RIM)	0.5

4.2.5 Self-Direct (On-Going Program)

AEP Ohio commercial and industrial “mercantile” customers that consume more than 700,000 kWh/year or customers that are part of a national account can participate. Projects must be cost effective. The program is designed to capture energy savings and demand reduction from large customers with the capability to administer internal energy management efforts of their own. To participate, customers submit an application, calculation spreadsheets and supporting documentation. The application is

reviewed and if approved by AEP Ohio and by the PUCO, a one-time payment is made or an EE/PDR rider exemption is applied. Customers accepting an exemption from the rider for a specified number of months are not allowed to participate in any other AEP Ohio EE/PDR programs during the period of exemption. The program allows customers to submit energy efficiency projects that are up to three years old. The standard percentage of 75 percent of the calculated incentive under the Efficient Products for Business, Process Efficiency Program, or Data Center Program for customers applies.

Adjustments and Enhancements

AEP Ohio modifications to the Self- Direct Program as shown below:

- Incentives may be adjusted to increase cost effectiveness and/or program participation.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results, and program implementation experience. These measures are a proxy for the broad variety of measures that will generate the savings expected.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total 2015 - 2019
LED Lighting <10W - Indoor	Lamp	154	257	229	217	192	1,049
LED Lighting >=10W - Indoor	Lamp	19	23	0	0	0	41
Outdoor LED Lighting (130W), TC Control, Pole/Area Mount	Fixture	0	290	629	981	930	2,831
Self Direct Program	Project	46	42	47	49	49	233
Self Direct Program	Project	28	26	28	30	30	141

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Budget						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$466,288	\$447,773	\$505,691	\$548,386	\$525,148	\$2,493,286
Incentive	\$638,934	\$670,320	\$809,253	\$932,305	\$918,944	\$3,969,755
Total	\$1,105,222	\$1,118,093	\$1,314,944	\$1,480,691	\$1,444,092	\$6,463,041

Incremental Annual						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant	\$1,051,785	\$1,107,375	\$1,352,736	\$1,566,643	\$1,349,411	\$6,427,950

Costs						
Savings Targets						
<p>Program impact assessment is performed beginning with the first year of EE/PDR program implementation, in 2009. The reason to do so is to ensure that the effects of consumer actions at the end of measure life are accounted for. The analysis assumes that a certain percentage of program first life participants do not maintain the higher efficiency level but rather return to the baseline condition. This return to the baseline condition causes a loss to cumulative potential, but does not affect incremental potential. Normally these effects are not large. However, in some cases, when a measure has high participation in an early year, relative to later years, the effect can be noticeable. This is the case with the Self Direct Program. In its first year, 2009, savings were 142,101 MWh. This compares to the average annual incremental impacts between 2015 and 2019 of about 12,500 MWh. The original savings in 2009 is over a factor of 10 larger. The average measure life for the program is about 10 years. This means that in about 2019, a certain percentage of this large 142,101 MWh savings will be reverting back to the base technology and thus this savings is effectively lost on a cumulative basis. This loss of savings is not taken from incremental new savings but rather from cumulative potential.</p>						
Incremental Annual Savings – at Meter						
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	11,006	10,559	11,915	12,911	12,868	26,081
Summer Peak Demand (kW)	1,264	1,180	1,297	1,371	1,372	2,678
Benefit-Cost Test Results						
Benefit-Cost Test					2015-2019 Benefit-Cost Test Ratio	
Total Resource Cost (TRC)					3.3	
Utility System Resource Cost (UCT)					6.7	
Participant Cost (PCT)					5.1	
Rate Impact Measure (RIM)					0.8	

4.2.6 Retro-Commissioning (On-Going Program)

The Retro-Commissioning program obtains energy savings through the identification and implementation of low-cost, operational adjustments that improve the efficiency of existing buildings' operating systems by optimizing the systems to meet the building's requirements, with a focus on building controls and HVAC systems.

The Retro-commissioning (RCx) Program targets 125 kW or greater, medium to large business customers.

Eligible measures will vary depending on the business sector served, but should include at least:

- **HVAC systems and controls:** Economizers, demand control ventilation,

heat/energy recovery ventilators, fan and pump controls, head-pressure controls, setback controls, night venting controls.

- **Lighting controls:** Occupancy/vacancy controls, photo-sensors, timer controls.
- **Motor controls:** Variable frequency/speed drives, timer controls.
- **Process controls:** Where applicable.
- **Distribution transformers:** Harmonic filtering and harmonic mitigating.

Adjustments and Enhancements

AEP Ohio modifications to the Retro-commissioning Program as shown below:

- The program changes from a requirement for customers with a peak demand of 500 kW to a peak demand of 125 kW to avoid eliminating schools which are excellent candidates.
- Incentives not included in the measure mix from previous plan(s) have been deemed either not cost effective or had low participation.
- Customer incentives may be adjusted to increase cost effectiveness and/or program participation.
- Cost effective measures developed during Plan implementation may be added and measures currently on the list may be changed or removed depending on both cost effectiveness and customer participation.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results and program implementation experience.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total
							2015 - 2019
RCx Program - IND	Program	1	1	1	1	1	5
RCx Program - COM	Program	1	1	1	1	1	5

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Budget						
	2015	2016	2017	2018	2019	Total
						2015 – 2019

Administrative	\$69,433	\$76,864	\$84,314	\$93,698	\$99,957	\$424,266
Incentive	\$472,819	\$511,200	\$560,296	\$622,164	\$687,169	\$2,853,649
Total	\$542,252	\$588,065	\$644,610	\$715,862	\$787,126	\$3,277,916

	Incremental Annual					
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	\$1,457,600	\$1,624,129	\$1,780,111	\$1,976,671	\$1,983,389	\$8,821,901

Savings Targets						
	Incremental Annual Savings – at Meter					
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	3,298	3,651	4,005	4,451	4,920	19,736
Summer Peak Demand (kW)	550	609	667	742	820	3,289

Benefit-Cost Test Results	
Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
Total Resource Cost (TRC)	1.2
Utility System Resource Cost (UCT)	4.5
Participant Cost (PCT)	1.7
Rate Impact Measure (RIM)	0.7

4.2.7 Continuous Energy Improvement (On-Going Program)

This program facilitates a comprehensive and ongoing strategic approach to energy reduction at key customer facilities. The Continuous Energy Improvement Program (CEI) realizes widespread, substantial energy savings for participants willing to participate in and partner with the program. The CEI program utilizes low cost/no cost measures to deliver productivity improvements that reduce the energy intensity of those customers. The program targets low cost and no cost operational savings opportunities.

The target participants are:

- Transmission, sub-transmission and self-assessor customers.

- Large, account managed business customers with site electric energy expenditures exceeding \$500,000 per annum or with annual consumption greater than 10 GWh.
- Mid-range industrial accounts with energy expenditures ranging from \$100,000 to \$500,000 per annum.
- Institutional facilities.

Adjustments and Enhancements

AEP Ohio modifications to the Continuous Energy Improvement Program as shown:

- A streamlined option to baseline and model productivity improvements and energy density reductions through the program for transmission, sub-transmission and self-assessor customers.
- Measurement of facility productivity, energy density per product/service reductions and streamlined processes focused efforts are enhanced for this program to increase economic development, retain and enhance manufacturing and increase customer competitiveness.
- Incentives not included in the measure mix from previous plan(s) have been deemed either not cost effective or had low participation.
- Customer incentives may be adjusted to increase cost effectiveness and/or program participation.
- Cost effective measures developed during Plan implementation may be added and measures currently included may be changed or removed depending on both cost effectiveness and customer participation.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results and program implementation experience. These measures are a proxy for the types of low cost, no cost activities that will generate the savings expected.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total
							2015 - 2019
Multiplex system with oversized condenser	Tons of Refrigeration	87	104	102	94	87	475
T8 Delamping	Lamp	172,685	208,162	211,073	193,798	171,810	957,528

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

	Incremental Annual Budget					
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$304,636	\$367,367	\$372,645	\$342,284	\$292,992	\$1,679,924
Incentive	\$2,635,535	\$3,105,281	\$3,148,662	\$2,890,969	\$2,563,007	\$14,343,454
Total	\$2,940,171	\$3,472,648	\$3,521,307	\$3,233,252	\$2,855,999	\$16,023,379

	Incremental Annual					
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	\$5,974,516	\$7,273,597	\$7,375,141	\$6,771,545	\$5,407,466	\$32,802,265

Savings Targets

	Incremental Annual Savings – at Meter					
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	13,568	16,362	16,597	15,245	13,521	73,638
Summer Peak Demand (kW)	2,885	3,479	3,529	3,242	2,875	15,660

Benefit-Cost Test Results

Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
Total Resource Cost (TRC)	1.2
Utility System Resource Cost (UCT)	3.7
Participant Cost (PCT)	2.3
Rate Impact Measure (RIM)	0.5

4.2.8 Bid to Win (On-Going Program)

The program produces long-term electric energy savings in the business sector by introducing a competitive bidding approach to EE/PDR. In addition, typical EE/PDR programs don't match up effectively with customers' capital planning schedules. This program provides an opportunity to competitively bid for EE/PDR projects and reserve funds won in a timeframe that fits the individual customer's capital planning needs. The target market consists primarily of larger customers and customer groups that may include industrial and manufacturing facilities, healthcare, government and education. Auction timeframes are planned for fall of each year for future year(s) projects. The auction will also inform AEP Ohio in the process of setting incentives for most of its other major Business programs in the following year.

The Bid to Win Program concept involves the following steps:

- 1) Customers or project sponsors develop projects with significant savings potential and prepare their projects for pre-qualification.
- 2) Bidders submit their projects for pre-qualification and qualified bidders are approved to bid their projected energy savings in cost per annual energy saved (\$/kWh).
- 3) Once bidding process is complete, AEP Ohio selects winning applicants based on specified criteria set prior to the scheduled Bid-to-Win auction event.

Adjustments and Enhancements

AEP Ohio modifications to the Bid-to-Win Program as shown below:

- Requires a useful life of 10 years or greater.
- Expansion of the program to provide input to business incentives across multiple programs. Anticipate an annual auction event, ideally in the fall, to gain large projects for the following year at cost competitive incentive rates and where results will provide information to AEP Ohio for setting incentive levels on all major programs in the following year, where appropriate.
- Projects to receive payment based on verified energy savings following project completion and final project application approval.
- Projects and measures eligible for incentive bidding may be added or removed to increase cost effectiveness and/or program participation.
- The number of available auctions may be increased, decreased or eliminated based on customer participation levels.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results and program implementation experience.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total
							2015 - 2019
Bid to Win Program - IND	Project	8	8	8	8	8	39
Bid to Win Program - COM	Project	5	5	5	5	5	27

Budget

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results and program

implementation experience.

	Incremental Annual Budget					
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$750,117	\$779,498	\$775,029	\$774,576	\$746,461	\$3,825,680
Incentive	\$2,477,647	\$2,571,614	\$2,553,816	\$2,549,278	\$2,561,908	\$12,714,263
Total	\$3,227,765	\$3,351,112	\$3,328,845	\$3,323,854	\$3,308,368	\$16,539,944

	Incremental Annual					
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	\$25,340,419	\$26,301,470	\$26,119,446	\$26,073,033	\$23,144,764	\$126,979,133

Savings Targets

	Incremental Annual Savings – at Meter					
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	43,083	44,771	44,514	44,488	44,762	221,619
Summer Peak Demand (kW)	7,181	7,462	7,419	7,415	7,460	36,936

Benefit-Cost Test Results

Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
Total Resource Cost (TRC)	1.2
Utility System Resource Cost (UCT)	10.6
Participant Cost (PCT)	1.5
Rate Impact Measure (RIM)	0.8

4.2.9 Data Center (On-Going Program)

The program provides energy efficiency opportunities for both new and existing data centers that lead to energy savings. Incentives are provided to qualifying measures, as well as to offset the cost of a preliminary study. The study will be utilized in identifying current and new energy efficiency opportunities.

The Data Center Program is designed for data centers seeking to improve the efficiency of new and existing facilities. Special attention is given to meet the specific needs of each of the three sizes of data centers as defined by the Environmental Protection

Agency, which include: Localized Data Centers (500-1,000 sq. ft.), Mid-tier Data Centers (1,000-5,000 sq. ft.), and Enterprise-class Data Centers (5,000+ sq. ft.).

The following energy efficient opportunities are eligible for the Data Center Program:

- Server Virtualization
- ENERGY STAR® Servers
- High Efficiency UPS –Power Distribution Optimization
- Distribution Power Transformer Optimization
- Storage Optimization –Row-Oriented Cooling Systems
- Efficient Floor Layout Properly Located Vented Floor Tiles
- Optimize Temperature and Humidity Set Points –Economizers PC Power Management –Desktop Virtualization VoIP
- Airflow Optimization
- Variable Flow Devices
- Integrated Controls
- Energy Recovery Devices and Strategies
- Emerging Technologies (Power Management)
- Optimize Data Center Cooling Technology

Adjustments and Enhancements

AEP Ohio modifications to the Data Center program as shown below:

- Incentives not included in the measure mix from previous plan(s) have been deemed either not cost effective or had low participation.
- Customer incentives may be adjusted to increase cost effectiveness and/or program participation.
- Cost effective measures developed during Plan implementation may be added and measures currently on the list may be changed or removed depending on both cost effectiveness and customer participation.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results and program implementation experience.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total
							2015 - 2019
2013 OH Data Center	Sqft (DC Floor Area)	1,316	1,442	1,594	1,784	1,985	8,122
2013 OH Data Center Post Retrofit	Sqft (DC Floor Area)	215,908	192,122	175,917	167,532	163,111	914,590

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

	Incremental Annual Budget					
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$349,910	\$311,761	\$285,848	\$272,592	\$256,517	\$1,476,627
Incentive	\$1,552,725	\$1,351,578	\$1,238,602	\$1,180,565	\$1,150,340	\$6,473,810
Total	\$1,902,635	\$1,663,340	\$1,524,450	\$1,453,156	\$1,406,856	\$7,950,437

	Incremental Annual					
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	\$2,485,933	\$2,244,289	\$2,056,143	\$1,959,265	\$1,696,771	\$10,442,402

Savings Targets

	Incremental Annual Savings – at Meter					
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	8,318	7,412	6,798	6,484	6,322	33,868
Summer Peak Demand (kW)	750	668	613	585	570	3,054

Benefit-Cost Test Results

Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
-	
Total Resource Cost (TRC)	1.2
Utility System Resource Cost (UCT)	2.8
Participant Cost (PCT)	2.8
Rate Impact Measure (RIM)	0.5

4.2.10 Demand Response (On-Going Program)

The Demand Response Program is available to non-residential customers only and may be used to supplement the peak demand reductions achieved from EE/PDR programs in order to ensure the peak demand reduction benchmark requirements of SB 221 are met. The program includes monitoring, participation and compliance with any then in effect Commercial and Industrial Interruptible Rates offered in the AEP Ohio service territory. In addition, PJM Demand Response Program participation may be utilized, provided mercantile customers commit that resource to AEP Ohio. Program funding is

primarily limited to gaining customer commitments for the supplemental peak demand reduction needed by AEP Ohio that could include interruptible tariffs, special arrangements, a standard offer or a bid process. No savings for the program are estimated since the program may not be needed during the five-year period.

Adjustments and Enhancements

AEP Ohio modifications to the Demand Response program as shown below:

- Incentives may be adjusted to increase cost effectiveness and/or program participation.

Budget

Incremental Annual Budget						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	\$0	\$0	\$0	\$0	\$0	\$0
Incentive	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$500,000
Total	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$500,000

4.3 Cross-Sector Programs and Other Activities

AEP Ohio new cross-sector programs and activities that provide measurable savings:

- Multifamily
- Combined Heat and Power (CHP)/Waste Energy Resources (WER)
- Customer Power Factor
- T&D Customer Efficiency

Cross-sector programs for which energy savings are counted from other AEP Ohio activities:

- gridSMART Enabled EE/PDR Savings
- T&D Loss Reduction (formerly T&D and Internal System Efficiency Improvements)

AEP Ohio continuing cross-sector activities for 2015 to 2019:

- Education and Training
- Targeted Advertising
- Research and Development

4.3.1 Multifamily Program (New Program)

Program	Multifamily Program
Objective	To produce long-term electric energy savings in both Consumer and Business sectors for multifamily buildings. The Consumer and Business components are difficult to service separately and maximize savings from a multifamily location. The program may include new construction, retrofit complexes, walk-through audits, direct install measures and recommendations for next level energy efficiency measures.
Target Market	The target market consists of multifamily structures, typically up to three floors, containing three or more dwelling units. Investigation of Multifamily structures such as mid (4-6 floors) rise units may also be considered during the Plan.
Program Duration	The Multifamily Program will be an ongoing component of the AEP Ohio EE/PDR Plan.
Program Description	Working with property owners and managers may allow for an all-in-one program to conduct audits of both individual units and common areas. Consumers may receive direct install measures, recommendations for additional measures and opportunity to apply for additional incentives through other programs such as the Efficient Products and Efficient Products for Business Programs. The savings and cost associated with the Consumer measures will be allocated to the Consumer program and budget. Business sector measures will explore common areas such as hallway lighting, exterior lighting and exit sign lighting. Common area measures will be funded and energy savings attributed to the C&I sector.
Incentive Strategy	Customers may be eligible for direct install measures, incentives for next level implementation measures and may choose from a list of pre-qualified contractors to have energy-saving improvements installed. Incentives may be adjusted to increase cost effectiveness and/or program participation.
Eligible Measures	Eligible measures will vary depending on whether retrofit or new housing and the opportunities presented: <ul style="list-style-type: none"> • Cost effective measures developed during Plan implementation may be added and measures currently on the list may be changed or removed depending on both cost effectiveness and customer participation.

Implementation Strategy

An implementation contractor will oversee the development and delivery of the Multifamily program. The main focus of the implementation strategy is designed to lower the cost of delivery with combining both consumer and business portions of the multi-family facility into one visit. Property Managers and Owners will be engaged prior to the on-site visit and possibly incentivized to participate for common areas and engage the majority of tenants if not all. Additionally, recommendations for home and common areas will promote the use of the Efficient Products program rebates for consumer and business sectors.

Marketing Strategy

Engage property managers and owners at the onset and encourage and secure full capacity participation from tenants.

Milestones

Tasks	Timeframe
Program Implementation Contractor selected	3 months
Program materials developed	5 months
Program launch – marketing begins	6 months

EM&V Strategy

All evaluation activities will be conducted by AEP Ohio's evaluation contractor. An integrated evaluation approach will be taken that includes the following components:

- Addressing evaluation needs at the onset of program design and collecting evaluation data as part of program administration.
- Assessing and documenting baseline conditions.
- Establishing tracking metrics.
- Conducting primary and secondary research as part of the impact and process evaluations.

The overall goal of the impact evaluation will be to validate/calibrate savings values and determine program cost-effectiveness. The participant and nonparticipant surveys will also address program awareness, barriers to participation, participant satisfaction, and process efficiency. These surveys will be enhanced by collecting market data and assessing trends as well as interviews with program staff, the implementation contractor, collaborating program administrators, and participating manufacturers.

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

AEP Ohio Administrative Requirements

Initial program administration will be conducted by AEP Ohio EE/PDR personnel. To develop and manage the third-party implementation, it is estimated that 0.25 FTE equivalent will be required for program oversight. Key oversight functions include:

- Recruitment, selection, and management of the implementation contractor(s)
- Customer, Property Owner/Managers recruitment
- Coordination of marketing strategy/public relations among programs and market sectors
- Coordination of all education and training
- Data warehousing
- Management of the evaluation contractor
- Goal achievement within budget

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

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

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results and program implementation experience.

Incremental Annual Participants (units installed)							
Measure Name	Units	2015	2016	2017	2018	2019	Total 2015 - 2019
1L4T8 HP	Lamp	3,449	4,170	3,156	2,464	2,024	15,263
6L4T5 HLO	Fixture	2,554	3,357	3,076	2,820	2,589	14,396
6L4T8HP	Fixture	418	516	407	312	231	1,884
CFL: Pin-Based (13W) Indoor	Fixture	81	97	72	54	39	343
CFL: Pin-Based (26W) Indoor	Fixture	2	2	2	1	1	7
CFL: Pin-Based (42W) Outdoor Wall Pack	Fixture	12	16	15	15	15	73
CFL: Pin-Based (84W) Outdoor Wall Pack	Fixture	52	71	69	68	67	327
CFL: Screw-In (>26W) Indoor	Lamp	77	102	96	90	85	451
CFL: Screw-In (10-15W) Indoor	Lamp	461	601	543	499	464	2,569
CFL: Screw-In (16-21W) Indoor	Lamp	169	224	211	199	189	992
CFL: Screw-In (22-26W) Indoor	Lamp	21	28	26	24	23	121
Daylighting Controls	Watts Controlled, 1 DC	286	288	116	27	0	716
LED Exit Sign	Sign	35	46	43	41	39	204
LED Lighting <10W - Indoor	Lamp	0	0	7	14	20	40
Occupancy Sensor	Watts Controlled, 1 OC	1,304	1,694	1,523	1,407	1,335	7,262
Outdoor LED Lighting (80W), TC Control, Pole/Area Mount	Fixture	119	157	144	133	123	676
Photocell (Outdoor Lighting)	Watts Controlled, 1 PC	192	257	243	232	223	1,147
Photocell + Timedlock (Outdoor Lighting)	Watts Controlled, 1 TC, 1 PC	602	801	756	717	685	3,561
Specialty CFL - 16W PAR30	Lamp	1	1	1	1	1	3
Specialty CFL - 23W Dimmable R40	Lamp	1	1	1	1	1	3
Split/Package system A/C (< 5.4 tons, 14 SEER) - Direct Exp /All Heating Types	Rated Tons Cooling	147	199	195	191	188	921
Split/Packaged Air Conditioner (120 - 240 kBtu/h) 12 EER, 13 IEER - Direct Exp /All Heating Types	Rated Tons Cooling	18	25	24	24	23	115
Split/Packaged Air Conditioner (240 - 760 kBtu/h) 10.6 EER; 12.1 IEER - Direct Exp /All Heating Types	Rated Tons Cooling	47	64	62	61	60	295
Split/Packaged Air Conditioner (65 - 120 kBtu/h) 12 EER, 13 IEER - Direct Exp /All Heating Types	Rated Tons Cooling	104	141	138	135	133	651
Split/Packaged Heat Pump (<65 kBtu/h) SEER 14 - Heat Pump	Rated Tons Cooling	20	27	26	26	25	123
Split/Packaged Heat Pump (135 - 240 kBtu/h) EER 11.5 - Heat Pump	Rated Tons Cooling	42	57	56	55	54	265
Split/Packaged Heat Pump (240 - 760 kBtu/h) EER 10.8 - Heat Pump	Rated Tons Cooling	42	57	56	55	54	265
Split/Packaged Heat Pump (65 - 135 kBtu/h) EER 12 - Heat Pump	Rated Tons Cooling	108	147	143	141	138	677
Water Source Heat Pump (<17 kBtu/h) EER 17 - Heat Pump	Rated Tons Cooling	22	30	29	29	30	140
Water Source Heat Pump (>17 kBtu/h and < 135 kBtu/h) EER 17 - Heat Pump	Rated Tons Cooling	22	30	29	29	30	140

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Budget						
	2015	2016	2017	2018	2019	Total 2015 - 2019
Administrative	\$1,437,239	\$1,893,286	\$1,744,086	\$1,623,662	\$1,518,455	\$8,216,729
Incentive	\$463,445	\$598,212	\$531,100	\$486,765	\$453,448	\$2,532,970
Total	\$1,900,684	\$2,491,499	\$2,275,186	\$2,110,427	\$1,971,903	\$10,749,699

Incremental Annual						
	2015	2016	2017	2018	2019	Total 2015 - 2019
Participant Costs	\$882,059	\$1,154,793	\$1,048,345	\$961,168	\$855,187	\$4,901,552

Savings Targets

Incremental Annual Savings - at Meter						
	2015	2016	2017	2018	2019	Cumulative Total 2015 - 2019

Energy (MWh)	3,920	5,165	4,769	4,444	4,184	22,338
Summer Peak Demand (kW)	958	1,240	1,104	995	910	5,077
Benefit-Cost Test Results						
Benefit-Cost Test			2015-2019 Benefit-Cost Test Ratio			
-						
Total Resource Cost (TRC)			1.2			
Utility System Resource Cost (UCT)			1.7			
Participant Cost (PCT)			4.4			
Rate Impact Measure (RIM)			0.5			

4.3.2 Combined Heat and Power and Waste Energy Recovery – CHP/WER (New Program)

Program Objective	Combined Heat and Power and Waste Energy Recovery (CHP/WER)
<p>The objective of this program is to support the installation of high efficiency, sustainable and cost effective CHP/WER projects in AEP Ohio's service territory as allowed by SB 315 and supported by the PUCO and state of Ohio.</p>	
Target Market	<p>The primary targets for CHP/WER will be large users of steam for ongoing processes and could include industrial, institutional and healthcare facilities. Other types of CHP/WER projects can be considered if they meet minimum efficiency requirements.</p>
Program Duration	<p>The program will operate while funds are available through the Plan period. Filed and approved reasonable arrangements will have their own individual terms.</p>
Program Description	<p>CHP/WER projects can be treated similarly to other energy efficiency projects, but this requires looking at efficiency for this type of application in a different way than the typical upfront incentive. CHP/WER projects, as distributed generation, should be subject to the same cost effectiveness analyses and performance based incentives as any other supply-side generation resource must face. A distributed generation project is not comparable to any other energy efficiency (EE) project due to the surety and permanence of the EE measures installed. It is highly likely that the normal EE measures installed will remain permanent and be a true offset to supply-side options. It is highly unlikely that a customer will install less efficient lighting, air conditioning or production equipment after the end of their ten or twenty year life. On the other hand, it is a complete unknown whether the CHP/WER system will operate two, three, five, ten or twenty years of its expected life. CHP/WER operational longevity will all depend on the price of electricity, price of natural gas and/or availability of waste heat recovery source. Natural gas pricing has always been highly volatile. CHP/WER longevity will</p>

further depend on the operation, maintenance and ongoing efficiency of the system. For those reasons, CHP/WER should be directly comparable to supply-side generation in its viability, where the ongoing efficiency and fuel price of the generation unit is critical to whether the generator can run profitably or not and the generator receives payment for energy only when it is delivered. A reasonable proxy for cost effectiveness based on TRC is a seven year simple payback without incentives. It is important that CHP/WER projects have some reasonable expectation of longevity in order to be cost effective.

The efficiency with CHP/WER projects is commonly referred to as total system efficiency, conversion efficiency or Lower Heating Value (LHV). AEP Ohio will utilize LHV until such time as the Commission determines a uniform calculation methodology for measuring total system efficiency for CHP/WER systems. Simply, LHV is the sum of the electrical efficiency plus the thermal efficiency of the system. A higher LHV means greater value and cost effectiveness of the system for the customer and the utility. The minimum total system efficiency required is 60% with a minimum 20% useful thermal energy. AEP Ohio will pay incentives on utility grade metering for the production kWhs generated and will tier the payments based on CHP/WER total system efficiency to encourage the highest efficiency systems that have the greatest chance of long term viability. This method reduces financial risk for all customers by requiring both certainty in production kWhs generated and total system efficiency obtained.

CHP/WER projects can be very large and funding requests can be significant. Exemption from the EE/PDR rider isn't an effective option in some cases. Approved utility program portfolio plan budgets provide programs for all customers, so a balance is provided in this program design to encourage customer participation in CHP/WER while also preserving funds for all other customers to participate in programs. Further, AEP Ohio supports flexibility due to the wide variety and complexity of projects. AEP Ohio recommends joint filing of reasonable arrangements for CHP/WER of significant size. The PUCO standard mercantile commitment form should provide opportunities for smaller customer projects that need funding, either filed jointly and individually. AEP Ohio encourages joint filing to ensure that funding is available from the Plan. The PUCO standard mercantile commitment form should cover every customer that prefers an exemption from the EE/PDR rider.

Incentive Strategy

All incentive payments are subject to AEP Ohio approval and are based on measured production kWhs generated by the CHP/WER project, subject to the following conditions:

For projects up to 2.5 MW:

- Incentive payments on production kWhs cannot exceed \$0.01/kWh for five years.
- Total incentive payments are limited to the lower of 25% of the cost of the project or \$250,000.

- Incentive payments will be made annually, beginning twelve months following full commissioning date of the project.

For projects greater than 1 MW:

- Project requests will be reviewed by AEP Ohio
- If agreement on project terms can be reached, a joint arrangement between AEP Ohio and the customer will be filed for approval with the PUCO.
- Subject to budget limitations for CHP/WER.
- Incentive payments will be made annually, beginning twelve months following full commissioning date of the project.

For all CHP/WER projects:

- LHV = 80% or more: 100% of the calculated payment.
- LHV = 70% up to 80%: 75% of the calculated payment.
- LHV = 60% up to 70%: 50% of the calculated payment.

Any projects that have payments that extend past December 31, 2019 are required to be jointly filed with the PUCO for approval. In addition to AEP Ohio incentives, ensure that customers are aware of Ohio and Federal incentives and educational opportunities.

Eligible Measures

The minimum total CHP/WER system efficiency required is 60% with a minimum 20% useful thermal energy.

Implementation Strategy

AEP Ohio has received significant requests and is working with a number of customers to develop joint applications for projects. Upon filing and approval of this Plan, it is expected that project activity will increase significantly with a likely backlog of projects available for limited funding. AEP Ohio intends to reach out to large customer groups for potential opportunities as well as work with CHP/WER developers who may be interested, if customer interest is insufficient.

Marketing Strategy

Develop promotional material, utilizing readily available information from the state of Ohio, Department of Energy, the Environmental Protection Agency and the Midwest CHP Application Center, among others.

Milestones

Tasks	Timeframe
Develop promotional material	1st qtr. 2015
Conduct outreach to large customers and segments	Ongoing
Hold periodic education/training on CHP/WER in conjunction with state, regional and federal efforts	Min. 1 per year

EM&V Strategy

- Measure and validate production kWh and total system efficiency measurements for LHV prior to payments on an annual basis.

- Develop effective measurement strategy for average total system efficiencies over the annual period to determine payment eligibility.
- Reach out to CHP/WER experts to develop appropriate LHV, or other methodology to calculate ongoing total system efficiencies.

Participation

The following participation levels have been used for planning purposes. However, AEP Ohio may adjust qualifying energy efficiency measures and anticipated participation levels as necessary in accordance with current market conditions, EM&V results and program implementation experience.

Incremental Annual Participants						
Measure	2015	2016	2017	2018	2019	Total 2015 – 2019
Project	not presented					65

Budget

The following budget has been used for planning purposes. However, AEP Ohio may adjust program budgets as necessary in accordance with current market conditions, EM&V results, and program implementation experience.

Incremental Annual Budget						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Administrative	not presented					
Incentive	not presented					
Total	not presented					\$13,034,128

Incremental Annual						
	2015	2016	2017	2018	2019	Total 2015 – 2019
Participant Costs	not presented					\$189,985,148

Savings Targets

Incremental Annual Savings – at Meter						
	2015	2016	2017	2018	2019	Cumulative Total 2015 – 2019
Energy (MWh)	not presented					600,000
Summer Peak Demand (kW)	not presented					81,930

Benefit-Cost Test Results	
Benefit-Cost Test	2015-2019 Benefit-Cost Test Ratio
Total Resource Cost (TRC)	1.2
Utility System Resource Cost (UCT)	18.1
Participant Cost (PCT)	1.2
Rate Impact Measure (RIM)	1.0

4.3.3 Customer Power Factor Correction

Program	Customer Power Factor Correction
Objective	Power Factor Correction provides customers with specific technology measures that can be implemented to improve power quality and to produce energy and demand savings within the customers' facilities or the AEP Ohio Distribution System.
Target Market	Power Factor Correction – large industrial customers (>700,000 kWh/12 month average) with process equipment.
Program Duration	5 years
Program Description	Power Factor Correction. Certain production intensive Manufacturing Industries have production equipment and facilities that contribute to low power factors that affect their equipment and reflect losses back to the Distribution system limiting the ability to use this energy for useful purposes. The power factor correction at the customer delivery point reduces losses to provide small levels of energy savings to the customer. It also reduces KVA, which is equivalent to KW at unity power factor. This is a program under development and any required funding will come from the Process Efficiency program.
Incentive Strategy	Power Factor Correction – Power factor correction at the customer delivery point does not provide energy savings to the customer, but does reduce losses on the distribution and transmission system, which can be converted to energy savings. It does provide KVA savings. Incentives will be paid for energy and KVA reduced.
Eligible Measures	Power Factor Correction Capacitors
Implementation Strategy	AEP Ohio Program Management
Marketing Strategy	Power Factor Correction Capacitors. The marketing of this measure is by direct communication by the account managers to the customer and through their industry associations.

EM&V Strategy

Power Factor Correction Capacitors. Pre and post metering to determine power factor values for evaluation with deemed values. The Commission has indicated that a simplified methodology (deemed value) for capacitors has some merit and that setting a standard ratio of energy savings per kVAR of capacitance does not appear feasible, since energy savings depends on the line loading in kVA (which depends on kW and kVAR loads). It also is required that the methodology be consistent with the Protocol formulas in the Ohio TRM.

For Power factor capacitors added at distribution voltages: $kW = kV \times I \times pf$, so the initial current (I_i) before power factor correction is $I_i = kW / (kV \times pf_i)$, after capacitors are added kW does not change and the final current (I_f) is $I_f = kW / (kV \times pf_f)$. The reduced current (I_r) is $I_r = I_i - I_f$. The base kW saved is $I^2 R$.

Following the Commission's recommendation, the deemed value for R is the resistance of typical conductor used to connect large industrial facilities with the high kW usage multiplied by the typical distance from the substation to customer connection point. The final system loss reduction = base kW loss x average loss factor (used in T&D loss studies) x 8760 (for fixed power factor correction capacitors), or base kW loss x average loss factor (used in T&D studies) x hours of operation (for switched power factor correction capacitors).

4.3.4 Transmission and Distribution (T&D) Customer Efficiency Projects (New Program)

Program
Objective

T&D Customer Efficiency Projects

AEP Ohio has opportunities to improve efficiency for customers on its distribution facilities through the installation of EE/PDR measures that can provide long term savings. Utility distribution side energy efficiency programs are elective programs not loss reductions as covered in the T&D Loss Reduction Projects. Capital and O&M cost recovery for T&D Customer Efficiency Projects can be managed in the EE/PDR rider just as other EE/PDR programs. The objective of this program is to describe those opportunities for implementation in a similar manner as other customer efficiency programs and/or complete further investigation. One difference from other programs due to the capital investment required could be to treat any earnings from T&D Customer Efficiency Projects using an enhanced return on investment instead of shared savings. Two of these programs are Volt Var Optimization (VVO) and LED Street/Outdoor Lighting.

Program Description

Volt Var Optimization (VVO). End-of-line monitoring allows the utility to determine where AEP can maintain the voltage on the circuit through automating regulators and capacitors to reduce energy consumption and peak demand. In addition, it helps

maintain unity power factor.

The VVO system that AEP Ohio piloted in its gridSMART phase 1 allows a reduction in voltage while remaining within acceptable ranges. This reduction in voltage yields a reduction in energy and demand that is measurable and consistent as long as the system is operational. In the initial pilot, the average savings in demand and energy was 3%. While this level of savings will vary by circuit, a key advantage of this program is that every customer on the circuits implemented will receive the savings. The non-participants in AEP Ohio's other EE/PDR programs that reside or have businesses on these circuits will become participants in AEP Ohio's EE/PDR programs.

An 80 circuit VVO proposal was filed in the gridSMART Phase 2 expansion that will be removed from that rate mechanism and added to the EE/PDR rider. The build out will be spread over the five year Plan period. Capital and O&M costs for this program will be requested in the EE/PDR rider for this customer efficiency program.

LED Street/Outdoor Lighting. AEP Ohio has been considering LED Street/Outdoor lighting for a period of time; however, pricing and utility grade LED technology concerns have not been conducive to moving forward. Even with the light and O&M savings, the capital costs offset those savings requiring a significant increase in the SL and OL rates. As pricing comes down and quality improves, it is expected that during this Plan period, LED Street/Outdoor lighting conversions may be justified. This program would investigate the opportunity further, and if successful, would develop an implementation plan to move forward. Ideally, the energy and O&M savings would offset the capital costs. At that point, AEP Ohio would file for Commission approval, start the conversion process and complete it over several years.

Capital and O&M costs for this program may be requested in the EE/PDR rider for this customer program, or through another rate mechanism.

4.3.5 gridSMART[®] Enabled EE/PDR Savings

Program	gridSMART Enabled EE/PDR Savings
Objective	The gridSMART project is funded under a separate rider and no cost recovery is proposed under the EE/PDR rider. The project is listed here to note that any peak demand reduction and energy efficiency savings results from this effort will be reported toward AEP Ohio's EE/PDR achievements during the respective year in which those results occur.
Program Description	The current programs that could produce reportable savings include programs designed to reduce the growing demand for electricity, especially at times when demand is high: <ul style="list-style-type: none">• Energy Portal. Programs designed to produce energy and demand savings through greater access to energy information• Home Energy Report. An option was filed for Phase 2 AMI-Smart Meter

Deployment.

Enhancements/Adjustments

AEP Ohio has filed a plan to broaden the company's gridSMART program with Advanced Metering Infrastructure (AMI) and Distribution Automation Circuit Reconfiguration (DACR) expansion. Upon approval of the plan by the Public Utilities Commission of Ohio, gridSMART Phase 2 installations are planned to begin in 2015.

- AMI deployment in more than 31 communities.
- DACR on approximately 250 distribution circuits serving more than 300,000 customers.
- Home Energy Reports
 - Savings from gridSMART Phase 1 web portal and reports
 - Savings from gridSMART Phase 2 web portal

4.3.6 Transmission and Distribution (T&D) Loss Reduction Projects (formerly T&D and Internal Efficiency Improvements)

Program Objective	T&D Loss Reduction Projects
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AEP Ohio T&D are funded through FERC and PUCO approved rates and no cost recovery is proposed under the EE/PDR rider in this Plan. This program captures loss reductions from projects AEP Ohio undertakes to improve the efficiency of its transmission and distribution facilities. These loss reductions will be reported in the annual Plan Status Report.

Program Description

The operation of a T&D power system includes a loss of the portion of the power being transmitted due to the electrical resistance of the power system elements (conductors, transformers and regulators). The transmission of power at different voltage levels throughout the power system yields different losses during the delivery of Power. The farther the delivery through the system from the generation point, the greater the loss component associated with the transfer through the voltage transformations.

There are various system improvements that, if made, will reduce the T&D losses, including:

- Re-conductoring of lines, substation improvements and the replacement of regulators.
- Re-conductoring projects involve the replacement of existing wires with larger wires and wires designed for lower losses at transmission and distribution voltages. Re-conductoring projects reduce line losses by lowering the resistance of the system through which energy is provided, such that the power lost during

transmission is lowered.

- Substation projects typically include connecting previously unconnected T&D lines, and/or the addition or upgrade of transformers and circuits in new or existing locations. These projects can improve efficiency and reduce line losses by providing additional transformation points closer to customers' loads. As a result, a greater portion of the energy is transmitted in the lower resistance transmission lines instead of the higher resistance distribution lines.

4.3.7 Education and Training

Program Objective	Education and Training
To raise awareness about the benefits of energy efficiency, to promote adoption of energy efficient behaviors and technologies, and to continue to build demand for AEP Ohio EE/PDR programs.	
Target Market	
The Education and Training Program is targeted to customers, customer groups, contractors, trade associations, civic associations and employees.	
Program Description	
<p>This program will continue to coordinate AEP Ohio's efforts to provide education, training and direct outreach for customers, customer groups, contractors, trade associations, civic associations and employees. Activities and materials will be tailored to specific audiences: facilities managers, building operators, financial decision makers, builders, contractors, trade associations, civic organizations, workforce development practitioners and students, and AEP Ohio employees whose work brings them in contact with customers.</p> <p>Education and training participants will be surveyed for feedback on relevance, quality and satisfaction with activities. Pre- and post-learning will be evaluated. Customer Services employees will be surveyed annually in order to help direct training and development focus. Third-party implementers may be selected via competitive bids to assist with education and training activities. Audiences for training and education activities include:</p> <ul style="list-style-type: none">• Commercial & Industrial (C&I) Customers: Customer education events will continue to be offered via webinar and face-to-face seminars at multiple sites throughout the service area as needed to permit customers to participate while minimizing travel. Seminars will continue to feature subject-matter experts, trade allies, and hands-on demonstrations of high efficiency technologies eligible for C&I programs. <p>Content and outreach will be designed to increase participation by key decision makers, plant managers, finance managers, treasurers, energy managers and</p>	

sustainability coordinators. Technical, in-depth training will be offered for building operators, facilities managers, designers, engineers and others whose day-to-day practices influence energy use. Ongoing customer education programs will be marketed to appropriate customer segments across the 61 counties served by AEP Ohio. Marketing may include contact by customer service account representatives, direct mail, E-mail, and/or telephone. Overall objectives will be to develop knowledgeable and informed customers and EE/PDR providers to identify energy saving opportunities and take action to achieve long-term efficiency gains.

- **Customer Service Employees:** AEP Ohio C&I customers have account representatives who assist them with new service, changes, power quality, billing inquiries and more. Whether power engineers or representatives with more business than engineering training, all customer service employees are expected to assist customers with EE/PDR. Accordingly, they have participated in training on every one of AEP Ohio's programs as they have launched. Customer service employee training will continue through webinars, face-to-face meetings, and E-mail to continue to build staff knowledge about EE/PDR programs, to help them identify customers' energy efficiency opportunities, and to assist customers in applying for, monitoring and re-investing incentives in ongoing energy efficiency practices and equipment. Training will cover programs, technologies, decision-making support, financing and the benefits of energy efficiency to customers, their communities and AEP Ohio. The 2015-2019 Plan will focus on more efficient delivery through the development of more on-line, on-demand education and training resources. Objectives for training will be to raise awareness of the benefits of energy efficiency and to increase customer participation in AEP Ohio programs.
- **Customer-Facing Employees:** Meter readers, line crews, field technicians, and community affairs representatives are among the many AEP Ohio employees who interact with customers daily - though they are not identified strictly as "customer service" employees. To date, many of these customer-facing employees, or their supervisors, have participated in briefings about AEP Ohio's EE/PDR programs. All have received printed materials for them to share with customers when opportunity and safety permit. Education activities will continue to help customer-facing employees understand the benefits energy efficiency can bring to communities, customers and AEP Ohio, to increase their awareness and understanding of programs to help business and residential customers save energy and money, and to encourage them to share information about these programs with the customers they encounter and with others in their communities.
- **Trade Associations, Civic and Other External organizations:** AEP Ohio will expand outreach activities tailored for trade associations, civic and other external

organizations whose members may be customers, and/or may provide services to customers. These activities will be coordinated with, and marketed through customer service employees, third-party implementers, direct mail, E-mail, and/or telephone. This outreach effort will develop targeted presentations, recruit and train presenters, and deliver presentations to help trade associations' members understand the benefits energy efficiency brings to customers and to their members, to raise awareness of AEP Ohio programs, to help them participate in these programs as contractors and/or as customers, and to help them provide feedback to AEP Ohio.

Implementation Strategy

Education and training participants will be surveyed for feedback on relevance, quality and satisfaction with activities. Pre and post-learning will be evaluated. Customer Services employees will be surveyed annually with results compared to survey baseline. Third-party implementers may be selected via competitive bids to assist with education and training activities.

4.3.8 Targeted Advertising

4.3.2 Program

Targeted Advertising

Objective

The Targeted Advertising program builds customer awareness and program participation of energy efficiency in support of AEP Ohio EE/PDR programs and also encourages market transformation in support of AEP Ohio's commitment and key goals of this Plan.

Target Market

This program will target the mass market, as well as business customers.

Program Duration

This program is expected to be ongoing.

Program Description

Media outreach and advertising primarily is for the mass market, but outreach also will target small commercial and industrial customer participation. The program is designed to increase customer adoption of EE/PDR programs as well as bringing AEP Ohio's commitment to energy efficiency to its customers.

There are several barriers to the adoption of energy efficiency. In some cases, it is simple lack of customer awareness or customers' misperception. In other cases, it is a lack of contractor awareness or support to make efficiency a realistic decision choice for customers. For other cases, many technology choices are made spur of the moment or in a fail and replace scenario, where the person or contractor contacted are aware of the Plan programs and make the efficient decision. In all cases, these programs should further AEP Ohio's commitment to efficiency and bridge the Plan program goals and the consumer lack of adoption.

The Targeted Advertising program will focus on improving customer awareness and

adoption of EE/PDR programs specifically, as well as encourage market transformation and adoption of energy efficiency in general through the following activities:

- Market research and market segmentation for target marketing
- Emphasis on customer satisfaction
- Advertising development
- Advertising campaigns
- Program promotional materials and displays
- Event marketing and outreach campaigns
- Increased social and mobile device media efforts
- Customer testimonials
- More emphasis on customer touch points and cross selling and promotion
- Customer surveys to identify market transformation opportunities and impacts

Adjustments and Enhancements

AEP Ohio modifications to Targeted Advertising will increase customer awareness and participation in AEP Ohio programs and gain cost effective energy savings. Outreach will be customized to strengthen relevance and increase program participation in some hard to reach customer groups. Other customer groups may be identified and added to the following:

Customized Customer Outreach:

Agriculture. AEP Ohio will bring energy savings and demand reduction to the specialized needs of the agricultural sector by continuing to offer facility audits, assistance identifying additional funding sources, and installation support services of energy efficient measures incentivized through AEP Ohio's energy efficiency programs. Agriculture farms that produce poultry, livestock, dairy and/or edible crops in AEP Ohio's service territory will be eligible, whether their electric service tariff is classified as residential or non-residential. All measures demonstrating energy savings and capable of measurement and verification are eligible for the Agriculture initiative. Typically, measures are those in existing programs such as Efficient Residential Products, Efficient Business Products, and Process Efficiency. AEP Ohio will cover some or all of the cost of agriculture audits for those customers that install a significant portion of the recommended measures identified in the audit. AEP Ohio will continue to work closely with the extended agricultural community including the Ohio Farm Bureau, Extension Service, United States Department of Agriculture's (USDA) Natural Resources Conservation Services, (NRCS), and other market actors. Outreach will help demonstrate how energy efficiency contributes to increased competitiveness and/or profitability while promoting compliance with environmental requirements through successful implementation of the program measures.

- **Chain Stores (National Accounts).** AEP Ohio will develop a comprehensive and ongoing outreach strategy to achieve energy reduction at National Accounts and Chain Stores. These accounts typically act on a regional or national basis with decision makers that are outside the AEP Ohio footprint and hard to engage. The differing designs, incentives, and terms and conditions of efficiency programs offered by individual utilities across regions or the nation present a barrier to participation by National Accounts. The outreach program will overcome this barrier with a successfully demonstrated outreach and engagement strategy to enlist participation and facilitate program adoption. Incentives will generally be offered to customers by way of existing programs such as Efficient Business Products, Process Efficiency, Retro-commissioning, Data Centers, and New Construction (and major renovation). However, unique incentive mechanisms which match National Accounts business strategies will be considered. All measures demonstrating energy savings and capable of measurement and verification are eligible for the National Accounts initiative.

- Commercial Real Estate.** AEP Ohio will develop a comprehensive and ongoing outreach strategy to achieve energy reduction at key managed real estate facilities. The commercial real estate market is hard to reach since real estate management seldom is responsible for energy cost and it does not always fully comprehend the importance of building asset improvement as a business driver. The outreach program will address these obstacles with a successfully demonstrated program design to enlist participation of commercial real estate customers. Incentives will generally be offered to customers by way of existing programs such as Efficient Business Products, Process Efficiency, Retro-commissioning, Data Centers, and New Construction (and major renovation). However, unique program designs with incentives designed to attract both owners and tenants could be offered through this effort without going through existing programs. All measures demonstrating energy savings and capable of measurement and verification are eligible.
- Community Energy Savers.** AEP Ohio will establish partnerships with communities to engage their communication channels and relationships towards mutually shared goals of increasing the percentage of their residents and businesses that participate in and benefit from energy efficiency programs. AEP Ohio will provide supporting resources and communities will earn awards for projects they choose to encourage local support for meeting those goals. AEP Ohio believes that these partnerships will lower the costs of acquiring participation in energy efficiency programs, will link energy efficiency programs to community-based sustainability efforts, will recruit hard-to-reach populations and will deepen the understanding of the value of energy efficiency within Ohio's communities.

4.3.9 Research and Development

Objective	Research and Development
Key objectives of Research and Development include:	
<ul style="list-style-type: none"> Provide support to the implementation team for testing and making mid-stream adjustments to the current Plan as needed. Prepare for the new and modified cost effective programs needed to achieve EE/PDR targets in future plans. Support market transformation. 	

Description

AEP Ohio believes that a systematic research and development (R&D) process to test new and innovative technologies, program concepts, implementation methods and marketing techniques is critical to finding opportunities to drive down EE/PDR Plan costs, increase customer opportunities for participation and satisfaction with the programs. AEP Ohio will manage that R&D capacity and function with the flexibility and analytical rigor to assess changes in the market and alternative approaches to energy efficiency delivery for inclusion in the Plan.

AEP Ohio proposes that any kWh savings realized from R&D pilot activities count towards the annual kWh goal. AEP Ohio also intends to work with the AEP Ohio Collaborative on the new concepts for consideration.

Given the ongoing rapid pace of change, AEP Ohio does not attempt to identify every project that could potentially be funded over the course of the Plan. Instead, AEP Ohio intends to continually monitor the energy efficiency space and identify opportunities when they arrive in partnership with the AEP Ohio Collaborative.

Implementation Strategy

For this Plan, AEP Ohio intends to continue the screening process that identifies opportunities, ranks them, pilots the most promising, evaluates them for kWh savings and cost-effectiveness, and recommends appropriateness for Plan inclusion and application to the annual kWh goal.

- **Scan & Screen Options:** This initial screen involves reviewing other utility programs, contacting various associations and communicating with key stakeholders to determine suitability, and expected savings. Next, the remaining technologies/programs are assessed for market opportunity, estimated costs, risks and barriers, proposed pilot strategies, targeted customers, and non-energy benefits (e.g., improved performance, water efficiency) to identify the most promising options for further development.
- **Define Pilots:** In this step, AEP Ohio completes a work plan including target market, measurement and verification, budget and timeline and then launches a pilot implementation strategy.
- **Evaluate Results:** AEP Ohio evaluates the pilot results to determine the kWh savings, the cost-effectiveness and whether the emerging technology or program strategy tested is suitable for inclusion in AEP Ohio's Plan.
- **Transfer to Programs:** AEP Ohio determines whether or not the technology or strategy should be incorporated into the Plan, whether as a new measure within an existing program or as an entirely new program, the determination of incentive levels and articulation of the value proposition.

Planned R&D Programs

AEP Ohio is considering R&D and pilot programs for the following technologies and/or programs:

Energy ABCs-Auditing, Benchmarking, and Capturing Savings. AEP Ohio's Energy ABCs Pilot expands beyond the offers of financial assistance for energy efficiency audits under the AEP Ohio Business Incentives program. In addition to incentives for energy audits to non-residential (commercial and industrial) customers, AEP Ohio will provide the technical platform and the customer services support to help customers establish a monthly automatic upload of their electricity usage data to ENERGY STAR® Portfolio Manager to help them make informed electrical energy decisions and implement strategies to capture energy savings. Portfolio Manager is an interactive, online energy management tool developed by the U.S. Environmental Protection Agency that allows building owners and managers to track and assess energy and water consumption within individual buildings as well as across an entire portfolio of buildings in a secure online environment. Portfolio Manager can help set investment priorities, identify under-performing buildings, verify efficiency improvements and receive EPA recognition for superior energy performance. Benchmarking will help non-residential customers set priorities for the facilities where energy audits will further identify economically viable improvements to yield annual energy savings by participating in the AEP Ohio Business incentives program. AEP Ohio began implementing the C/I Audit Pilot Program in early 2011 and plans to test this expanded program offering through this planning cycle.

Energy Efficiency Advisor. This pilot will explore offering a service to business customers, and possibly consumers, that may require a more one on one in depth approach in understanding energy efficiency and savings opportunities. The goal is to make it easier and less time intensive for customers to participate in energy efficiency programs. The Energy Efficiency Advisor could provide an opportunity for customers to make informed decisions, optimize their energy consumption and efficiency. The Advisor may provide a variety of services, including audits, energy efficiency recommendations, program management, completing applications and measurement and verification. The Advisor aims also to provide guidance on other energy efficiency programs, processes and incentive opportunities that are available. In addition, the relationship with consumer and business customers may improve with the assistance of the Energy Efficiency Advisor. Incentives may be available for engineering and design costs, in depth facility audits and per kwh saved for retrofits and financing options.

Energy Efficiency Financing and Funding. AEP Ohio has had initial discussions with lending institutions to encourage financing, a streamlined process, and alternative financing mechanisms to support capital investment in EE/PDR, with the goal of reducing incentives in favor of financing or funding alternatives. In addition, AEP Ohio hopes to work collaboratively with customers to tie their sustainability activities and emission reduction activities to energy efficiency and increase the total available funding for investment. Also, AEP Ohio will continue to actively seek out state and

federal funding opportunities for EE/PDR projects that will enable customers to save energy.

Business Behavior/Intelligent Prospecting. Business Behavior programs will continue to be investigated as pilot programs. Analytics, also known as Intelligent Prospecting, may be used to identify potential participants in more effective ways. Additional Intelligent Prospecting pilots targeting small to medium business customers and possibly large business customers are planned. In addition, AEP Ohio may conduct auditing of facilities and provide business behavioral recommendations. Candidates may also be funneled directly to our other Business programs where appropriate.

The following planned programs require additional R&D prior to full scale launch:

- **Advanced Lighting.** The pilot will investigate opportunities to incentivize advanced lighting techniques for business sector customers. This lighting and intelligent controls initiative will encourage early adoption of innovative, commercially available technologies that drive deeper energy savings. Customers may receive enhanced administrative, technical and financial offerings and services. AEP Ohio may offer this program to its business sector customers. This is an opportunity to introduce enhanced energy savings to customers as they advance in their energy efficiency knowledge and as new technologies continue to enter the marketplace.
- **Commercial New Construction Code Support.** AEP Ohio will research approaches to overcome the barriers to the effective implementation of improved commercial building energy codes to capture all the energy savings available. AEP Ohio will consider approaches including but not limited to measuring commercial energy code compliance, providing training and technical support to improve compliance and capture the energy savings available from the code, providing funding and/or other resources to better equip local code agencies to enforce and improve energy code compliance over time, and promoting market awareness of the value of compliant construction. A calculation methodology to apportion energy savings attribution from energy codes will be developed and approved by the PUCO.
- **Programmable Communicating Thermostat.** AEP Ohio will research various thermostats; if proven, AEP Ohio will add respective measures and incentives to Efficient Products.
- **Remodeling.** Energy codes for residential and non-residential construction apply when certain thresholds such as change in use, percentage of affected area are exceeded. Code compliance practitioners generally agree that substantial energy savings may be gained by improving remodelers' understanding of energy code, when it applies, and how to comply. This pilot will assess the potential for savings, identify the activities with greatest likelihood for

improving compliance, and test those with the estimated greatest cost-effectiveness. Benefits will include increased awareness by remodelers and the opportunity to promote installation of energy efficient lighting, appliances, and HVAC equipment and controls at the time that residential and commercial property owners are making investment decisions.

- **Water/Energy Nexus.** AEP Ohio will research water/energy pilot programs for business customers. By focusing in a few target sectors, AEP Ohio will develop relationships with customers and become a trusted advisor for customers' industry challenges. The program may include detailed energy audits, recommendations, project management assistance and financial incentives for implementations. Successful case studies could be developed to demonstrate the energy savings and market achievements.

Additional Research Under Consideration

New technologies enter the market every year. As a result, energy efficiency options are likely to be different from those being promoted today. AEP Ohio believes continuing to screen and research new technologies and program concepts will aid in developing future program plans.

5 GLOSSARY OF TERMS

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

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

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

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

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

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

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

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

Dispatchable: refers to generation technologies such as coal, natural gas, nuclear, geothermal and biomass whose output can be varied to follow demand. For non-dispatchable technologies such as wind, solar and hydro, operation is tied to the availability of an intermittent resource.

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

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

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

End-Use: a category of equipment or service that consumes energy (e.g., lighting, refrigeration, cooling, mechanical ventilation, heating, process heat, pumping, conveyance, compressed air).

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

Ex-Ante: refers to the “claimed” savings values reported by an implementer or administrator *and often referred to in “deemed savings” or engineering calculations to estimate savings.*

Ex-Post: refers to the “evaluated” or “verified” savings values reported by an independent, third-party evaluator after the subject energy efficiency activities have been implemented and an impact evaluation has been completed.

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

Free Riders: the participants in an EE/PDR program who would have adopted an EE/PDR technology or improvement in the absence of a program or financial incentive.

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

Impact Evaluation: the estimation of effects from the implementation of one or more EE/PDR programs. Most program impact projections contain ex-ante estimates of energy savings and demand reductions expected from program implementation efforts often used for program planning and contracting purposes and for setting program funding priorities. In contrast, the impact evaluation focuses on identifying and estimating the amount of energy and demand the program actually provides.

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

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

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

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

Measure: any action taken to increase efficiency, whether through changes in construction, equipment, control strategies, or behavior. Examples are above-code buildings, higher-efficiency central air conditioners, occupancy sensor control of lighting,

and retro-commissioning. In some cases, bundles of technologies or practices may be modeled as single measures. For example, an ENERGY STAR™ home package may be treated as a single measure.

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

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

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

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

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

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

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

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

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

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

Retrofit: refers to an efficiency measure or efficiency program that seeks to encourage the replacement of functional equipment before the end of its operating life with

higher-efficiency units (also called “early retirement”) or the installation of additional controls, equipment, or materials in existing facilities for purposes of reducing energy consumption (e.g., increased insulation, low flow devices, lighting occupancy controls, economizer ventilation systems).

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

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