

- A program's estimated contribution (MWh and MW) to the whole portfolio savings.
- The stage in a program's life cycle.
- A program's budget share of the whole portfolio.
- The expected degree of uncertainty in a program's savings.
- The input values currently listed in the Technical Reference Manual (TRM).
- The life expectancy of a program.
- The importance of a program to market transformation and awareness.
- Specific research issues relevant to particular programs.
- Whether any special features of a program require exceptional evaluation effort.

Evaluation plans designed around the above issues will help ensure DP&L uses evaluation resources appropriately and where they are most needed.

Pillar Three: Evaluations Adhere to Accepted and Proven Protocols

DP&L expects and requires all plans and work are prepared in a manner meeting industry standards and established protocols. These include: (1) International Program Measurement and Verification Protocols: Concepts and Options for Determining Energy and Water Savings Volume 1, June 2014; (2) Model Energy Efficiency Program Impact Evaluation Guide: A Resource of the National Action Plan for Energy Efficiency, December 2012; (3) Electric Power Research Institute: Guidebook for Energy Efficiency Program Evaluation, Measurement, and Verification, 2008; and (4) Uniform Method Project for Determining Energy Efficiency Program Savings, 2014.

Pillar Four: Evaluations Must be Flexible and Adaptive

Finally, DP&L believes that successful and useful evaluations begin from well-conceived and comprehensive evaluation plans. At the same time, various influences such as changes in program design, regulatory environment, and market trends require that evaluation plans (and those implementing the plans) be adaptable to mid-course adjustments. DP&L views evaluation plans as a living document, which may change during the program cycle.

EM&V PLANNING

Before evaluation work begins for each calendar year, DP&L's independent evaluator develops a comprehensive evaluations plan for each program. Elements of each



program's plan will conform to the independent state evaluator template which includes the following sections:

- Program description,
- Evaluation objectives,
- Overall evaluation approach,
- Impact evaluations,
- Process evaluations,
- Tracking system review,
- Sampling plan, and
- An evaluations schedule.

In developing the plan, the independent evaluator takes into account the availability of data from previous EM&V results, the relative size of the program within the overall portfolio, implementation staff feedback, and any changes to program design that may require additional evaluations. Depending on the program, impact evaluations may include engineering analysis, billing analysis, site visits and a review of calculations. Process evaluations may include telephone surveys and interviews with various market participants.

The impact evaluation objectives are as follows:

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

Primary process evaluation objectives are:

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

PROGRAM PROCESS REVIEW

The process evaluation focuses on qualitative assessments of the program's design, operation, and implementation. DP&L's independent evaluator will assess how well the program is functioning by using multiple industry standard approaches, such as a telephone survey with customers, contractors, or other stakeholders. Depending on the type of program and overall objectives, in-depth interviews or focus groups may be used to gather deeper qualitative data from these stakeholders.

Process objectives will be identified in the evaluation planning stage each year and include DP&L, evaluator and any third-party program implementers. Ensuring all parties are involved in the process planning will confirm process objectives not only produce



results needed from the independent evaluator perspective, but also from the program implementers so they receive feedback to make necessary course corrections.

ESTIMATION OF GROSS SAVINGS

DP&L primarily uses the Ohio Technical Reference Manual (TRM) as well as other appropriate data specific to each measure to report *ex ante* or “pre-evaluation savings” estimates. This *ex ante* value is reported to the independent evaluator along with appropriate back-up data. The evaluator then reviews the savings estimates for each program and assesses the reasonableness of the values. This assessment includes:

- Review of deemed savings, such as those found in the Ohio TRM;
- On-site visits to collect information regarding installation rates;
- Simple engineering calculations; and
- Statistical analysis.

As stated previously, DP&L works with its independent evaluator throughout the program lifecycle, which includes establishing reasonable *ex ante* values. This, combined with using the Ohio TRM, minimizes issues at the end of the evaluation and affords implementers the opportunity to adjust program design in order to meet the savings goals. Further, this approach helps minimize differences between program and portfolio realization rates.

CALCULATING COST EFFECTIVENESS

DP&L’s independent evaluator calculates cost effectiveness for individual programs and the portfolio as a whole. Cost effectiveness is calculated based on costs incurred by DP&L and participants, energy savings and avoided capacity and energy wholesale prices. Four cost effectiveness tests are calculated for each program and the portfolio as a whole: Total Resource Cost Test (TRC), Utility Cost Test (UCT), Ratepayer Impact Measure Test (RIM), and Participant Cost Test (PCT).

REPORTING

DP&L submits the independent evaluator report as an appendix to its annual energy efficiency and demand reduction/response portfolio status report. The EM&V report includes an executive summary, a comprehensive review of program-by-program evaluations, recommendations and cost effectiveness results.

STATEWIDE EVALUATOR

Once the PUCO appoints an independent statewide evaluator to review and monitor the Ohio utilities energy efficiency program evaluations, DP&L will fully cooperate with the process. DP&L will provide the statewide evaluator with a copy of each year’s evaluation plan for their review as well as survey instruments used throughout the year. DP&L will also provide the notice of pending site visits which will provide the statewide evaluator with the opportunity to participate.



Cost Effectiveness

OVERVIEW

In compliance with PUCO rules, DP&L used the Total Resource Cost Test (TRC) as the overall test of the portfolio's cost effectiveness and as a guide to determine the inclusion of programs in the portfolio. Overall, DP&L's portfolio is cost-effective as measured by the TRC. In addition, cost effectiveness calculations were performed using the Utility Cost Test (UCT), the Ratepayer Impact Measure (RIM), and the Participant Cost Test (PCT).

For all tests, a program is cost effective when the present value of the benefits is greater than the present value of the costs. What varies among the different cost effectiveness tests is which benefits and costs are included. Using the benefit/cost ratio, an offering is cost effective when the ratio is greater than one.

$$\frac{B}{C} \text{ ratio} = \frac{\text{Present Value of Benefits}}{\text{Present Value of Costs}} \geq 1$$

Total Resource Cost Test (TRC): The TRC measures the benefits of avoided supply costs over the lifecycle incremental costs of the energy efficiency measures and program administrative costs. Unlike the UCT, the TRC considers the full cost of the measure, not just the utility incentive cost.

$$\text{Total Resource Benefits} = \text{PV} \left(\sum_{\text{Year}=1}^{\text{Measure Life}} \left(\sum_i^{i=8760} (\text{impact}_i \times \text{avoided cost}_i) \right) \right)$$

$$\text{Total Resource Costs} = \text{PV} (\text{incremental measure costs} + \text{utility administrative costs})$$

Utility Cost Test (UCT): The UCT is a valuation of the costs and benefits from the perspective of the utility. It is measured by comparing the value of the supply-side benefits to the incentive and administrative costs associated with the energy efficiency programs. Unlike the TRC, the UCT considers incentive costs as opposed to full incremental measure costs.

$$\text{Utility Benefits} = \text{PV} \left(\sum_{\text{Year}=1}^{\text{Measure Life}} \left(\sum_i^{i=8760} (\text{impact}_i \times \text{avoided cost}_i) \right) \right)$$

$$\text{Utility Costs} = \text{PV} (\text{utility incentive costs} + \text{utility administrative costs})$$



Ratepayer Impact Measure (RIM): The RIM is a valuation of the net benefits of the energy efficiency programs from the perspective of the nonparticipants. It is measured by comparing the supply-side benefits to the costs of the programs, in terms of utility incentive costs, utility administrative costs and electric monetary savings, or lost revenue from the utility perspective.

$$\text{Ratepayer Benefits} = \text{PV} \left(\sum_{\text{Year}=1}^{\text{Measure Life}} \left(\sum_i^{i=8760} (\text{impact}_i \times \text{avoided cost}_i) \right) \right)$$

$$\text{Ratepayer Costs} = \text{PV} (\text{utility incentive costs} + \text{utility admin costs} + \text{lost revenue})$$

Participant Cost Test (PCT): The PCT values the benefits of the programs from the perspective of program participants. It measures the electric monetary savings of the participants as compared to the measures costs net of utility incentives.

$$\text{Participant Benefits} = \text{PV} \left(\sum_{\text{Year}=1}^{\text{Measure Life}} \left(\sum_i^{i=8760} (\text{impact}_i \times \text{rate}_i) \right) \right)$$

$$\text{Participant Costs} = \text{PV} (\text{net participant measure costs})$$

Presented below in Table 4 are the discount rates applied to each cost-effectiveness test.

Benefit – Cost Test	Discount Rate
TRC	7.86%
UCT	7.86%
RIM	7.86%
PCT	10.00%

Table 4 Discount Rates

Presented below in Table is the cost effectiveness for each program and for the portfolio as a whole by the various tests.

	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Ratepayer Impact Measure Test (RIM)
Residential Programs				
Efficient Products	1.37	2.36	3.55	0.40
HVAC Equipment	0.53	2.19	1.20	0.41
Appliance Recycling	1.30	1.30	-	0.36
Income Eligible Efficiency	0.46	0.46	-	0.23
School Education	2.44	2.44	-	0.40
Home Audit	0.33	0.33	-	0.18
Behavior Change	1.72	1.72	-	0.33
Energy Savings Kits	1.00	1.00	-	0.44
Multi-Family Direct Install	0.74	0.74	-	0.26
Residential Total	1.01	1.69	3.50	0.37
Business Programs				
Prescriptive	2.47	6.07	3.40	0.71
Custom	1.53	3.50	2.47	0.65
Commercial Midstream	3.82	8.91	5.32	0.77
Small Business Direct Install	1.34	2.72	2.03	0.67
Combined Heat and Power	2.34	8.68	3.16	0.67
Mercantile Self-Direct	0.92	5.37	1.30	0.66
Business Total	2.07	5.38	2.95	0.70
	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Ratepayer Impact Measure Test (RIM)
PLAN TOTAL*	1.57	3.16	3.13	0.57

*Costs in plan total include customer education and EM&V.

Table 5 Cost Effectiveness by Program and Total Portfolio

PROGRAM BENEFIT COMPONENTS

Benefits counted in the TRC, Utility, RIM, and PCT include the full value of time and seasonally differentiated energy and capacity costs. They also take into account avoided line losses. Line loss assumptions are specified in Table 6. For each energy-efficiency measure included in a program, hourly (8,760) system-avoided costs were applied to estimate hourly impacts derived using hourly load shapes of the affected end use. Non-energy benefits such as water savings were not factored into the calculation.

Sector	Energy Line Losses	Demand Line Losses
Residential	7.05%	8.14%
Commercial & Industrial	3.90%	5.01%

Table 6 Line Loss Assumptions Used in Cost Effectiveness Calculations

PROGRAM COST COMPONENTS

The following are the cost components included in the cost-effectiveness analysis.

Incremental measure costs: The incremental purchase cost of the energy efficiency measure to the participant.

Utility administrative costs: The administrative costs incurred by the utility to run the program, including program development, implementation vendor administrative costs, marketing, operation, and evaluations, measurement and verification.

Utility incentive costs: Direct incentives paid to customers by either the utility or the utility's implementation vendor.

Lost revenue: This can also be defined as the participants' electric monetary benefits. It is the energy impact multiplied by the retail rate. It is also a benefit in the PCT.

Net participant measure costs: The incremental purchase cost of the energy efficiency measure to the participant net of utility incentives paid to the participant.

Cost categories and whether they are applied at the program or portfolio level are summarized in Table .

Cost Category	Level Cost Applied	Description
Implementation Vendor, Direct Program Marketing	Program	Costs paid to program implementation vendors; costs to market individual programs.
Incentives	Program	Incentives paid to customers for each program.
DP&L Administrative	Program & Portfolio	DP&L costs assigned to a specific program are applied at the program level.
General Education, Market Transformation	Portfolio	Costs associated with education and market transformation.
Evaluations, Measurement & Verification	Portfolio	Costs associated with performing EM&V activities.

Table 7 Cost Categories and Descriptions

PROJECTED NET BENEFITS

Presented below in Table 8 are the net benefits for each program and for the portfolio as a whole by the various tests.

	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Ratepayer Impact Measure Test (RIM)
Residential Programs				
Efficient Products	\$ 9,148,896	\$ 19,490,767	\$ 52,863,334	\$ (50,531,186)
HVAC Equipment	\$ (9,160,139)	\$ 5,522,679	\$ 3,434,572	\$ (14,435,399)
Appliance Recycling	\$ 657,685	\$ 657,685	\$ 5,374,723	\$ (5,156,948)
Income Eligible Efficiency	\$ (2,063,094)	\$ (2,063,094)	\$ 3,314,231	\$ (5,768,013)
School Education	\$ 1,603,746	\$ 1,603,746	\$ 5,432,620	\$ (4,156,855)
Home Audit	\$ (1,668,031)	\$ (1,668,031)	\$ 1,928,215	\$ (3,726,013)
Behavior Change	\$ 2,776,684	\$ 2,776,684	\$ 15,665,212	\$ (13,548,871)
Energy Savings Kits	\$ 3,595	\$ 3,595	\$ 3,360,626	\$ (3,571,090)
Multi-Family Direct Install	\$ (649,948)	\$ (649,948)	\$ 4,341,904	\$ (5,256,439)
Residential Total	\$ 649,394	\$ 25,674,083	\$ 95,715,437	\$ (106,150,814)
Business Programs				
Prescriptive	\$ 58,151,229	\$ 81,595,592	\$ 84,774,853	\$ (40,121,074)
Custom	\$ 10,664,075	\$ 22,056,201	\$ 23,124,757	\$ (16,554,293)
Commercial Midstream	\$ 21,153,124	\$ 25,437,005	\$ 25,890,358	\$ (8,720,882)
Small Business Direct Install	\$ 2,912,085	\$ 7,306,030	\$ 7,089,462	\$ (5,632,563)
Combined Heat and Power	\$ 8,327,828	\$ 12,887,064	\$ 12,764,925	\$ (7,220,438)
Mercantile Self-Direct	\$ (908,900)	\$ 8,339,246	\$ 3,243,210	\$ (5,181,742)
Business Total	\$ 100,299,441	\$ 157,621,138	\$ 156,887,565	\$ (83,430,992)
	Total Resource Cost Test (TRC)	Utility Cost Test (UCT)	Participant Cost Test (PCT)	Ratepayer Impact Measure Test (RIM)
PLAN TOTAL*	\$93,147,309	\$175,675,985	\$252,603,003	(\$197,383,333)

*Costs in plan total include customer education and EM&V.

Table 8 Projected Net Benefits

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Summary: Application Supplemental Pages to Exhibit 1 attached to the Application of The Dayton Power and Light Company for Approval of Its Energy Efficiency and Peak Reduction Program Portfolio Plan which was filed on June 15, 2015 - these pages are marked as pages 91-98 of Exhibit 1 and should be combined with that filing. electronically filed by Mr. Jeremy M. Grayem on behalf of Dayton Power & Light