EVALUATION, MEASUREMENT & VERIFICATION FRAMEWORK FOR ONTARIO POWER AUTHORITY CONSERVATION PROGRAMS

FINAL VERSION 1.0
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1. INTRODUCTION

The *Evaluation, Measurement & Verification Framework for OPA Conservation Programs* (EM&V Framework) was created to provide the basis for a consistent and systematic methodology for tracking, reporting and evaluating the effectiveness and impacts of Conservation programs funded by the OPA.

The EM&V Framework includes information on the following:

- Overview of the OPA's Conservation strategy and program structure
- Tracking and reporting of OPA Conservation program activity (specifically energy and peak demand savings)
- Evaluating the cost effectiveness of OPA Conservation program activity using the TRC test and others
- Evaluation of OPA Conservation program activity – specifically,
    - the EM&V process,
    - EM&V's purpose and objectives,
    - Types of evaluation activities that will be undertaken for the different categories of programs, and
    - Reporting of EM&V results on OPA Conservation program activity

The intended audience for various sections of the EM&V Framework includes OPA policy staff, OPA program staff, third-party program administrators, evaluation contractors, government, other Conservation jurisdictions, and other stakeholders (internal and external).

A GLOSSARY of terms is provided at the back of this document for readers that are unfamiliar with EM&V terminology as well as to establish consistent definitions for terminology within the OPA.

It is expected that over time, additions and modifications will be made to this document as the OPA gains more experience in Conservation program evaluation.

2. EM&V FRAMEWORK OVERVIEW

The Framework document contains the following elements:

- Section 3: An Overview of Conservation Program Activities at the OPA including a description of OPA Conservation program categories and program types.
- Section 4: A discussion of Conservation Program activity tracking and reporting, focussing on Resource Acquisition type programs.
- Section 5: An Overview of EM&V at the OPA

3. OPA CONSERVATION OVERVIEW

The Province has set aggressive targets for reductions in peak electricity demand: 1,350 megawatts (MW) to be achieved by the end of 2007, an additional 1,350 MW to be achieved by the end of 2010 and a further 3,600 MW to be saved by 2025. It has tasked the OPA with leadership in seeing that the targets are met.[1]

The OPA has proposed a three pronged strategy[1] in support of meeting the provincial targets. The strategy is as follows:

- To procure Conservation resources to meet the 2010 targets
- To enhance capabilities across the conservation industry
- To transform the market and build a culture of conservation

The OPA's immediate focus is on meeting the 2010 demand reduction target, however, the mid-to-long term focus includes changes to codes and standards, influencing attitudes, improving knowledge, removing barriers, enhancing delivery capability and introducing new incentives. While procurement programs secure savings almost immediately, changes to codes and standards will play a significant role in achieving energy and demand savings as turnover in capital stock start to take root and the conservation industry develops greater depth and resilience. In the mid-to-long term it is expected there will be less need for procurement of conservation programs because a transformed marketplace will be securing more of the available Conservation resource than it does today.

The estimates of achievable demand reductions developed in Ontario's Integrated Power System Plan[1] (IPSP) are shown in the table below:

Table 1 Proposed Peak Demand Reductions (2008 – 2025)

Conservation Category	2010	2015	2020	2025
Energy Efficiency	623	1,938	2,694	3,189
Fuel Switching	70	156	215	268
Customer-based Generation	148	188	377	544
Demand Management / Conservation Behaviour	566	769	925	1,004
Total	**1,410**	**3,050**	**4,210**	**5,000**

The IPSP emphasizes the importance of Evaluation, Measurement & Verification (EM&V) in making Conservation a reliable and durable resource because it provides regular feedback about performance and leads to better estimates of Conservation potential and more effective programs and activities to secure it. EM&V systems need to be embedded in the development and delivery of Conservation programs. The OPA will complete evaluations for all programs it manages, using standardized performance

[1] "Conservation Resource", EB-2007-0707 – Exhibit D, Tab 4, Schedule 1, Table 10.

metrics to the extent possible. The reports will track the net energy and demand savings and peak demand savings achieved, consider the impacts on buyers and sellers in the given market, and suggest ways to improve the program design or delivery system.

Reflecting the importance of EM&V in the sector as a whole, the OPA also proposes to develop a standardized reporting format that could potentially be adopted for use throughout the electricity sector, thereby enhancing overall knowledge of what is taking place in the industry.

3.1. Conservation Program Categories

The IPSP has divided conservation activities into four separate categories[2] of Conservation for analytical purposes:

1. **Demand Management / Conservation Behaviour** - Actions to reduce peak demand are encouraged through demand management programs and other programs aimed at influencing Conservation Behaviour (collectively referred to as "Demand Management/Conservation Behaviour"). Demand Management occurs when customers reduce their electricity demand during peak use hours (peak clipping) or shift some of their demand to off-peak hours (peak shifting). Demand Management can occur in a number of ways: for example, when residential customers shift use of their dishwasher and laundry appliances to off-peak hours; when certain industrial customers contractually agree to shut down assembly lines in response to an automatic signal; and when residential and other customers participate in programs, allowing their use to be temporarily reduced by their utility or a demand aggregator. Conservation Behaviour occurs when customers voluntarily reduce their electricity consumption by scaling back the activity which is powered by electricity (e.g., reduce their air conditioner use by raising the set point temperature by a couple of degrees).

2. **Energy Efficiency** - Energy Efficiency occurs when customers reduce their electricity consumption but retain at least the same level of end-use service. Energy Efficiency is the gain from using more efficient appliances, equipment and buildings (e.g., replace household electric appliances and the air conditioner with more efficient models).

3. **Fuel Switching -** Fuel Switching occurs when customers elect to use other energy sources in place of electricity (e.g., replace their electric clothes dryer with a natural gas dryer).

4. **Customer-based Generation** - Customer-based Generation occurs when customers elect to install either a generator or a combined heat and power facility to meet all or a portion of their electricity consumption needs. Combined heat and power is also referred to as cogeneration. For the purpose of defining

[2] "Conservation Resource", EB-2007-0707 – Exhibit D, Tab 4, Schedule 1, p 1-2.

Conservation as distinct from supply resources, cogeneration projects of less than or equal to 10 MW, and renewable energy projects of less than or equal to 500 kW are included as contributing to the Conservation target. The Directive also allows electricity generated by Ontario customers under the net metering program to be counted towards meeting the Conservation target.

3.2. Conservation Program Types

The OPA's approach to meeting demand reduction targets includes facilitating their achievement by delivering savings from the four Conservation Program Categories through three overlapping but distinct types of Conservation programs:

- **Resource Acquisition** – Resource Acquisition refers to the procurement of energy and/or demand savings. These savings are encouraged through such tools as payments to customers for demand management, customer incentives for energy efficient building retrofits and new construction upgrades.
- **Capability Building** - Capability Building includes the development of skills and knowledge necessary to deliver effective Conservation programs and training and educating customers about the opportunity, need and ways to conserve.
- **Market Transformation** - Market Transformation refers to achieving a substantial and sustainable increase in the market share of energy efficient technologies, buildings and production processes.

All three types of programs will be utilized in the short and long-term. However, it is expected that Resource Acquisition programs will make the most significant contribution to meeting the 2010 target.

In the longer term, the expectation is that the Conservation goals will continue to be met through the investment in Capability Building and Market Transformation and that there will be less need for Resource Acquisition programs.

The current version of this document does not include details on Capability Building and Market Transformation evaluations. As the OPA starts to develop formal Capability Building and Market Transformation programs, details on how these programs will be evaluated will be included in future versions of this document. Current OPA programs which have elements of Capability Building and Market Transformation as part of their program strategy will have these elements evaluated on a customized basis until formal evaluation strategies are developed.

4. TRACKING AND REPORTING ENERGY AND PEAK DEMAND SAVINGS FROM CONSERVATION ACTIVITIES

The OPA will track and report energy and peak demand savings from Conservation program activity based on the category (or combination of categories) of the program being delivered. Energy and peak demand savings are not a direct measure – they are always determined from the difference of a "high-efficiency" case and a "base" case. It is essential when reporting energy and peak demand savings that the "high-efficiency" cases and "base" cases are normalized for factors that may impact reported savings, but are not a function of the Conservation action the savings are being attributed to. Normalization for such factors (e.g., weather, occupancy, and production schedules) is required when reporting energy and peak demand savings for OPA programs.

Energy and peak demand savings attributed to customer actions influenced by OPA Conservation programs will be tracked and reported using either one, or a combination, of three methods: Prescriptive, Quasi-Prescriptive, and Custom. The three methods are described in the following paragraphs.

a) **Prescriptive** – Energy and peak demand savings are prescribed on a per participant or per measure basis and are meant to represent the typical or average energy and peak demand savings that would be achieved by a participant undertaking the activity promoted in the Conservation program. Prescriptive input assumptions (PIAs) are also referred to as "deemed savings" assumptions or "ex ante savings" assumptions. Gross program savings are calculated from the number of tracked participants / measures installed multiplied by the prescribed energy or peak demand savings per participant or measure. The gross program savings are calculated as shown in Eq1.

$$PS_{gross} = N \times s \qquad \text{(Eq1)}$$

where,

PS_{gross} =	Gross program savings (kWh or kW)
N =	Number of tracked participants (or measures installed)
s =	Prescribed energy or peak demand savings per participant (kW or kWh per participant)

The net program savings are calculated in a similar manner as the gross program savings with the difference being the number tracked participants is reduced by the number of free rider participants, determined from program evaluation activities. The net program savings may be further discounted (or increased) by other "adjustment factors" determined from the program evaluations e.g., installation rates, rebound effects, and spill-over. The combination of all adjustment factors is commonly referred to as the "net-to-gross" ratio (NGR) which scales the gross program savings up, or more commonly down, to the net program savings. The net program savings are calculated as shown in Eq2.

$$PS_{net} = AF_1 \times ... \times AF_n \times NGR \times N \times s \quad \text{(Eq2)}$$

where,

PS_{net} =	Net program savings (kWh or kW)
$AF_{x's}$ =	Other adjustment factors (%)
NGR =	Net-to-gross ratio
N =	Number of tracked participants (or measures installed)
s =	Prescribed energy or peak demand savings per participant (kW or kWh per participant)

Example: A refrigerator retirement program assumes an annual energy savings of 1200 kWh/yr per participant. The program has 10,000 participants and the free rider rate for this program is estimated to be 30%. Calculate the annual gross and net energy savings from the program.

Using Eq1, with 10,000 participants and a prescribed energy savings per participant of 1200 kWh/yr, the gross energy savings for the refrigerator retirement program are:

PS_{gross} =	N x s
=	10,000 participants x 1200 kWh / participant
=	**12,000,000 kWh OR 12,000 MWh**

Using Eq2, with a free rider rate of 30% (net-to-gross ratio of 70%), the net energy savings for the refrigerator retirement program are:

PS_{net} =	NGR x N x s
=	70% x 10,000 participants x 1200 kWh / participant
=	**8,400,000 kWh OR 8,400 MWh**

b) **Quasi-Prescriptive** - Energy and peak demand savings are determined using a prescribed methodology that uses key, project-specific, inputs to estimate the energy and peak demand savings for each project or participant (or measure installed). A common quasi-prescriptive methodology is to prescribe energy and peak demand savings for a measure on a scalable basis (such as per unit-of-capacity or per hour-of-operation). If the relationship between the scalable basis and the energy and peak demand savings is linear, the gross program savings are calculated from the number of reported participants or measures installed (N) multiplied the average participant value of the scalable basis (SB_{avg}) multiplied by the prescribed scalable energy or peak demand savings (s_{scale}). The gross program savings are calculated as shown in Eq3.

$$PS_{gross} = N \times SB_{avg} \times s_{scale} \quad \text{(Eq3)}$$

where,

PS_{gross} =	Gross program savings (kWh or kW)
N =	Number of tracked participants (or measures installed)
SB_{avg} =	Scalable basis (e.g. average participant equipment capacity)
s_{scale} =	Prescribed energy or peak demand savings per participant (kW or kWh per participant per scalable basis)

The net program savings are calculated in a similar manner as the gross program savings with the difference being the number tracked participants is reduced by the number of free rider participants, determined from program evaluation activities. The net program savings may be further discounted (or increased) by other "adjustment factors" determined from program evaluations e.g., installation rates, rebound effects, spillover. The net program savings are calculated as shown in Eq4.

$$PS_{net} = AF_1 \times ... \times AF_n \times NGR \times N \times SB_{avg} \times s_{scale} \quad \text{(Eq4)}$$

where,

PS_{net} =	Net program savings (kWh or kW)
$AF_{x's}$ =	Other adjustment factors (%)
NGR =	Net-to-gross ratio
N =	Number of tracked participants (or measures installed)
SB_{avg} =	Scalable basis (e.g. average participant equipment capacity)
s_{scale} =	Prescribed energy or peak demand savings per participant (kW or kWh per participant per scalable basis)

Example: A high-efficiency motor replacement program assumes an annual energy savings of 2.07 kWh of energy savings per hour of operation for 20 hp motors. The program has 100 participants (i.e, 100 x 20hp motors installed) and the average annual operating hours is 2800 hrs - determined from data gathered from the participants. The free rider rate for this program is estimated to be 30%. Calculate the annual gross and net energy savings from the program.

Using Eq3, with 100 participants, a prescribed energy savings per participant of 2.07 kWh/hr of operation, and an average hours of operation of 2800 hrs, the gross energy savings for the high-efficiency motor replacement program are:

PS_{gross} = N x SB_{avg} x s_{scale}
= 100 participants x 2800 hrs x 2.07 kWh / hr / participant
= **579600 kWh OR 579.6 MWh**

Using Eq4, with a free rider rate of 30% (net-to-gross ratio of 70%), the net energy savings for the high-efficiency motor replacement program are:

PS_{net} = NGR x N x SB_{avg} x s_{scale}
= 70% x 100 participants x 2800 hrs x 2.07 kWh / hr / participant
= **405,720 kWh OR 405.7 MWh**

Other potential quasi-prescriptive methodologies may, as an example, include engineering equations that utilize key participant inputs, prescribed inputs, default values to generate energy and peak demand savings estimates OR the use of the similar inputs to lookup pre-generated values in tables. For these quasi-prescriptive methodologies the gross program savings are calculated from the sum of the savings calculated for each project / participant (or measure installed) as shown in Eq5.

$$PS_{gross} = \sum_{i=0}^{N} (ps_i) \qquad \text{(Eq5)}$$

where,

PS_{gross} =	Gross program savings (kWh or kW)
N =	Number of tracked participants (or measures installed)
ps_i =	savings reported for the ith participant using the quasi-prescriptive methodology

The net program savings are determined from the gross program savings discounted by the rate of free ridership. The net program savings may be further discounted (or increased) by other "adjustment factors" determined from program evaluations e.g., installation rates, rebound effects, spillover. The net program savings are calculated as shown in Eq6.

$$PS_{net} = AF_1 \times ... \times AF_x \times NGR \times \sum_{i=0}^{N} (ps_i) \qquad \text{(Eq6)}$$

where,

PS_{net} =	Net program savings (kWh / kW)
$AF_{x's}$ =	Other adjustment factors (%)
FR =	Net-to-gross ratio
N =	Number of tracked participants (or measures installed)
ps_i =	savings reported for the ith participant using the quasi-prescriptive methodology)

Example: A high-efficiency air-conditioning program uses a web calculator to determine energy savings based on participant specific inputs (e.g., equipment capacity, thermostat set points, geographic location, etc.). The web calculator estimates savings for the 5 program participants as 3000 kWh, 4000 kWh, 3500 kWh, 3250 kWh, 3750 kWh based on the participant specific inputs. The free rider rate for this program is estimated to be 30%. Calculate the annual gross and net energy savings from the program.

Using Eq5, with the reported savings for each participant, the gross energy savings for the high-efficiency air-conditioning program are:

PS_{gross} = $\sum_{i=0}^{N} (ps_i)$

= 3000 kWh + 4000 kWh + 3500 kWh + 3250 kWh + 3750 kWh
= **17,500 kWh OR 17.5 MWh**

Using Eq6, with a free rider rate of 30% (net-to-gross ratio of 70%), the net energy savings for the high-efficiency air-conditioning program are:

$PS_{net} = NGR \times \sum_{i=0}^{N} (ps_i)$
= 70% x 17500 kWh
= **12,250 kWh OR 12.5 MWh**

c) **Custom** – The gross energy and peak demand savings are tracked and reported on a project-by-project basis. The net program savings are determined from the gross program savings discounted by the rate of free ridership. The net program savings may be further discounted by other "adjustment factors" determined from program evaluations.

Table 2 shows the typical application of the three tracking methods for the four Conservation program categories.

Table 2 Typical Methods of Tracking and Reporting Energy and Peak Demand Savings

	Method of Tracking Savings		
Program Category	**Prescriptive**	**Quasi-Prescriptive**	**Custom**
Energy Efficiency	Residential, Small Commercial (market segment specific)	Commercial, Industrial	Large Commercial, Industrial, Unique projects/programs
Demand Management / Conservation Behaviour	Residential, Small Commercial (market segment specific)	Commercial, Industrial	Aggregated Residential or Commercial, Large Commercial, Industrial
Fuel Switching	Residential, Small Commercial (market segment specific)	Commercial, Industrial	Large Commercial, Industrial, Unique (one-off) projects
Self-Generation / Cogeneration	n/a	n/a	All

4.1. OPA Measures and Assumptions List

Prescriptive input assumptions (PIAs) used for reporting energy and peak demand savings and cost-effectiveness have been published previously in a list of assumptions and measures contained in the OEB's *Total Resource Cost Guide*[3]. The OPA has used this list of measures as the basis for the OPA Measures and Assumptions List for OPA programs in 2007. The OPA Measures and Assumptions List will be updated annually, as required, based on directed research and EM&V research on program results. A companion substantiation handbook will be published with the OPA Measures and

[3] Total Resource Cost Guide, Ontario Energy Board, Revised: October 2, 2006.

Assumptions List (utilizing the OPA Measures and Assumptions Substantiation Template - see Appendix A) to reference the source of all values in the OPA Measure and Assumptions List.

4.2. OPA Program Activity Tracking

The use of prescriptive and quasi-prescriptive savings reporting methods amplify the need for an efficient and effective tracking system. Program tracking systems are designed primarily to produce estimates of reported program savings but may also be used to aid evaluators in verifying the energy and peak demand savings resulting from the program. Program activity will be tracked by the program administrators (LDC or others) and reported back to the OPA. There are two options for OPA tracking of reported program activity: discrete tracking and continuous tracking.

Discrete Program Tracking refers to receiving program activity and expenditure reporting from program administrators on a discrete basis e.g., quarterly and final reports.

Continuous Program Tracking refers to receiving program activity reporting from program administrators on a continuous basis, with the goal of being able to review program activity in real-time or close to real-time.

Continuous program tracking is the preferred option for most program activity tracking but requires the proper infrastructure and resources to support it. There may be some programs where discrete program tracking is acceptable or, possibly, preferable. The OPA is currently developing a Conservation data warehouse to facilitate continuous program tracking.

Regardless of the type of tracking option employed, a minimum set of data needs to be collected while the program is running to estimate the energy and peak demand savings attributable to the program and to assess its cost-effectiveness. Table 3 describes the minimum OPA data collection requirements for tracking reported energy and peak demand savings and program cost-effectiveness. Examples of additional participant and program delivery specific information that must be collected by the program administrator for potential use during the program evaluation (participant verification, process improvement studies, market effect studies, etc.) are also listed.

Table 3 Minimum OPA Data Collection Requirements for Tracking and Reporting Energy and Peak Demand Savings and Cost-Effectiveness

	Minimum Data Collection Requirements		
Method of Tracking Savings	**Energy and Peak Demand Savings**	**Cost Effectiveness Tests (TRC and others)**	**General**
Prescriptive	• Gross participants and measures installed	• Gross participants, • Program costs • Program Incentives	• Gross participants, • Detailed reporting of program expenditures (incentives and program costs), • Program delivery specific metrics such as website hits, training session attendees, marketing materials delivered, calls received at Call Centre, etc. • Participant information (name, address, contact info, etc.) collected by program administrator • Measure information (equipment model numbers, equipment capacity, etc.)
Quasi-prescriptive	• Gross participants, • Actual values of participant inputs (hours of operation, equipment capacities, etc.) used to generate energy and peak demand savings estimates	• Gross participants, • Actual values of participant inputs (hours of operation, equipment capacities, etc.) used to generate energy and peak demand savings estimates • Program costs • Program Incentives	• Gross participants, • Detailed reporting of program expenditures (incentives and program costs), • Program delivery specific metrics such as website hits, training session attendees, marketing materials delivered, calls received at Call Centre, etc. • Participant information (name, address, contact info, etc.) collected by program administrator • Measure information (equipment model numbers, equipment capacity, etc.)

Custom	• Energy and peak demand savings per project - this must include a detailed description of the assumed base case and high-efficiency case and provide sufficient detail to substantiate all reported savings. • For projects comprised of multiple custom measures – the energy and peak demand savings should be provided with a breakdown by measure	• Energy and peak demand savings per project, incremental equipment costs per project (supported by invoices), equipment life per project, program costs, and per project incentive costs • For projects comprised of multiple custom measures – the energy and peak demand savings, incremental equipment costs, and equipment lives should be provided with a breakdown by measure	• Energy and peak demand savings per project, incremental equipment costs per project, equipment life per project • Detailed reporting of program expenditures (incentives and program costs) • Program delivery specific metrics such as website hits, training session attendees, marketing materials delivered, calls received at Call Centre, etc. • Participant information (name, address, contact info, etc.) collected by program administrator • Measure information (equipment model numbers, equipment capacity, etc.)

The tracking system should store the collected data to enable in-year monitoring and reporting on a hierarchy of levels such as at the measure level, program administrator (LDC or other) level, a program level, and a portfolio level.

4.3. OPA Program Activity Reporting

Conservation program activity tracked data is an integral part of all Conservation results reporting (internal and external) occurring at the OPA. The main reporting functions within the OPA are:

- Public reporting by Chief Energy Conservation Officer (CECO)
- OPA reporting to Ontario Energy Board (OEB)
- OPA Board of Directors and Executive
- OPA reports for Conservation community in Ontario
- OPA Power System Planning staff who assess the overall potential for Conservation programs to replace generation and transmission
- OPA Conservation programs staff involved in programs portfolio management for continuous improvement of their design and procurement processes

Each of these reporting functions requires reliable, verified data to provide assurance to their audiences that the results being reported are accurate, and have a sufficient degree of certainty to be relied on for decision-making purposes. To provide this assurance, the OPA has created an EM&V business unit to provide independent evaluation of Conservation program activities and their reported results.

5. EVALUATION, MEASUREMENT & VERIFICATION (EM&V)

EM&V refers to the evaluation, measurement and verification of Conservation program activities and the associated effects anticipated by program planners and designers.

The OPA uses the term "Evaluation" as a general term that describes all of the activities associated with measuring a program's energy and peak demand savings (i.e., load impacts), verifying the installations of program measures, valuating the program benefits versus its costs, determining the program's market impacts, and process evaluations that comment on program implementation and provide recommendations for program improvements. These evaluation activities can broadly be categorized as serving two functions:

1) **Evaluating Program Induced Effects**
    - Energy and peak demand savings claims
    - Cost-effectiveness
    - Market impacts

2) **Evaluating the Effectiveness of Program Design and Delivery Processes**
    - Validating the program's theory of how suppliers and customers will perceive and react to the Conservation program's stimulus and then take action to achieve energy savings
    - Identifying opportunities for improvement in the Conservation program's design and delivery process

5.1. EM&V Objectives & Purpose

EM&V at the OPA serves the following purposes by providing:

- Assurances to all interested parties that reported benefits (energy and peak demand) are being attained and that program spending is cost effective,
- Energy and peak demand savings numbers from Conservation activities that are reliable for integrated power system planning purposes, and
- Feedback on program design and delivery to facilitate continuous improvement of the ongoing OPA Conservation program portfolio.

EM&V at the OPA will fulfill these purposes by delivering on the following key objectives:

- Providing timely reports to the OPA Board and Conservation community (internal and external stakeholders) on the actual energy / peak demand impacts and cost effectiveness of OPA Conservation programs.
- Providing useful recommendations and feedback to improve program effectiveness during the entire program cycle, when possible.
- Ensuring program evaluations remain objective and independent from any potential bias.
- Increasing the level of confidence in Conservation program results for policy makers and the OPA Board by publishing transparent protocols that apply to

all programs and developing a competitive EM&V vendor procurement process.

5.2. EM&V Process

Figure 1 conceptually depicts the OPA's EM&V process cycle in relation to the ideal Conservation program cycle and shows the typical interactions between the two.

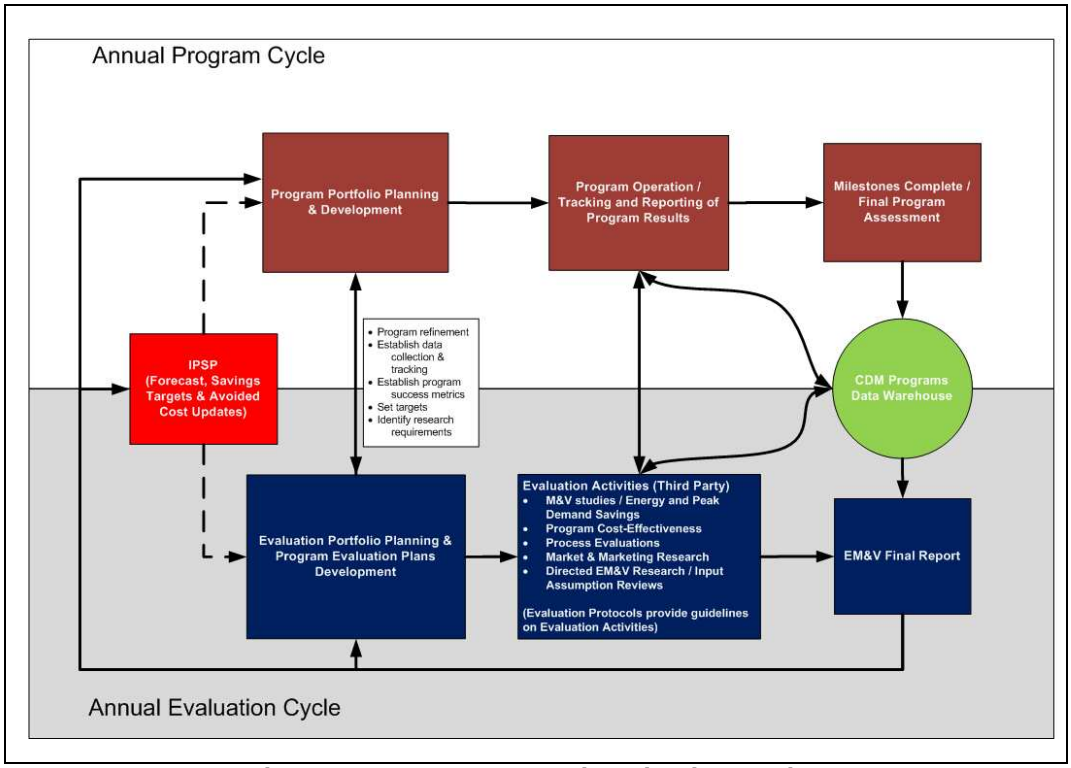

Figure 1 OPA Program and Evaluation Cycles

The key elements of the EM&V process, as illustrated in Figure 1, are:

- Evaluation Portfolio Planning & Program Evaluation Plan Development
- Evaluation Activities
- EM&V Reporting

Each of these key elements is discussed in the following sections.

5.2.1. Evaluation Portfolio Planning & Program Evaluation Plans Development

Evaluation Portfolio Planning

Evaluation portfolio planning is a planning process used to decide what evaluation activities should be pursued in the upcoming year and what budgets should be allocated to these activities. It is an iterative process that takes the inputs from the IPSP, the previous year's evaluation reports, and portfolio planning & program development to determine and refine the portfolio of evaluation activities to be completed in the upcoming year. This list of activities is refined into detailed Draft Evaluation Plans and directed research plans.

The development of Draft Evaluation Plans includes prioritizing and focusing. The initial Draft Evaluation Plans will represent the "ideal" evaluation that would occur if evaluation resources (time, budgets, personnel, contractors, etc.) were unlimited. These initial Draft Evaluation Plans will be filtered through a number of "checks and balances" at the Evaluation Portfolio Planning level to develop prioritized and focused Draft Evaluation Plans. The Draft Evaluation Plans will be further refined during the development / transition to the Final Evaluation Plans. The filtering process is illustrated in Figure 2.

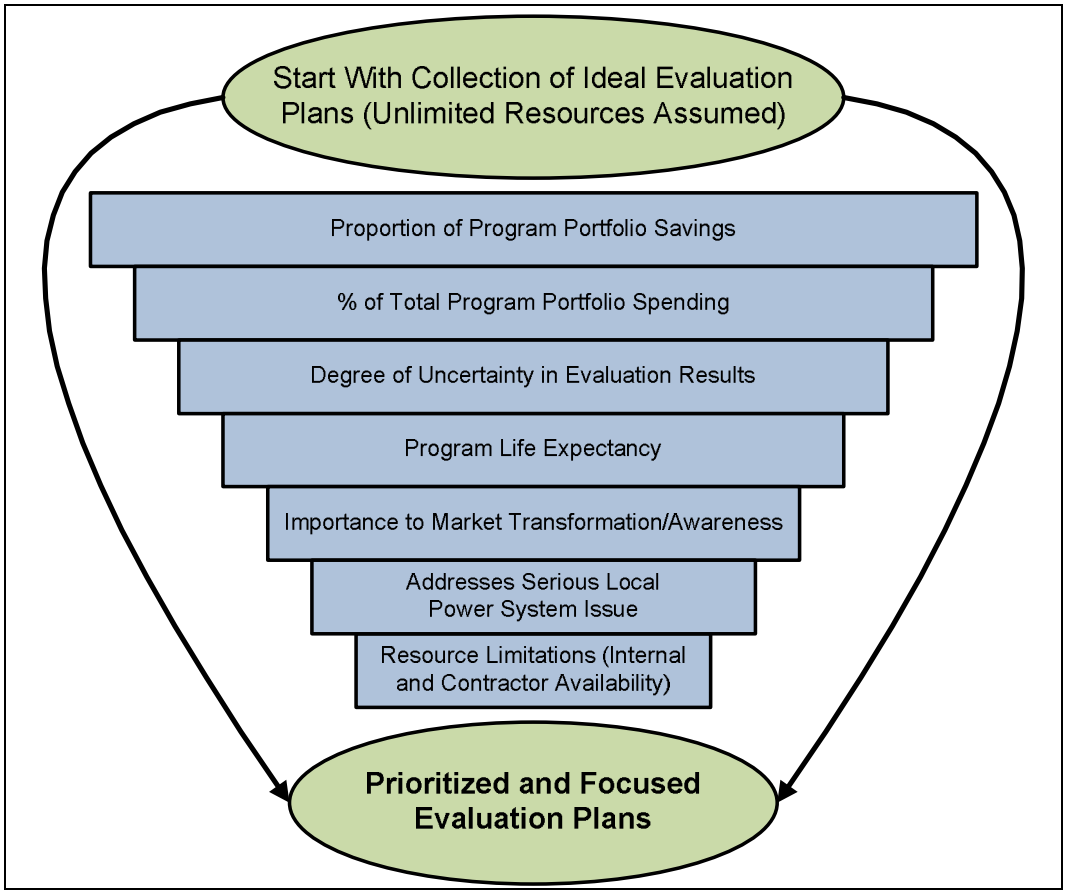

Figure 2 EM&V Portfolio Planning

Evaluation portfolio planning activities include:

- Setting priorities for prescriptive input assumption reviews
- TRC measure screening to estimate the cost-effectiveness of measures prior to program development or refinement
- Determining EM&V research needs based on feedback from previous year's evaluations
- Prioritizing and focusing Draft Evaluation Plans for the spectrum of individual programs
- Planning any portfolio-level EM&V activities (e.g. determining PIAs for measures that are not offered in OPA programs)

An important element of the iterative evaluation portfolio planning process is the Evaluation Coordinating Committee.

Evaluation Coordinating Committee
Evaluation activities may be initiated by multiple groups / departments / business units within the OPA. Current state-of-the-practice evaluation efforts incorporate a cross-functional "evaluation oversight team" to oversee the program's process, market, and impact evaluations. A cross-functional Evaluation Coordinating Committee has been established at the OPA to serve the following functions:

- Help identify current and future program evaluation priorities
- Contribute to the development of the Draft Evaluation Plans
- Identify synergies between departmental evaluation activities and prevent duplication of evaluation efforts
- Establish departmental responsibilities for evaluation activities identified in the Draft Evaluation Plans

The Evaluation Coordinating Committee has representatives from EM&V, Conservation Programs staff and may include representatives from other groups such as CECO and Power System Planning (PSP) who may have responsibilities or significant inputs.

Detailed Program Evaluation Plans
Experience in other jurisdictions has shown that evaluation planning should be done at the time of program design. This provides the opportunity for baseline conditions to be determined in advance of the launch, EM&V input for program design, and provisions put in place for data collection prior to a program's launch. To maximize a program's effectiveness the following should be established during program development and before program launch.

1) **Prescriptive Input Assumptions** for prescriptive measures included in the program should be determined at the initial stages of the program development to enable potential energy and peak demand savings estimations, to craft the evaluation parameters for the individual measures, and for estimation of program cost effectiveness. The detailed program

evaluation plan will indicate whether the input assumptions require a third-party review. For prescriptive input assumptions that have been developed internally, a third party review will be mandatory in the first year of the program. Existing prescriptive input assumptions should have a cursory annual review (internal or external) to assess whether a detailed review or data collection is warranted. If anything has substantially changed in the marketplace (e.g., changes in market offerings or changes to codes, standards, or regulations that may impact energy and peak demand savings) a detailed review should be undertaken. The input assumptions for each measure in the portfolio will be reviewed at least once every three years. The development of the measure's input assumptions will be documented in a standard format (see Appendix A) with the substantiation for the prescribed values referenced.

2) **Cost-Effectiveness Screening** (from different perspectives) of the individual measures and at the program level should be conducted based on the input assumptions and anticipated program participation and costs. This will be done at the beginning and throughout the stages of program development. The results of the cost-effectiveness screening will be used as a key input in the decision making process that continues the program development as-is, modifies it, or abandons it.

3) **Key Program Success Factors** for evaluating the success of the program need to be identified and provisions to evaluate them need to be integrated into the draft evaluation plan. Targets for the success factors should be set before program launch to gauge the program's success relative to the initial expectations. Examples of key program success factors are:
    a) number of participants,
    b) measures installed,
    c) program expenditures,
    d) trade allies signed up or participating,
    e) customer satisfaction,
    f) customer awareness

4) A **Draft Evaluation Plan** will be developed during program design to identify all the key research requirements for the program evaluation and all of the data required for collection to support the program evaluation as well as how it will be used. Provisions for data collection, in addition to standard program tracking and reporting, should be integrated into the program design whenever possible and practical to minimize "after-the-fact" data collection. The OPA Evaluation Protocols (further described in Section 5.2.2) describe the Draft Evaluation Plan in more detail and provide guidance on its construction. The elements of the Draft Evaluation Plan are as follows:

a) **Evaluation Objectives** – A high-level description of what the objectives of the program evaluation are e.g. confirm energy and peak demand savings and cost-effectiveness.
b) **Program Description** – A brief description of the program activities.
c) **Program Theory** – The program theory should include the following:
    - Identify the barriers in the market that are preventing the desired market actor behaviour from naturally occurring i.e. without the program's influence
    - Identify the market actors the program intends to influence
    - Explain how the elements of the program will stimulate the desired changes in the market actors' behaviour and what market effects will manifest themselves
    - Explain how energy and peak demand savings, if any, will occur from the changes in market actor behaviour resulting from program activity
d) **Key Research Objectives** – A listing of the key research objectives that the evaluation will examine and who at the OPA will be responsible for initiating the research.
e) **Data Collection Responsibilities** - A listing of the data collection requirements that are necessary to complete the evaluation and who is responsible to collect this data.
f) **Schedule for Evaluation Deliverables** – A schedule of when the evaluation pieces must be delivered.

5) A **Final Evaluation Plan** will be developed from the Draft Evaluation Plan, typically by a third-party Evaluation Contractor. The Final Evaluation Plan will identify the activities planned for the program evaluation and provide the explicit details of the methodology (sampling plans, measurement and verification studies), timeline, and budget related to how plan will be accomplished. The OPA Evaluation Protocols (further described in Section 5.2.2) describe the Final Evaluation Plan in more detail and provide guidance on its construction.

5.2.2. Evaluation Activities

OPA Evaluation Protocols

The OPA Evaluation Protocols are guidelines that describe acceptable methods for evaluating OPA Conservation programs. The OPA Evaluation Protocols include the types of evaluations to be completed over the life cycle of a program, expected outputs or results from the evaluation reports, acceptable methods for use in drawing up sample designs, guidelines for verifying energy and peak savings, and a frequency or schedule specifying the timing of reports relative to the program launch date. The current list of OPA Evaluation Protocols is as follows:

1) Draft Evaluation Plan Development
2) Final Evaluation Plan Development
3) Prescriptive Assumptions Review – OPA Measures and Assumptions List
4) Verification of Program Expenditures
5) Process Evaluations
6) Measurement of Energy Savings and Verification of Installation
7) Estimation of Energy (kWh) Savings and Program Cost Effectiveness
8) Estimation of Peak Demand (kW) Savings

M&V Studies

Measurement & Verification (M&V) studies are used to confirm that energy and peak demand savings claims from program activities are actually occurring, reported program-related expenditures actually were spent as reported, and provide an estimate of the cost-effectiveness of the program using verified program savings results and actual program costs.

The Measurement component of EM&V involves collecting data on parameters that affect energy and peak demand savings and cost-effectiveness claims. Typical sources of data for measurement studies include: site-visits, surveys, utility bills, sub-metering, equipment invoices, temperature and humidity sensors, occupancy logs/studies, equipment run-time logs/studies, and production reports.

The Verification component of EM&V involves using the Measurement data collected to verify that anticipated energy and peak demand savings occurred, i.e., the measures were actually installed, the installation meets reasonable standards of quality, and the measures are operating as intended and have the ability to generate energy and peak demand savings. Verification activities are generally conducted during on-site surveys or audits on a sample of projects. Phone, internet, and mail surveys may be used for very simple measures (such as CFL replacements), but on-site inspection is preferred.[4]

Cost Effectiveness

Valuation of Conservation activities involves using the collected data to provide an assessment of the cost effectiveness of the program. The primary metric for assessing program cost effectiveness will be the Total Resource Cost (TRC) test. The TRC test is defined in California Standard Practice Manual[5] as follows:

> "The Total Resource Cost Test measures the net costs of a demand-side management program as a resource option based on the total costs of the program, including both the participants' and the utility's costs. The test is applicable to conservation, load management, and fuel substitution programs. For fuel substitution programs, the test measures the net effect

[4] The California Evaluation Framework, TecMarket Works, prepared for the California Public Utilities Commission and the Project Advisory Group, June 2004.

[5] California Standard Practice Manual – Economic Analysis of Demand-Side Programs and Projects, October 2001.

of the impacts from the fuel not chosen versus the impacts from the fuel that is chosen as a result of the program. TRC test results for fuel substitution programs should be viewed as a measure of the economic efficiency implications of the total energy supply system (gas and electric)."

To assess a program's cost effectiveness with the TRC test the following information is required:

- Energy and peak demand savings (kWh and kW) - verified by M&V studies
- Incremental Costs - verified by M&V studies
- Equipment Life or Effective Useful Life of the measure
- Avoided Electricity/Other Avoided Resource Costs (updated Avoided Electricity Costs will be published annually by the OPA)
- Program Costs and Incentive Costs
- Net-to-gross ratios

The OPA will use the TRC test in accordance with the *Total Resource Cost Guide* published by the OEB[3]. This TRC test methodology has been incorporated into the OPA Cost Effectiveness Tests Guide published by the OPA that describes a number of different cost-effectiveness tests (including the TRC test) complete with guidance and examples on how to implement them.

A measure / program / portfolio valuated using the TRC test is considered cost effective if the ratio of benefits to costs is greater than or equal to 1, in other words, if there are non-negative net benefits (net benefits = benefits - costs ≥ 0).

Other cost effectiveness tests that may be utilized are:

- **Participants Test** – "The Participants Test is the measure of the quantifiable benefits and costs to the customer due to participation in a program. Since many customers do not base their decision to participate in a program entirely on quantifiable variables, this test cannot be a complete measure of the benefits and costs of a program to a customer."[5]
- **Societal Cost Test (SCT)** – "A variant on the TRC test is the Societal Test. The Societal Test differs from the TRC test in that it includes the effects of externalities (e.g., environmental, national security), excludes tax credit benefits, and uses a different (societal) discount rate."[5]
- **Program Administrator Cost (PAC) Test** – "The Program Administrator Cost Test measures the net costs of a demand-side management program as a resource option based on the costs incurred by the program administrator (including incentive costs) and excluding any net costs incurred by the participant. The benefits are similar to the TRC benefits. Costs are defined more narrowly."[5]
- **Ratepayer Impact Measure (RIM) Test** – "The Ratepayer Impact Measure (RIM) test measures what happens to customer bills or rates due to changes in

utility revenues and operating costs caused by the program. Rates will go down if the change in revenues from the program is greater than the change in utility costs. Conversely, rates or bills will go up if revenues collected after program implementation are less than the total costs incurred by the utility in implementing the program. This test indicates the direction and magnitude of the expected change in customer bills or rate levels."[5]

Figure 3 depicts the different cost effectiveness tests that may be utilized for a program evaluation. Arrows into a box represent a benefit and arrows out of a box represent a cost. The results of the tests will be expressed as both a ratio (benefit / cost) and a net benefit (benefit – cost).

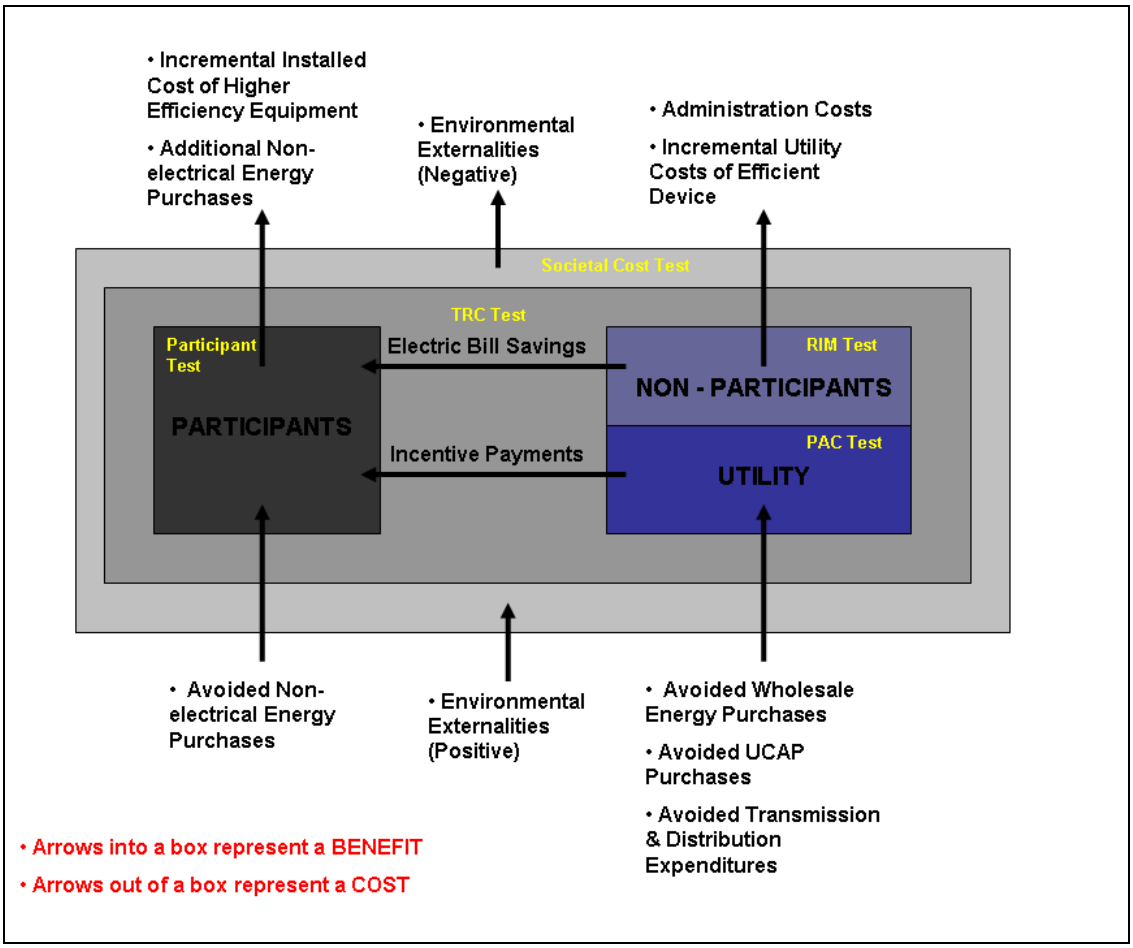

Figure 3 Cost-Effectiveness Tests Diagram

Savings Assumptions Reviews

Table 4 lists the typical evaluation activities that may be undertaken for evaluations of programs that rely on prescriptive and quasi-prescriptive measures for capturing energy and peak demand savings from program activities.

Table 4 M&V Activities for Prescriptive / Quasi-Prescriptive Programs

M&V Activity	Acceptable Methods	Typical Timing / Frequency
Input Assumptions Review / Determination / Update	Existing (OPA list) - review input assumptions and update if necessary using: • Literature search of existing reputable research • Detailed M&V study (billing analysis, sub-metering, engineering analysis, etc.) on a sample of participants and non-participants • Simple engineering calculations with M&V research on key inputs • Computer simulation models with M&V research on key inputs • Quasi-prescriptive measures may include development of calculators (e.g. web-based applications) to compute savings based on customer-specific inputs New - determine input assumptions in advance of program launch from: • Pilot project with M&V study • Literature search of existing reputable research • Detailed M&V study billing analysis, sub-metering, engineering analysis, etc.) on a sample of potential program participants • Simple engineering calculations with M&V research on key inputs, • Computer simulation models with M&V research on key inputs • Quasi-prescriptive measures may include development of calculators (e.g. web-based applications) to compute savings based on customer-specific inputs	If input assumptions are new, based on outdated research, or possess a high level of uncertainty, a detailed review will take place during the initial stages of program design and at least once every three years going forward. Detailed reviews / updates may also be triggered by events such as changes in codes, standards, and regulations or by the introduction of higher efficiency product offerings. An annual cursory review of the input assumptions will be done to confirm if any of these events have occurred since the last detailed review.
Net-to-Gross Studies	• Free rider / adjustment factor research by qualified Evaluation Contractor • Requirements for adjustment factors other than free rider rate, if necessary at all, are determined by the program's design and delivery (e.g. installation rates) • For a new program, current market share may be used as a proxy value until research can be conducted.	Research will take place in first year of the program and at least once every three years going forward. New research will be undertaken if substantial changes to program design or delivery are made.

Cost effectiveness screening (measure and program level) for planned activity	• Screening with OPA Cost Effectiveness Tests tool that has up-to-date input assumptions and avoided costs	Measure / program cost effectiveness screening will be undertaken at the initial stages of program development. For continuing programs, the cost-effectiveness should be reassessed annually with updates to avoided costs, input assumptions, and anticipated program costs.
Verification of participants and expenditures	• Proper tracking and reporting systems and suitable program design and delivery reduce the evaluation burden. • Verification of a sample of participants and an audit of a sample of program expenditures to provide a minimum statistical confidence of 90% in the reported results.	Verification of participants and expenditures will be conducted annually.
Cost Effectiveness of annual program / portfolio results	• Screening with OPA Cost Effectiveness Tests tool that has up-to-date input assumptions and avoided costs	Program / portfolio cost effectiveness screening will be done annually to assess cost-effectiveness based on actual program / portfolio performance and costs.

The specific timing for these activities is described in the OPA Evaluation Protocols.

Table 5 lists the typical evaluation activities undertaken for programs that have custom energy and peak demand savings.

Table 5 M&V Activities for Custom Programs

M&V Activity	Acceptable Methods	Typical Timing / Frequency
Review of Reported Energy and Peak Demand Savings	• For programs that incorporate M&V into application process (Project M&V), an additional review of a sample of projects' M&V work • For programs that do not incorporate M&V into application process, initiate M&V studies on a sample of projects	Annually
Free Rider Studies	• Free rider research by qualified Evaluation Contractor • TRC Guide currently suggests a free rider rate of 30% for custom projects	Every three years

Verification of installations and expenditures	• Proper tracking and reporting systems and suitable program design and delivery reduce the evaluation burden. • Verification of a sample of participants and an audit of a sample of program expenditures to provide a minimum statistical confidence of 90% in the reported results.	Verification of participants and expenditures should be conducted annually.
TRC screening of annual program / portfolio results	• Screening with OPA Cost Effectiveness Tests tool with project inputs and avoided costs that are applicable to the year.	Project / portfolio cost effectiveness screening should be done annually to assess cost-effectiveness based on actual program / portfolio performance and costs.

The specific timing for these activities is described in the OPA Evaluation Protocols.

Process Evaluations

Conservation program process evaluations identify and make recommendations for improvement to increase the program's efficiency and/or effectiveness in achieving its objectives (energy and peak demand savings, education and awareness, etc.) while maintaining high levels of participant satisfaction. The purpose of the process evaluations are to give feedback (in-program and post-program) to program design and implementation as well all parties involved with administering and implementing the programs to foster continuous program improvement.

Process evaluations will focus on the four following key elements:

1. **Program Design** – an assessment of program design and theory including recommendations for improvement from evaluation results or best practices.
2. **Program Administration** – an assessment of program administration including identifying staffing requirements and training needs, and review program tracking and information systems.
3. **Program Implementation and Delivery** – an assessment of program implementation and delivery including identifying process issues, assessing program targeting and marketing efforts, and quality control methods employed.
4. **Market Feedback** – an assessment of market satisfaction with program elements and identification of market effects (intended and unintended).

Table 6 contains examples of typical process evaluation activities for each of the key elements.

Table 6 Examples Typical Process Evaluation Activities

Process Element	Examples of Process Evaluation Activities
Program Design	• Review program design and program theory in the context of the program's, OPA's, and Ontario's objectives may include interviews with program design and delivery staff • Assessment of expected market behaviour in program theory to actual market behaviour • Identify areas of improvement in program design from evaluation and new or best practices in other jurisdictions
Program Administration	• Review staffing requirements • Identify training needs • Review program tracking and information systems
Program Implementation and Delivery	• Review implementation and delivery process • Review quality control methods
Market Feedback	• Survey participants / non-participants to determine satisfaction with program elements • Survey market allies to determine satisfaction with program elements • Identify intended or unintended market effects

In summary, process evaluation activities may include some or all of the following:

- Interviews or surveys with Program Design, Program Delivery, program administrators, implementers and deliverers, market channels representatives, participants, and non-participants
- Unannounced participation in the program by the Evaluation Contractor
- Observing field efforts and operations
- Review and testing of data collection systems
- Focus groups with participants, non-participants, market channel representatives, and others

Market & Marketing Research

The majority of Market & Marketing Research conducted by the OPA is not expected to be an EM&V specific activity, but rather, a source of information to support the effects (energy and peak demand savings, cost effectiveness, etc.) evaluations and the process evaluations (this will change when formal Market Transformation programs are developed). The Market & Marketing Research representative on the Evaluation Coordinating Committee will identify opportunities within their current research plans that would be suitable (or suitably adapted) to support planned EM&V activities as well

assisting, as appropriate, in the development of additional market research required to properly evaluate the programs.

5.2.3. EM&V Reporting

EM&V proposes to report three tracks of Conservation Program Savings Results (energy and peak demand savings, and cost-effectiveness) at the program and portfolio level for use by the different Conservation results clients. The three EM&V reporting tracks are as follow:

1) **Forecasted Program Savings Results** - Based on the savings and cost-effectiveness assumptions in-place at the time of each program's launch. The Forecasted Program Savings Results incorporate the forecasted levels of participation (discounted by estimated free rider rates and any other external adjustment factors) and forecasted program expenditures. These results provide the program/portfolio targets to which the program/portfolio achievement can be measured against.

2) **Reported Program Savings Results** - Based on the savings and cost-effectiveness assumptions in-place at the time of each program's launch. The Reported Program Savings Results incorporate the verified levels of participation (factoring in the net-to-gross ratio) and actual program expenditures. These results allow for a straight comparison of the Forecasted Program Savings Results with program achievement - before any M&V adjustments are made.

3) **Verified Program Savings Results** - based on the "most-up-to-date" savings and cost-effectiveness assumptions, which may have been adjusted (using EM&V research) from the values that were in-place at the time of the program's launch. The Verified Program Savings Results incorporate the same verified levels for participation and program expenditures that are used in the Reported Program Savings Results. These results represent the best estimate of the Conservation program savings and cost effectiveness. It should be noted that uncertainty in the Verified Program Savings Results is an unavoidable consequence of reporting on energy and peak demand savings and cost effectiveness, regardless of the level of EM&V rigour employed. Part of the EM&V strategy is to reduce the inherent uncertainty of the Conservation program results and to provide an assessment of level of uncertainty contained in the results.

Figure 4 is an illustrative example of the different levels of uncertainty that may result in each reporting track. Note: the nominal value of the Reported Program Savings Results may be greater than, equal to, or less than the nominal value of the Verified Program Savings Results, but will have always greater band of uncertainty attached to it.

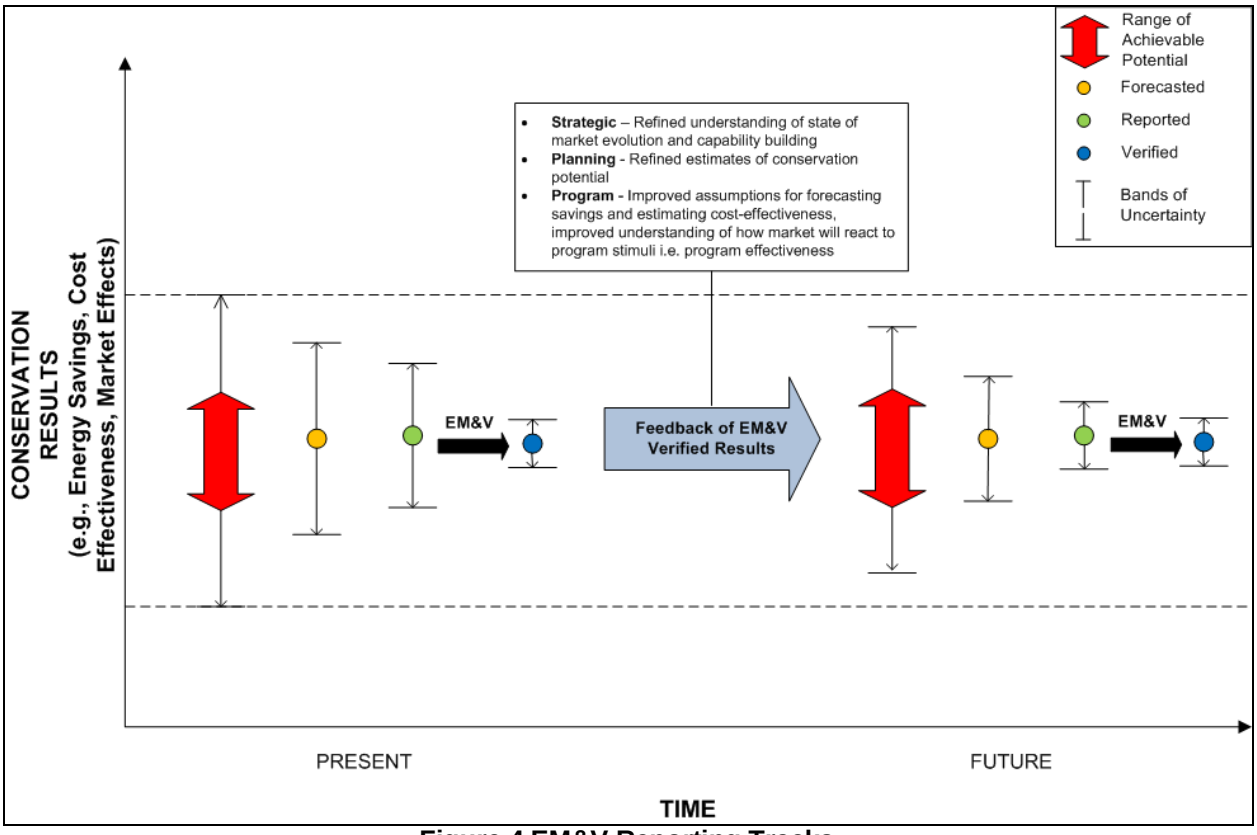

Figure 4 EM&V Reporting Tracks

The potential clients for the some or all of the three EM&V reporting tracks are as follows:

- Public reporting by CECO
- OPA Conservation Programs Staff
- OEB
- OPA Board of Directors and Executive
- Conservation community in Ontario
- OPA Power System Planning

Reviewing of year-to-date Conservation Program results can be done on a continuous basis when results are tracked using a Continuous Program Tracking system. For results based on Discrete Program Tracking, in-year results viewing can be done only once results have been submitted by program administrators. While viewing of reported results can be done at any time during the program year, EM&V proposes to provide discrete verified program results reporting.

5.3. EM&V Budget

The California Evaluation Framework[4] provides the following guidance on determining Evaluation Budgets:

> *"There is no single specific percentage of a program's budget that should be allocated for the independent evaluation process. Evaluation budgets for small pilot programs, testing new designs or delivery concepts, may need to be set at a level higher than the program costs in order to collect and analyze the information needed to determine if the program should be continued or expanded. In these cases it would not be unusual for a pilot test program to have a program budget of $100,000 and an evaluation budget of $100,000. At the other end of the scale are large statewide programs offering technologies and services that have been evaluated in the past, offered in well-understood environments in which the energy and peak demand impacts and operational procedures are well-documented, and in which the procedures are working smoothly and efficiently. In this case a $15,000,000 program may need only two percent of the program budget to verify what is already understood.*
>
> *Most energy and demand programs can be pegged somewhere between these two extremes. One of the key questions that needs to be addressed in establishing a program-level evaluation budget is found in the answer to the question: What are the energy and demand supply decisions that must be made in relation to the performance of this program and what is the supply risk of making a wrong decision relative to this program and these technologies? This is a decision for policy makers and for portfolio managers charged with providing an overall portfolio of low-cost and reliable energy and demand supply and demand side resources.*
>
> *In establishing an evaluation budget policy, one must also look at the cost of the program and the number of years over which the program may be implemented. Some may suggest that a $100,000 program is too small to worry about conducting a rigorous or reliable evaluation. Yet if that program is funded for a period of ten years, the program becomes a $1,000,000 program that is never evaluated. Policy makers are then placed in a position to defend the spending of a million dollars without an understanding of the program's effects or potential effects. At the end of the day, and after all arguments have been aired, policy makers still need to allocate a budget to the evaluation effort. Adequate budgets are generally lower than ten percent but higher than four percent. Budgets can stay toward the lower end when prior evaluations are drawn upon and circumstances are explored to determine the necessity for repeat evaluations. In order to establish an evaluation framework that incorporates a wide range of evaluation needs into a program cycle*

evaluation planning process, the evaluation budget needs to be in the range of six to eight percent of the total portfolio budget. However, this budget should not be equivalently distributed across the programs. Rather, the budget should be allocated at the program level based on the need for reliable information after careful examination of past program evaluations, an assessment of the rigor (reliability of findings and levels of uncertainty) of those evaluations, an understanding of the current mix of programs and technologies, and their associated mix of targeting and delivery practices. This approach will help assure that evaluation resources are wisely used and that the information gained from the evaluation improves the ability of policy makers and energy and demand supply planners to make informed decisions."

EM&V at the OPA has a "ceiling" budget of 5% of the total Conservation programs spending. The evaluation needs for each program will be individually assessed through the EM&V process. It is not expected that each program will require 5% of its budget for evaluation – some programs will require more and some less. Part of the EM&V process is the filtering and focussing of evaluation plans at the portfolio level (as described earlier and shown in Figure 2. At this step, the budgetary constraints will be factored into the evaluation activity prioritization to determine the appropriate evaluation spending for each program.

GLOSSARY

Avoided Costs
Avoided costs are the marginal costs that are avoided by not producing and delivering the next unit of energy to the customer. Marginal costs (or avoided costs) include energy, generation, transmission and distribution costs. They measure the expected change in the systems total costs due to a decrease or increase in load and are calculated using either a short-run or long run perspective.

Base Case
The base case defines the scenario of energy use that program participants would encounter without taking the actions promoted by the Conservation program.

Demand Savings
Demand savings may be expressed in many different ways. Three common ways of expressing demand savings are described in the following paragraphs:

1. Connected Demand Savings
2. Average Demand Savings, and
3. Coincident Peak Demand Savings.

Connected Demand Savings is the simplest way of expressing demand savings and is the difference between the load required by an efficient (high efficiency case) device and that required by a standard efficiency (base case) device.

Average Demand Savings represents the difference between the load required by an efficient (high efficiency case) device and that required by a standard (base case) device - averaged over a specified period of time. When referred to simply as demand, capacity or kW savings, the data is most often referring to this average measure of demand savings (as called average or non-coincident demand savings).

Coincident Peak Demand Savings is the demand savings that occurs during the system peak. This measure accounts for whether a device will be operating during the system peak and at what capacity level. Coincident peak demand savings may be seasonally differentiated, indicating coincidence with a summer and/or winter peak. The relationship between the non-coincident and coincident peak demand savings is often represented through a coincidence factor. The coincident factor is most commonly defined as the ratio of coincident peak demand to non-coincident demand savings.

Draft Evaluation Plan
An initial report plan designed as an internal pre-program assessment of the included technologies, delivery strategies, objectives, and program cost effectiveness. Its purpose is to ensure the methodologies prescribed will facilitate effective program

evaluation and promote common program understandings among all parties concerned.

Energy Savings
The reduction in use of energy from pre-program baseline to post-program energy use, once independent variables (ie. weather and occupancy) have been adjusted for.

Effective Measure Life
An estimate of the median number of years that the measures installed under a program are still in place and operable. Important when estimating the levelized cost or the TRC of a program.

Equipment Life
The equipment life variable represents the number of years that the more efficient equipment installed under a Conservation program is assumed to produce energy savings. The benefits from an energy efficient piece of equipment are assumed to persist for the life of the equipment. Term also known as Effective Useful Life.

Evaluation Protocols
A set of guidelines implemented to govern the technical, methodological and reporting requirements for evaluation professionals designed to meet Conservation objectives.

Evaluation Contractor
Parties responsible for the assessment and reporting of various Conservation programs, all while adhering to the guidelines of the concerning Evaluation Protocols.

Evaluation, Measurement & Verification (EM&V)
The undertaking of studies and activities aimed at assessing and reporting the effects of a Conservation program on its participants and/or the market environment. Effectiveness is measured though energy efficiency and cost effectiveness.

Final Evaluation Plan
Transitions similar objectives as the Draft Evaluation Plan with addition of further formalizations. The Final Evaluation Plan is prepared by the Evaluation Contractor.

Free rider
A free rider is a program participant who would have installed a measure on his or her own without the influence of the Conservation program. This participant simply uses the program to offset the cost of installing or undertaking the energy efficient initiative.

Fuel Shifting (aka Fuel Switching or Fuel Substitution)
The substitution of one energy source for another, usually based on price and availability.

High Efficiency Case
The high efficiency case defines the scenario of energy use that program participants

would encounter by taking the actions promoted by the Conservation program. This usually involves the installation of equipment or technology that is considered more energy efficient then existing base case installations.

Incremental Cost
The cost of undertaking a Conservation measure calculated from the price differential between energy-efficient equipment and standard baseline measure.

Independent Electricity System Operator (IESO)
A regulated government corporation who acts as both the settlement agent for the wholesale spot market and as a system controller, ensuring system reliability through the forecast of electricity demand.

Incentives
Financial support designated to encourage program participation and lower additional incremental equipment costs. The most common form of incentive is a rebate which is designed to help off set the cost of purchasing a more expensive piece of efficient equipment.

Levilization
A technique used to compare different net dollar flows over time by converting a stream of net dollar flows into a single payment, which if paid over the same number of years, provides the equivalent NPV.

Load Shape
The time-of-use pattern of customer or equipment energy use. Pattern can be over a day (24 hours) or over a year (8760 hours).

Local Distribution Company (LDC)
An entity that owns and operates low-voltage wires and distributes electricity from the IESO controlled grid to end-use customers in local regions.

Market Transformation
Achieving a substantial and sustainable increase in the market share of energy efficient technologies, building and production processes though the removal of market barriers that slow the process of adapting more efficient measures.

Measure
An action undertaken by a Conservation program which involves the application of a technology, type of equipment, or procedure used to replace another technology or type of equipment.

Measurement
A component of EM&V that involves the collection of data to describe pre- and post-program conditions.

Net-to Gross Ratio (NGR)
The NGR accounts for only those energy efficiency gains that are attributed to, and the direct result of, the energy efficiency program in question. It gives evaluators an estimate of savings achieved as a direct result of program expenditures by removing savings that would have occurred even absent a conservation program.

New (Decision-Type)
A customer decision type targeted by energy efficiency measure that encourages builders and developers to install energy efficiency measures that go above and beyond building standards at the time of construction.

OEB Measures and Assumptions List
Published in the OEB Total Resource Cost Guide, serves as basis document for OPA's Measurements and Assumptions List.

OEB Total Resource Cost Guide
A guide prepared by the OEB to assist LDCs in meeting filing requirements for intended Conservation plans approved by the OEB.

Ontario Energy Board (OEB)
The OEB regulates all non-commodity electricity rates, sets electricity prices for low volume and designated customers and licences the IESO and all market participants.

OPA Measures and Assumptions List
Prescriptive input assumptions used in determining reported energy, peak demand savings and cost-effectiveness. Published and revised annually by the OPA.

OPA Conservation Cost Effectiveness Tests Guide
A guide prepared by the OPA to assist Conservation stakeholders in cost effectiveness test analysis for Conservation programs.

Program Theory
A presentation of the goals of a program, incorporated with a detailed presentation of the activities that the program will use to accomplish those goals and the identification of the causal relationships between the activities and the program's effects.

Verification
A component of evaluation that involves the use of the Measurement data to verify that anticipated energy and peak demand savings have occurred. Verified results usually available at the end of the program.

Appendix A
OPA Measures and Assumptions Substantiation Template

MEASURE NAME

Efficient Equipment and Technologies Description
Base Equipment and Technologies Description

Codes, Standards, and Regulations

Decision Type	Load Type

Resource Savings Assumptions

Annual Electricity Savings			**kWh**
Average Demand Savings	**Winter On-Peak**		**kW**
	Summer On-Peak		**kW**
Coincident Peak Demand Savings	**Winter On-Peak**		**kW**
	Summer On-Peak		**kW**
Other Resource Savings	**Resource #1**		**Units**
	Resource #2		**Units**
	Resource #3		**Units**

Seasonal Energy Savings Pattern

	Winter Peak	Winter Mid	Winter Off Peak	Summer Peak	Summer Mid	Summer Off Peak	Shoulder Mid	Shoulder Off	
Measure	602	688	1614	522	783	1623	1305	1623	hrs
									%

Description / References:

Other Input Assumptions

Effective Useful Life		**years**
Incremental Cost (Cust. / Contr. Install)	**$**	**$**

Measure Assumptions Used by Other Jurisdictions

Source	Annual Electricity Savings (kWh)	On-Peak Demand Reduction		Effective Useful Life (yrs)	Incremental Cost ($)
		Winter (kW)	Summer (kW)		
Comments:					
Comments:					