

Ontario's EM&V Protocols and Requirements: An Author's Perspective

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Abstract

In March of 2011, the Province of Ontario published its *Evaluation Monitoring & Verification (EM&V) Protocols and Requirements*. This publication requires electric distribution companies to verify energy savings in lieu of conservation and demand targets.

The EM&V Protocols and Requirements are supported by eighteen Supporting and Technical Guides as well as a Measures & Assumptions List. Together they address evaluation planning for all program types, evaluation contractor procurement, cost-benefit tests, and regulatory oversight used to assess Ontario's \$1.4 Billion Conservation and Demand Portfolio.

Readers will appreciate Ontario's move toward market transformational initiatives and how evaluations will be impacted in the future. Participants will be given plenty of opportunity to ask questions and benefit from lessons learned. Participants may leverage our experience to structure evaluation, measurement, and verification requirements for programs offered within the European Union.

Preface

In March of 2011, the Ontario Power Authority published a document titled, "EM&V Protocols and Requirements". The document was created by a team of contributors. In this effort, I served as the documents primary author. My main responsibility was to lay out the steps required to verify energy savings across a wide range of Conservation and Demand Management initiatives.

This paper offers the readers insight into the construction of the protocols and how their publication is intended to raise the efficacy of Ontario's energy policy. The paper in no way reflects the opinions, commentary, discussions, or policy of the Ontario Power Authority, past or present.

This paper will not aim to recite the *EM&V Protocols and Requirements*, which can be downloaded at <http://www.powerauthority.on.ca/benefits/evaluation-measurement-and-verification>; rather, it seeks to offer this author's experience in drafting these protocols. By sharing this experience, other jurisdictions may benefit while attempting to synthesize an evaluation framework for the verification of energy savings and demand reductions.

The views expressed in this paper are solely those of the author, Kevin Monte de Ramos. They in no way reflect the views, opinions, or beliefs of KMDR Research, the Ontario Power Authority, or any other organization leveraging Ontario's *EM&V Protocols and Requirements*.

Introduction

The *Green Energy Act of 2009* (available at http://www.ontla.on.ca/web/bills/bills_detail.do?BillID=2145) evolved Ontario's energy policy framework and resulted in the development of a broad suite of conservation and demand management. These programs are administered by the Ontario Power Authority (OPA), an organization formed out of *The Electricity Restructuring Act, 2004* (available at http://www.e-laws.gov.on.ca/DBLaws/Source/Statutes/English/2004/S04023_e.htm).

With the responsibility to ensure the adequacy of electricity reliability in Ontario, facilitate the diversification of energy supply, provide energy information to regulators, and to promote conservation and efficient use of electricity, the OPA offered a \$1.4 billion conservation and demand management (CDM) portfolio. This portfolio received international recognition via the 2011 Platts

Global Energy Award winner for Energy Efficiency Program of the Year by an Energy Supplier. Nationally, OPA won the 2011 Advocate of the Year for ENERGY STAR Market Transformation Award offered by the Government of Canada to firms demonstrating leadership in the promotion of energy efficiency products, technologies, and services.

The CDM programs cover a wide range of conservation and demand management initiatives through three tiers of offerings. Tier 1 offerings are of Provincial scope and available to all utility customers; namely, those programs designed and administered by the OPA. Tier 2 offerings are regional in scope; allowing a set of local distribution companies to offer services together and to share in administrative expenses. Tier 3 offerings, also known as third-tranche initiatives, allow individual utilities to offer CDM programs.

A ruling by the utility regulatory body, the Ontario Energy Board (OEB), gives Tier 1 offerings dominion over the other two tiers. As a result, Tier 2 or Tier 3 must offer services not found within the broadly-scoped Tier 1 offerings. While this ruling creates a very high burden for utilities wishing to offer additional CDM programs, some programs have resulted. Still, readers need understand that Tier 1 offerings comprise a \$1.4 billion CDM portfolio covering every customer segment and nearly every market niche. As such, the *EM&V Protocols and Requirements* had to address nearly every CDM program imaginable.

For the European Commission on Energy, who may wish to establish evaluation protocols that cross 27 member countries in addition to five candidate countries, may face a similar challenge: how should energy savings, demand reductions, and emission improvements be evaluated consistently across the many independent jurisdictions?

Theory-based Evaluation

For Ontario, a strict adherence to the scientific method was chosen to overcome the tendency to apply deemed savings estimates for programs of increasing complexity. For example, the OPA has sought to establish a “culture of conservation”; whereby, energy-related behaviors are altered via program-funded promotion, informational, educational, and regulatory initiatives. These types of initiatives vary significantly from programs that replace one technology with another (like the replacement of incandescent bulbs with compact fluorescents) where efficiency savings can be reliably estimated through engineering calculations.

To move evaluation practice from deemed savings assessment to theory-based evaluation, we leveraged the scientific method to promote the theory-based evaluation. *"The chief characteristic which distinguishes a scientific method of inquiry from other methods of acquiring knowledge is that scientists seek to let reality speak for itself, and contradict their theories about it when those theories are incorrect."* (Gauch, 2003)

Notice that the scientific method requires the testing of a theory. For energy efficiency evaluation, we require that designers articulate program theory (generally through the program logic models) and evaluators test the program theory before allocating observed energy impacts to the CDM program under study. It was this vision of Huey-Tsyh Chen that drove us to theory-based evaluation; resulting in the eight steps embedded within Ontario's *EM&V Protocols and Requirements*.

"The role of the theory-driven evaluator is much more broad and encompassing than that of merely providing information requested by decision makers or program staff. Instead, she or he should be a source of important and unanticipated information concerning a variety of policy issues relevant to program planning, implementation, evaluation, and utilization of evaluation results." (Chen, 1990) Furthermore, theory-based evaluation can be applied to any initiative; thereby, making theory-based evaluation particularly relevant for Ontario where 80 independent electric utilities operate and a wide range of CDM initiatives are offered.

A Glimpse at the Protocols

On page five of the *EM&V Protocols and Requirements*, the document structure is introduced along with the EM&V requirements. The document consists of five sections, eight steps, and eighteen *Supporting and Technical Guidelines*. The latter of these elements is beyond the scope of this paper as many of the guides are sizable documents themselves. In Figure 1 below, the structure of the protocols and the required steps are revealed.

<u><i>EM&V Protocols and Requirements</i></u>	
SECTION I INTRODUCTION TO THE EM&V PROTOCOLS	
Preface: Introduction to EM&V Protocols	
SECTION II REQUIREMENTS AND PREREQUISITES TO PROCURING AN EVALUATION CONTRACTOR	
Step 1: Document Market Strategy and Program Offer	
Step 2: Illustrate Program Cause and Effect	
Step 3: Properly Scope Program Evaluation	
Step 4: Develop an Analytical Approach to Address a Relevant Set of Research Questions	
Step 5: Specify Evaluation Deliverables	
SECTION III PROCUREMENT OF AN EVALUATION CONTRACTOR	
Step 6: Hire Independent and Authoritative Evaluation Contractor	
SECTION IV MANAGING EVALUATION TO GET FINAL RESULTS	
Step 7: Co-ordinate EM&V Activities and Report Findings	
SECTION V PUBLISHING EVALUATION RESULTS	
Step 8: Publish Evaluation Methods and Findings	

Figure 1. The structure of Ontario's *EM&V Protocols and Requirements*

The Five Sections of the EM&V Protocols and Requirements

Ontario's *EM&V Protocols and Requirements* have five sections. Section I provides legislative and regulatory context around which the protocols were developed. It also outlines the role of evaluation within North America's regulatory state and highlights the intended use of the protocols, and distinguishes the roles and responsibilities of various stakeholders. Section II defines the five prerequisites toward the procurement of an evaluation contractor; namely, the development of a draft evaluation plan. Section III specifies the use of a public competitive procurement. The objective was to ensure the selection of an independent evaluation contractor based on an objective assessment of proposed methods and contractor qualifications. Section IV prepares the evaluation administrator for the management of a large multifaceted evaluation. And Section V makes the sharing of evaluation results mandatory. The *EM&V Protocols and Requirements* must be adhered when electric utilities claim for the attainment of regulatory demand reduction and energy savings targets.

Theory-based Evaluation Planning

Theory-based evaluation is useful when assessing the impact of demand-side management offerings. The approach requires the documentation of program theory and the verification of a causal linkage between the program offer and estimated energy savings. To expose the advantage of theory-based evaluation, the paper focuses exclusively on the five steps outlined in Section II of the *EM&V Protocols and Requirements*. Readers interested in the administration of theory-based evaluation are referred to Sections III, IV, and V of Ontario's *EM&V Protocols and Requirements*.

Step 1: Document Market Strategy and Program Offer. Program implementers possess valuable market knowledge. They understand the actors within their markets and the day-to-day decisions made by these actors. The normal inquiry into the program offer, associated budgets, measure selection, impact forecasts, and market opportunities apply when investigating program theory. Individuals, charged with developing the draft evaluation plan, should request marketing collateral, business cases, and regulatory filings associated with the program during this initial step.

Individuals should also explore program theory; regardless as to whether or not program theory has been adequately formalized by program staff. One key consideration is whether the program under study is considered a resource acquisition or market transformational program. The former purchases energy savings on par with other energy supply options. The latter seeks to transform the market; whereby, persistent energy savings result from changes in behavior of market actors. To distinguish between the two program types, the *EM&V Protocols and Requirements* classify market impediments as either market hurdles or market barriers.

- **Market hurdles** are temporary obstacles that discourage the adoption of energy efficient behaviors. An example of a market hurdle from the commercial sector is thresholds for payback periods or returns-on-investment. Within the household, a hurdle could be the retail price of an energy efficient appliance. In both cases, a financial incentive is offered to overcome the simple investment hurdle.
- **Market barriers** are persistent obstacles that prevent energy efficiency behaviors. An example from the industrial sector is the unique requirements and strict technical specifications for replacement equipment. For institutions, the lack of trained maintenance staff may prohibit the use of advanced energy efficient technologies. In both scenarios, technical assistance and education are the preferred interventions.

In short, the distinction is that hurdles are small, temporary, and discouraging while barriers are large, permanent, and foreboding. Understanding the type of market impediments addressed and the types of interventions used within the program is our preferred approach when determining whether or not to assess associated market effects and market transformational effects.

Our experience is that program implementers wish to claim benefit streams from long-term market effects; however, program managers rarely allocate resources to the tougher task of tearing down market barriers and opt to provide financial incentives. The evaluator who has taken time to document the strategies and impediments addressed by the program will be prepared to defend his/her decision to allocate research dollars to the study of short-term impacts versus considering long-term market transformational effects. We have also seen programs that addressed market barriers whose managers sought only to quantify participant savings. By categorizing market impediments and chosen intervention strategies, we were able to expand the evaluation mandate into the study of market transformational effects versus the requested study short-term market spillover.

Step 2: Anticipate Program Cause and Effect. The *EM&V Protocols and Requirements* requires evaluators to attribute observed effects to program-sponsored interventions. This requires mapping program resource expenditures to program activities. The four types of resource categories

as outlined in Table 1 and the four intervention strategies are defined in Table 2. While categories can be added as necessary, our experience suggest these categories generally suffice.

Table 1: Program Resource Expenditure Categories

Resource Category	Category Description
Capital	The dollars allocated to fund specific program activities and administrative expenses.
Infrastructure (in-kind)	The business and information systems utilized by the sponsoring organization to operate the program.
Human (in-kind)	Domain expertise and support staff offered by an organization to assist in the delivery of a program without a direct budget allocation.
Strategic Relationships	Organizations sponsoring energy efficiency may have ties or relationships with vendors that add to service provisioning without significant added costs.

Table 2: Program Activity Categories

Activity Category	Category Description
Financial Assistance	Monies used to assist market actors take a desired behavior. This will include direct financial incentives, rebates, or in-store discounts. Indirect financial assist may be offered in the form of financing, guarantees, or price buy-downs.
Technical Assistance	Services offered to buyers of energy efficiency or trade allies. These services may be offered as consulting services, training courses, or in the form of technical help lines. Also included are legislative and regulatory initiatives that alter markets or the practices cool actors within those markets.
Informational and Educational Materials	Media used to communicate technical information, technology options, end-use applications, or emergent practices. The form of media is less important than the message included; namely, technical information versus promotional materials.
Promotional Materials	Media used to highlight the program's presence within a market. These materials are used to encourage program uptake.

Perhaps the most important aspect of evaluation planning, and even program design, is a deep and detailed exploration of program theory. We recommend a logic model based on the Cognitive-Structural-Behavioral (CSB) Construct. The construct is a framework for exploring program theory. We have used CSB Construct to successfully develop program logic models for a wide range of programs: appliance rebate programs, comprehensive building retrofits, energy education, time-of-use rates, and regulation.

For more information on the CSB Construct, please review the IEPEC conference proceedings for our paper, *Exploring Behavioral Change Theory*. Readers should understand that the CSB Construct is used in conjunction with Dr. Prochaska's Transtheoretical Model of Behavioral Change to facilitate and evaluate energy conservation and voluntary demand response programs.

The *EM&V Protocols and Requirements* adopted the program logic model template developed by KMDR Research after two decades of modeling energy efficiency program theory. This logic model template is shown in Figure 2.

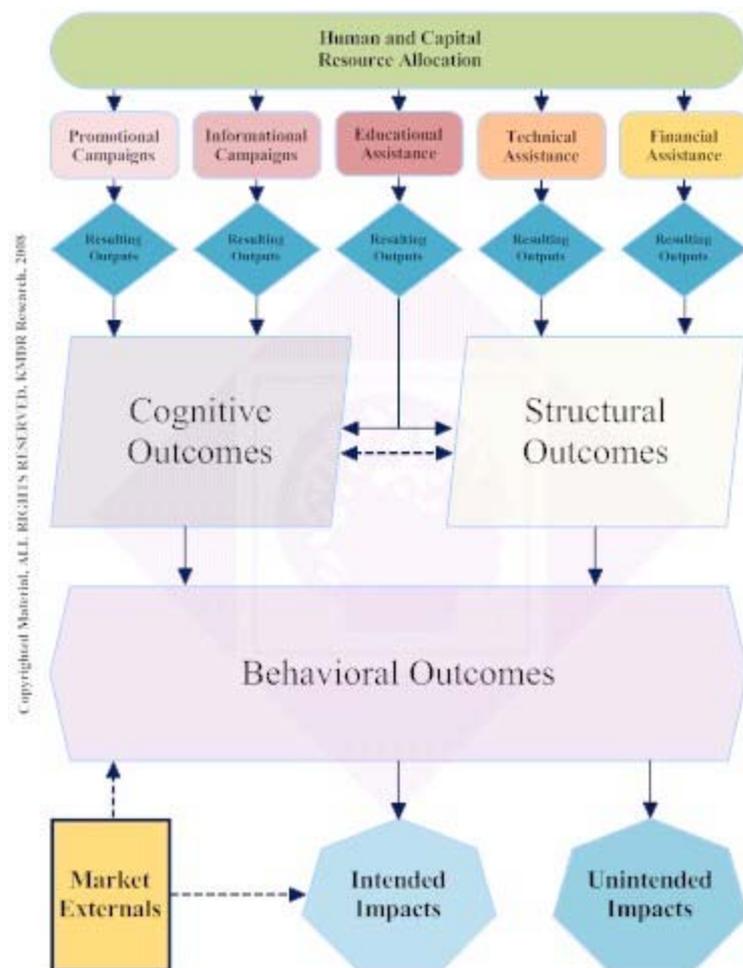


Figure 2. Program Logic Model Template¹

The most prominent elements of the logic model template are the cognitive, structural, and behavioral outcomes associated with the CSB Construct. These elements are as follows:

Cognitive outcomes are characterized by changes in the mental processes realized by individual market actors and reflected in organizations affected by programmatic outputs. These changes are typified by changes in awareness, knowledge, and attitudes, but also include changes in traits and characteristics altered via acquired learning, skills development, insight, understanding, perspective, outlook, ambition, desire, etc.

Structural outcomes are the physical changes observed in the marketplace that have resulted from programmatic outputs. These structural outcomes are typified by changes in the overall capability of the market; often in the form of enhanced tools, technical references, standards of practice, regulatory requirements, technology innovation, market

¹ Used with permission from KMDR Research; an illustration taken from *"Modeling the Logic of Market Transformational Programs"* (2008), an evaluation planning training course for utility staff.

structure, financing instruments, product pricing, quantity of skilled tradesmen, and other market changes that alter the cumulative abilities of relevant market actors.

Behavioural outcomes are the changes in market activities resulting from the structural or cognitive outcomes. These actor behaviors are typified by product shipments, retail transactions, stocking practices, technology utilization, energy use, load shifting, etc. These outcomes are manifested by market actors influenced by the program.

The template also acknowledges that program impacts may be either intended or unintended. Still, both result from behavioral outcomes. For behaviors to change as a result of the program; either cognition must change or the market structure must be altered. This understanding is important to define and clarify the causal attribution pathway; necessary for theory-based evaluations.

Of course, no program stands alone. Every initiative exists within a marketplace influenced by other factors. Competing or complimentary governmental initiatives often affect utility-sponsored energy efficiency programs. The logic model notes key market externalities that can influence behaviors and alter intended impacts.

Step 3: Properly Scope Program Evaluation. Market transformational programming, popular throughout the European Union, is difficult to properly scope. How does one determine the length of time evaluations must occur to document the persistent effects of transformational initiatives: one year, two years, twenty years? If twenty years, do you measure annual, every two years, or five years? In many cases, the answer relies on program theory, the research questions asked, and the methods proposed in their study.

To ensure causality of correlated outcomes to the program offer, theory-based evaluations require causal linkages to be tested. Proper scoping of evaluation efforts must, therefore, explore critical elements of the modeled program theory. The *EM&V Protocols and Requirements* acknowledge that tough choices must be made and exploration of critical causal pathways may be limited by practical constraints. Where opportunities provide for an extensive investigation, the logic model can direct evaluation efforts; including the influence of market externals on behaviors sought within the sponsored programs.

The *EM&V Protocols and Requirements* point to five primary study types: outcome evaluation, impact evaluation, process assessment, market effects study, and cost-effectiveness. While most programs require the study of impacts and processes, program assessments often ignore outcome evaluation and market study. These cannot be ignored when studying market transformational programs. In fact, market study and outcome evaluation are likely to be the two most critical areas of study for transformational initiatives; especially when the CSB Construct is employed. Furthermore, these outcome evaluation are likely to be repeated frequently to qualify factors associated with observed behavioral outcomes.

Step 4: Identify Analytical Approaches to Address Research Questions. Given each research question requires its own experimental considerations, only a handful of research questions should be addressed within the evaluation plan. Our experience is that too many research questions is the tendency of program administrators, but the evaluator must guard against an unduly complex evaluation.

Each well-constructed research question represents a narrowed field of investigation critical to the substantiation of program theory. The research question represents a hypothesis tested to be either true or false. In other cases, the research questions are one of quantity; whereby, the researchers' path is equally clear. The *EM&V Protocols and Requirements* insist that analytical methods should be developed in the context of a singular focus defined by the individual research questions. Considering multiple research questions while planning analytical approaches tends to try measure too many variables in fewer data collection instruments.

At first glance, this appears to result in cost efficiencies; however, data quality often suffers when this occurs. The experimental method is easily compromised when several avenues of inquiry

are being combined. Study groups may be chosen out of convenience, rather than being carefully considered within each area of inquiry. Also, biases can be introduced by respondents who are asked a series of interrelated questions. In an attempt to logically justify behaviors, respondents may simply connect the dots from program advertising, recollection of key messages on energy efficiency, and their choice of a high-efficiency appliance.

The *EM&V Protocols and Requirements* suggest that external factors influencing each area of inquiry be documented. This often requires market conditions to be considered, external factors taken into account, and research constraints addressed openly. Only then is it recommended that experimental approaches be considered to answer each research question.

Within the discussion of experimental approach, the choice of study populations is of paramount importance. Still, market transformational initiatives make defining a study population difficult. First, many regulatory initiatives have grand-fathered evaluation frameworks around narrowly-scoped set of market actors; like recipients of program rebates. Still, the target population for market transformation initiatives is not a single actor, but rather all actors within a single market. Still, behavioral outcomes often must focus on a small set of actors within the market. Therefore, you have a broad market effect realized by the actions of a few. The question then becomes “who is the study population: the actors whose behaviors are restricted or the market actor whose effect is to be studied?”

Sampling strategies and the associated analytical methods depend on the population under study, research constraints, and market conditions. Still, the researcher must reduce the study into a clearly articulated set of analytical methods. These methods should be presented in a manner that demonstrates the evaluability of the proposed research questions. In cases where multiple methods are available and advisable, the available options can be discussed and preferred approaches revealed within the text of the evaluation plan.

How much detail to include in the description of analytical methods depends on audience to whom you are writing. A program administrator will simply want the approach highlighted to know an evaluation is feasible. The program implementer often wants to know the details of an approach and seeks to be educated about the study. And the evaluation contractor may want either, depending on his/her level of familiarity with the proposed area of inquiry.

The authors gave considerable weight in the consideration of what level of detail to provide within a draft evaluation plan. In the end, the recommendation was that analytical methods need only be identified and supported with a brief description of the resulting key performance metrics. Additional disclosure requirements would violate the principles of a competitive solicitation that seeks innovation in analytical approaches at a reasonable price.

Step 5: Specify Evaluation Deliverables. The final step of Section II outlines a procurement strategy for an evaluation contractor, who will deliver the evaluation services. The list begins with a high level workplan identifying the timing of each type of planned evaluations. Also required is a workplan that outlines the delivery of each of the following: a formalized evaluation plan, the development of data collection instruments, a schedule of in-field data collection instruments, a presentation of findings, and the requirements of the formal evaluation report.

Other Considerations

The *EM&V Protocols and Requirements* adopted by Ontario were built upon industry standards. All major evaluation guides and frameworks were reviewed. These include publications from the US Department of Energy, the US Environmental Protection Agency, the Office of Energy Efficiency and Renewable Energy, State of California, and conversations occurring within the Canadian Demand-side Management Alliance.

Pulling the best practices from each, the *EM&V Protocols and Requirements* offer a generic approach for the evaluation of conservation and demand management programs. This guide to theory-based evaluation will apply to market transformational programs, as well as resource

acquisition style programs. While the steps will be cumbersome at first, the benefit of a systematic process of inquiry is the quality of resulting evaluations.

Our experience in the authorship of the *EM&V Protocols and Requirements* has led us to author this paper with the hopes of helping other jurisdictions through the difficult process of standardizing protocols. A particular environment suitable for this type of document and associated training courses is the European Union who must establish standard practice across 27 member nations.

Those interested in this area of investigation should download Ontario's *EM&V Protocols and Requirements* and examine the overall approach. While the words offer specific guidance, the overall approach offers a strategy by which standards of practice can be established without stifling the flexibility and innovation needed to foster leadership in energy program evaluation.

References

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Gauch, Hugh G., Jr. (2003), [Scientific Method in Practice](#), Cambridge University Press, [ISBN 0-521-01708-4](#) 435, page 35.