

# **Demystifying EM&V: Best Practices and Lessons Learned from the First Year Evaluations of the 2011-2014 Portfolio**

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## **ABSTRACT**

The Ontario Power Authority (OPA) has a leadership role in helping Ontario meet its long-term energy targets. Ontario has set an aggressive long-term energy target of achieving 7,100 MW of peak electricity demand reductions and 28 billion kWh in annual energy use by the year 2030. Interim provincial energy targets are also included for the 2015, 2020, and 2025 periods.

The OPA funds province-wide electricity energy efficiency and demand response initiatives and has responsibility to undertake evaluation, measurement, & verification (EM&V) studies for these province-wide initiatives. The OPA maintains the framework and protocols for how EM&V is undertaken for all electricity efficiency and demand response initiatives in the province (OPA 2011).

This paper provides an overview of the lessons learned from performing the EM&V process for the evaluation of the first year of the 2011-2014 Province-wide conservation framework. It discusses the approach to evaluation in this regulatory environment, outlining the methodology and specific issues and methodology, as well as sharing lessons learned from the first cycle of evaluation. It also discusses the success the OPA had in communicating the EM&V discipline to the partner community and thus, building EM&V capability into the marketplace.

## **Introduction**

All energy efficiency and demand response initiatives implemented by the OPA in the 2011-2014 program cycle are subject to independent third-party evaluation, measurement and verification (EM&V). The EM&V process involves undertaking activities aimed at assessing the resource savings, cost-effectiveness and market impacts of each program and initiative. Assessing performance through the EM&V process allows the OPA to transparently report on the energy savings and demand reduction achieved and confidently incorporate conservation resources into the power system planning process.

The unique regulatory framework within the Province of Ontario presents certain challenges and opportunities for conducting evaluations of energy efficiency and demand response initiatives. A comprehensive evaluation framework was developed for this portfolio period and captured in a public document under the name “*EM&V Protocols and Requirements 2011-2014*” (OPA 2011). This paper outlines how this framework sets the foundation and scope for the evaluation of the 2011-2014 program cycle, outlining the approaches to address the challenges for undertaking EM&V, specifically the education and communication efforts put in place for the delivery agents in the Province.

## **Background**

The *Green Energy and Economy Act of (2009)* enabled the Ontario Government to set electricity conservation targets for the Province, including individual net energy and demand targets for the 77 local distribution companies (LCDs) operating as delivery agents in the Province, for the years 2011-2014. Verification of these targets requires annual impact evaluations and attribution of savings to all active delivery agents. This level of evaluation has not been undertaken in the Province to date, and created uncertainty with delivery agents unfamiliar with the intricacies of the evaluation process, and its role in the achievement of their targets.

The OPA guides the province's electricity conservation efforts and works collaboratively with LDCs and other industry partners to ensure Ontario residents have reliable, clean and cost-effective sources of energy today and in the future.

The OPA's current conservation portfolio consist of a series of conservation Programs and Initiatives offered under the saveONenergy® brand which are collaboratively delivered with LDCs or offered directly by the OPA to consumers. Conservation programs encourage homeowners and businesses to reduce their energy use, support the Province in meeting its provincial energy targets, and reduce greenhouse gas emissions. Initiatives within the residential and business programs span across all customer segments and include incentives for energy-and demand-saving activities. Energy efficiency initiatives are designed to help residents and businesses better manage their electricity consumption. Demand response initiatives reward customers for reducing their consumption during periods of peak electricity demand. Provincially, programs offered in 2011 by both the OPA directly and through the LDCs achieved 645 MW of net demand reduction and 717 GWh of net energy savings (OPA 2012).

## **EM&V Challenges**

2011 marked the beginning of a new efficiency portfolio as well as a new EM&V framework (OPA 2011). In previous conservation portfolios in Ontario, there were very few actors in the EM&V research being undertaken. Evaluation results were produced for a very limited audience. The new portfolio and framework marked a shift in EM&V, with EM&V becoming mandatory, the results of EM&V studies accounting for progress against LDC targets.

OPA's EM&V team has undertaken significant efforts to ensure proper EM&V methodology that can capture the sophistication of the program delivery align with a sustained communication effort to ensure that the discipline is understood and adhered to.

## **Education and Communication**

2011 marked the first year the LDCs had been given mandatory conservation targets as condition of their licensing. This represents an evolution over the previous framework where conservation targets were solely the responsibility of the OPA and the LDCs had little incentive to deliver conservation and therefore to understand the associated EM&V process. With minimal EM&V knowledge or experience, many LDCs were apprehensive and concerned with results being evaluated by external parties. This uncertainty and concern was apparent to the OPA's EM&V administrators early on in the portfolio cycle.

## **LDC Attribution**

The LDCs have a regulatory requirement to report annual results to the Ontario Energy Board (OEB), as per the *Conservation and Demand Management Guidelines* (OEB 2010), governing the LDCs. As the OPA is responsible for evaluation of province-wide initiatives, the OPA annual evaluation reports are required to attribute savings to the LDCs.

Many initiatives in the 2011-2014 portfolio are legacy initiatives from the OPA's previous 2007-2010 portfolio and were transitioned to fit within the new delivery framework portfolio. The previous portfolio was evaluated at a macro (province-wide) level, and individual initiatives were only evaluated as deemed necessary. Only high-risk, high-impact initiatives received annual evaluation reports. This provided greater flexibility in the allocation of the EM&V budget to the most appropriate initiatives. However, given the need for LDC attribution in the current 2011-2014 portfolio, annual verified results

are required for each initiative. This requirement directly impacts the EM&V budget, leaving little room to re-direct budget to higher risk initiatives.

## **Provincial Impact**

In addition to the suite of OPA initiatives LDCs currently deliver in their service territory, there are a number of other conservation initiatives active in the province, whose impact must be verified and credited against the overall conservation target set out in the Provinces Long-term Energy Plan (LTEP).

Properly quantifying and characterizing these impacts in order to ensure that they are attributed to the appropriate party is a challenging exercise in both process and communication. With so many delivery agents having individual targets, apportioning net savings can be a delicate and controversial task.

## **Austerity Constraints**

The Provincial government has been dealing with budget deficits in recent years, in part due to the recent global economic recession. An era of austerity has shrouded all government departments, and recently has been extended to government agencies such as the OPA. A requirement to tighten budgets has put pressure to find efficiencies and cost-savings in all work being undertaken, including EM&V. OPA's EM&V team was challenged to respect the need for austerity while balancing the needs for precision in verifying initiative impacts and providing insights for initiative enhancement and future initiative design.

## **Approach**

The above challenges lead to new innovative EM&V approaches not yet undertaken in the Province. The methods and activities carried out as part of the 2011 evaluations were chosen in large part to ensure that LDCs were engaged in the process and fully understand the process from claimed savings to verified savings.

## **Approach to Education and Communication**

The OPA's EM&V determined early on to engage the LDCs on the purpose and importance of EM&V. The LDCs play a vital role in the collection and dissemination of initiative and participant-related data. Apprehension by LDCs in supporting the EM&V process and providing timely data may compromise the results of the EM&V investigations.

An education plan was prepared to increase the capability of EM&V in the LDC community. The plan focused on communicating the basic principles of evaluation, the sequencing of evaluation activities, and the evaluation approach for the current portfolio. The following training and communication forums were used:

- 1-day workshop focusing on the basics of EM&V (EM&V 101)
- A series of six 1-hour webinars focusing on discrete EM&V topics (Impact Evaluation, Net-to-Gross, etc)
- A series of four 1-hour "office hours" sessions hosted by the EM&V team to allow specific question to be answered and addressed

All sessions were recorded and archived for future use by the LDC community.

The OPA leveraged these sessions to solicit input and feedback from the LDCs regarding the types of information they would like and their preferred forum. A communication plan was developed to disseminate key information to the LDCs, which included the following:

- Bi-weekly email blasts to the LDCs that included a paragraph on key EM&V issues, as well as a table listing all active evaluations outlining current evaluation activities and any ongoing requests for LDC support or interactions
- Monthly 1-hour webinars on specific initiative-level evaluation issues
- Regular in-person EM&V updates at monthly LDC sector working group meetings (Consumer, Business, and Industrial)
- Co-chairing the LDC Reporting working group
- An annual EM&V results workshop
- Publishing of detailed third-party EM&V annual reports on our corporate website

## **Approach for the Evaluations**

In general, energy efficiency initiative evaluation is designed to:

- 1) document and assess the effects of a initiative with respect to its goals or targets for energy savings; and
- 2) better understand why those effects occurred and identify ways to improve an initiative and/or influence future initiative design.

The general objectives of all OPA initiative evaluations are:

- 1) conduct an impact evaluation to determine and assess gross and net energy savings as well as demand savings for each of the relevant initiatives;
- 2) conduct a process evaluation to review and assess the delivery of each initiative and to identify potential changes that could enhance initiative delivery; and
- 3) be consistent with the OPA EM&V Protocols and Requirements (OPA 2011).

Given the challenges identified above, the OPA's EM&V team established a plan to evaluate the portfolio based on four bundled initiative/sector types: Consumer (residential) initiatives, Business (commercial and institutional) initiatives, Industrial initiatives, and Demand Response initiatives. The team believed this grouping increased the ability to deliver timely verified results that could be attributed by LDC with an appropriate level of precision and confidence. It also allowed the flexibility to undertake a more granular analysis on key initiative elements that had a higher degree of risk or uncertainty, while falling within the budgetary guidelines. The approach to the four initiatives evaluation bundles is described below.

## **Consumer Initiatives**

There were a number of initiatives active in 2011 for the Consumer marketplace. They include the Fridge and Freezer Pick-up (appliance retirement), Heating & Cooling Incentive, Coupons (both annual and bi-annual retailer coupon events), and Exchange Event (bi-annual retailers appliance exchange events) initiatives.

The approach to the evaluation was to investigate each Consumer initiative individually while assessing the overall impact of the saveONenergy® brand as a whole on the marketplace. The 2011 evaluation represented the OPA's first evaluation of the saveONenergy® brand since its change in marketing strategy and rebranding. Two broad objectives were established:

- 1) assess the overall effectiveness of the saveONenergy® branding strategy in achieving its goals (as described above), and
- 2) demonstrate the overall gross and net verified energy savings and demand savings of each of the Consumer initiatives and summarize the results into an annual aggregate Consumer initiative evaluation report, including the cost-effectiveness of the 2011 consumer initiatives.

The overall method to the evaluation utilizes a variety of approaches: detailed reviews of previous evaluations and results; interviews with initiative and LDC staff; in-depth telephone interviews with trade allies and channel partners; telephone and web surveys; and on-site device metering and inspections. Most approaches used in the evaluation were consistent with the Uniform Methods Protocol published by the US Department of Energy (DOE 2013)

## **Business Initiatives**

There were a number of initiatives active in 2011 for the Commercial and Institutional marketplace. They include the Small Business Lighting, Retrofit, Audit Funding, Existing Building Commissioning, and High Performance New Construction initiatives.

The following goals and objectives were developed for the evaluation of the 2011 Business initiatives.

- Verify energy and demand savings with a high degree of confidence by project type (i.e., prescriptive, quasi-prescriptive, and custom applications), by measure type, spillover savings
- Review and compare key initiative elements and delivery/results across business or property types (i.e., office, retail, warehouse, hospital, etc.)
- Conduct cost effectiveness analyses Undertake a process evaluation to understand the effectiveness of initiatives and to understand the follow-through rate from audit results to retrofit project initiation and completion;
- Determine what specific measures / technologies have a high incidence of installation as well as what measure paybacks appear most appealing

## **Industrial Initiatives**

There were two initiatives active in 2011 for the Industrial marketplace. They include the Process and Systems Upgrade (distribution connected), and the Industrial Accelerator Program (transmission connected). The goals and objectives for the evaluation of the industrial initiatives included:

- Estimating end-use saturation, energy use consumption, and energy management practices of participants under the Initiatives through a multi-phased baseline study.
- Determining with a high degree of confidence the annual verified gross energy and demand savings resulting from projects funded through each of the Initiatives and their various enabling initiatives.
- Periodically reviewing and monitoring the overall effectiveness and comprehensiveness of key initiative elements associated with the Initiatives.
- Determine the annual net verified energy and demand savings resulting from the Initiatives, and determining the cost effectiveness of both initiatives.

## **Demand Response (DR) Initiatives**

There were three initiatives active in 2011 for the demand response marketplace. They include Demand Respond 2 (daily load shifting), Demand Respond 3 (event-based load curtailment), and *peaksaverPLUS*® (residential direct load control). Due to the complexity of the evaluations, they were

split into two separate evaluations: Industrial demand response (DR-2 and DR-3) and residential demand response (*peaksaverPLUS*®).

The DR-2 and DR-3 evaluations were consistent with the OPA *Protocols for Estimating Load Impacts Associated with Demand Response Resources in Ontario* (OPA 2009) and were designed to meet the following objectives:

- Estimate regional and province-wide load reduction capability (*ex ante* load reductions) for each initiative;
- Estimate regional and provincial load reductions and annual electricity savings delivered by each initiative in 2011 (*ex post* load impacts);
- Analyze key drivers of participant performance, and
- Assess cost-effectiveness of DR initiatives.

The goals and objectives of the 2011 *peaksaverPLUS*® evaluation were as follows:

- Determine the annual regional and aggregate load reduction capabilities (*ex ante* load impacts) and verified load impacts (*ex post* load impacts) for load control devices on residential central air conditioners, residential electric water heaters, and small commercial central air conditioners;
- Assess the effectiveness of the load control strategies and determine participant's comfort level and satisfaction for each strategy;
- Assess the effectiveness of the initiative offering; and
- Determine the cost effectiveness of the initiative offerings.

## Results

As a result proper planning and execution, the first year of EM&V activities can be considered a success. The 2011 program year marked a turning point for EM&V in the Province and there is general consensus is that conservation in Ontario is progressing on the right direction. Feedback from LDCs partners shows a dramatic shift in attitudes regarding the necessity and value of EM&V research.

### Education and Communication

Feedback from the OPA's partner engagement efforts has been overwhelmingly positive. Most EM&V sessions were well attended and received positive ratings and feedback from participants. In turn, a high benchmark was set for the EM&V team moving forward.

Attendance from EM&V representatives at meetings, forums, and workshops is being sought out with regularity and is now expected in many instances. The value proposition from EM&V research is becoming more apparent to our partners and relationships being steadily strengthened. EM&V updates on current evaluations have become part of the regular communication process to the LDCs.

### LDC Attribution

The dissemination of 2011 verified results to the LDCs and the OEB was believed to be a relatively smooth process. The savings attribution methodology used to represent net vs. gross savings was well communicated by the OPA and generally well understood by the stakeholders. Questions on verified results were nuanced and focused on LDC-specific details. The evaluations produced the

following key deliverables that facilitated the understanding of their understanding of the attribution process:

- Measurement and verification of energy and demand savings (gross and net)
  - Examination of the gap between verified and reported savings
  - Updated input assumptions of energy savings measures
  - Spillover savings from the initiative
- 8760 load shapes by measure and facility type, where applicable;
- *Ex ante* and *ex post* load reduction estimates, where applicable;
- Review of measure characterization (prescriptive, quasi-prescriptive, custom), input assumptions and project type attribution analysis;
- Analysis of LDC QA/QC process in approving custom M&V plans in order to improve realization rates;
- Initiative process analysis, including all stakeholders – participants, nonparticipants, LDCs, and OPA – and the manner in which they interact with or deliver the initiative, consequently influencing the attribution analysis

The OPA was able to allocate the savings as agreed upon with the LDCs through consultation. The approach to EM&V met its desired outcome, while providing additional benefit of being able to uncover the unexpected benefit of initiative spillover and some savings resulting from interactive effects from the efficiency measures.

## Provincial Impact

The 2011 evaluations also met the requirement to assess provincial impacts. The verified results were provided directly to the OPA's power system planning team as part of the short and long term planning process. The level of granularity of the verified results allowed for refinements of the planning models being used, including new regional level models currently being developed. The studies also collected and analysed all relevant data to assess the macro-economic effect of the conservation initiatives. We were able to undertake a review of incentive levels and job creation effects, and conduct both initiative-level and portfolio-level cost effectiveness analyses.

## Conclusions

Overall, the evaluations undertaken for year one for the 2011-2014 initiative cycle delivered high quality results, with an acceptable level of rigour, and within the framework and budget that was put in place. The results were delivered in a very cost-efficient manner, with strong acceptance and buy-in from the initiative delivery agents.

From 2006 to 2011, conservation initiatives have seen an investment of \$2.0 billion and have saved customers \$4.0 billion in avoided costs. Overall, 2011 conservation initiatives in Ontario influenced 717 million kWh of verified and sustainable annual energy savings yielding an initiative cost to consumers of 3 cents per kWh. The most cost effective year to date. (OPA 2012)

In 2011, centrally coordinated and collaboratively delivered saveONenergy® suite of conservation initiatives with our local distribution partners exceeded our 2011 forecasts and generated 216 MW of net demand reduction and 606 GWh of net energy savings for the province. This includes savings from energy efficiency and demand response initiatives offered province-wide through the suite of saveONenergy® initiatives.

There was a measurable success in educating the OPA's delivery agents on the process, methods, and value of EM&V. As the evaluation cycle progressed, the level of engagement from the LDC community increased, and questions that were previously characterized as "resistive" transformed to "inquisitive", and further evolved into proactive and assistive. The perception of the EM&V process is believed to have changed. No longer is EM&V viewed as a negative impact on results. It is now generally viewed as a key element of the process in helping the LDCs confidently achieve their conservation targets. Understanding the EM&V process led the LDCs to move towards a more collaborative framework to explore opportunities to uncover additional savings.

One reason attributable to the success of 2011 was the focus to engage LDCs early in the evaluation process, and providing a detailed communication plan for EM&V activities. Focusing on engagement and transparency has aided in building the capability for LDCs to understand EM&V, and ultimately, to support the process.

Another reason for success is believed to have been the transparency in attribution of savings to the LDCs. Projects completed within a specific LDC were directly attributed to the appropriate service territory, where as savings which could not be allocated directly to a given service territory, savings were allocated based on an LDC-approved allocation methodology based on energy throughput in their territory. These approaches allowed the LDCs to confidently claim savings against their conservation targets and allow the EM&V process to be cost efficient.

## **Next Steps**

There were many lessons learned concerning the data collection process. While large central databases exist for many initiatives, the ability to supplement data with LDC-specific information greatly enhances the ability to properly attribute savings to the rightful party, as well as assess any spillover effect resulting from initiative activity. Unfortunately, since the structure and format of the data often varies by LDC, increased outreach is often required to receive data that can be aggregated with the other central databases.

The OPA will also continue to enhance the EM&V communication plan with our stakeholders. Although the communication forums used in 2011 were believed to be successful and will continue for the 2012 results, we shall enhance the key messages and expand the education process.

Our customer/stakeholder engagement plan will also evolve focus for reporting verified 2012 results by communicating multi-year trends and opportunities for initiative enhancement and evolution. Our attention will be both on the current portfolio results and ensuring we are soliciting adequate feedback to inform upcoming EM&V research that can influence future initiative portfolios.

The biggest challenge for EM&V moving forward will be increasing the capability of the market in Ontario to undertake and contribute to EM&V research. It would be seen as a benefit to the entire conservation portfolio if everyone involved has an appreciation of the value that EM&V brings to operations and development of conservation initiatives. We will continue to grow this capability through training and partnerships with our initiative partners.



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