Developing a Performance Assessment Framework for Canada's Energy Efficiency Programs: Results and Challenges

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ABSTRACT

This paper summarizes the performance assessment work carried out by Natural Resources Canada's Office of Energy Efficiency since the publication of a previous paper entitled, *Performance Monitoring for Energy Efficiency Programs: Defining the Canadian Experience* (Taylor and McIntosh 1999). This paper picks up where the other left off, and presents the recent progress made by the Office of Energy Efficiency towards its ultimate goal of establishing a comprehensive performance assessment framework. The work described herein discusses the current performance assessment framework in terms of the program metrics that were developed to facilitate program information reporting. This work is discussed both in general, and in the context of an energy efficiency initiative. The Office of Energy Efficiency's efforts at continually improving the performance assessment of its programs are also discussed in light of the next phase of our work, which involves the development of an evaluative component that measures program impacts in terms of energy savings and greenhouse gas emissions reductions.

Introduction and Background: The Evolution of Performance Monitoring in the OEE

Natural Resources Canada's (NRCan's) Office of Energy Efficiency (OEE) delivers 15 market transformation energy efficiency programs that cover four major end-use sectors: residential, commercial, industrial and transportation. Although these programs rely on different policy instruments to influence energy use in a particular end-use sector, they all share the overall goal of improving energy efficiency (and thus reducing energy consumption) and reducing energy-related greenhouse gas (GHG) emissions in the Canadian economy.

The Demand Policy and Analysis Division of the OEE (also referred to as DPAD, the division that retains primary responsibility for program performance assessment) had already begun tracking economy-wide changes in energy use and GHG emissions when the Office of the Auditor General of Canada (OAG) released a report in April 1997 assessing the quality of the performance information available for the OEE's energy efficiency initiatives. Although the OEE was already publishing the observed energy trends in its *Energy Efficiency Trends in Canada: 1990 to 1996* document (NRCan 1998), the report concluded that the OEE's efforts at explicitly linking economy-wide energy use trends with the performance of its initiatives were insufficient. Specifically, the report stated that, *"NRCan's current performance information, on both expectations and achievements, is not sufficient to determine the overall success of its energy efficiency initiatives"* (OAG 1997). In its main points, the report noted

that 1) objectives established for many of the initiatives *"do not provide a clear and concrete expectation of achievement"* and that 2) *"for many of the initiatives, there is a lack of reported targets in terms of outcomes"* (OAG 1997). In order for the OEE to assess the performance of its programs, and to assess its own progress towards meeting its mandate of improving energy efficiency in Canada "at home, at work and on the road", it was necessary to explicitly address both of these critiques.

In response to the Auditor General's comments, and it keeping with its own commitments towards government accountability and transparency, the OEE and DPAD began developing a comprehensive performance assessment framework that included a monitoring component and an evaluative (impact analysis) component. Developing the performance monitoring component in general, and the program metrics that are the basis of the monitoring component in particular, was a challenge for DPAD principally because there is no prescribed method or protocol to guide the development of program performance indicators (Taylor and McIntosh 1999). The OEE undertook the challenge with a strong belief that the appropriate program metrics could:

- greatly improve its tracking of program performance,
- improve its overall understanding of the links between various program metrics, and
- contribute directly to developing the evaluative component of the performance assessment framework, specifically in terms of quantifying program impacts in terms of energy savings and GHG emissions reductions.

Thus, the OEE's performance assessment framework began to evolve from one that mainly tracked economy-wide and sectoral changes in energy use (the tracking component), to one that currently includes a monitoring component designed to facilitate program performance reporting and to monitor program progress towards established targets. Development of the evaluative component of the framework has already begun. However, additional work in several areas is still required before this phase can be completed. The first part of this paper discusses the program metrics that form the core of the OEE's performance monitoring component, while the second part briefly presents the steps currently being taken to establish the evaluative component of the framework.

The Metrics Approach to Performance Reporting and Monitoring

Increasingly, energy efficiency programs in general, and market transformation programs in particular, are attempting to change the energy-use behaviour of the general public. The indirect nature of such initiatives is one of the key factors making the collection of appropriate monitoring data more difficult and more costly. Recent reductions in program funds, coupled with the advent of "survey fatigue", further compound this problem (Taylor and McIntosh 1999). Consequently, DPAD decided to adopt a metrics or indicators-based approach to performance monitoring, since it is considered to be a relatively cost-effective and practical means of developing good performance information.

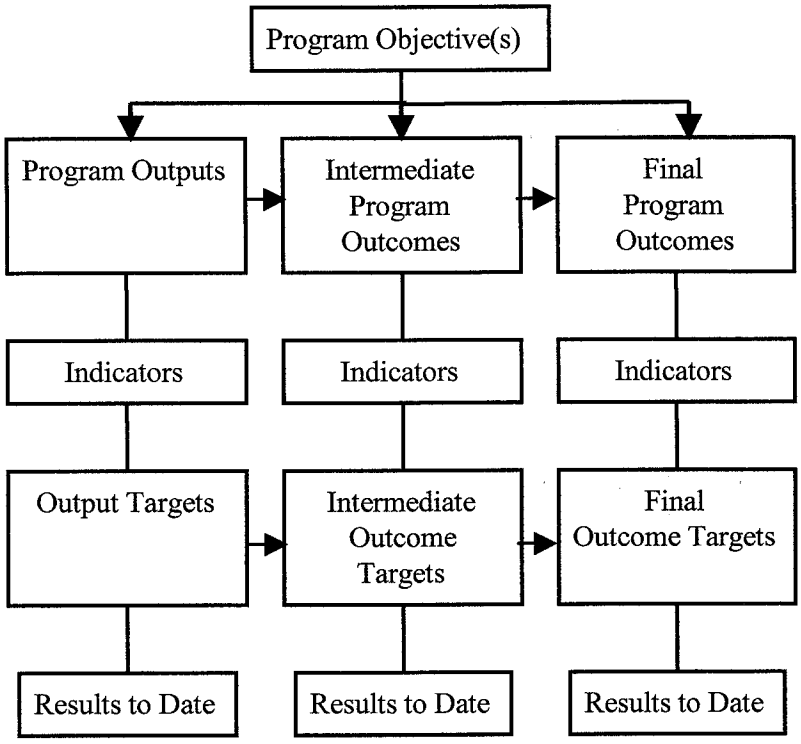
A significant advantage of the metrics approach, therefore, is the ability to obtain a great deal of program performance information in a relatively inexpensive manner. However, as the amount of useful information collected increases, so too does the potential for collecting program information of limited usefulness. To avoid this problem, and to ensure that performance monitoring (and not data collection) remained the focal point of the exercise, DPAD and the rest of the OEE engaged in five main activities

designed to obtain useful information for the program metrics (Taylor and McIntosh 1999). These involved:

- establishing clear, concise and consistent descriptions of each program and their objectives,
- identifying the relevant program activities that contribute directly to the stated objectives, and that lead directly to program outputs and outcomes,
- establishing meaningful, measurable, and wherever possible, quantitative output and outcome targets for each program,
- developing clear and practical indicators for all identified targets, and finally
- linking program objectives, activities, targets, outputs and outcomes to program impacts.

Collecting Information for Program Metrics

Figure 1: Links between different program metrics



In order to ensure that each program's particular characteristics were accurately represented, DPAD began to collect performance information in conjunction with program managers. To facilitate the process, DPAD designed a performance monitoring template that provided managers with a relatively straightforward and self-explanatory method of inputting the necessary program information. Filling out the template requires managers to examine the activities, outputs, targets and outcomes of their programs in substantial detail. The flowchart in Figure 1 summarizes the metrics that are the core of the OEE's performance monitoring component, and also illustrates graphically how they collectively offer a broad perspective on the performance of a particular program. By contrast, table 1 (below) demonstrates how the metrics fit together to form the performance monitoring template for one of the OEE's programs – the New Buildings Initiative (NBI).

Table 1: Performance Information for New Buildings Initiative

Program Objective(s)	To improve the energy efficiency of new commercial, institutional and industrial buildings by changing design practices so that energy efficiency is routinely integrated into new buildings.		
	Indicator	**Target**	**Results to Date**
Output(s)		**by March 31, 2002**	
Training workshops and technical tools	Number of workshops	Hold 20 training workshops	30 workshops
	Number of charrettes developed and implemented	Hold 5 charrettes	2 charrettes
	Number of training CDs distributed	Distribute 500 training CDs	new element
	Number of engineers and architects trained	Train 350 engineers and architects	1000 engineers and architects
Marketing	number of ad insertions	20 ad insertions	1998-99: 20 1999-00: 20 2000-01: 25
	number of trade shows attended	Attend 20 trade shows	1998-99: 15 1999-00: 25 2000-01: 35
Financial incentives for energy-efficient building design (25 % better than MNECB)	Contribution agreements for 87 buildings totalling 456,000 m^2 of floorspace	Issue Contribution Agreements for 87 buildings	104 Contribution Agreements
	Value of contribution agreements (monetary value of incentive funds for each project included in the agreement)	Total value of $2.7 million in 2001-2002	$3.638M
	Number of plans reviewed	Review 120 plans	Reviewed 150 plans

EE4 simulation software integral to changing design practice	Number of users	300 users	50
	Number of downloads of advanced version	1000 downloads	1200
	Update and debug EE4 simulation software	Release updated and debugged version of EE4	16 previous versions released
Consultations and assessment of com/institutional building labelling programs	Progress on OEE positioning on labelling issues	Recomenda-tions generated	new element
Evaluation activity	Surveys and other instruments	Annual report	1 program evaluation
Industrial Building Incentive Program-extend program to Industry sector buildings	Number of contribution agreements with industrial innovators	3 Contribution agreements	new element
Conduct case studies of industrial buildings	Number of case studies	1 Case study	
Intermediate Outcome(s)			
Demonstrate market feasibility of designing and constructing highly efficient commercial and institutional buildings	Share of total building starts constructed 25% above code	Near-term target is to have 1.5% of new construction by March, 2002 (relative to an estimated baseline level of 0.8%)	To be determined by CBEUS and other methods
Final Outcome(s)			
Improve energy efficiency of new commercial and institutional buildings so that energy efficiency is routinely integrated into new buildings	Share and number of total building starts constructed 25% above code	To be established by CBEUS and other surveys	
Revised MNECB	Revised building code that further decreases energy use in new commercial and institutional buildings by 25%	All new commercial and institutional buildings use 25% less energy than 1997 MNECB, by 2005	
Estimated Program Impacts			
1999	2000	2001	2002
XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXX	XXXXXXXXX

Source: NRCan (2001).

The use of a flowchart, such as the one depicted in figure 1, helped DPAD extract program information from managers in an intuitive and logical fashion. This approach to obtaining program data proved very useful in ensuring that only information related directly to performance assessment was collected. The first, and probably most important step in the process of collecting information for the program metrics, involved stating and clarifying the objectives of each energy efficiency program. This was necessary, given that all program activities, outputs, and indicators (effectively, all the information in the performance monitoring template) essentially stem from, but are also reflections of, a program's stated objectives. This was not always easily done; while all of the OEE's energy efficiency initiatives strive to improve energy efficiency and reduce GHG emissions in general, a program's objectives typically reflect a number of other "sub-objectives" that can be either short or long-term, or direct and indirect. For example, the OEE's EnerGuide for Houses initiative is an audit-based energy efficiency program that encourages the retrofit of existing homes. Increasing the number of retrofitted homes is therefore an important objective of the program. However, the program also has a broader objective - that of reducing energy intensity for the residential sector as a whole. Given that a program's performance is generally measured directly against these objectives, the OEE was careful to pay particular attention to this initial step.

Programs also engage in activities that are central to the achievement of their stated objectives. For the most part, these activities are inherent in a program's outputs (examples include pamphlets and workshops). In turn, outputs are designed to lead to program outcomes, or the behavioural changes that occur in the groups or market segments targeted by a program. The NBI, for instance, offers financing for clients who agree to improve the energy efficiency of their buildings by 25 per cent more than the current code. Financing, therefore, constitutes a major activity for this program. While this activity is not included in the template per se, it is explicitly reflected in the output that results from the activity - the issuance of contribution agreements stipulating the funds to be allocated to each program participant. To correctly link the two, the purpose of each activity, and its intended target audience, were examined. Wherever possible, targets were also identified for each program output. These too correspond closely to level of program activity program managers are hoping to achieve over the coming fiscal year. This is evident in table 1, where the number and value of contribution agreements targeted for the next year refer directly to the anticipated increase in financing activity for that year.

Perhaps the most challenging step involved developing indicators that could accurately track the progress of program outputs towards attaining their targets. Finding an appropriate indicator meant not only accurately reflecting the progress of program outputs, but also considering the practicality of collecting data for the indicator in future years. For the most part, the OEE developed indicators that were relatively easy to comprehend and monitor, and that derived directly from program outputs.

Logically speaking, the "sum total" of a program's outputs are designed to lead to either intermediate and final program outcomes, or to simply lead to final program outcomes. For example, in table 1, all program outputs (workshops, incentives, consultations, etc.) ultimately contribute to the program's intermediate outcome. Intermediate outcomes can be thought of as a necessary prerequisite (a necessary condition) to the attainment of a program's final outcome. With respect to the NBI, the feasibility of constructing highly efficient buildings is necessary in order for the anticipated final outcome, that of improving the energy efficiency of all new and future building construction, to occur. Intermediate program outcomes are therefore intimately linked to the achievement of a program's final outcomes (and by default, to the objectives of the program). While not all programs specify an

intermediate outcome, initiatives that identified this step were assigned indicators in order to monitor progress towards this outcome.

The final outcome of a program can be defined as the effect it has on the energy-use behaviour of the sector/group it targets. A program's final outcome should, over the life of the program, contribute directly to realizing the program's stated objectives. Targets set for this step tend to be more long term compared to those typically set for either program outputs, or intermediate outcomes. For example, the final outcome of the NBI is expected to be a 25% reduction in the energy used by commercial and institutional buildings by the year 2005. Indicators assigned to track progress towards this outcome are very similar to the others, but collecting the necessary information can sometimes require more effort since it typically involves assessing behavioural changes. In the case of the NBI, a large-scale, first-of-its-kind, formal survey of energy use in the commercial and institutional sectors is being administered to meet this need.

The final column of the template presents program results to date. The information in this column is intended to reflect progress towards the achievement of all program outputs and outcomes, and as such, the information is (or should be) obtained directly from the indicators that were developed to track program performance. Since these templates are updated annually as part of the OEE's annual business planning process, the results to date also provide managers with a starting point for setting targets for the coming fiscal year.

Lessons Learned from the Metrics/Template Approach

Gathering basic program performance indicators in a single, comprehensive template, and using the same indicators to set targets and measure results, allows for program progress to be assessed at a glance. Adoption of the metrics approach led to the development of a performance monitoring template that was more cohesive and logical. Because the table presents information on the program's targets, a relationship between past program progress and future progress can also be readily determined by those within the OEE, and by interested parties outside the OEE. The table also serves as a "map" of program activity by providing interested parties with an overview of where program activities will be focused at a given point in time, where overall program efforts are concentrated, and what kinds of results are expected thanks to these efforts. For these reasons, and because it is relatively easy to use, the performance monitoring template has now become a fixture in the OEE's annual Business Plan.

Next Steps: Transitioning from Indicators to Impacts

The performance monitoring template, and the metrics employed by the OEE to collect performance information, were ultimately designed to supply the information needed for evaluating program impacts in terms of energy savings and GHG emissions reductions. The intermediate, and especially final, program outcomes described in table 1 directly affect the amount and type of energy consumed in the market. In other words, they contribute, in part, to observable market outcomes. Market outcomes ultimately reflect the *impacts* of OEE programs, in terms of changes in energy efficiency, energy intensity, alternative energy consumption and reduced greenhouse gas emissions in

the economy. Program impacts therefore form a logical part, or next step, in the performance assessment process. As such, impacts will form the core of the evaluative component of the OEE's performance assessment framework.

Developing an Evaluation Methodology For Assessing Impacts

Aside from simply being the "next step" in a typical evaluation process, there were three reasons the OEE elected to quantify the energy and GHG impacts of its energy efficiency initiatives (specifically, its market transformation programs). First, estimating the energy and GHG impacts of OEE programs would yield concrete information about the effects of program efforts in the market – something that cannot be directly obtained from information in the performance monitoring templates. Second, when taken together, the impacts and the templates yield a comprehensive and complete set of program performance information. Ideally, this "set" could answer all questions concerning a program's objectives, its efforts and activities, and the impacts and outcomes of those activities – both qualitatively and quantitatively. Third, the OEE felt that impact estimates would provide programs managers with feedback on how their program activities had, to date, influenced energy use and GHG emissions levels in the economy. This could realistically help managers set better targets and/or improve their program outcomes. In sum, the OEE considered the estimation of program impacts to be a potentially valuable way of improving future program performance.

When the OEE began this phase of its assessment framework, it set out to measure the incremental energy savings and GHG emissions reductions associated with its programs. To do this, DPAD forecasted baseline energy use for each of its programs (estimated energy use in the absence of a program) and compared it to the actual energy consumption of groups targets by the programs. Almost immediately, however, the OEE encountered a common problem associated with estimating the impacts of market transformation initiatives – that of correctly attributing estimated energy savings and GHG emissions reductions to a particular program.

According to Violette (1996), the central challenge of evaluating a market transformation program lies in accurately distinguishing between naturally occurring market changes, and the market changes that are/have occurred solely as a result of program activities. Factors such as weather, fuel prices and economic structure, can all affect the level of energy savings for a target public, in addition to the programs administered by a government. *Program attribution* therefore refers to the percentage or proportion of estimated energy savings that can be reasonably and solely attributed to a particular program. For example, if the level of program attribution is deemed to be 50%, then only 50% of the estimated energy savings are truly a result of program activities. Put another way, 50% of the estimated savings would not have occurred in the absence of the program.

Determining the correct level of program attribution is an important part of estimating program impacts. However, it is also the most challenging aspect of such an exercise, since separating program impacts from the impacts of other factors requires detailed knowledge of how the energy consuming behaviour of a program's target group changes directly as a result of only program activities. Knowledge of the latter is often difficult to identify and quantify. Given these difficulties, and the current lack of data supporting the use of specific levels of program attribution for OEE programs, DPAD elected to begin this phase of its assessment process by estimating the "upper bound", or maximum amount of energy savings that could be attributed to a particular OEE program. To this end,

we (generously) assumed that unless there were data, knowledge, or estimates indicating an accurate level of attribution for a specific program, 100% of all estimated energy savings occur solely as a result of the program. By relying on this assumption, the OEE was able to estimate the upper bounds of energy savings for all of its market transformation initiatives – something we have designated as a "first step in the right direction".

Onwards and Upwards: Refining Our Program Impact Estimates

The OEE is now using the preliminary, "upper bound" estimates as a basis for further refining the measurement of its program impacts. While there is no unique method for determining program attribution (Violette 1996), the OEE is taking steps to deal with program attribution issues in more detail, and in the context of specific programs. The OEE is currently working with consultants on a feasibility study designed to examine the use of discrete choice theory (a method of analysis that allows for program-induced changes in behaviour to be isolated using either experimental and/or survey means) in establishing program attribution for OEE programs. Several divisions of the OEE have already allocated funds for examining this issue in the context of their programs, and the results of the feasibility study will provide DPAD with knowledge about the most appropriate methods for establishing attribution for all OEE programs. This will likely go a long way towards accurately estimating program impacts, and will also bring the OEE closer to establishing the evaluative component of its performance assessment framework.

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