

## **Evaluating Attribution In A Business Markets Program**

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### **ABSTRACT**

This paper describes the method, results and conclusions of a study of the influences Enbridge Gas Distribution's business markets program has had on commercial, industrial and multi-residential customers. The study was done to help determine Enbridge's shareholder financial incentive for the program by estimating the level of program-driven attribution, including both free riders and participant spillover. Initial review of previous attribution findings and the method used previously for determining attribution suggested an opportunity to improve the program's attribution estimates by altering the dimensions of the attribution estimation, the design of the survey used to determine the estimate inputs, and scoring of survey responses to obtain a more robust estimate.

The research assessed the 2001 and 2002 program years in light of a program audit process recently concluded for the 2000 program year. A customer survey process was developed that refined both previous attribution survey designs and incorporated additional market perspectives by including the perspective of field sales staff as a legitimate class of market actors. Another approach, to reduce memory-loss and self-acclaim biases, was to recreate the customer project decision and Enbridge relationship context.

The effort included interviews with customers of a statistical sample of projects implemented in program years 2001 and 2002. Interview responses were used to estimate program influence for each project interviewed, with overall survey responses compiled to estimate the level of attribution. Looking to the future, the survey process may be used as the basis for on-going customer attribution surveying to improve the quality of information concerning customers' project decisions and the utility's influence.

### **Introduction and Background**

Enbridge Gas Distribution is a large natural gas distribution utility headquartered in the Toronto, Ontario area, serving 1.3 million residential and 200,000 commercial and industrial customers. Enbridge has operated a demand-side management (DSM) program for its customers since 1995, according to a provincial government mandate issued in 1993. The program is operated as a resource-acquisition (vs. a market-transformation) program and so its impact accounting focuses primarily on the energy savings achieved by program participants.

As part of the broader context of natural gas restructuring and a shift to performance-based regulation, in late 1998 a financial incentive mechanism was approved to allow Enbridge's shareholders to share in the benefits of DSM. The resulting shareholder incentive mechanism instituted in 1999 is a shared-savings design, which rewards or penalizes Enbridge depending on achievement of actual net benefits relative to a budget net benefits baseline. A significant result of implementing this Shared-Savings Mechanism (SSM) design was that the approach to evaluating Enbridge's DSM programs changed. The approach had been primarily oriented to tracking and verification of program participation and efficiency measure installation. With its net-savings design, the SSM has expanded the scope of evaluation because its calculation implicitly reflects the influence of Enbridge's programs on customer participation and overall level of energy savings. Thus, part of determining the dollar amount

of the SSM involves estimating the level of free ridership and spillover (components that allow for adjusting gross estimates of savings), with which to adjust the level of the SSM award.

Enbridge works with a DSM Consultative group that advises the Company on its DSM strategies, evaluations and, since 1999, the SSM. When the SSM was implemented the role and function of the Consultative changed, becoming more decision-oriented. One activity that has been undertaken that directly affects the SSM calculation is a general audit of Enbridge's draft annual DSM Evaluation Report.

The first such audit was concluded in 2002 and addressed the fiscal 2000 (F2000) program. Of the audit's various findings, perhaps the most critical was that about half the custom-type large commercial and industrial customer energy efficiency projects subsumed under the business markets programs were found to be free riders.<sup>1</sup> Because the program audit found such a significant free rider level, with the methodological and statistical uncertainties cited by the audit, and because the audit did not estimate participant spillover, Enbridge decided to conduct a study of the F2001 and F2002 programs' attribution, including an assessment of both free riders and spillover.

This paper presents the method, results and conclusions of the study undertaken by Enbridge to update the program audit's attribution estimates.

## Method

### Introduction

Attribution has proven to be one of the most methodologically challenging issues in the field of energy efficiency impact and cost-benefit assessment. This is partly because attribution is relatively unimportant in most of the economy: if one sells a widget it makes no difference how the customer was influenced or what they would have done otherwise. One simply assumes that because the sale got made and the sale is profitable, the product or service, and associated marketing and sales efforts, must have had a sufficient influence. Granted, product managers do not last long if they cannot figure out how to maintain influence, but rarely is free-ridership examined explicitly and/or adjustments made as a result when evaluating product or service profitability. Spillover in such markets is pure "gravy" and obviously adds to the profitability of the product line.

In the DSM field, though, attribution has gained criticality because shareholder financial incentives such as Enbridge's depend on attribution estimates for their determination – even if, as some jurisdictions have ruled, the estimate is based on assuming net-to-gross ratios (the outcome of applying attribution factors) to be 100% unless information is produced to the contrary.<sup>2</sup> Three basic approaches have evolved to address attribution:

- Quantitative statistical research using billing analysis of participants and non-participants; used for estimating overall market effects as well as intra-program effects
- Qualitative research using survey-generated self-reports of participants and, in some cases, non-participants; may include additional perspectives of involved other market actors
- Hybrid research methods using some combination of quantitative and qualitative approaches

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<sup>1</sup> The estimates were produced by a qualitative customer survey process commissioned by the Consultative and paid for by Enbridge. See Method section for discussion of the audit's survey method compared to the current study's approach.

<sup>2</sup> See, for example, Raab & Violette (1994) and Nanduri (2001). Also, throughout the 1980's and 1990's Northern States Power Company used for its DSM financial incentive a default assumption of 100% net-to-gross until evaluation work demonstrated otherwise.

For this study we chose a purely qualitative approach that used in-depth interviews as the basis for collecting information on program influences. We chose this approach for a number of reasons:

- Similarity with and to build upon the general approach used in the F2000 program audit
- The target market is large commercial and industrial customers and custom-type projects, meaning that billing analysis would be more difficult, and with potentially high uncertainty in results<sup>3</sup>
- The nature of the customers involved, their decision processes and the length of time since many of the projects being addressed were commissioned
- Limited research resources, which limited the sample design and size and so further exacerbated the potential uncertainty of a quantitative approach
- Findings from previous research which indicates that a well-designed self-reporting approach can produce results as robust as those from more quantitative approaches<sup>4</sup>

This study dealt only with SSM adjustments (i.e., it was not a market transformation study) so there was no need to conduct quasi-experimental or other analyses of the program's overall market effects. Thus, no attempt was made to address non-participants and broader market effects other than for understanding how the interview sample compared to the customer population.

## Previous Methods

Enbridge historically had been assuming a 10% free rider effect across all business markets custom projects. This basic assumption reflected the need to recognize some level of free ridership, but was criticized as being too simplistic and likely too low a level. The DSM Consultative group advised Enbridge that the estimate should be updated using a more empirical approach, and included such an effort as part of the broader F2000 program audit.

The F2000 program audit process to estimate free ridership was a first step to go beyond the general assumption Enbridge had been using for free riders. The F2000 audit employed a qualitative approach for estimating free ridership, conducted in two steps. It began with an independent engineer's detailed review of selected project files to identify the project makeup and verify projects' energy savings realization rates. This first-round process concluded with an in-depth interview with the customer whose project was being examined by the auditing engineer, and used a battery of questions relying on customer self-reports about the nature of the program's influence.

A second round of interviews was conducted with a small, but statistically drawn sample of customers in each of three segments: commercial, industrial and multi-residential. The same types of self-reporting questions were asked of this statistical sample so that the results could be extrapolated to the population of business markets custom projects. Questions addressed a variety of decision making issues, past and current energy efficiency practices and the relationship with Enbridge. For example, customers were asked about satisfaction with measures installed and whether similar measures would be considered in the future. Other questions asked if measures would be considered without Enbridge program assistance, the likelihood the measures taken would have been taken without Enbridge's program incentive and to what relative extent and timing (to address partial and delayed free ridership), and what made the customer start thinking about taking the measures. In all, 19 questions were asked around the attribution issue, including two concerning participant spillover which were not used subsequently in the final attribution estimate.

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<sup>3</sup> See discussion in Cavalli, Torok & Richardson (1999) regarding concerns over case viability due to billing data problems.

<sup>4</sup> See, for example, Seiden & Platis (1999) and Torok, Cavalli & O'Drain (1999).

In fact, only a portion of the 17 free ridership questions in the F2000 audit appear to have been used to score each customer's free ridership, though qualitative consideration was given to the responses to the entire question set, to direct additional probing. In addition, a battery of 6 questions about gas price spikes and their effect on energy efficiency measures taken was asked in the middle of the interview, after some initial questions about what the customer had done historically in energy efficiency but before the "final" free rider questions that were the actual basis of the free rider score for each customer. One cannot fully know the response-biasing effect of inserting questions about gas price spikes' influence, and both having a number of such questions and inserting them immediately before the "final" free rider questions (those used to score free ridership). In our opinion there likely was an influence on interview responses about the influence of prices versus the influence of Enbridge on customers deciding to take the actions they did. As well, in reviewing the semantic construction of the interview questions and the way the responses were scored,<sup>5</sup> some doubt arose as to the validity of the final free rider scores. Added to this uncertainty was the basic statistical uncertainty of the small sample, although we acknowledge that the stratification method used helped minimize the sample's statistical uncertainty. Finally, we noted that the F2000 audit made no estimate of spillover effects, either participant or non-participant.

### **F2001/2002 Method**

Given these methodological concerns for the F2000 audit, this study of F2001/2002 projects worked to improve upon the F2000 audit work. As with the F2000 program audit, there were substantial bias issues to address in using the selected approach to this study of the F2001/2002 program. To address our concern that over-reliance on customer self-reports would unduly bias the research findings in favor of high free ridership rates, we instituted three strategies that, to our knowledge, have not been used *together* in program evaluation.<sup>6</sup> One strategy was to add a second perspective to that of the customer alone by interviewing the Enbridge Energy Solutions Consultants (ESCs). This augmentation brought in the observations of ESCs under the assumption that they are a legitimate, if also biased, class of market actors. As such, their perspective should be considered, though tempered to offset the bias their responses carried.

A second strategy was to reconstruct the context and situation at the time the custom project was being developed so that the extant biases of lost memory and self-acclaim could be partly offset. This situation reconstruction, done as a prologue to the interviews with each customer, utilized available program information and ESC knowledge regarding the target projects and historical relationship with Enbridge. We consciously included the situation reconstruction as a counter to what we term "memory loss" and "self-acclaim" biases. These biases result from customers not recalling the full extent of the catalytic effect Enbridge's programs and ongoing general customer relationship management efforts have had. This includes the influences Enbridge has had on the trade community, who in turn influence customers. This third-party attribution effect was recognized by the F2000 audit, but it did not address the effect otherwise.

A third bias-reducing strategy employed directed the way the interview guide used to survey customers and ESCs was designed, the questions used and the scoring of responses. The strategy was to break down the customer decision process and Enbridge customer relationship management process into components that would not elicit overly patronizing responses, and that as much as possible elicited

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<sup>5</sup> I.e., focusing on "final" free rider questions and effectively declaring each project to be either 0% or 100% free rider, with some adjusting for partial and delayed effects.

<sup>6</sup> We credit the F2000 program audit's suggestion to obtain additional market perspectives, in particular that of customer service representatives. Also, other research has pointed out the value of multiple lines of evidence. Xenergy (2002) and Tiedemann (1999).

factual observations instead of judgmental opinions. We also avoided asking questions about price spikes and other significant outside influences, as we felt such questions would bring even more biases into play and that those influences in most cases would be adequately incorporated in customers' interview responses without calling them out for special attention.<sup>7</sup>

The study also addressed participant spillover, though more simplistically than it addressed free rider effects. Participant spillover was included for symmetry reasons, because just as other influences can affect the level of Enbridge's program influences, so, too, can Enbridge's influences persuade customers to take additional actions that ought to be given credit in the SSM calculation. The F2000 audit implicitly acknowledged this in the questions asked of customers, and other financial incentive-related evaluations have rightly incorporated this factor.<sup>8</sup>

## **Sample Design**

Because the SSM depends implicitly on impact data this research keyed on projects as the sampling unit. To identify the group of projects to study we selected a sample of 34 F2001 and F2002 projects stratified by market segment (industrial, commercial and multifamily), with approximately half the projects coming from each year.<sup>9</sup> We slightly over-sampled larger projects to capture as much of the total impact as possible within the limited resources allowed for the study. This resulted in over 1/3 of the total program impacts being included in the sample. The resulting sample has a +/-20% accuracy and 90% confidence interval.

## **Interview Development**

The interview development reflected an underlying program logic theory of change and its associated indicators, and reduced the need to rely on the traditional, but simplistic approach of simply asking customers what they would have done absent the program.<sup>10</sup> In all, eighteen questions were used to assess free ridership and one for spillover.

The survey interview guide consisted of three parts. The first part involved identifying information available from Enbridge's program files and ESC staff, and then working that information into a form useable in the customer interviews. This part included a battery of questions to be asked of ESCs concerning the genesis and interaction of projects with Enbridge marketing and technical support. For example, a question asked about the general context of Enbridge's relationship with the customer as evidenced by education efforts to build program awareness, energy audits provided that help identify project opportunities, and even distribution and merchant services that help ingratiate customers to Enbridge's DSM offerings. Other questions asked about project-specific support services and trade partner involvement with the project. This aspect of the survey process was implemented to provide an additional market actor perspective, that of Enbridge's sales staff (and, indirectly, trades' perspective). It was also necessary to help build a picture of the project genesis, because there could have been up to

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<sup>7</sup> Our experience in other in-depth interview research, especially in probing about why an energy manager makes the project decisions they do, has repeatedly seen respondents bring up such issues without specific prompting. This strongly indicates they consider major other influences in their responses to what they do and why they do it.

<sup>8</sup> We would agree, however, that non-participant spillover is not an appropriate factor to include in the SSM calculation, though it can be appropriate for examining societal effects of programs.

<sup>9</sup> The programs supporting custom projects did not experience significant structural changes throughout the F2001-2002 period.

<sup>10</sup> That question was indeed asked, but not until other indicators had been explored so as to avoid prejudicing the respondents' answers to the various indicator questions.

two years since the project was commissioned, so that the customer could better recall the nature of their interaction with Enbridge and the program influences.

The second part of the interview guide turned to the customer side, as a prologue to asking about the project specifically. In this opening part of the customer interview, the customer was asked about historical energy conservation policies and practices, recollections of Enbridge energy efficiency marketing and sales efforts, a discussion of the background information obtained from the ESC interview and whether the customer has found Enbridge's programs and supporting services helpful in managing energy.

The third part of the interview guide focused in on the project itself. Here, questions were designed considering likely program/customer intervention points and the kinds of information being exchanged and decisions made, as well as points of satisfaction and dissatisfaction that would indicate program influence. For example, it asked about information presentations to customer management and the decision outcome of such presentations. It asked whether Enbridge or other incentives were received and what influence on project economics those had. Enbridge's help in selecting technologies, trade support and provision of supporting Enbridge services such as billing histories and energy audits were also questions asked. Questions of impact scope and timing addressed the issues of partial and delayed free ridership, and the traditional "what if no program" question was asked (as was a question about "what if programs were discontinued"). This part also included a question about spillover within the customer's facilities, asking whether they were taking efficiency actions in addition to the target project because of their experience with the project.<sup>11</sup>

The interviews with Enbridge ESCs and customers were conducted during December and January, 2002-2003. Recruiting was highly successful and resulted in non-response from customers representing only 4 projects. After reviewing the non-responding projects' program information, we concluded a non-response comparison was not needed.

## **Interview Process**

The interview process began with selecting prospective cases randomly from a pool of 60 projects sampled from the F2001 and F2002 program years, though with interview case selection done to maintain the segment and savings-proportionate characteristics of the sample pool.<sup>12</sup> Once selected, customers were recruited to sit for an interview, with a commitment made to take no longer than 30 minutes unless the customer wished to provide a longer interview. Once recruited, the interviewing contractor reviewed the Enbridge files on the project and interviewed the Enbridge sales person associated with the project to obtain the interview prologue information and survey the Enbridge person about their observations of various energy services provided to the customer.<sup>13</sup> Then the customer interview was conducted, responses noted and transferred to a spreadsheet database for subsequent attribution scoring and analysis.

This process yielded a very high response rate due to successful recruiting techniques, the commitment to minimize customers' time, and apparently high interest (mostly positive) by customers in providing feedback on their program experience. To address non-response profile concerns, two questions were reserved from the interview guide to be asked of those declining interviews. These were never used because three of the four refusals were situations where contact calls were never returned and so no opportunity arose to ask the control questions. Given the high response rate and the known

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<sup>11</sup> A question about impact realization relative to expected impact level also was asked, to address gross realization rate. For brevity that issue is not addressed in this paper.

<sup>12</sup> This was never a major issue in case selection as only 4 replacement cases were ever needed, and suitable replacements were available from the sample pool.

<sup>13</sup> This approach is very similar to that employed in work reported by Goldberg & Scheuermann (1997).

characteristics of non-respondents, however, we concluded there likely are no significant non-response biases in play. In all the interviews conducted there were very few questions that went unanswered, so missing data were not a concern, either.

In all, 38 attempts were made and 34 interviews completed (89% completion rate) during the interview period which ran from mid-December 2002 through mid-March 2003.

### **Attribution Scoring**

The scoring scheme we developed reflected a holistic view of program influence by adding together in a weighted fashion the various components of the project history, implementation decision and relationship with Enbridge. In this construct we took the underlying position that in estimating free ridership and spillover, customers are neither wholly isolated from program influences, nor are they wholly influenced by the program, and indeed the scoring of free ridership never resulted in any case being either 100% or 0% free rider. Thus, the scoring method was to build a cumulative picture of free ridership, based on multiple stakeholder perspectives and kinds of influence. Both customer self-reports and Enbridge staff observations were utilized to develop information for assessing free ridership.

Scores for free riders and spillover were determined by associating responses to individual questions with a range of influence.<sup>14</sup> For example, most free rider questions were scored on a three-level basis of 0%, 50% or 100% free rider *for that question*. Spillover was determined by a single question. Free rider scores across all responses were grouped by type of interaction or influence. The groups were weighted judgmentally to avoid over- or under-counting various influence sources and to reflect (again, qualitatively) the relative importance of the various dimensions of influence, so that no one dimension would unreasonably dominate the overall free rider picture for that project. Interview responses were grouped into six weighted scoring groups to address the various dimensions of program influence:

1. Enbridge Staff Perspective (20% weight)
2. Customer Historical Efficiency Practices and Enbridge Relationship (15% weight)
3. Value of Project-related Information, Services and Incentives (30% weight)
4. Project Technical Relationship (10% weight)
5. Likely Alternative Actions (25% weight)
6. Scope/Timing Situation (to account for partial and delayed free ridership; separate 25% weight given, with result used as final adjustment to the free rider score)

The group weights were determined by considering each group's relative importance in the overall market (including past customer practices and Enbridge program efforts) and the customer decision environment. They also were determined in part by the way the individual question scores were designed, whereby free rider percentages were similarly specified in a simply understood manner, yet would not yield reasonable overall results without some weighting to put them in context with the other groups. Within groups, questions are assumed to have equal weights because of uncertainties in the nature of influence dynamics – influence can be effected through any of the means identified by the various questions. Item scoring generally follows a trinary (three-way) logic for methodological simplicity (i.e., 0/50/100% free ridership for a given question response), with grouping and group weighting used to combine item scores.

The Scope/Timing situation group weight is independent of the other weights because it is used to adjust the FR % after the other scores have been determined. It is set at 25% because of how the

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<sup>14</sup> Gross impact realization rates, again not addressed in this paper, were similarly determined.

individual question responses in the group are set up, whereby unreasonably high results occur with greater weighting, yet lower weighting would fail to account sufficiently for scope and timing effects.

To ensure robust results, two scoring approaches were undertaken, one more conservative than the other. This was accomplished by interpreting the interview responses either more or less critically in terms of the role Enbridge's influence played in both general customer awareness building and specific project development and efficiency measure incorporation.

## **Results**

The results derive from the combination of a refined qualitative research approach, solid field execution of the interviews and a holistic attribution scoring approach that expanded the previous scope to include spillover. Perhaps not surprisingly, the results thus differ from those of the F2000 program audit.

### **Free Riders**

The results of the interviews, when scored using the component logic described above, showed significantly lower free rider rates than the F2000 program audit result. Using the two-level scoring approach, this study found savings-weighted average free rider levels of 29% and 38%, while the F2000 program audit found nearly 49% free ridership (range of estimate was 45%-52%).

The F2000 program audit also included an analysis of alternative scenarios for free ridership, where an assumption was made to provide full credit for contractor-initiate projects, full credit for delayed free riders or both credits combined. The resulting free rider estimate ranged as low as 32% when both credits were applied, which approaches the results found in this study.

Given the +/-20% statistical uncertainty of the small sample used in this study, one can reasonably conclude that the 29%/38% free rider levels could range widely, and up to nearly as high as the F2000 program audit results indicated. While we acknowledge this large uncertainty, the information that resulted from the interviews suggests more influence of the program than what might be inferred by free rider estimates in the range suggested by the F2000 program audit. For example, the majority of customers stated they had had a long history of interaction with Enbridge's efficiency programs, and that they had been working with trade partners with whom Enbridge in turn has had long-term relationships with (for example, in providing training to customers). Even the direct responses of many interviewees to the simplistic question "What is the probability you would have undertaken this project otherwise" tended to give Enbridge more credit than the similar question asked in the F2000 audit survey.

### **Participant Spillover**

Analysis of the survey results suggested a savings-weighted participant spillover rate of 12% of project impacts.<sup>15</sup> This result is driven in part by the simplifying assumption used in the scoring design that keyed off customer responses about how much their project experience encouraged them to take similar or other efficiency measures at the target facility or their other facilities. Depending on the response spillover was assumed to range from 0% to 20% of project impacts.<sup>16</sup> Because of the

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<sup>15</sup> Again, the F2000 audit did not estimate participant spillover.

<sup>16</sup> That is, if a customer saved 100,000 cubic meters of gas in the project the intra-customer spillover could range from 0 to an additional 20,000 cubic meters of gas saved. We did not attempt to measure non-participant spillover.



assumption basis of this estimate, we suggest using the result as part of the bounding analysis to adjust the overall net impact of the program, e.g., to reduce the free rider estimate by upwards of 12%.

## **Conclusions and Future Direction**

This study found lower free ridership levels than the preceding audit of the F2000 program. Whether the difference is due to the way the qualitative interview method was applied, whether it is due to basic statistical uncertainty or whether it is due to real changes in free ridership rates over program years, is not apparent. However, from our experience planning, managing and evaluating programs and because Enbridge's program did not change substantially from 2000 through 2002, it is most likely that the difference is due to the way the method was applied and the results scored. This conclusion suggests a need for further comparative efforts with similar types of attribution research, though the current study benefited from years of efforts both by the study team and others in understanding important survey design components, such as what questions are appropriate to ask, how to ask them and how to minimize the inevitable biases they contain.

We did find that the free ridership bounding analysis performed both in this study and in the prior audit work produced an overlapping range, which suggests a possible consensus somewhere in that range that could be acceptable for deciding a fair and reasonable incentive amount. We also found evidence of significant spillover. Thus, there is support for making an adjustment to the SSM for both free riders and spillover for the F2001/2002 program, with a lower free rider percentage than found by the F2000 audit.

Of particular interest in the project was the use of survey strategies that explicitly acknowledge customer biases. Self-reporting approaches to estimating attribution, especially free ridership, are fraught with biases that give customers more credit for taking initiative on their own, uninfluenced by the program – what we have called memory-loss and self-acclaim bias. We concluded that such biases are so significant that an explicitly offsetting strategy is necessary to neutralize them. Thus, we instituted the unique features of tapping ESC knowledge and observations of program interaction and general customer relationships, and also a briefing to the customer as a prologue to the interview. The results likely offset at least some of these potential biases.

Lessons learned from this experience include trying to evaluate attribution as soon as possible during the course of when projects are being planned, developed and built. This can and should address not only project-direct support but also more general customer relationship factors that over long periods of time can influence customers' overall energy efficiency culture and future decisions to proceed with a given project. After all, when a customer states they would have done a given project regardless of the program's existence, they usually are not acknowledging any educational effects (subliminal or otherwise) from long-term relationships with their utility.

Additionally, to better estimate these critical attribution factors, we suggest instituting an ongoing, semi-real-time evaluation process to capture selected indicators of program influence. Enbridge is currently considering practical ways to do this which will minimize internal staff efforts and separate potentially conflicting attribution measurement interests. In particular, Enbridge is considering ways to enumerate activities it undertakes to support projects, and also a customer survey to be administered as the project is being commissioned.

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