101 Sources of Spillover: An Analysis of Unclaimed Savings at the Portfolio Level

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ABSTRACT

This paper presents methodologies and lessons learned from a recently completed assessment of various kinds of spillover under the umbrella of Commonwealth Edison's Commercial & Industrial (C&I) portfolio evaluation.¹ The study went beyond the traditional concepts of participant and non-participant spillover and examined sources of spillover not commonly assessed. This paper focuses on two unique aspects of the 2015 study that address study and research planning: (1) development of a spillover logic model to systematically document potential sources of spillover and prioritize among various research activities and (2) efforts to minimize measurement error in our online Trade Ally survey through cognitive interviewing, a survey pretest method designed to assess respondents' understanding of key survey questions.

Introduction

Study Background

The 2015 study included an assessment of various sources of spillover for Commonwealth Edison's (ComEd) Program Year 6 (PY6), which began on June 1, 2013 and ended on May 31, 2014. We examined (1) spillover as reported by trade allies (TAs) registered with the Smart Ideas Program; (2) spillover from customers who started the participation process but whose application was cancelled or withdrawn ("drop-outs"); and (3) spillover from customers who received a Smart Ideas assessment. The evaluation team, in consultation with ComEd, selected these sources of spillover for inclusion in this study based on a C&I portfolio-level logic model, which we developed to identify and prioritize potential sources of spillover.

Three primary data collection efforts informed the spillover study:

- 1. **Online survey** with ComEd Trade Allies in five C&I programs: Standard/Custom, Industrial Systems, Data Centers, Small Business
- 2. **Telephone survey** with C&I customers with cancelled or withdrawn projects ("drop-outs") from the Standard and Custom programs
- 3. **Telephone survey** with C&I customers who received one of three types of Smart Ideas assessment²

¹ *C&I Cross-Cutting Evaluation: PY6 C&I Spillover Report.* Presented to Commonwealth Edison Company. Antje Flanders, Opinion Dynamics Corporation, under subcontract to Navigant Consulting. Draft June 2015. The final report is forthcoming and will be available at www.ilsag.info.

 $^{^2}$ The three types of assessment are: 1) Smart Ideas Opportunity Assessment – a free 2-hour on-site facility assessment; 2) Technical Assistance Services – an in-depth facility assessment conducted by an approved service provider offered to data center, laboratory, and hospital customers; and 3) Commercial Building Assessment – an in-depth energy-efficiency assessment provided to large commercial office buildings by a third-party provider approved by ComEd.

In addition, Opinion Dynamics leveraged spillover estimates from the individual PY6 C&I program evaluations, most of which included investigation of self-reported spillover.

Spillover Results

The study's overall estimate of spillover was 3.2% of PY6 verified gross savings for the C&I portfolio. This estimate was built up from the new primary research-based analyses and the estimates from the individual program evaluations. Spillover estimates vary significantly by program, ranging from 0% to 7.0% of the program's verified gross savings (see Table 1).

| | PY6 Verified | PY6 Sp | illover | |
|--------------------|--------------|--------|---------|--|
| Program | (MWh) | MWh | % | Sources of Spillover ^{A,B,C} |
| Standard | 267,664 | 3,071 | 1.1% | Participant survey, TA survey, Drop-out survey |
| Custom | 26,588 | 123 | 0.5% | Participant survey, TA survey, Drop-out survey |
| Industrial Systems | 22,390 | 328 | 1.5% | Participant survey, TA survey |
| Data Centers | 21,333 | - | 0.0% | Participant survey |
| Small Business | 135,303 | 2,728 | 2.0% | TA survey |
| New Construction | 27,518 | - | 0.0% | Participant survey, Trainee survey |
| RCx | 24,704 | 988 | 4.0% | Service provider survey |
| BILD ^D | 261,342 | 18,294 | 7.0% | Customer survey |
| C&I TOTAL | 786,842 | 25,533 | 3.2% | |

| Table 1. Summary of Community of Community of |
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^A In addition, the assessment survey found spillover of 0.012% which is not included in this table.

^B Spillover estimates for the New Construction, Retro-Commissioning, and BILD programs are based on the PY6 evaluation reports. This study did not include any new research or analysis for these programs.

^C Sample sizes for new primary data collection efforts: TA survey: n=48 (census attempt); Drop-out survey: n=85; Assessment survey-Smart Ideas Opportunity Assessment: n=72; Assessment survey-Technical Assistance Services/Commercial Building Assessment: n=8 (census attempt).

^D BILD is the midstream incentives program for lighting.

Focus of This Paper

As described above, the spillover study included several research activities and analyses. However, this paper focuses on two unique aspects of the 2015 study that address study and research planning:

- 1. Development of a spillover logic model to systematically document potential sources of spillover and prioritize among various potential research activities; and
- 2. Efforts to minimize measurement error in our online TA survey through cognitive interviewing, a survey pretest method designed to assess respondents' understanding of key survey questions.

Spillover Logic Model

The first part of this study was the development of a high-level C&I portfolio logic model that documents the various program activities that might lead to spillover. ComEd already has a detailed logic model for each of its C&I programs. The intent of this portfolio-level model, therefore, was not to document all program activities that might lead to energy or demand savings, but rather to focus on sources of potential spillover. We used this model to identify sources of potential spillover that (1) have already been addressed by the individual program evaluations, (2) could be addressed with new primary research in this study, and (3) would not be included in this study.

Figure 1 presents the logic model for the Smart Ideas for Your Business portfolio. The potential sources of spillover are shown in the "Spillover Definition" row at the bottom of the model. The rows above show how program activities and outputs might lead to these spillover outcomes. Sources of spillover included in the study are indicated with a thick border in the "Spillover Definition" row. As described in the study report, they include:

- Spillover addressed through new primary research is shown in orange shading (1 drop-out survey; 2 assessment survey; and 3 TA survey).
- Spillover that was already quantified through the PY6 program evaluations is shown in blue shading (4a program-specific participant spillover and 4b distributor-induced spillover from the midstream lighting program, BILD).

In addition, there are three potential sources of spillover identified in the logic model that were not included in this study (shown in gray shading), due to budget limitations. They include:

- Non-participant spillover from customers who have not had any direct interaction with the program but who might have been influenced to install energy efficient equipment by general program marketing and outreach activities (5a);
- Spillover from customers who used the online Business Energy Analyzer (5b) and implemented recommended solutions without receiving an incentive; and
- Spillover from past participants who might have made additional energy efficiency improvements, influenced by their prior participation, without receiving an incentive.

It is important to note that all potential sources of spillover identified in the logic model also lead to customer participation in the various Smart Ideas programs. This is because the available incentives are generally a prominent part of any communication provided by the program.



Figure 1. ComEd Smart Ideas for Your Business Program: Spillover Logic Model

Key:
1-3: New research efforts: 1. Drop-Out Spillover: Measured through drop-out survey; 2. Assessment Spillover: Measured through assessment survey; 3. Trade Ally-Induced Spillover: Measured through TA survey (orange)
4: Part of program-specific evaluation efforts: 4a. Participant Spillover (anous programs, participant self-reported); 4b. Distributor-Induced Spillover (BILD, distributor self-reported) (light blue)
5: Not measured in current spillover task: 5a. Non-Participant Spillover; 5b. Business Energy Analyzer Spillover; 5c. Delayed Participant Spillover (gray)
*This outcome also leads to participation in SIFVB programs, i.e., the installation of energy efficient equipment with a SIFVB incentive.

Our new research efforts focused on TA-induced spillover, spillover from drop-outs, and spillover from assessment participants. The following are brief discussions of the theories underlying each type spillover and the findings and conclusions from our research.

TA-Induced Spillover

The theory behind the potential for TA-induced spillover is that TA training and educational materials provided by the program help TAs become more knowledgeable about the program and about energy efficiency in general, leading to changes in TA's business practices (e.g., they might hire more staff or recommend energy efficient options more frequently). As a result, their customers learn about energy efficient options and might install energy efficient equipment, with or without a ComEd incentive, where they otherwise would have chosen a less efficient option. Savings from installations that did not receive an incentive are considered TA-induced spillover.

Our methodology included a fairly conservative approach to crediting the program with spillover. In addition to providing high program influence ratings, which are often subject to measurement error, TAs had to confirm in open-ended responses that the influence ratings they provided really constituted spillover. To test the theory of why program actions would lead to TA-induced spillover, we asked the following open-ended questions:

- 1. How did the program contribute to an increase in a) the total volume of high efficiency equipment installed in ComEd's service territory OR b) the percentage of jobs in which the TA installed high efficiency equipment?
- 2. What other factors contributed to these increases?
- 3. Why do customers that qualify for an incentive choose not to participate in the Smart Ideas Program?

We estimated TA spillover to be 2.0% of savings associated with projects implemented by TAs, for the programs covered by the TA survey (the Standard and Custom programs, the Small Business program, and the Industrial Systems program).³ Taking into account the share of total program saving associated with TA-implemented projects (65%), we estimated spillover as a percent of total verified gross program savings to be 1.3% (for the four programs).

Other key findings are that 92% of TAs experienced increases in high efficiency installations⁴ since becoming a program-registered Trade Ally, and 75% of them reported that the program had a significant influence on this increase. However, the key drivers to energy efficient installations are the program incentives and the resulting shorter payback or increased ROI – factors associated with program participation. TAs give less credit to program training, education, and marketing; they also cited increased customer knowledge and awareness, tax benefits, technology improvements, and factors internal to the customers. Notably, only 48% of TAs who had high efficiency installations in the program year reported that at least some of those installations did *not* receive an incentive.

³ The TA survey also included TAs for Data Centers. However, none of the three TAs flagged by ComEd for this program, responded to the TA survey.

⁴ This includes all high efficiency installation, both incented and non-incented.

Overall, we find that the program and TAs heavily emphasize incentives. Customers take advantage of the incentives, leading to solid program participation but reducing the potential for spillover. Recent program design changes introduced a performance reward that pays participating TAs an incentive based on the volume of incentives they generate. More than half of interviewed TAs channeled all of their high efficiency projects through the program, explaining the lower than expected level of TA spillover.

Drop-Out Spillover

The theory behind the potential for drop-out spillover is that some customers start the participation process but, for a variety of reasons, their application is cancelled or withdrawn. Reasons might include changes in project timing or the scope of the project. Most of these customers are not candidates for drop-out spillover because they (1) do not complete their project, (2) complete the project with standard efficiency equipment, or (3) install energy efficient equipment and receive an incentive through the program (i.e., they become participants). However, some customers complete their installation of program-qualifying equipment without applying for an incentive. To the extent that these customers were influenced by the program in choosing the energy efficient equipment, savings from their projects are considered drop-out spillover.

Key questions in the drop-out survey included whether the customer completed the project that they initially applied for, whether the installations (by end-use) were eligible for a ComEd incentive (i.e., high efficiency), and whether they had received an incentive for the installation (or had an incentive application pending). Customers with eligible equipment installations who had not received an incentive (or had an incentive application pending) were asked how much their experience with the program influenced their decision to install the energy efficient equipment (by end use).

We estimated drop-out spillover of 0.1% of verified gross savings for both, the Standard and Custom programs. This is based on 5 of 85 interviewed customers (6%) who completed an eligible project subsequent to dropping out of the application process, did not receive an incentive, and were influenced by the program. For these five projects, we quantified savings and divided those savings by 85 to determined average spillover savings per drop-out (857 kWh). We applied this average value to all PY6 drop-out projects to estimate total spillover for the Standard and Custom programs, respectively.⁵

To better understand the mechanisms of drop-out spillover, we asked customers who were highly influenced by the program *how* the program influenced their decision to install the energy efficient equipment. The primary reason given was the initial expectation that the project would get an incentive. Reasons that the projects did not end up receiving an incentive include misunderstanding of the participation process (the customer did not receive an incentive because they did not seek pre-approval when pre-approval was required) or because of project timing (the customer could not wait for the project to be pre-approved before starting the work). The relatively small number of spillover drop-out projects (5 out of 85) indicates that program processes generally work well and do not present a major hassle to participants that would cause them to discontinue the application process.

⁵ Overall, 45% of drop-outs completed the project they had initially applied for. Of the completed installations, 47% received an incentive or had an incentive application pending (making them a program participant), 31% were not strongly influenced by the program, and 11% were not eligible for an incentive. The remaining 11% of completed installations (associated with five interviewed customers) were highly influenced by the program and qualified as spillover.

Assessment Spillover

The theory behind the potential for assessment spillover is that customers who receive ComEdsponsored assessments often go on to install some or all of the recommended energy efficient improvements. Some of these customers receive an incentive from one of the ComEd C&I programs for the installation of the improvements. However, some customers install recommended energy efficient equipment but do not apply for an incentive and others make recommended improvements to their operational and maintenance (O&M) practices, for which ComEd does not offer incentives. To the extent that these customers made the energy efficient installations and/or O&M changes because they were recommended by the assessment, savings from their projects are considered assessment spillover.

Similar to the drop-out survey, key questions in the assessment survey included whether the customer completed a project (i.e., implemented any of the recommendations from the assessment), whether the installations (by end-use) were eligible for a ComEd incentive (i.e., high efficiency), and whether they had received an incentive for the installation (or had an incentive application pending). Customers with eligible equipment installations that had not received an incentive (or had an incentive application pending) were asked how much their experience with the program influenced their decision to install the energy efficient equipment (by end-use).

We found very little spillover from assessment participants. While approximately half of all participants made one or more installations following the assessment, many of these received an incentive (49% of installations following the free 2-hour Smart Ideas Opportunity Assessments and all installations following the more comprehensive Commercial Building Assessments and Technical Assistance Services). The high rate of incentives for completed installations is not surprising given the emphasis that assessment reports place on available incentives. Survey results found that ComEd's assessments effectively channel participants into the Smart Ideas incentive programs.

Conclusions of Spillover Logic Model Study

In conclusion, we found the logic model a useful tool in identifying potential sources of spillover and prioritizing research activities. While our study found relatively little spillover, our research design, based on the logic model, allowed us to explore specific pathways of program activity and influence and to quantify the effects of program channeling versus spillover.

Cognitive Interviewing

Spillover analyses generally rely on self-reported information from customers or market actors about decision-making processes and influences that led to the installation of energy efficient equipment. Respondents are asked about a complex and multi-faceted topic, generally in a short series of questions that are intended to capture the nuances of decision-making and provide the evaluator with enough information to put a number on spillover. Evaluators tend to spend a lot of time developing algorithms to analyze the survey data and drafting questions that will provide the exact inputs needed; however, they generally spend much less time (if any) understanding how respondents interpret the questions and ensuring that survey concepts are measured as intended.

Survey monitoring prior to launching a full-scale primary research effort is a useful tool that can shed light on respondent confusion and can help improve survey questions and flow. However, it does not tell us much about what respondents are thinking when providing their responses and whether their responses mean what we think they mean. Another survey pretest method is cognitive interviewing, defined as "the administration of draft survey questions while collecting additional verbal information about the survey responses, which is used to evaluate the quality of the response or to help determine whether the question is generating the information that its author intends." (Beatty & Willis, 2007) In survey research, cognitive interviewing is regarded as "one of the more prominent methods for identifying and correcting problems with survey questions." (Beatty & Willis, 2007)

Online survey responses from program TAs were key inputs into the ComEd spillover study. We tried to determine if the program had changed TAs' business practices and/or outcomes, the influence of the program on those changes, and the influence of their recommendations on their customers' decision to install energy efficient equipment. Our methodology also required TAs to provide an estimate of the percentage of their "jobs" that fall into the following three categories: (1) standard efficiency installations, (2) high efficiency installations that received a ComEd incentive, and (3) high efficiency installations that did not receive a ComEd incentive. Since responses to each of the questions resulted in direct inputs into the spillover algorithm, certainty that we were measuring these values correctly was very important.⁶

Since we fielded the TA survey as an online survey, we had no ability to conduct a more standard, monitoring-based pretest and therefore decided to conduct cognitive interviews. For these interviews, we set up a GoToMeeting and asked respondents to take the online survey while we followed their progress online. We asked them to comment on their thinking as they responded to each question and also prompted them about their understanding of key questions. We conducted a total of four cognitive interviews: two covered the original survey and two a modified version that incorporated changes based on findings from the first interviews.

Below, we provide two examples of key changes we made to our survey instrument as a result of the cognitive interviews.

Changes in Business Practices and Influence of the Program and Other Factors

Our original survey design used two grid-style questions (see Figure 2a) to collect information about (1) whether the TA's business practices or outcomes had changed since becoming a program-registered TA and (2) to what degree the program had influenced this change. Both were key inputs into the algorithm for calculating spillover. These types of questions are very common in attribution surveys. The intention of using grids in online surveys is to reduce respondent burden, since the same question does not have to be repeated multiple times.

We found that the first grid (i.e., changes to business practices or outcomes) worked very well but the second one (influence of the program and other factors) did not. In an effort to define program factors and non-program factors and to only list each change once, too much information ended up on the page, resulting in the respondent not fully reading the instructions. What was really disconcerting is that respondents still answered the questions, giving valid responses, just not to the question we asked. In this case, the response was to the question "How would you rate your knowledge of high efficiency options?" rather than "How influential was the program in the increase in your knowledge of high efficiency options?"

⁶ We did include open-ended questions as a check on responses, as described above.

Figure 2a. Original Questions: Changes in Business Practices and Influence of the Program and Other Factors



The final design of the influence questions in the second grid incorporated the following changes (see Figure 2b):

- 1. In the introduction to the question, we read back their response to the first grid question, i.e., "You noted that the percentage of jobs in which <TA> installs high efficiency equipment has increased." This helped tie the influence question back to the increase they just reported.
- 2. We asked about the changes from the first grid one at a time. That is, rather than trying to be efficient and ask 10 questions in one, we asked them, explicitly, one at a time.
- 3. Instead of immediately asking to provide an influence rating on an 11-point scale (which is the response we wanted to use in our algorithm since it is more granular than a yes/no response) we first asked if the program contributed at all to the increase. This eased the respondent into the concept of the question. We followed up with the scale question only if they said "Yes" to this introductory question.
- 4. Given edits #1-3, we could no longer ask about all five changes to business practices or outcomes, as the respondent burden would have been too high. We limited the influence questions to those about the percentage of jobs that are high efficiency and the total volume of

high efficiency jobs. While the other questions would have provided interesting context, only these two changes were inputs into the spillover algorithm.

Figure 2b. Revised Questions: Influence of the Program (and Other Factors)⁷

| increased. | hat the p | ercent of | jobs in w | /hich | | | |] installs | high effi | ciency equipr | nent has |
|---|---------------------------------------|---------------------------------------|-----------------------------|-----------------------------|------------------------------|------------------------------|----------------------------|----------------------------|---------------------------|--|---|
| Did the Sma the program | art Ideas n provide | Program d) contrik | (includin oute at al | g the pro | ogram in increase? | centive a | nd any <mark>t</mark> i | aining, ir | nformati | on or other su | pport that |
| Yes | | | | | | | | | | | |
| O No | | | | | | | | | | | |
| O Don't know | V | | | | | | | | | | |
| | | | | | | | | | \sim | | |
| On a scale o I deas Prog r provided) in | of 0 to 10 am (inclution this incr |), where (uding the ease? | 0 is "not a program | at all imp incentiv | oortant" a /e and an | and 10 is by trainin | "very im g, inform | portant," ation or | how im other su | portant was tl pport that the | he Smart program |
| On a scale o Ideas Progr provided) in Not at all important 0 | of 0 to 10 am (inclu this incr |), where (uding the ease? 2 | 0 is "not a program 3 | at all imp incentiv 4 | oortant" a ve and an 5 | and 10 is ny trainin 6 | "very im g, inform 7 | portant," ation or 8 | ' how im other su 9 | portant was t pport that the Very important 10 | he Smart program Don't know |

The interviews showed that while survey efficiency and the reduction of respondent burden are good goals, they need to be carefully weighed against the quality of the collected data. Less may be better if it increases the quality and validity of questions that are core to the research objectives.

Percentage of High Efficiency Equipment that Received an Incentive

Another key input into quantifying spillover for each TA, once program influence is established, was the share of the TA's high efficiency installations (in terms of dollars) that did not receive an incentive through the ComEd program. We used this share – together with the TA's program savings, as tracked in the participation database, and a size adjustment factor⁸ – to estimate the TA's spillover.

The original survey included two questions that attempted to directly measure the share of the TA's high efficiency installations that did not receive an incentive (see Figure 3a). The first question asked

⁷ Note that the original survey also included open-ended follow-ups. These were asked following the second grid.

⁸ The size adjustment factor was TA specific and designed to account for any difference in size between incented and unincented high efficiency projects.

about the percentage of the TA's total sales of equipment that qualifies for a ComEd incentive (i.e., is high efficiency). The second question asked what share of the qualifying sales actually received an incentive.

Figure 3a. Original Question: Share of High Efficiency Installations That Received an Incentive

| Approximately w qualifies for a Co | hat percentage of your total sales of equipment in ComEd's service territory (in terms of dollars) mEd Smart Ideas incentive? |
|---------------------------------------|---|
| O Don't know | % |
| Of the equipmen from ComEd? | t that qualifies for a ComEd incentive, for what percentage do customers receive an incentive |
| O Don't know | % |

We found that TAs had a hard time answering the first question as it was asking them to isolate a part of their installations that they do not intuitively consider a defined category. While evaluators assessing spillover tend to think about installations as being eligible or ineligible for an incentive, contractors do not. The second question turned out to be difficult to answer because it asked for a percentage of a percentage, which requires respondents to perform instantaneous calculations, if they think about installations in terms of units or jobs, rather than percentages. For example, if a contractor does 10 jobs in a year, of which 5 are high efficiency and 2 received an incentive, the response to the first question should be 50% (5/10) while the response to the second question should be 40% (2/5). However, we either received an incorrect response of 20% (2 out of 10 jobs received an incentive) for the second question, or the respondent commented on the difficulty to do the math on the spot. An additional drawback of this question design was that we had no way of checking the validity based on the two responses. Because there are no invalid answers, we could not apply consistency checks or follow up with another question to confirm the response.

The final design of the questions to determine the share of high efficiency installations that did not receive an incentive incorporated the following changes (see Figure 3b):

- We asked respondents to think about all of their installations together and divide them into three categories (standard efficiency, high efficiency with incentive, and high efficiency without incentive). This framed the question in terms of the contractor's total work, which provided a better basis for providing percentages for specific categories of installations. With this question design, the respondents also know that the three categories should add up to account for all of their installations, which helps them think about assigning projects to the different categories. In addition, this design provided us with a way to prompt the respondent for a new answer (or a clarification), if the responses were not internally consistent, i.e., they did not add up to 100%.
- 2. We changed the wording from "sales" to "installations." Some of the respondents were also lighting distributors, and we did not want them to think about their lighting sales.

Figure 3b. Revised Question: Share of High Efficiency Installations That Received an Incentive

| Approximately what percentage of your total equipment | installations (in ter | ms of | dollars) was. | (Please provide |
|---|-----------------------|-------|---------------|-----------------|
| your best estimate, if unsure of exact percentages.) | Percentado | | Don't Know | |
| your best estimate, if unsure of exact percentages.) Standard Efficiency | Percentage | % | Don't Know | |
| your best estimate, if unsure of exact percentages.) Standard Efficiency High Efficiency - that DID RECEIVE an incentive from ComEd | Percentage | % | Don't Know | |

Conclusions of Cognitive Interviews

In conclusion, evaluators should ask questions in a way that matches how respondents think about a concept, rather than how the responses best fit into an algorithm or what might make sense to us as evaluators. If possible, questions should be asked in a way that enables trouble-shooting responses – preferably in a way that allows us to apply an in-survey consistency check in form of a follow-up question, but at a minimum in a way that allows us to spot questionable responses during the analysis phase.

Conclusion

The 2015 ComEd spillover study included an assessment of various sources of spillover associated with ComEd's C&I portfolio of energy efficiency programs. The study also included two unique aspects related to study and research planning, discussed in this paper: 1) development of a spillover logic model to identify potential sources of spillover and prioritize research efforts and 2) cognitive interviewing of TAs to assess respondents' understanding of key survey questions and minimize measurement error. These two activities provided valuable upfront insights and helped maximize the value and validity of our research and results.

References

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