OPA MF 2009 Interim Report

Prepared for
Ontario Power Authority

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Executive Summary

The Ontario Power Authority’s (OPA) 2009-2010 cross-cutting multifamily buildings retrofit initiative consisted of four delivery agents and programs:

- The Better Buildings Partnership (BPP), delivered by the City of Toronto.
- The Multifamily Energy Efficiency Rebates Program (MEER), delivered throughout Ontario by GreenSaver, a nonprofit organization.
- The Electricity Retrofit Incentives Program (ERIP), delivered throughout the province by local distribution companies (LDCs).
- The Building Incentive Program (BIP), run by Toronto Hydro.

This interim evaluation report concentrates on only the 2009 projects, and the final two-year evaluation results will be available in June of 2011. The evaluation objectives were threefold:

1. Determine verified energy and demand savings.
2. Follow up and assess the implementation of 2008 program evaluation recommendations, and identify opportunities for further program improvements.
3. Review and compare key program elements and delivery/results across all four program streams and building sectors.

This study consisted of an impact and a process evaluation as well as several ancillary studies, including an assessment of “green jobs” created and a review of the initiative’s tenant education component (though virtually no residential education activity was observed for 2009).

Impact Evaluation Results

The impact evaluation consisted of a paper review and site visits of a sample of the 395 total projects reported, measure-level load shape creation and analysis, determination of program level realization rates to extrapolate sample verification to the population, and a net-to-gross analysis. These activities produced energy and demand savings values for each stream and the program overall.

Table 1 shows the reported and verified energy savings values evaluated in the impact evaluation. Realization rates were calculated for each stream which ranged from 81% to 151%, with a weighted overall average of 98%. The number of projects (N) is also listed, showing the relative impact of the realization rate on the total projects. For example, ERIP has nearly two-thirds of the projects but had the lowest realization rate, whereas the realization rate of Toronto Hydro is 151% but only accounts for 63 projects.

<table>
<thead>
<tr>
<th>Stream</th>
<th>Verified (kWh)</th>
<th>Reported (kWh)</th>
<th>Realization Rate</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>211,311</td>
<td>210,008</td>
<td>101%</td>
<td>90</td>
</tr>
<tr>
<td>ERIP</td>
<td>224,557</td>
<td>276,449</td>
<td>81%</td>
<td>224</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>109,477</td>
<td>120,056</td>
<td>91%</td>
<td>18</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>455,419</td>
<td>301,819</td>
<td>151%</td>
<td>63</td>
</tr>
<tr>
<td>Weighted Realization Rate</td>
<td></td>
<td></td>
<td>98%</td>
<td>395</td>
</tr>
</tbody>
</table>

Table 1. Stream Level Energy Realization Rates
Table 2 shows the reported and gross verified energy savings in GWh. The summer peak SESP is the seasonal energy savings pattern that has been determined by weighting the various technology and stream specific SESPs. The reported and verified summer peak demand is shown in Table 2 using the following equation:

\[ \text{Summer Peak kW Savings} = (\text{SESP}) \times (\text{Total Verified kWh}) / (522 \text{ hrs}) \]

Table 2. Verification Results MW

<table>
<thead>
<tr>
<th>Stream</th>
<th>Reported Consumption Savings (GWh)</th>
<th>Summer Peak SESP %</th>
<th>Average Summer Peak Demand (MW)</th>
<th>Gross Verified Consumption Savings (GWh)</th>
<th>Summer Peak SESP %</th>
<th>Average Summer Peak Demand (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>12.94</td>
<td>7.18%</td>
<td>1.78</td>
<td>13.02</td>
<td>7.18%</td>
<td>1.79</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>1.75</td>
<td>9.59%</td>
<td>0.32</td>
<td>1.60</td>
<td>9.59%</td>
<td>0.29</td>
</tr>
<tr>
<td>ERIP</td>
<td>35.50</td>
<td>5.12%</td>
<td>3.48</td>
<td>28.84</td>
<td>5.12%</td>
<td>2.83</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>8.51</td>
<td>2.64%</td>
<td>0.43</td>
<td>12.84</td>
<td>2.64%</td>
<td>0.65</td>
</tr>
<tr>
<td>All</td>
<td>58.71</td>
<td>4.81%</td>
<td>6.01</td>
<td>57.49</td>
<td>4.81%</td>
<td>5.56</td>
</tr>
</tbody>
</table>

Table 3 below shows the freeridership scores obtained during the participant surveys, and the corresponding net-to-gross (NTG). The verified gross savings is adjusted to take NTG into account to correctly calculate the amount of savings that is attributable to the program. Table 1 shows that overall freeridership was 23 percent, and therefore the NTG was 77 percent.

Table 3. Freeridership and NTG Ratios

<table>
<thead>
<tr>
<th>Stream</th>
<th>Freeridership</th>
<th>Net-to-Gross</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>0.30</td>
<td>0.70</td>
</tr>
<tr>
<td>ERIP</td>
<td>0.17</td>
<td>0.83</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>0.18</td>
<td>0.82</td>
</tr>
<tr>
<td>All</td>
<td>0.23</td>
<td>0.77</td>
</tr>
</tbody>
</table>

Table 4 provides a summary of all impact activities and results. The table is broken into two sections, energy and demand. For energy, the reported savings are adjusted by the realization rate that was determined by the paper review and site visits to determine criteria such as installation and eligibility rates, which yields the gross verified energy savings. The NTG ratio is then applied to derive the net energy. Demand is calculated in a similar fashion, with the exception of instead of using a realization rate, the peak summer demand was calculated by creating load shapes and determining what percentage of load occurred during the peak. Savings results for the 2009 program year were 44.27 GWh and a 4.28 MW reduction in demand during the summer peak. The largest contributor to the overall savings was ERIP. Though Toronto Hydro had the second highest energy savings, it resulted in much less demand savings due to savings occurring primarily off peak.

\[1\] The 522 hours in the formula above is the number of hours that occur each year in the summer on-peak period.
Table 4. 2009 Program Year Multifamily Sector Savings Results

<table>
<thead>
<tr>
<th>Implementer</th>
<th>City of Toronto (BPP)</th>
<th>Toronto Hydro (BIP)</th>
<th>GreenSaver (MEER)</th>
<th>LDCs (ERIP)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Program Metric</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program Reported Energy Savings (GWh)</td>
<td>12.94</td>
<td>8.51</td>
<td>1.75</td>
<td>35.50</td>
<td>58.71</td>
</tr>
<tr>
<td>Energy Realization Rate (%)</td>
<td>101%</td>
<td>151%</td>
<td>91%</td>
<td>81%</td>
<td>98%</td>
</tr>
<tr>
<td>Gross Verified Energy Savings (GWh)</td>
<td>13.02</td>
<td>12.84</td>
<td>1.60</td>
<td>28.84</td>
<td>57.49</td>
</tr>
<tr>
<td>NTG Ratio (%)</td>
<td>70%</td>
<td>82%</td>
<td>100%</td>
<td>83%</td>
<td>77%</td>
</tr>
<tr>
<td>Net GWh savings</td>
<td>9.12</td>
<td>10.53</td>
<td>1.60</td>
<td>23.93</td>
<td>44.27</td>
</tr>
<tr>
<td><strong>Demand</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program Reported Summer Peak Demand (MW)</td>
<td>1.78</td>
<td>0.43</td>
<td>0.32</td>
<td>3.48</td>
<td>6.01</td>
</tr>
<tr>
<td>Gross Verified Summer Peak Demand (MW)</td>
<td>1.79</td>
<td>0.65</td>
<td>0.29</td>
<td>2.83</td>
<td>5.56</td>
</tr>
<tr>
<td>NTG Ratio (%)</td>
<td>70%</td>
<td>82%</td>
<td>100%</td>
<td>83%</td>
<td>77%</td>
</tr>
<tr>
<td>Net MW savings</td>
<td>1.25</td>
<td>0.53</td>
<td>0.29</td>
<td>2.35</td>
<td>4.28</td>
</tr>
</tbody>
</table>

**Process Evaluation Results**

The process evaluation consisted of participant, active nonparticipant, and true nonparticipant surveys and interviews with program implementer staff, OPA staff, and contractors. The process evaluation sought to:

1. Evaluate the effectiveness of the various approaches to program implementation;
2. Document which activities and methods were effective and identify areas of improvement;
3. Determine how to increase efficiency from the program implementer perspective; and
4. Determine participant program satisfaction.

The process evaluation approach is summarized in Figure 1 below.

**Figure 1. Process Evaluation Approach**

- Development of Participant survey instrument by Stream
- Research Canadian survey firms to field telephone surveys
- Surveys conducted
- Net to Gross Analysis
- Net to Gross Findings reported
- Data Analysis
- 2009 Report
We successfully surveyed 68 individual participants that spoke for 170 of the projects (many participants had several project applications) therefore exceeding our goal. 57 nonparticipants were contacted, falling short of our goal for nonparticipants largely due to difficulties encountered with obtaining nonparticipant contact information.

Program process flows were analyzed for each program stream to highlight similarities and differences, to analyze the approval process, and determine program structure. Rather than a common set of procedures and a common organizational structure, we found that each implementer developed their own unique approach to the program, and each was successful in their own way. Given the varying size and infrastructure of LDCs, it is entirely possible implementation of future programs will take many different organizational forms.

There were no obvious relationships between participant satisfaction or program stream success and process flows, but there were clear differences between the process flows themselves. Each organization emphasized different aspects of the program flows, despite the many similarities in the overall procedures of accepting applications, vetting them, and disbursing funds for payment.

Several program implementers were interviewed and the following topics were explored in detail:

- What implementers thought worked well.
- What program aspects could be improved.
- How data were tracked, including nonparticipant information.
- Whether implementers had dedicated sales staff.
- Were channel partners engaged by the implementers, and was program training provided.
- Were customers asking for measures not currently included in the suite of offerings.

Overall, program participants and nonparticipants were satisfied with the program across all streams and would recommend the program to others. The majority of respondents participated with a desire to save money or electricity. Program influence on installing energy efficient measures was reported as 63 percent being very influential, including a portion of participants that were sufficiently enticed to install additional measures on their own without an incentive. Overall awareness of OPA and program offerings was limited-to-low among participants, especially among ERIP and Greensaver customers. However, participants were much more familiar with the program implementers and just below two-thirds of ERIP and Toronto Hydro participants claimed to be very satisfied with the implementer interaction.

Nonparticipant surveys were tailored to understand why they did not participate. Answers included:

- The application was too complicated or had too many questions.
- Thought the program was terminated.
- Did not know about the program.
- The project was in progress or they were working to fill out the paperwork.
- Other, higher-priority projects needed to be completed.
A marketing analysis was performed on marketing documentation and advertising, interviews, surveys, and other available metrics. Findings included: levels of market confusion, market characteristics influenced success strategies, service and education-intensive efforts drive participation, trade-associated word-of-mouth drives participation, and OPA support impacts LDC performance.

**Program Comprehensiveness Results**

Program comprehensiveness is defined as the entire program’s overall mix of different measure types, so therefore the comprehensiveness can be examined by reviewing the measures installed in program year 2009. Figure 2 below shows the proportions of measure type for all measures installed in 2009. Notice that over three-quarters of the total measures installed are lighting.

![Figure 2. Breakdown of All 2009 Measures by Type](image)

Across all program streams, lighting measures comprised the largest majority of 2009 projects. It should be noted the “General Mechanical” category included measures such as electric heating replacements. The “Other” category included measures not clearly identified in the respective program stream databases and not included in our sample audit.

Table 5 presents the relative prevalence of measure types varying by stream. For example, the relative prevalence of lighting measures varied from only 53 percent for GreenSaver to 90 percent for Toronto Hydro.
**Table 5. 2009 Measure Types by Program Stream**

<table>
<thead>
<tr>
<th>Measure Type</th>
<th>City of Toronto</th>
<th>ERIP</th>
<th>GreenSaver</th>
<th>Toronto Hydro</th>
<th>All Streams</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Qty</td>
<td>%</td>
<td>Qty</td>
<td>%</td>
<td>Qty</td>
</tr>
<tr>
<td>Lighting Measure</td>
<td>77</td>
<td>59%</td>
<td>196</td>
<td>86%</td>
<td>10</td>
</tr>
<tr>
<td>Variable Frequency Drive</td>
<td>34</td>
<td>26%</td>
<td>1</td>
<td>0%</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>1%</td>
<td>26</td>
<td>11%</td>
<td>0%</td>
</tr>
<tr>
<td>Chiller Retrofit</td>
<td>6</td>
<td>5%</td>
<td>2</td>
<td>1%</td>
<td>5</td>
</tr>
<tr>
<td>CO Control</td>
<td>8</td>
<td>6%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>General Mechanical</td>
<td>4</td>
<td>3%</td>
<td>2</td>
<td>1%</td>
<td>1</td>
</tr>
<tr>
<td>Energy Star Appliances</td>
<td>0</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>3</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>130</td>
<td></td>
<td>227</td>
<td></td>
<td>19</td>
</tr>
</tbody>
</table>

**Green Jobs Creation**

Seventeen out of thirty-six identified contractors were interviewed to obtain information about job creation and retention. It was determined that the 2009 multifamily initiatives retained or created a total of 64 jobs. Field staff tended to fall into one of two categories, depending on the nature of the business: auditor/energy-efficiency professional or general contractor. Firms hiring the former cited higher full-time employee costs (generally around $400,000), as these employees were more experienced, trained, and generally required capital investments, such as offices and trucks.

Firms hiring the latter generally cited lower full-time employee costs (generally around $100,000), as these individuals tended to be younger and paid less. Table 6 shows costs per full-time employee, jobs created per program stream, and total job creation estimate. The average FTE cost estimate was derived by averaging the responses of the respondents who felt comfortable providing an estimate.

**Table 6. Total Jobs Created**

<table>
<thead>
<tr>
<th>Total 2009 Project Cost (By Program Stream)</th>
<th>Average FTE Cost Estimate</th>
<th>Estimated Jobs Created by Each Stream in 2009</th>
<th>Total Jobs Created by 2009 OPA MF Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>$ 4,794,057</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GreenSaver</td>
<td>$ 1,998,226</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERIP</td>
<td>$ 3,914,210</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>$ 4,206,745</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$ 233,333(^2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Findings and Recommendations**

Broad evaluation findings and recommendations are presented here for the programs and the evaluation.

**Program Findings and Recommendations:**

- There must to be common assumptions throughout the programs, such as consistent deemed savings for prescriptive measures and a specified peak kW definition.

---

\(^2\) One contractor mentioned the general rule for his company was: project work equaled 2.2 times a perspective employee’s salary, before hiring them.
Implementers and OPA do not necessarily have a consistent, common definition about demand definitions, and this creates inconsistent reporting across streams.

- The current incentive structure favors quick, walk-through audits and lighting only projects. The incentive structure should be changed to foster non-lighting measures. This method of auditing and project planning do not lend themselves to more comprehensive project types as they stand now.

- Recordkeeping should be re-worked for consistency and completeness. Project costs, contact information, incremental costs, measure level information, installer and contractor information were not consistent or present in all of the streams.

- The new database, Icon, should have a field that distinguishes the number of buildings in each project application. Project contact information, savings reported, project costs, and measure information should be mandatory in project tracking databases, as it is essential for rigorous evaluation and proper long-term record keeping.

- Property management firms should be targeted. One property management firm fully utilized the program across the province. Further effort should be taken to understand why this particular property management firm understood and participated in the program to the extent they did, and how OPA can entice others to participate.

**Evaluation Findings and Recommendations:**

- Each program database was very different in content and format and thus created barriers to a clear understanding of claimed savings. Therefore, recordkeeping should be re-worked for consistency and completeness. Project costs, contact information, incremental costs, measure level information, installer and contractor information were not consistent or present in all of the streams.

- Implementers and OPA do not necessarily have a consistent, common definition about demand, which was a hindrance in the evaluation. Clear definitions will help LDCs understand how to meet savings goals in the coming year’s programs.

- Many project applications ended up having several buildings worth of projects, sometimes with different measures. Explicit statement of number of locations and measure types and counts would enable more precise assessment.

- Implementers should be brought into the evaluation process earlier and in a transparent way. This could foster more streamlined communication and relationships that will aid in gathering information for the evaluation and may also help the implementers feel more involved.
1. Introduction and Background

This report presents interim results, focusing only on the 2009 program year, of a two-year evaluation of the multifamily buildings retrofit initiative developed by the Ontario Power Authority (OPA). The final report, encompassing the 2009–2010 period, will be completed in June 2011. The evaluation is termed cross-cutting as the multifamily sector has been targeted through several delivery agents and programs, including:

- The Better Buildings Partnership (BPP), delivered by the City of Toronto.
- The Multifamily Energy Efficiency Rebates Program (MEER), delivered throughout Ontario by GreenSaver, a nonprofit organization.
- The Electricity Retrofit Incentives Program (ERIP), delivered throughout the province by local distribution companies (LDCs).
- The Building Incentive Program (BIP), run by Toronto Hydro.

The 2009–2010 evaluation goals and objectives are:

4. Determine verified energy and demand savings, with a high degree of confidence, for four levels:
   a. Program streams.
   b. Building sectors (i.e., private sector vs. assisted/social housing).
   c. Project type (i.e., prescriptive vs. custom).
   d. Measure type.

5. Follow up and assess the implementation of 2008 program evaluation recommendations, and identify opportunities for further program improvements.

6. Review and compare key program elements and delivery/results across all four program streams and building sectors.

This evaluation consisted of an impact and a process evaluation as well as several ancillary studies, including an assessment of “green jobs” created and a review of the initiative’s tenant education component.

The impact evaluation was a multistage effort, which included: document and assumption review; site visit verification of a sample of buildings within each delivery agent’s territory; the development of realization rates for the verification sample; and calculation of program energy savings using those realization rates. Demand savings were calculated independently for the population using seasonal energy savings patterns (SESPs). Net savings were estimated using a freeridership ratio derived from participant self-reports, and were applied to both energy and demand gross estimates.

The process evaluation examined: how the initiative was implemented by various delivery agents; what worked well and what was less affective; how the initiative was managed at OPA; and program perspectives by multifamily participants and various nonparticipant populations. Marketing and outreach efforts were also reviewed.
1.1. Program Purpose
The multifamily buildings initiative targets building owners, building managers, building operators, housing providers, and condominium corporations throughout Ontario with buildings having six or more units.

The OPA Multifamily initiative provides incentives to qualified multifamily building owners for installing energy-efficiency retrofit measures. These measures include:

- Energy-efficient lighting
- Heating and ventilation
- Air conditioning improvements
- Electric motors and transformers
- Building control improvements
- Recommissioning
- Appliance replacements (refrigerators, washing machines, etc.)
- Building envelope upgrades (insulation, caulking, weather stripping, windows, etc.)

Incentives are offered on both a prescriptive and a custom basis. The prescriptive basis applies to a list of predefined measures for which specific incentives are offered. For custom measures, a fixed incentive is offered on either a per kW or per kWh basis. Per unit assumptions developed by the OPA were reviewed as a program objective.

The multifamily buildings program was designed to be a comprehensive, whole building approach, providing financial incentives, technical assistance, project facilitation, education, and integration with other energy programs.3

1.2. Program Goals
The OPA’s strategic objective has been: “execute on prioritized conservation initiatives, build capabilities across all sectors, and advance a sustained conservation culture.” The Multifamily Building Program4 objectives include:

- Raise energy awareness levels through education.
- By 2010, reduce the multifamily building sector’s summer peak electricity demand by at least 100 MW, and overall energy consumption by 385 GWh/yr.
- Notably reduce energy burdens imposed on low-income residents and their housing providers, and/or building owners, managers, and operators.

4 OPA Website. March 5, 2009. OPA Initiatives/2008 Housing Initiatives: http://www.powerauthority.on.ca/Page.asp?PageID=751&ContentID=&SiteNodeID=406&BL_ExpandID=96 Also found in the Multifamily Buildings Program concept
• Promote sustainable, comprehensive, “building as a system” energy management initiatives, in which buildings are regarded as an integrated whole, with interactions among energy-efficient measures within a project affecting a building’s overall energy-efficiency performance.

• Integrate multifamily building conservation projects with other OPA initiatives; for example: OPA demand response, distributed generation, and renewable energy.

• Promote a conservation culture within the multifamily sector.

This report has been broken into the following chapters:

Chapter 2 describes the impact evaluation, and estimation of gross and net energy and demand savings for the 2009 multifamily sector.

Chapter 3 describes the process evaluation and assessment of marketing and outreach.

Chapter 4 examines program comprehensiveness.

Chapter 5 summarizes program and evaluation conclusions and recommendations.

Each chapter examines methodology, results, and analysis of conclusions and recommendations. Appendices provide greater detail on analysis and materials used for the evaluation.
2. Impact Evaluation

For reporting the program’s 2009 net energy and demand savings, we sampled projects in each program stream to develop realization rates. These realization rates were derived from the ratio between our verified energy savings and savings reported under the program. They have been used to extrapolate our sample findings across the 2009 program project portfolio.

To develop realization rates based on our sample audits, we employed the following, two-step approach.

First, verified savings were calculated at the project level by:

- Reviewing databases provided for each of the four program streams.
- Selecting a sample set for each program stream.
- Conducting verification audits of the sample facilities, including a paper review of project documentation and on-site visits.
- Calculating verified savings for the sample facilities.

Second, a high-level analysis was conducted, aggregating our results by subsector for each program stream to calculate savings-weighted realization rates and average summer peak demand values.

The following subsections explain our methodology and analytical results.

2.1. Impact Sampling Approach

To accurately reflect a representative sample of the project population, the following criteria were utilized to create a stratified sample:

- Program stream
- Building sector (private vs. social)
- Project type (prescriptive vs. custom)
- Measure type (lighting vs. other)

Site visits and paper reviews were conducted for a total number of projects, seeking to yield a 90 percent confidence and 15 percent precision (90/15) within each four streams by project, thereby achieving a confidence and precision level well above 90/10 for the overall program. This sampling methodology was applied to the projects’ original population; thus, the numbers sampled reflected the old population value. After all verification activities were completed, additional projects were added to the 2009 program year and were therefore not included in the sampling methodology.

Consequently, the number of projects sampled for each stream may have been less than 90/15, though overall program sampling was still greater than 90/10. For example, 90/10 on 395 projects is only 58. Note that the confidence and precision of the program savings is presented in section 2.5.4.
Table 1 below shows: the total number of projects for each program stream; the number sampled in each stream; and the stratification of sampled projects between building sector, project type, and measure type. Note that some projects had multiple elements, such as one project having prescriptive and custom measures; thus total projects in a given strata may be more than the sample total.

Table 1. Sample Stratification Methodology

<table>
<thead>
<tr>
<th></th>
<th>City of Toronto</th>
<th>GreenSaver</th>
<th>ERIP</th>
<th>Toronto Hydro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Sample</td>
<td>105</td>
<td>28</td>
<td>19</td>
<td>12</td>
</tr>
<tr>
<td>Social</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Private</td>
<td>99</td>
<td>23</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>Prescriptive</td>
<td>5</td>
<td>2</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Custom</td>
<td>100</td>
<td>26</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Lighting</td>
<td>65</td>
<td>12</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Other</td>
<td>40</td>
<td>16</td>
<td>9</td>
<td>7</td>
</tr>
</tbody>
</table>

2.2. Paper Review

2.2.1. Methodology

This evaluation task consisted of a remote, desktop review of transaction-level program information, obtained from program managers at the implementing organizations.

Two types of program information were received for this task: program data in the form of Excel spreadsheets; and scanned or hardcopy application and payment request file information.

Each program stream had its own database for storing project information, such as building addresses, installed retrofit measures, and reported demand (kW) and consumption (kWh) savings.

Information was obtained from the following sources:

- City of Toronto: Directly from the City of Toronto
- GreenSaver: Directly from GreenSaver
- ERIP: Aggregated database and application information through the OPA
- Toronto Hydro: Directly through Toronto Hydro

Given differing datasets and data structures, we had to undertake extensive data conditioning to develop a single and consistent dataset for all four program streams. This included: defining appropriate database keys for the program data hierarchy (program, application, project, building, measure, etc.); developing consistent nomenclature for project phases; formatting data types; and migrating data from one format into the common format.

We compared application and payment request information against a checklist of audit criteria, as follows:
• Applican eligibility: deals with all aspects of applicant eligibility, including that the applicant must be the owner or renter of the multifamily facility.

• Building eligibility: deals with the nature of the building where the project takes place, in the context of this program: a multifamily building with six or more units.

• Project eligibility: deals with the nature of the measures proposed, which must be in accordance with published program criteria.

• Preapproval: deals with whether or not there appropriate evidence of project preapproval exists in the file, a program prerequisite for the custom streams.

• Financial Eligibility: deals with whether or not invoices provided by the proponent support incentive claims from the perspectives of amount, description, and timing.

The information was then compiled to identify issues and trends.

2.2.2. Results
Table 2 presents detailed results of the paper-based review, per various eligibility criteria. Each project was reviewed to determine whether it met various eligibility criteria, as stated in the program documentation. For each sample project file, several criteria may have been applicable. The table below shows the total number of criteria applicable for each of four criteria types (applicant eligibility, building eligibility, project eligibility, and preapproval). The table summarizes total criteria across all sampled projects in each program stream. For example, each City of Toronto project had one applicant eligibility criteria and four building eligibility criteria.

**Table 2. Eligibility Audit Results—Sampled Projects**

<table>
<thead>
<tr>
<th>Criteria Type</th>
<th>Program Stream</th>
<th>Total Criteria</th>
<th>Criteria Met</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applicant Eligibility Criteria</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>71</td>
<td>70</td>
<td>99%</td>
</tr>
<tr>
<td>City of Toronto</td>
<td></td>
<td>21</td>
<td>20</td>
<td>95%</td>
</tr>
<tr>
<td>ERIP</td>
<td></td>
<td>23</td>
<td>23</td>
<td>100%</td>
</tr>
<tr>
<td>GreenSaver</td>
<td></td>
<td>9</td>
<td>9</td>
<td>100%</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td></td>
<td>18</td>
<td>18</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Building Eligibility Criteria</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>152</td>
<td>152</td>
<td>100%</td>
</tr>
<tr>
<td>City of Toronto</td>
<td></td>
<td>84</td>
<td>84</td>
<td>100%</td>
</tr>
<tr>
<td>ERIP</td>
<td></td>
<td>23</td>
<td>23</td>
<td>100%</td>
</tr>
<tr>
<td>GreenSaver</td>
<td></td>
<td>27</td>
<td>27</td>
<td>100%</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td></td>
<td>18</td>
<td>18</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Project Eligibility Criteria</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>142</td>
<td>139</td>
<td>98%</td>
</tr>
<tr>
<td>City of Toronto</td>
<td></td>
<td>42</td>
<td>41</td>
<td>98%</td>
</tr>
<tr>
<td>ERIP</td>
<td></td>
<td>46</td>
<td>45</td>
<td>98%</td>
</tr>
<tr>
<td>GreenSaver</td>
<td></td>
<td>18</td>
<td>18</td>
<td>100%</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td></td>
<td>36</td>
<td>35</td>
<td>97%</td>
</tr>
<tr>
<td>Criteria Type</td>
<td>Program Stream</td>
<td>Total Criteria</td>
<td>Criteria Met</td>
<td>Percentage</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------</td>
<td>----------------</td>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>Pre-Approval Criteria</td>
<td>Total</td>
<td>89</td>
<td>59</td>
<td>66%</td>
</tr>
<tr>
<td></td>
<td>City of Toronto</td>
<td>21</td>
<td>15</td>
<td>71%</td>
</tr>
<tr>
<td></td>
<td>ERIP</td>
<td>23</td>
<td>23</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>GreenSaver</td>
<td>9</td>
<td>9</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Toronto Hydro</td>
<td>36</td>
<td>12</td>
<td>33%</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td>454</td>
<td>420</td>
<td>93%</td>
</tr>
</tbody>
</table>

As shown in the grand total, 454 individual stated program criteria were evaluated for the sample projects; of these, 420 (93 percent) were determined to have met eligibility requirements. This is a strong overall percentage indicating a generally good level of oversight and review for program eligibility and preapproval criteria.

**Figure 1. Overall Criteria by Program Manager**

As shown in Figure 1, both GreenSaver and ERIP were particularly effective at screening applications for program criteria, while the City of Toronto and Toronto Hydro had a number of applications where criteria were not met. Per Table 2, preapproval criteria were the ones these
organizations most often failed to meet: only 33 percent of Toronto Hydro projects and 71 percent of City of Toronto projects met the preapproval criteria.

**Review of Financial Information in Support of Application**

The review sought to determine if eligible costs were reported accurately by participants, and if the programs adequately screened for these criteria. This had a bearing on preapproval screening (given invoice dates), and could also affect the incentive payable, if these were tied to eligible costs. We reviewed all information in support of eligible costs, and found all but four projects had invoices matching claimed eligible amounts.

In the four projects where discrepancies were found, causes related to projects where invoices covered a broader project scope than the incentive was actually based on. For example, a project may have involved a major renovation of a property, a small portion of which was retrofitting energy-efficient lighting. This lighting work would have been invoiced as only a small fraction of the overall total project invoices. As the applicant only applied for an incentive for lighting measures, the invoices received for review appeared to be disconnected from the incentive amount, but, on further review, were acceptable.

**2.2.3. Discussion and Recommendations**

This discussion is presented from two perspectives: discussion of the evaluation results, and discussion of issues relating to the evaluation itself.

**Discussion of Review Result**

Overall oversight appeared to be effective for both ERIP and GreenSaver.

Each of the four programs had preapproval requirements, particularly for their custom streams. A project preapproval mechanism typically is placed to lower freeridership risks, as applicants not preapproved may have started project work before learning about the program, and would therefore not be eligible to receive funding. Thus, for a program’s overall net performance, it was important for preapproval to be enforced without exception by program staff. If valid reasons occurred to waive preapproval, they should be clarified and stated in the program documentation.

The preapproval requirement had to be reviewed with staff from both the City of Toronto and Toronto Hydro to ensure: conditions were being met; documentation demonstrating criteria were met was in the files; and adequate oversight was in place to ensure program procedures were being followed. Generally, our review showed most lapses in preapproval conditions resulted from a lack of preapproval documentation in the file, as evidence existed preapprovals were actually obtained, but preapproval letters were absent. This particularly should be reviewed with staff during overall review of the preapproval requirements.

With respect to financial information supporting the incentive applications, results indicated there were no systematic problems. However, given several instances indicating the invoice review process lacked rigor, we recommend reminding program account representatives to thoroughly question the presentation of invoices and to request supporting documentation, enabling a clear understanding, and to trace which specific, eligible cost items related to the incentive—particularly where incentives were only a fraction of the overall retrofit project.
Discussion of Evaluation-Related Issues
Two issues affected our ability to conduct the paper-based review and, ultimately, the availability and usability of information:

- Access and coordination of information; and
- Database issues.

Access and Coordination of Information
Access to program document and database information was relatively straightforward for information relating to the City of Toronto, Toronto Hydro, and GreenSaver. Challenges encountered were typical of any project’s data acquisition phase. However, receiving and coordinating information from the participating ERIP LDC’s proved particularly challenging. The challenges mostly related to lead times required by the LDCs, and the availability of their staff to fulfill information requests. In these two areas, the LDCs’ ability to respond was significantly out of step with the evaluation timetable. Although LDC staff were courteous, helpful, and aware of our task as evaluators, they were preoccupied with other issues and priorities taking precedence over providing evaluation information.

We recommend future evaluations provide sufficient advance notice to the LDCs regarding specific information requirements, and an adequate evaluation timetable be allowed for the significant coordination required to receive information from the LDCs.

Program Database Issues
Each four program database was unique in design. From an evaluation perspective, this gave rise to a number of challenges:

- Information consistency. Each database stored and tracked different information types and details. For example, only two program streams tracked whether a building was considered social housing or not (City of Toronto and GreenSaver). Databases had different ways of tracking project status and used differing nomenclature.

- Structure. In many cases, database records contained several measures (e.g., a lighting retrofit and a CO control measure for the same building). For the City of Toronto, savings were reported individually for each measure; for the other three program streams, savings were only reported on an individual record basis. As we were interested in comparing similar measures, we eventually had to break each database record into separate measures. These issues were also present regarding multiple buildings entries under one application record.

- Completeness. In many cases, database records were incomplete. Some database records missed reported kWh or reported kW values. To fill these data gaps, we had to request more information from program managers. Ultimately, due to the compressed evaluation timetable, we were not able to fill all data gaps.

Reconciling four databases with differing structures, nomenclature, and content required extensive time and resources. This suggests OPA could improve data reporting requirements and achieve significant savings in future evaluations by standardizing these elements. This could be
done by developing a specification or by providing direct guidance for program managers on
database structure, nomenclature, and data entry/quality control; so data integrity would be
possible across programs. This would best be implemented during program design, when logic
models, results-based management frameworks, and performance indicators are developed.
Further, during program initiation, database requirements and data handling procedures should
be of foremost concern.

A full suite of recommendations for this area is beyond the present evaluation’s scope. However,
all standard information technology best practices relating to database design and
implementation apply to data involved in managing and evaluating these four programs.

2.3. Site Visits

2.3.1. Methodology
For this task, sample sites were visited to verify information in the files and to collect additional
site-specific information. We built on information obtained in the paper-based review described
in Section 2.2, first conducting a general document review. This began by examining the
following background information:

- Application materials and proof of payment evidence;
- Details on the project scope;
- Equipment performance specifications;
- Savings calculations; and
- Project evaluator review documentation.

This information was used two ways:

1. To develop an understanding of how applicants performed their savings calculation, and
   how project evaluators reviewed these calculations. This involved reviewing engineering
   principles applied, assumptions made, and whether significant interactive effects were
   accounted for.

2. To support our independent savings calculation.

We then visited each sample project facility to collect or verify site-specific information, such as
counts of installed measures, the nature of the installed measures, and basic facility information.
While on site, we confirmed the nature of the facility itself was as claimed in the application, that
the base-case scenario was appropriate and possible, and equipment was installed as claimed. We
also looked for specific site conditions that could affect the program’s prescriptive or custom
input assumptions, such as:

- Equipment models and capacities;
- Installation rates;
- Operating schedules;
- Operational issues; and
- Potential interactive effects.
Site visit scheduling was conducted in two steps. Program managers first notified selected sites of the audit using a form letter, explaining the audit’s purpose, timing, and objectives, and introducing the evaluation team. The evaluation team followed-up directly with the site authority to confirm audit requirements and timings, and issued a more detailed letter, presenting our site visit’s purpose and requirements.

### 2.3.2. Results

This task sought to review whether measures were implemented on-site, as claimed in the application. Table 3 presents the total number of individual project measures for sample projects. In this context, for example, a measure would be considered a type of lighting or type of motor installation. The table also presents the number of measures inspected on-site and found to be accurate in terms of total measures unit counts installed through the measure. For example, a single lighting measure might include installation of 100 CFL lighting units.

**Table 3. Reported and Verified Measure Counts by Program Stream**

<table>
<thead>
<tr>
<th>Program Stream</th>
<th>Total Measures</th>
<th>Measures With Correct Counts</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>41</td>
<td>41</td>
<td>100%</td>
</tr>
<tr>
<td>ERIP</td>
<td>38</td>
<td>32</td>
<td>84%</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>22</td>
<td>19</td>
<td>86%</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>23</td>
<td>23</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>124</strong></td>
<td><strong>115</strong></td>
<td><strong>92%</strong></td>
</tr>
</tbody>
</table>

Table 4 presents details on installed measure unit counts for the nine sampled projects where the counts were inaccurate. The table shows the reported count of a given measure unit (a light bulb, for example) versus counts verified in our site audit as well as the absolute differences between the two; this difference is expressed as a percentage.

**Table 4: Magnitude of Count Differences**

<table>
<thead>
<tr>
<th>Application ID</th>
<th>Stream Name</th>
<th>Prescriptive</th>
<th>Reported Count</th>
<th>Verified Count</th>
<th>Count Difference</th>
<th>Verified Percent Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>509</td>
<td>ERIP</td>
<td>Yes</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>100.00%</td>
</tr>
<tr>
<td>CLR-0001-001-01</td>
<td>GreenSaver</td>
<td>Yes</td>
<td>12</td>
<td>1</td>
<td>11</td>
<td>91.67%</td>
</tr>
<tr>
<td>SNR-0006-014-01</td>
<td>GreenSaver</td>
<td>Yes</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>20.00%</td>
</tr>
<tr>
<td>SLR-0006-006-01</td>
<td>GreenSaver</td>
<td>Yes</td>
<td>2147</td>
<td>1782</td>
<td>365</td>
<td>17.00%</td>
</tr>
<tr>
<td>989</td>
<td>ERIP</td>
<td>Yes</td>
<td>3700</td>
<td>3500</td>
<td>200</td>
<td>5.41%</td>
</tr>
<tr>
<td>126</td>
<td>ERIP</td>
<td>Yes</td>
<td>4048</td>
<td>3950</td>
<td>98</td>
<td>2.42%</td>
</tr>
<tr>
<td>128</td>
<td>ERIP</td>
<td>Yes</td>
<td>1208</td>
<td>1180</td>
<td>28</td>
<td>2.32%</td>
</tr>
<tr>
<td>135</td>
<td>ERIP</td>
<td>Yes</td>
<td>2344</td>
<td>2295</td>
<td>49</td>
<td>2.09%</td>
</tr>
<tr>
<td>140</td>
<td>ERIP</td>
<td>Yes</td>
<td>3128</td>
<td>3100</td>
<td>28</td>
<td>0.90%</td>
</tr>
</tbody>
</table>

The table addresses several notable issues. First, all sample projects with inaccurate counts were prescriptive files. Second, most issues arose with installed lighting counts. For projects with smaller counts, issues related to the installed number of occupancy sensors.
The results for each of the site visits are included in a separate document to this report for confidentiality purposes.

### 2.3.3. Discussion and Recommendations

This discussion is presented from two perspectives: discussion of the evaluation results; and discussion of issues related to the evaluation itself.

#### Discussion of Review Results

Results of our site visits suggest measures for custom projects were usually installed as indicated in the application. The level of oversight and review rigor for these files has been met by current program practices.

For prescriptive projects, a relatively small proportion of sites had inaccurate counts (usually lighting); however, differences were fairly minor. Consequently, no major changes appear to be required, though programs continue to employ a post-installation inspection process using random file sampling.

#### Discussion of Issues Relating to the Evaluation

Three issues affected our ability to conduct the site visits:

- Access and coordination of information
- Tight timetable
- Perception of duplication

**Access and Coordination of Notification and Site Visit Scheduling**

Coordinating access to the sites, particularly for the seven LDC jurisdictions, proved challenging. Issues addressed included:

- Dealing with 10 separate program management authorities, through which we had to manage site information and notifications.
- Discovering late in the process that some sites were part of a coordinated application process by building owners with projects having several of the 10 program authorities, and a central participant coordinator having been assigned.
- Dealing with a regional coordinator for site scheduling and coordination for these projects.

All this led to some confusion and delays in scheduling site visits. In several instances, when we arrived on site, the site was not prepared to provide the required information.

To improve the process for 2010, additional time should be allotted for coordinating and scheduling site visits with multiple players involved in the multifamily portfolio. Further, additional time should be spent reviewing the various databases to better identify group accounts and their associated contacts.

**Tight Timetable**

The issues noted were greatly exacerbated by an audit timetable requiring the compressed schedule for the 2009 Evaluation, with some 80 sites visited within a 10-week window, from
start to finish. With greater advance warning for the 2010 Evaluation, many of the coordination issues noted should be avoidable or manageable.

**Perception of Duplication**

Our audit team encountered frustration from some program participants, who perceived the site visits as duplicating the project evaluators’ verification audits. This was particularly difficult for property managers of rental housing, where the Landlord and Tenant Act requires tenants be notified in advance of any requirement to enter individual suites.

Although both site visits may be necessary, it may also be helpful to better educate program participants on distinctions between the two and the different purposes they serve. It would also be beneficial for evaluators to access data to see which files have been the subject of a project evaluation visit; so attempts can be made to minimize duplication.

### 2.4. Measure-Level Load Shape Analysis

#### 2.4.1. Methodology

To accurately assess the savings’ impact on generation requirements, the OPA requires an understanding of the nature and shape of load profiles associated with equipment retrofitted within the multifamily building sector. Further, the load shape analysis will be needed to determine average summer peak savings achieved by the multifamily programs in 2009.

Research has been limited in this area, particularly within the Ontario market. The best way to truly understand the load profiles within the sector would be to undertake a comprehensive, physical measurement project across all building types and seasons. Where a retrofit has taken place, the metering effort would need to be doubled to examine pre- and post-retrofit load profiles. Metering is an expensive undertaking, and other significant barriers make it even more challenging in the multifamily sector; these include:

- Common area and residential areas being served from the same meter;
- Practical issues in submetering suites that have not been designed with submetering in mind; and
- Privacy concerns in obtaining metering data from tenants.

Consequently, the load profiles developed under this program result from engineering calculations informed by site visits, rather than metering. This process required us to make several assumptions, which are detailed in the measure-level sections, below.

Load profile analysis began with engineering calculations of energy savings achieved by a particular energy conservation measure. Load shapes were derived as follows:
We computed individual savings load shapes for all (approximately) 124 energy-conservation measures evaluated under this study. Many of these load shapes were similar (e.g., MURB parking garage lighting had the same load shape as MURB corridor lighting, as both space types operated 24 hours a day, all year long), while others were created specifically for a particular measure.

Where load shapes for a particular savings measure varied throughout the year, we created a different load shape for each season, using the seasons and time-of-use periods defined in the 2010 Quasi-Prescriptive document. When load shapes varied from day to day, we created unique load shapes for each different day. Thus, our load shapes represented an entire year of savings for each sampled measure. An example of typical seasonal chiller 24-hour savings load shapes is presented below.
Figure 2. Summer Savings Profile

![Figure 2. Summer Savings Profile](image1)

Figure 3. Shoulder Savings Profile

![Figure 3. Shoulder Savings Profile](image2)
In the case of chillers, the bulk of the energy savings occurred during summer, with some savings occurring in the shoulder seasons. No savings were recorded during winter, as the chiller would be turned off.

Load shapes developed for this study were designed as normalized load shapes, with the y-axis values recorded as a percentage of the verified connected demand savings for each particular measure.

Through our sampled projects, we identified six measure types, each with associated load shapes. For ENERGY STAR appliances and General Mechanical measures, we assumed energy savings occurred equally during all hours of the year. While making a gross simplification, we did not feel making further assumptions for these measures was warranted. For the remaining four measure types, the assumptions and basis for these load shape types are described below.

**Lighting**

Lighting measures sampled generally fell into four different savings profile classes:

- 24-hour lighting
- In-suite lighting—away during the day
- In-suite lighting—home during the day
- General use lighting

As indicated, through our site visits, we identified two distinct cases of in-suite lighting, depending if tenants generally were home during the day, or if they were generally gone during the day. The type of tenant in each building affected both verified energy savings and the savings’ load shape.

Data indicating exact on-off times for in-suite lighting were both unavailable and subject to variability; so we made the following assumptions:

- For “In-suite lighting—away during the day”: we assumed six, full-load equivalent (FLE) hours per day between 6:00 am to 9:00 am and 5:00 pm to 10:00 pm. This was based on the 2,100 hours per year figure, listed in the table “Annual Operating Hours of Selected Buildings (Indoor Lighting)” in the OPA’s 2010 Quasi-Prescriptive Measures and Assumptions document.

- For “In-suite lighting—home during the day”: we assumed lights would be on for 12 FLE hours per day, between 6:00 am to 10:00 pm.

- For both in-suite lighting profiles, we assumed the weekend load profile was the same as the weekday load profile. It may be possible to make a case that all tenants left their apartments for longer on weekends, but, without directly metering energy consumption of the apartments, we did not have a sufficient basis to develop a different weekend load profile.

**Chiller**

Savings provided by a chiller retrofit varied with the outdoor air temperature. We obtained hourly temperatures for calendar year 2008 from Environment Canada’s National Climate Data...
and Information Archive. From this temperature data, we were able to estimate the cooling load a typical chiller would have for each hour of the summer and shoulder seasons.

This chiller load profile was combined with the part-load efficiency curves of the new and existing chillers for each project to estimate the kW savings profile.

This methodology was applied to all outdoor air temperature-dependent measures, including cooling towers and chilled water, variable-speed pumping systems.

**Variable Frequency Drives**

Variable frequency drive measures sampled under this program generally fell into two categories: make-up air units, or cooling pumps.

Typically, make-up air units are constant-volume devices, with blower fan running at one speed continuously to pressurize building corridors. This pressurization is intended to control odors and provide fresh air to tenants via spaces under the hallway doors.

A common savings measure used in multifamily buildings is varying the make-up air blower motor speed according to the time of day and year. For example, in one project, a VFD ran at 70 percent speed during summer. In winter and shoulder seasons, the VFD alternated between 60 percent and 90 percent of full speed, according to the time of day.

We created specific savings profiles for each sample VFD measure. In many cases, VFD’s schedule for the winter/summer switchover did not align with OPA’s summer/shoulder/winter times. In such situations, we used weighted averages of the various profiles to align the actual schedule with OPA’s seasonal boundaries.

In cases where a variable frequency drive was used as part of a chiller system, the drive’s speed would be determined by the outdoor air temperature, not the time of day. For this reason, load profiles in these cases were determined using the chiller methodology described above.

**CO Parking Garage Fan Control**

Projects implementing a CO control system for their parking garage fans reported, on average, that fans ran 25 percent of the time, as opposed to the 100 percent of the time, as they previously operated. Since the fans only operated when cars entered or left parking garages, we made the following assumptions:

- For buildings with residents away during the day, we built the savings profile around times residents left for work in the morning and returned at night. We assumed six FLE hours per day, occurring between 8:00 am to 11:00 am and 5:00 pm to 8:00 pm.
- For buildings with residents home during the day, we assumed most car traffic occurred during daytime hours; thus, most savings occurred in nighttime hours, when fans would be off.
2.4.2. Results

Savings Load Shape Aggregation
To apply load shape analysis results to the balance of the project population, we needed to aggregate the shapes into categories that matched information available in the broader database. Thus, load shapes of all sampled measures were combined to form the following, aggregated savings load shapes:

- Lighting
- Chiller
- ENERGY STAR Appliances
- CO Parking Garage Fan Control
- VFD
- General Mechanical

These aggregate load shapes are included in Appendix A. A sample savings load shape for summer lighting savings is included below:

**Figure 4. Summer Lighting Energy Savings**

Pre- and Post-Retrofit Load Shape Calculation
Once aggregated savings load shapes were determined, they were used to calculate load shapes before and after the retrofit took place. For some energy conservation measures, load shapes of pre and post-retrofit cases were exactly the same (e.g., lighting). In the case of VFDs and CO parking garage fan control, the post-retrofit profile differed from the pre-retrofit case. For each measure type, we created pre- and post-retrofit load shapes, which are supplied in Appendix A.
Comparisons to Other Jurisdictions

To provide a comparison point between calculated load shapes and other jurisdictions, we used the eShapes database, which provides whole-building load shapes for New York and Pennsylvania multi-residential buildings.

To compare our lighting load shape, we selected an eShapes\(^5\) shape for a building with gas heat and no electrical cooling, as this shape would represent the sum of lighting, receptacle, and HVAC loads within a typical residential building in the Northeastern United States. As part of the OPA multifamily evaluation, we did not account for receptacle loads. However, even with that in mind, a comparison with eShapes proved informative, as shown below (the comparison between eShapes and our lighting load profile plotted on relative scales).

Figure 5. Lighting Load Shape Comparison

As seen in the above graph, peaks of the shapes from this study and the eShapes curves are coincident. Peaks on the eShapes curves are much less pronounced as the supplied curve represents the entire building’s demand. The relative size of the morning and afternoon peaks are also similar, further supporting our estimate for the lighting load profile. This comparison indicates the lighting profiles developed within this project are reasonable. The correlation

\(^5\) Referent load shapes available from Itron, Inc.
The coefficient of the two shapes is 0.72, indicating the shapes have similar variations throughout the day.

A comparison between eShapes and the chiller savings profile is presented below.

**Figure 6. Chiller Load Shape Comparison**

The eShape shape used for this comparison represents a multifamily building in the Northeastern United States, with central air conditioning in the summer months. The graph allows us to note the following:

- Generally, our chiller profile matches the eShapes, particularly in the peak demand around 3:00 or 4:00 pm.
- The eShapes shape contains lighting and other loads, which explains the “bump” at 9:00 pm.

The correlation coefficient between the two profiles is 0.96, which indicates the shapes are very similar in their variations throughout the day

As the eShapes database did not allow us to isolate specific equipment load profiles, we were not able to perform meaningful comparisons with the other equipment load profiles developed in this study (ENERGY STAR appliances, HVAC fans and pumps, or CO parking garage fans).
Seasonal Energy Savings Profile Calculation

We also reported our load profile findings as seasonal energy savings patterns (SESP) to remain consistent with the format in the OPA Measures and Assumptions documents. An example of a SESP is shown below.

**Table 5. Example Seasonal Energy Savings Patterns**

<table>
<thead>
<tr>
<th>End-Use Load Profile</th>
<th>Winter</th>
<th>Summer</th>
<th>Shoulder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Peak</td>
<td>Mid-Peak</td>
<td>Off-Peak</td>
</tr>
<tr>
<td>OPA Com Lighting</td>
<td>602h</td>
<td>688h</td>
<td>1614h</td>
</tr>
<tr>
<td></td>
<td>8.6%</td>
<td>10.5%</td>
<td>13.8%</td>
</tr>
</tbody>
</table>

We developed a SESP for each sampled measure. Beginning with the three seasonal savings load shapes (winter, summer, and shoulder) developed for each measure, the percentage in each window was calculated using the following, bottom-up approach:

1. **Daily Savings within each Window.** For each seasonal 24-hour load shape, energy savings were segregated into respective windows (peak, mid-peak, and off-peak).

2. **Total Savings within each Window.** Daily energy savings for a given window were multiplied by the number of days in that window, distinguishing between weekdays and weekends, when appropriate. This produced total energy savings for each window.

3. **Percent of Savings within each Window.** For each window, total energy savings were divided by total annual energy savings for that measure.

As each of the approximately 124 measures sampled in the project had a unique load shape, for each program stream, we grouped sample measures into these aggregated load shape categories, and performed a weighted-average calculation for each hour of the day, for each season. The resulting SESPs are shown below.

**Table 6. Calculated SESPs from Sampled Measures**

<table>
<thead>
<tr>
<th>End-Use Load Profile</th>
<th>Winter</th>
<th>Summer</th>
<th>Shoulder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Peak</td>
<td>Mid-Peak</td>
<td>Off-Peak</td>
</tr>
<tr>
<td>Chiller Retrofit</td>
<td>602h</td>
<td>688h</td>
<td>1614h</td>
</tr>
<tr>
<td></td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>CO Parking lot ventilation control</td>
<td>2.1%</td>
<td>10.1%</td>
<td>21.0%</td>
</tr>
<tr>
<td>Energy Star Appliances</td>
<td>6.9%</td>
<td>7.9%</td>
<td>18.4%</td>
</tr>
<tr>
<td>General Mechanical</td>
<td>12.3%</td>
<td>13.2%</td>
<td>33.6%</td>
</tr>
<tr>
<td>Lighting Measure</td>
<td>11.5%</td>
<td>7.1%</td>
<td>13.8%</td>
</tr>
<tr>
<td>Variable Frequency Drive</td>
<td>5.7%</td>
<td>7.1%</td>
<td>18.3%</td>
</tr>
</tbody>
</table>

We were able to compare three of the SESPs developed under this project with existing OPA SESPs. The OPA residential SESPs were taken from the *OPA 2009 Mass Market Assumptions, Appendix A*, and the commercial SESP was taken from the *2010 Prescriptive Measure Assumptions*. 
Table 7. Space Cooling SESP

<table>
<thead>
<tr>
<th>End-Use Load Profile</th>
<th>Winter</th>
<th>Summer</th>
<th>Shoulder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Peak</td>
<td>Mid-Peak</td>
<td>Off-Peak</td>
</tr>
<tr>
<td>OPA Res Space Cooling – Central</td>
<td>602h</td>
<td>688h</td>
<td>1614h</td>
</tr>
<tr>
<td>Chiller Retrofit</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Chiller patterns were similar to OPA’s existing values. Our profiles predicted considerably higher savings in the shoulder seasons than were found in the existing SESP. The summer peak value calculated in this study was 6 percent below the current summer peak percentage.

Table 8. Lighting SESP

<table>
<thead>
<tr>
<th>End-Use Load Profile</th>
<th>Winter</th>
<th>Summer</th>
<th>Shoulder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Peak</td>
<td>Mid-Peak</td>
<td>Off-Peak</td>
</tr>
<tr>
<td>OPA Res Lighting</td>
<td>602h</td>
<td>688h</td>
<td>1614h</td>
</tr>
<tr>
<td>Lighting Measure</td>
<td>8.7%</td>
<td>8.1%</td>
<td>19.4%</td>
</tr>
</tbody>
</table>

As be expected, savings were lowest during summer peak hours, when many residents were gone during the days. Percentages calculated in this report were significantly higher than existing values for summer peak and mid-peak. This was attributed to our building audits, where tenants stay home during the days. Further, buildings in this study were multifamily, whereas existing OPA data were likely for multi- and single-family dwellings.

Table 9. Ventilation SESP

<table>
<thead>
<tr>
<th>End-Use Load Profile</th>
<th>Winter</th>
<th>Summer</th>
<th>Shoulder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Peak</td>
<td>Mid-Peak</td>
<td>Off-Peak</td>
</tr>
<tr>
<td>OPA Com Ventilation</td>
<td>602h</td>
<td>688h</td>
<td>1614h</td>
</tr>
<tr>
<td>Variable Frequency Drive</td>
<td>7.4%</td>
<td>8.8%</td>
<td>21.9%</td>
</tr>
</tbody>
</table>

For assessment purposes, we have compared variable frequency drive measures (the majority of which were located on make-up air ventilation units) with the existing commercial ventilation SESP. Values calculated in this study were very similar to existing measure percentages.

2.4.3. Discussion

We developed SESPs based on our site visits and engineering calculations. Considering all measures in the 2009 study, chiller projects provided the most savings during the summer peak period. Parking lot CO controls also provided considerable savings during the summer peak.
2.5.   Verified Gross Consumption Savings

2.5.1. Measure Level Savings Estimation Methodology
For each project measure sampled, we recalculated energy savings, based on data gathered during the site visit, and compared our findings to those reported by the program streams. Any discrepancies were noted, and potential explanations were identified.

Custom Calculations
In general, we employed a four-step approach to calculating custom project savings:

1. **Input high-level data.** High-level data were entered into our in-house MS Excel measure templates. This included: capacity, load factor, and performance-related data for equipment involved in the retrofit. For example, for a typical VFD project, we input: motor size, motor efficiency, motor load factor, and VFD efficiency data.

2. **Input operating profile data.** Operating profile characteristics were entered into our measure templates. The operating profile accounted for hours of operation as well as load profiles of equipment. For example, a VFD installed on a make-up air unit would run 24/7, and may have as many as three operation stages.

3. **Calculate direct project measure savings.** Project measure savings were calculated by subtracting post-retrofit consumption from baseline consumption, both of which were derived from the data input under steps one and two.

4. **Calculate significant interactive effects.** When significant electrical interactive effects were present, these were calculated, and their effects were added to savings derived under step three. For example, if a VFD was installed on a make-up air unit cooling and heating with electricity, the reduction in supply air would result in significant heating and cooling savings.

Specific examples of our savings verification analysis for the four most common custom measure types (lighting, chillers, VFDs, and CO parking garage fan controls) can be found in Appendix B.

Prescriptive Calculations
For prescriptive measures, auditors confirmed the following three pieces of information:

1. Actual equipment count, as verified on site.

2. Actual type of prescriptive equipment, verified on site (so the appropriate prescriptive demand savings assumption could be selected).

3. An annual estimate of operating hours for the equipment, based on types of space where equipment was installed.

This information was used to calculate energy consumption savings for each prescriptive measure, as follows:

\[ \text{kWh}_{\text{verified}} = \text{Count}_{\text{verified}} \times \text{Savings}_{\text{per unit}} \times \text{Hours}_{\text{annual}} \]
Prescriptive demand savings assumptions—more commonly known as prescriptive input assumptions (PIAs)—differed by program streams for some measure types. For example, the PIA for a screw-in compact fluorescent fixture under ERIP was 44.3 watts, while, under the City of Toronto, it was 46 watts. We further noted, in the case of screw-in CFLs, program streams listed “CFLs < 40W” as an energy-savings measure; the OPA prescriptive list did not list this as an option. The program streams may have aggregated the OPA PIA list to simplify applicants’ choices of lighting fixtures. In light of this, we standardized the PIAs using the most common values applied by the program streams; so a consistent set of assumptions could be applied. For CFLs, City of Toronto and GreenSaver used savings of 46 W per bulb; so we matched the ERIP value to this.

Finally, we standardized numbers of operating hours for each type of space. Table 10 presents lists of space types auditors had to choose from as well as corresponding annual operating hours.

<table>
<thead>
<tr>
<th>Space Description</th>
<th>Annual Operating Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MURB General</td>
<td>3,150</td>
</tr>
<tr>
<td>MURB Apartment</td>
<td>2,100</td>
</tr>
<tr>
<td>MURB Corridor</td>
<td>8,760</td>
</tr>
<tr>
<td>MURB Parking Garage</td>
<td>8,760</td>
</tr>
<tr>
<td>MURB Apartment - Home During Day</td>
<td>4,380</td>
</tr>
<tr>
<td>MURB Exterior</td>
<td>4,380</td>
</tr>
<tr>
<td>MURB Infrequent</td>
<td>1,500</td>
</tr>
</tbody>
</table>

This list was based on the 2010 Quasi-Prescriptive Measures and Assumptions document provided by the OPA. While we generally found the information in this document to be adequate, we made some modifications to the quasi-prescriptive space types, as discussed below:

- We added MURB Apartment—Home During the Day (12h/day, 4,380h/year) to reflect many apartment buildings having tenants not working outside the home and thus using lighting more often than suggested by the MURB Apartment (2,100 h/year) space category.
- We added MURB Infrequent (4h/day, 1,500h/year) to reflect many MURBs having spaces only used infrequently (e.g., common storage rooms, mechanical rooms).
- We eliminated the MURB Lobby (16h/day, 5,913 h/year) as all sampled lobbies had their lights on 24h/day, thus were considered MURB Corridors.

2.5.2. Realization Rates and Weighting

Gross energy savings were calculated by applying realization rates calculated for the verification sample of each stream to the remaining stream’s reported population savings. Savings were calculated for each stream and for the multifamily sector as a whole.

Initially, we calculated the following realization rate:
\[ RR = \frac{\sum_{i=1}^{n} \text{Verified}}{\sum_{i=1}^{n} \text{Reported}} \]

However, it was more correct to weight by the inverse of the sampling weight, as it accounted for the proportion each stream contributed to total program savings:

\[ RR = \frac{\sum_{h=1}^{4} \left( \frac{N_h}{n_h} \right) \sum_{i=1}^{n_h} \text{Verified}}{\sum_{h=1}^{4} \left( \frac{N_h}{n_h} \right) \sum_{i=1}^{n_h} \text{Reported}} \]

Which is equivalent to:

\[ RR = \frac{\sum_{h=1}^{4} N_h \left( \frac{\sum_{i=1}^{n_h} \text{Verified}}{n_h} \right)}{\sum_{h=1}^{4} N_h \left( \frac{\sum_{i=1}^{n_h} \text{Reported}}{n_h} \right)} \]

This approach took the mean in each stratum and multiplied it by the population size, then summed across strata. Below in Table 11, reported and verified energy savings are shown for the sample evaluated in the impact analysis. Each streams had a different realization rate, ranging from 81 percent for ERIP up to 151 percent for Toronto Hydro. The number of projects—listed as “N”—could be used to create a weighted overall realization rate by taking the sum product of verified savings and N, divided by the sum product of reported savings and N. This produced an overall realization rate of 98 percent realized energy savings for the entire 395 projects.

**Table 11. Steam Level Energy Realization Rates**

<table>
<thead>
<tr>
<th>Stream</th>
<th>Verified (kWh)</th>
<th>Reported (kWh)</th>
<th>Realization Rate</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>211,311</td>
<td>210,008</td>
<td>101%</td>
<td>90</td>
</tr>
<tr>
<td>ERIP</td>
<td>224,557</td>
<td>276,449</td>
<td>81%</td>
<td>224</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>109,477</td>
<td>120,056</td>
<td>91%</td>
<td>18</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>455,419</td>
<td>301,819</td>
<td>151%</td>
<td>63</td>
</tr>
<tr>
<td>Weighted Realization Rate</td>
<td></td>
<td></td>
<td>98%</td>
<td>395</td>
</tr>
</tbody>
</table>

**2.5.3. Total Multifamily Sector Gross Energy Savings**

Realization rates for each stream calculated above were applied to the unsampled population. Resulting savings are presented in
Table 12, along with the 90 percent confidence interval. As can be seen, each of the savings values fall directly within the 90 percent confidence intervals.

Table 12. Estimation of Verified Savings by Program Stream and Total

<table>
<thead>
<tr>
<th>Stream</th>
<th>Total Savings (MWh)</th>
<th>90% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>13,024</td>
<td>12,030 - 14,018</td>
</tr>
<tr>
<td>ERIP</td>
<td>28,841</td>
<td>22,789 - 34,892</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>1,599</td>
<td>1,288 - 1,909</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>12,840</td>
<td>7,604 - 18,076</td>
</tr>
<tr>
<td><strong>Total Savings</strong></td>
<td><strong>56,303</strong></td>
<td><strong>43,711 - 8,895</strong></td>
</tr>
</tbody>
</table>

*Sum of individual estimates is slightly different than the table stream numbers due to rounding.

In addition to overall gross energy savings estimates provided above, savings were calculated for three major areas of interest to OPA: multifamily building sector (social and private); project type (prescriptive and custom); and measure type. Results are shown below in the tables below.

Table 13. Savings by Stream and Sector

<table>
<thead>
<tr>
<th>Stream</th>
<th>Sector</th>
<th>Total Savings</th>
<th>90% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>Social</td>
<td>744</td>
<td>687 - 801</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>12,280</td>
<td>11,342 - 13,217</td>
</tr>
<tr>
<td>ERIP</td>
<td>Social</td>
<td>N/A</td>
<td>N/A - N/A</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>N/A</td>
<td>N/A - N/A</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>Social</td>
<td>12</td>
<td>10 - 15</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>1,587</td>
<td>1,279 - 1,895</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>Social</td>
<td>N/A</td>
<td>N/A - N/A</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>N/A</td>
<td>N/A - N/A</td>
</tr>
<tr>
<td><strong>All</strong></td>
<td>Social</td>
<td>737</td>
<td>601 - 873</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>13,654</td>
<td>11,129 - 16,179</td>
</tr>
</tbody>
</table>

Table 14. Savings by Stream and Project Type

<table>
<thead>
<tr>
<th>Stream</th>
<th>Program</th>
<th>Total Savings</th>
<th>90% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>Prescriptive</td>
<td>282</td>
<td>260 - 303</td>
</tr>
<tr>
<td></td>
<td>Custom</td>
<td>12,742</td>
<td>11,769 - 13,715</td>
</tr>
<tr>
<td>ERIP</td>
<td>Prescriptive</td>
<td>N/A</td>
<td>N/A - N/A</td>
</tr>
<tr>
<td></td>
<td>Custom</td>
<td>N/A</td>
<td>N/A - N/A</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>Prescriptive</td>
<td>1,063</td>
<td>856 - 1,269</td>
</tr>
<tr>
<td></td>
<td>Custom</td>
<td>536</td>
<td>432 - 640</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>Prescriptive</td>
<td>N/A</td>
<td>N/A - N/A</td>
</tr>
<tr>
<td></td>
<td>Custom</td>
<td>12,840</td>
<td>7,604 - 18,075</td>
</tr>
<tr>
<td><strong>All</strong></td>
<td>Prescriptive</td>
<td>34,802</td>
<td>28,367 - 41,237</td>
</tr>
<tr>
<td></td>
<td>Custom</td>
<td>22,686</td>
<td>18,491 - 26,881</td>
</tr>
</tbody>
</table>
Table 15. Savings by Stream and Measure Type

<table>
<thead>
<tr>
<th>Stream</th>
<th>Project</th>
<th>Total Savings</th>
<th>90% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>Lighting</td>
<td>9,235</td>
<td>8,530 - 9,940</td>
</tr>
<tr>
<td></td>
<td>Lighting + Other</td>
<td>1,400</td>
<td>1,293 - 1,507</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>2,389</td>
<td>2,206 - 2,571</td>
</tr>
<tr>
<td>ERIP</td>
<td>Lighting</td>
<td>27,103</td>
<td>21,416 - 32,790</td>
</tr>
<tr>
<td></td>
<td>Lighting + Other</td>
<td>N/A</td>
<td>N/A - N/A</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>1,738</td>
<td>1,373 - 2,103</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>Lighting</td>
<td>1,063</td>
<td>857 - 1,269</td>
</tr>
<tr>
<td></td>
<td>Lighting + Other</td>
<td>N/A</td>
<td>N/A - N/A</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>536</td>
<td>432 - 640</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>Lighting</td>
<td>11,793</td>
<td>6,984 - 16,602</td>
</tr>
<tr>
<td></td>
<td>Lighting + Other</td>
<td>N/A</td>
<td>N/A - N/A</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>1,047</td>
<td>620 - 1,473</td>
</tr>
<tr>
<td>All</td>
<td>Lighting</td>
<td>50,452</td>
<td>41,123 - 59,781</td>
</tr>
<tr>
<td></td>
<td>Lighting + Other</td>
<td>1,362</td>
<td>1,111 - 1,614</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>5,674</td>
<td>4,625 - 6,723</td>
</tr>
</tbody>
</table>

2.5.4. Confidence and Precision

Appendix C presents a full discussion of confidence and precision. The first column of Exhibit 2, below, shows the estimated realization rate by stratum. The half-width of the 90 percent confidence interval is shown in parentheses as a percentage of the ratio. The second column shows the estimate of the total verified savings. The half width of the 90 percent confidence interval is shown in relative terms in parentheses. The combined estimate is used to compute total verified savings with a precision of ±18.5 percent at 90 percent confidence.

Exhibit 2: Ratio Estimates by Program Stream
(Electricity Savings In Megawatt Hours)

<table>
<thead>
<tr>
<th>Program Stream</th>
<th>Realization Rates</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>1.01 (±7.6%)</td>
<td>13,024 (±7.6%)</td>
</tr>
<tr>
<td>ERIP</td>
<td>0.81 (±21.0%)</td>
<td>28,839 (±21.0%)</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>0.91 (±18.1%)</td>
<td>1,599 (±18.1%)</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>1.51 (±40.8%)</td>
<td>12,840 (±40.8%)</td>
</tr>
<tr>
<td>All</td>
<td>0.98 (±18.5%)</td>
<td>57,546 (±18.5%)</td>
</tr>
</tbody>
</table>

We also used the sample to estimate realization rates for a number of customer subcategories. Exhibit 3 shows the realization rate and relative 90 percent confidence interval for several customer classes.
### Exhibit 3. Realization Rates (Ratio of Verified and Reported Savings)
Relative Confidence Intervals in Parentheses

<table>
<thead>
<tr>
<th></th>
<th>City of Toronto</th>
<th>ERIP</th>
<th>GreenSaver</th>
<th>Toronto Hydro</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>1.015</td>
<td>N/A</td>
<td>0.911</td>
<td>N/A</td>
<td>1.003</td>
</tr>
<tr>
<td></td>
<td>(±8.9%)</td>
<td>N/A</td>
<td>(±18.3%)</td>
<td>N/A</td>
<td>(±8.1%)</td>
</tr>
<tr>
<td>Social</td>
<td>0.957</td>
<td>N/A</td>
<td>1.000</td>
<td>N/A</td>
<td>0.957</td>
</tr>
<tr>
<td></td>
<td>(±2.0%)</td>
<td>N/A</td>
<td>(±0.0%)</td>
<td>N/A</td>
<td>(±2.0%)</td>
</tr>
<tr>
<td>Custom</td>
<td>1.017</td>
<td>1.476</td>
<td>0.905</td>
<td>1.509</td>
<td>1.295</td>
</tr>
<tr>
<td></td>
<td>(±7.9%)</td>
<td>(±39.2%)</td>
<td>(±20.8%)</td>
<td>(±40.8%)</td>
<td>(±23.0%)</td>
</tr>
<tr>
<td>Prescriptive</td>
<td>0.815</td>
<td>0.733</td>
<td>0.916</td>
<td>N/A</td>
<td>0.739</td>
</tr>
<tr>
<td></td>
<td>(±4.3%)</td>
<td>(±22.2%)</td>
<td>(±25.6%)</td>
<td>N/A</td>
<td>(±21.2%)</td>
</tr>
<tr>
<td>Lighting + Other</td>
<td>0.997</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>0.997</td>
</tr>
<tr>
<td></td>
<td>(±5.9%)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>(±5.9%)</td>
</tr>
<tr>
<td>Lighting Only</td>
<td>0.928</td>
<td>0.806</td>
<td>0.916</td>
<td>1.617</td>
<td>0.975</td>
</tr>
<tr>
<td></td>
<td>(±11.5%)</td>
<td>(±21.7%)</td>
<td>(±25.6%)</td>
<td>(±42.0%)</td>
<td>(±21.6%)</td>
</tr>
<tr>
<td>Other</td>
<td>1.166</td>
<td>0.976</td>
<td>0.905</td>
<td>0.773</td>
<td>1.014</td>
</tr>
<tr>
<td></td>
<td>(±11.7%)</td>
<td>(±50.2%)</td>
<td>(±20.8%)</td>
<td>(±41.7%)</td>
<td>(±15.9%)</td>
</tr>
<tr>
<td>All</td>
<td>1.006</td>
<td>0.812</td>
<td>0.912</td>
<td>1.509</td>
<td>0.980</td>
</tr>
<tr>
<td></td>
<td>(±7.6%)</td>
<td>(±21.0%)</td>
<td>(±18.1%)</td>
<td>(±40.8%)</td>
<td>(±18.5%)</td>
</tr>
</tbody>
</table>

### 2.6. Gross Demand Savings

#### 2.6.1. Methodology
Accurately assessing total demand savings achieved under the program required aggregating reported demand savings from the four program streams. During the study, it was determined the four program streams reported demand savings in different ways, making a straightforward summation impossible. For example, Toronto Hydro’s applicants reported connected demand, while ERIP reported average on-peak demand over a time window not in line with the OPA’s summer peak window.

To compensate for such discontinuity, it was determined demand savings would be derived from reported energy consumption values, as this provided common ground to all program streams. As the goal was to determine summer on-peak demand savings, load shapes calculated for each measure type were applied to all reported kWh savings in the population.

Summer peak demand savings were derived from verified energy savings and measure-level load shapes. The load shapes were based on results of the sample site visit observations and engineering assumptions. From the load shapes, the percentage of energy savings occurring in the summer on-peak period was calculated. This SESP component has been used with the formula below to determine summer on-peak kW savings for each program stream. The SESP
summer peak percentages for individual measures categories are shown in Table 16. Summer Peak SESPs shown in Table 17 provided the weighted averages for the stream.

\[
\text{Summer Peak kW Savings} = (\text{SESP}) \times (\text{Total Verified kWh}) / (522 \text{ hrs})
\]

**Table 16. SESP Values for Major Measure Categories**

<table>
<thead>
<tr>
<th>SESP</th>
<th>Chiller Retrofit</th>
<th>CO Parking Lot Control</th>
<th>Lighting Measure</th>
<th>Variable Frequency Drive</th>
<th>General Mechanical</th>
<th>Energy Star Appliances</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>23.85%</td>
<td>7.95%</td>
<td>5.74%</td>
<td>5.80%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERIP</td>
<td>23.85%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GreenSaver</td>
<td>23.85%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>23.85%</td>
<td>7.20%</td>
<td>2.15%</td>
<td>5.41%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**2.6.2. Results**

Table 17 presents reported and verified demand savings, derived from reported energy savings, and applying an average summer Peak SESP to general measure categories by program stream. The total of average summer demand savings from the 2009 program was 5.56 MW.

**Table 17. Verification Results MW**

<table>
<thead>
<tr>
<th>Stream</th>
<th>Reported Consumption Savings (GWh)</th>
<th>Summer Peak SESP</th>
<th>Average Summer Peak Demand (MW)</th>
<th>Gross Verified Consumption Savings (GWh)</th>
<th>Summer Peak SESP</th>
<th>Average Summer Peak Demand (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>12.94</td>
<td>7.18%</td>
<td>1.78</td>
<td>13.02</td>
<td>7.18%</td>
<td>1.79</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>1.75</td>
<td>9.59%</td>
<td>0.32</td>
<td>1.60</td>
<td>9.59%</td>
<td>0.29</td>
</tr>
<tr>
<td>ERIP</td>
<td>35.50</td>
<td>5.12%</td>
<td>3.48</td>
<td>28.84</td>
<td>5.12%</td>
<td>2.83</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>8.51</td>
<td>2.64%</td>
<td>0.43</td>
<td>12.84</td>
<td>2.64%</td>
<td>0.65</td>
</tr>
<tr>
<td>All</td>
<td>58.71</td>
<td>4.81%</td>
<td>6.01</td>
<td>57.49</td>
<td>4.81%</td>
<td>5.56</td>
</tr>
</tbody>
</table>

**2.6.3. Discussion**

Chiller retrofits produced the best summer on-peak demand savings, followed by CO parking lot monitors. Lighting measures could be argued to have the worst peak savings, having a much lower SESP than all other measures. To increase overall demand savings, the program should advocate more comprehensive projects that deemphasize lighting.

**2.7. Net-to-Gross**

Reported gross savings adjusted during the site verification underwent a last adjustment to account for freeridership. Spillover was examined qualitatively, but was not applied to savings.

---

6 The 522 hours in the formula above is the number of hours that occur each year in the summer on-peak period.
estimates because estimation of savings had the same rigor requirement as savings for program measures—namely, specificity measures installed (size, efficiency, number), on that previously installed (what was replaced), operating conditions, etc. These parameters could not be accurately estimated unless assumptions were simplified. If the multifamily program essentially was a prescriptive program, and measures were covered in the Program Input Assumptions database, an approximation could be made. The 2010 program evaluation will examine this issue more closely.

2.7.1. Freeridership Analysis Methodology and Results
Freeridership was calculated using a prescriptive weighting approach, based on a battery of six questions administered to participants in each four program implementation streams. A savings-weighted freeridership percentage was calculated for each stream and for the overall program, and a net-to-gross ratio (NTG) (1-FR percentage) was calculated and applied to realized savings for each implementer and for the sector as a whole.

Freeridership estimation is one of the most discussed and controversial issues in DSM evaluation. Most freeridership estimates are a product of customer self-reports through surveys or interviews, and carry all the inherent reliability issues associated with self reports: memory, response bias, socially acceptable responses, and so on. There is also the issue of the calculation algorithm, which can be an arcane issue in and of itself.

For these reasons, we have developed—over the years—what we consider a transparent, straightforward matrix approach, based on objective responses to six questions. Response patterns to these questions are assigned freerider scores, and confidence and precision estimates can be calculated on the distribution of those scores. Because response patterns and scoring weights are explicit, they can be discussed and changed, and results can be shown in real time. We consider this approach reliable, transparent, and not burdensome for respondents. This specific approach has been cited in the *NAPEE Handbook on DSM Evaluation* (2007, Page 5-1).

The specific questions in the survey (see Appendix D) related to whether the participant would have installed the measure(s) without the program, and whether they would have installed the same quantity at the same efficiency at the same time. The actual matrix used in the calculation is shown below.

**Figure 7. Freeridership Matrix**

<table>
<thead>
<tr>
<th>Q1. First, would you have installed the same (MEASURE[s]) without the program?</th>
<th>Q5 &amp; Q10. Before participating in the program, had you ever installed any of the same type of (MEASURE[s]) that you installed through the program?</th>
<th>Q2 &amp; Q6. Let me make sure I understand. When you say you would have installed the same (MEASURE[s]), would you have installed (one[s]) that (was/were) just as energy efficient?</th>
<th>Q3 &amp; Q8. (Ask only for lighting, VSDs, motors) And would you have installed the same quantity of (MEASURE[s])?</th>
<th>Q4 &amp; Q9. And would you have installed the (MEASURE[s]) …</th>
<th>Freeridership Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>100%</td>
</tr>
<tr>
<td>No</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>0%</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>x</td>
<td>x</td>
<td>0%</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>50%</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>0%</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>12.5%</td>
</tr>
</tbody>
</table>
We examined two different calculations of freeridership, that of an average and savings weighted. Savings-weighted freeridership ratios ended up being applied to the realized savings numbers. Savings-weighted freeridership ratios are defined as the sum of savings adjusted for freeridership, divided by the sum of estimated savings. This program (or stream) freeridership ratio, applied to the entire program (or stream) verified savings, represented the total net savings, as shown in the ratio below:

\[
\text{Free Ridership}_j = \frac{\sum \text{FR}_j \cdot S_j}{\sum S_j}
\]

Where \( \text{FR}_j \) and \( S_j \) are estimates of freeridership and energy savings at site \( j \), respectively.

The net-to-gross ratio is defined as (1-freeridership). Unweighted freeridership is the average freeridership score. This score does not distinguish between large small projects, but treats each respondent’s score as equal. Clearly this is not appropriate when one respondent has 1,000 kWh savings and is not a freerider, while another respondent has a 100kWh savings and is a freerider. The average freeridership score for two such participants would be 0.5. However, it is not correct to apply the 0.5 to the total of 1100 kWh. In fact, net savings for this “program” would be 1,000 kWh or a NTG ratio of 0.91 (1-freerider).

The true program freerider score was 0.09 (9 percent), not 50 percent. Precision estimates at the 90 percent confidence level for the (unweighted) distribution were calculated, and results are shown in Table 18, below. These estimates included finite population adjustments. Note that this unweighted value was not used, but has been shown to highlight differences between weighted and unweighted methodologies, and to show confidence and precision calculations. Overall precision in the 90 percent confidence interval was 4 percent, proving the reliable nature of the results. Confidence and precision cannot be calculated after weighting has occurred.

<table>
<thead>
<tr>
<th>Stream</th>
<th>Score</th>
<th>N</th>
<th>Precision at 90% Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>0.24</td>
<td>34</td>
<td>6%</td>
</tr>
<tr>
<td>ERIP</td>
<td>0.29</td>
<td>17</td>
<td>12%</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>0.00</td>
<td>7</td>
<td>N/A</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>0.06</td>
<td>18</td>
<td>3%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>0.18</td>
<td>76</td>
<td>4%</td>
</tr>
</tbody>
</table>

Seven out of 18 participants were surveyed for the GreenSaver program stream, and all surveys clearly indicated participants would not have installed any efficiency measures without the program’s intervention. Thus—while a truly rare event—the GreenSaver program has a freeridership ratio of 0.0, and a realization rate of 100 percent. Caution should be taken in assuming this rate will continue in 2010.

As designed, the survey assumed each respondent represented a single participating building. Closer examination of the database revealed several respondents were property management executives, whose firms represented multiple buildings. This information was discovered only
after the surveys had been designed and implemented. Using this weighting would significantly improve freeridership scores and precision for ERIP and Toronto Hydro, and for the multifamily sector as a whole. However, as the survey instrument did not specifically address whether respondents’ decisions applied to some or all buildings they were responsible for, these results were not used in the overall program net savings calculation. Rather, the savings weighted method was employed. The 2010 survey has been revised to include these additional items.

Table 19 shows unweighted and savings-weighted freeridership ratios and NTG ratios. The savings-weighted method of freeridership measurement was used to determine an overall value of 23 percent freeridership, which translates into a 77 percent NTG value for savings overall.

<table>
<thead>
<tr>
<th>Stream</th>
<th>Freeridership Unweighted</th>
<th>Freeridership Savings-Weighted</th>
<th>NTG Ratio Unweighted</th>
<th>NTG Ratio Savings-Weighted</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>0.24</td>
<td>0.30</td>
<td>0.76</td>
<td>0.70</td>
</tr>
<tr>
<td>ERIP</td>
<td>0.29</td>
<td>0.17</td>
<td>0.71</td>
<td>0.83</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>0.06</td>
<td>0.18</td>
<td>0.94</td>
<td>0.82</td>
</tr>
<tr>
<td>All</td>
<td>0.18</td>
<td>0.23</td>
<td>0.82</td>
<td>0.77</td>
</tr>
</tbody>
</table>

Table 19. Freeridership and NTG Ratios

2.8. Impact Results and Recommendations

2.8.1. Program Energy and Demand Results

Total savings for the 2009 multifamily sector are shown in Table 20, which summarizes the steps involved in transforming the original reported energy and demand savings to gross verified energy and demand savings by using energy realization rates for each stream. The NTG ratio has then been applied to gross verified savings to determine net savings. Savings results for the 2009 program year were 44.27 GWh, with 4.28 MW during peak summer demand.

Table 20. 2009 Program Year Multifamily Sector Savings Results
2.8.2. Impact Evaluation Discussion

Total energy saved for the 2008 evaluation was 3.67 GWh. After adding the 2009 net savings of 44.27 GWh, total energy saved under the multifamily program, to date, was 47.94 GWh. This figure fell significantly short of the overall program goal of 385 GWh. Even with strong growth in the number of projects submitted to the program in 2010, it is extremely unlikely the energy savings goal will be achieved by the end of 2010.

While realization rates and NTG ratios reduce gross savings, the gross savings still are not sufficient to approach the energy savings goal.

Total demand saved in 2008 was 0.81 MW, not adjusted by the realization rate and NTG. The 2009 demand savings added another 4.28 MW, for a total of 5.1 MW demand savings to date. As with energy savings, demand results fell far short of the program goals of 100 MW by the end of the 2010 program.

Several possibilities may explain this shortfall in program savings:

1. The program goal was overly optimistic in estimating amounts of energy and demand savings achievable in the marketplace.
2. The program did not reach its intended audience.
3. The program did not incent enough of the audience to participate in the program.
4. Those participating did not participate enough.

It is likely all four of these factors contributed to the shortfall in achieved savings.

In the 2009 program year, the 44.27 GWh savings were achieved across the 395 projects, for an average energy savings of 67,089 kWh per project. If the average project savings amount stays the same for the 2010 program year, it will take over 3,000 new projects to meet the savings target. In light of this, we recommend the OPA first revisit the program goals, and determine the factors originally leading to the 385 GWh and 100 MW goals. Once program goals have been reassessed, further investigations about the nature of the shortfall can begin, using the remaining sections of this document as a starting point.
3. Process Evaluation

A process evaluation of the OPA’s Multifamily Retrofit programs was conducted to:

5. Evaluate the effectiveness of the various approaches to program implementation;
6. Document which activities and methods were effective and identify areas of improvement;
7. Determine how to increase efficiency from the program implementer perspective; and
8. Determine participant program satisfaction.

Freeridership and spillover batteries provided information used in the impact analysis to calculate net savings. The evaluation involved process flow document analysis, interviews with key stakeholders and implementers, and surveys of program participants, active nonparticipants, and true nonparticipants.

The process evaluation effort entailed conducting telephone surveys with program participants, active nonparticipants, and true nonparticipants. Telephone interviews were conducted with key program staff: both stakeholders and program implementers. Interviews focused on best management practices, lessons learned, and perceived customer satisfaction. This helped gain a better understanding of: how the programs were run; how to increase program participation; how to increase efficiency from the program implementer perspective; and ways improvements could be made for future program years. Additionally, we sought to collect information on the following:

- Program marketing
- Implementation methods used
- Eligibility for program participation
- Effectiveness of communications
- Program administration

The survey sample consisted of 2009 program participants, active nonparticipants, and true nonparticipants. Figure 8 provides an overview of the process evaluation approach.
This process evaluation chapter is segmented by major respondent groups and analysis areas, which includes the following topics:

3.1 Overview of Survey Strategy
3.2 Process Sampling
3.3 Business Process Flow Comparison
3.4 OPA Program Manager Interview
3.5 Implementer Interviews
3.6 Participant Survey Results
3.7 Active and True Nonparticipant Survey Results
3.8 Marketing Evaluation
3.9 Process Evaluation Synthesis and Conclusions

3.1. Overview of Survey Strategy

Surveys and interviews were designed to elicit information and opinions on similar topics from several perspectives. Specifically, the populations surveyed were:

- Participants
- Active nonparticipants
- True nonparticipants
- OPA staff
- Program implementer staff

The customer survey, which focused on the following issues to document the program implementation process and identify areas of improvement, included the following topics:

- Reasons why people participated.
- Ease of the application process.
• Measures customers would like to have installed but were not part of the program offerings.
• Program influence with installing additional energy-efficient equipment.
• Overall satisfaction with program.
• Suggestions for improvements.
• Savings realized after program participation (scaled response).

Program implementer and staff interviews focused on:
• What processes and procedures worked, and what did not work.
• Recommendations for improving the process and improving performance.
• Program satisfaction.
• Program strengths and weaknesses.

3.1.1. About the Interview Populations
We conducted interviews with stakeholders and program implementers. The effort involved creating interview questions, and scheduling and conducting the interviews. Evaluator staff spoke with OPA ERIP program management and nine program implementers. The interviews sought to examine current practices for implementing and delivering the program. Additionally, through the interviews, we attempted to identify issues making program delivery successful.

3.1.2. About the Survey Populations
For this report, survey population definitions are:
• Participants are building owners or managers completing a rebated energy-efficiency project in 2009.
• Active nonparticipants are individuals with knowledge of at least one program stream.
• True nonparticipants had not heard of any of the multifamily retrofit programs.

All surveys were given to building owners or on-site managers, as they were facility decision makers.

Participants
The participant population surveyed was randomly selected from the four streams’ participant databases.

Active Nonparticipants and True Nonparticipants
The nonparticipant survey objectives were to determine: if customers were aware of the programs, and, if so, why they chose not to participate; where they found information about energy savings; and their thoughts on other building owner’s participation barriers.

One of this effort’s biggest hurdles was to obtain active and true nonparticipant contact information. One approach used to gather the sample contact information was to ask
implementation staff. During each of the program interviews, we asked if nonparticipant contact information was tracked in 2009. Of streams interviewed, only one (GreenSaver) saw the value of tracking nonparticipant contact information.

GreenSaver tracks: all call-center calls; e-mails received; and program participants who did not complete the process. Data received from GreenSaver contained contact information for 133 active, nonparticipant, multifamily buildings. Of 133 contacts, 98 were viable; the other 35 were not in service, fax machines, or residential numbers. Other implementers did not see the value of tracking nonparticipants.

Making extensive efforts to obtain multifamily building contact information, evaluator staff researched multifamily building contact lists, and spoke to the contracted survey firm to see whether it had access to building contact information (as this information was not currently available to purchase). An exhaustive search of 18 cities was conducted in the Ontario area, researching multifamily building contact information. The search entailed reviewing apartment listing sites, building owner boards, and apartment cooperatives. A total of 542 contacts were used for the active and true nonparticipant survey contact sample (see Tables 22 and 23 for details).

3.2. Process Sampling

3.2.1. Participants

Participant databases from each stream were acquired in early 2010; however, complete contact information was not immediately available for Toronto Hydro and ERIP. To minimize the delay in starting the survey, it was necessary to begin fielding with incomplete contact lists, which were supplemented in coming weeks. It was hoped participant and nonparticipant survey goals would achieve 90/10, based on number of projects. Table 21 shows the breakout by program implementer and project for participant survey goals and achieved samples surveyed. Again, these values did not include the additional 50 ERIP projects as they were not a part of the program sample when the survey was fielded.

<table>
<thead>
<tr>
<th>City of Toronto (BBP)</th>
<th>GreenSaver (MEER)</th>
<th>ERIP</th>
<th>Toronto Hydro (BIP)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Projects</td>
<td>88</td>
<td>18</td>
<td>175</td>
<td>63</td>
</tr>
<tr>
<td>Project Survey Goal (90/10 per stream)</td>
<td>39</td>
<td>14</td>
<td>50</td>
<td>33</td>
</tr>
<tr>
<td>Completed Surveys (Number of Projects)</td>
<td>40</td>
<td>8</td>
<td>86</td>
<td>36</td>
</tr>
<tr>
<td>Completed Surveys (Number of Participants)</td>
<td>30</td>
<td>6</td>
<td>14</td>
<td>18</td>
</tr>
</tbody>
</table>

For participant surveys, the distinction should be recognized between completed numbers of surveys per participant or per number of projects. In several cases, one individual participant submitted several projects; consequently, one person’s survey response could effectively cover many projects. We were able to contact 68 unique participants over the four streams. These 68 spoke for a combined 170 projects. The survey sampling goal was based on number of projects, and, in every case, we were able to get better than 90/10 results, except for GreenSaver. GreenSaver proved difficult because of the 18 total projects, only 11 were unique participants, and we were only able to speak to six of these.
3.2.2. Active and True Nonparticipants

As discussed, obtaining a contact list for active and true nonparticipants was difficult. Only GreenSaver tracked nonparticipants and was able to provide us a list yielding 96 viable contacts, 38 of whom we spoke to (see Table 23). We amassed a list of 542 contacts not listed in the program databases. Of these, only 19 were successfully contacted: 15 true nonparticipants and four active nonparticipants. Prior to having the nonparticipant list to call from, the ideal goal was to speak to 80 active and 80 true nonparticipants. Ultimately, survey responses could only be obtained from 42 active nonparticipants and 15 true nonparticipants.

<table>
<thead>
<tr>
<th>Table 22. Active Nonparticipant Survey Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Contacts</strong></td>
</tr>
<tr>
<td>Survey Contacts</td>
</tr>
<tr>
<td>Survey Goal</td>
</tr>
<tr>
<td>Total Completed Surveys</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 23. True Nonparticipant Survey Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Contacts</strong></td>
</tr>
<tr>
<td>Survey Contacts</td>
</tr>
<tr>
<td>Survey Goal</td>
</tr>
<tr>
<td>Total Completed Surveys</td>
</tr>
</tbody>
</table>

3.3. Business Process Flow Comparison

Process flows represent or model information’s flow through a system. They can be very useful for summarizing business processes. Process flows graphically show how specific activities move through oversight, approval, or rejection by different departments, and how decisions affect outcomes. They can provide a complete picture succinctly communicating all activity aspects. Process flows can help improve understanding of business activities for internal staff as well as outsiders, serving as a kind of window into daily functions of a business. This comparison sought to gain an understanding of the particular components or processes leading to success in meeting program goals and objectives. Rather than a common set of procedures and a common organizational structure, found each implementer developed their own unique approach to the program, and each was successful in their own way. Given the varying size and infrastructure of LDCs, it is entirely possible implementation of future programs will take many different organizational forms.

To gain a more comprehensive understanding of multifamily programs for all program streams, we requested and received process flows from Toronto Hydro, the City of Toronto, Hydro Ottawa, Blue Water, GreenSaver, and London Hydro. We wanted to review these flows to identify their differences and similarities. We hoped these differences and similarities might help us understand why one program stream was more successful than another. We wanted to see if we could identify any process flow barriers that might preclude program stream success.

There were no obvious relationships between participant satisfaction or program stream success and process flows, but there were clear differences between the process flows themselves. Each organization emphasized different aspects of the program flows, despite the many similarities in the overall procedures of accepting applications, vetting them, and disbursing funds for payment.
Document processing formed the central element of four flows. Toronto Hydro focused more on application rejection. The City of Toronto focused on staff responsibilities at each stage. Ottawa Hydro and Blue Water had very similar flows, splitting different paths for prescriptive and custom flows. GreenSaver’s flow, by far the most detailed, included document processing, but also provided a high-level overview of all business processes, from developing customer prospects to database updating and disbursements. London Hydro’s flow took another tack, showing only processes related to obtaining prospects and keeping customers happy. Each approach had its merits. The elucidation of these flows and their distinctive features provided interesting contrasts and may prove useful in the future as we continue to track the progress of Ontario’s multifamily programs.

Included with this report are all flows in one somewhat standardized format in Appendix E. All original flows received are available in Appendix F. A written explanation of each of the flows follows, including descriptions of the differences between them.

**Toronto Hydro Business Incentive Program (BIP) Process Flow**

Toronto Hydro’s BIP process flow starts with the potential applicant contacting Toronto Hydro. The application was completed and the first vetting done: will the project save enough energy and/or qualify for a large enough incentive? If no, the applicant was rejected. The vetting process moved to the next stage.

If square footage was large, OPA had to be contacted for approval. Further, if more than 350 KW was being saved, another agency or office (DRP) became involved. DRP drafted a “PJF” and sent it for two executives’ approval—the CFO and the CCO. If they did not approve, the project was rejected. If they did approve, legal had to vet and approve.

Once the process arrived at the legal stage, the presumption was the project would continue to completion; there were no decision points on the chart ending in rejection. There was only further review, until after several processing steps and signature boxes, the project commenced, a PO was applied for, and applicant entered the “billing process.”

If the applicant was not too large or saved a great deal of energy, the applicant had to go on the program Website and enter a start date. The applicant had 90 days to enter that date, and would receive automated e-mail reminders every 30 days. If the applicant did not enter the start date within 90 days, the project was canceled. If the start date was entered, the next flow chart stage was the “billing process.” The applicant was on the road to receiving an incentive check, although that road was not part of the process flow chart.

This process flow focused most on identifying where applications might be rejected and who necessary approving bodies were. Tracking application flows and database updates were other features.

**City of Toronto Better Buildings Partnership (BBP) Process Flow**

The City of Toronto’s process flow was similar to Toronto Hydro’s in that an application was received and processed. It was also simpler, having fewer decision points. There were many steps where information was passed between persons, but only two real decision points. The first was where a question was asked, and the flow could go in different directions based on “yes” or “no” answers. These points were: “Is application complete?” and “Documents approved?”; this
were early in the process. There were two “Diligence done?” points, which looked like decisions, but there was only one option included: a “Yes.” One might assume “No” was also an option, but it was not represented in the process chart.

The City of Toronto’s chart differed from Toronto Hydro in that rejection was not an option, or at least was not described. There were no cancellations or steps where the client was informed they were not suitable. There was only review, approval, and payment, with the most detail reserved for individuals responsible for application processing at each stage. Some actual rejection was likely documented, but, as with the due diligence, it was not represented.

**Hydro Ottawa ERIP Approval Process**

As with Toronto Hydro and the City of Toronto, Hydro Ottawa’s focused on processing and handling of the application. With Hydro Ottawa, the first decision point was whether or not the project was prescriptive or custom. Prescriptive projects were handled exclusively in-house. After determining the application was complete and energy-efficiency savings occurred, the customer was notified the project was preapproved. Measures installation was verified. Deficiencies, if any, were addressed, and another verification was done. On project completion, an incentive check was sent, and the customer was logged into the tracking system.

**Blue Water Power ERIP Approval Process**

The Blue Water Power process flow had much in common with Hydro Ottawa. BWP also first identified if the project was prescriptive or custom. Both flows were pictured, but, in this case, prescriptive and custom flows were mirror images: each step along the way was identical. For both project types, the completed application was sent to a third-party evaluator for verification. If there were no problems, the project was approved. Otherwise, the chart showed “BWP works with customer to revise project,” and the evaluation step repeated. Once the project was approved, the customer completed the project and submitted invoices. At that stage, Blue Water Power again became involved, reviewing all paperwork and contacting the customer if deficiencies arose.

**GreenSaver Multifamily Energy Efficiency Rebates (MEER) Process**

GreenSaver provided the most detailed process flows. They also provided a one-page, high-level overview of the entire MEER program operations. Instead of decision-level detail, it shows the major processes in each of the five program phases: Lead Generation, Application, Retrofit Completion, Verification, and Payment.

The high-level overview provided a complete picture of all business activities related to MEER. Active marketing was done up front to generate leads through a private agency and through maintenance of a call center. Based on the chart, a third lead generation channel appears to be in development.

GreenSaver also differentiated between prescriptive and custom projects in its flows. Prescriptive projects were defined as projects comprising well-known and accepted energy-efficiency components, with well-understood characteristics and energy saving potentials. Custom projects were more ambitious projects likely to save more energy but needing to be assessed to determine claimed savings would be achievable. Each custom project had distinctive steps.
In support of the high-level overview, GreenSaver provided process flow detail for each five business activity phases. In addition to the application processing detail, these flows delineated each step of the lead generation process, including: characterizing prospects by type, and describing kinds of promotion and marketing efforts made for each type. Call center management, lead conversion, application, verification, and payment phases were covered in great detail.

GreenSaver developed a seemingly complete and vivid picture of their business processes. With the right level of management support, these could be of great value for the company.

**London Hydro ERIP Promotion Flows**

London Hydro, one of the Local Distribution Companies (LDCs) participating in the ERIP program stream, submitted its own process flow diagram. It uniquely differed from the others in that the focus was not on document processing, staff responsibilities, or a high-level overview. Their contribution was more of a program promotion flow chart, mapping efforts to promote the program and ideal responses to those promotions.

The process began with a central focus of the flows—London Hydro’s ERIP promotion efforts. Three areas were described. For local industry associations, London Hydro made presentations and accrued prospects. Similarly, they held seminars for distributors, suppliers, and manufacturers, and again identified a few prospects. With existing customers, they were prepared to respond to answers to customers’ questions.

The chart clearly suggested London Hydro saw these promotions as a key to a successful program, over and above clear descriptions of application processing flows.

In the interests of brevity, these detailed charts have not been presented in this section, but are included in Appendices E and F.

**3.4. OPA Program Manager Interview**

We conducted a short telephone interview with ERIP program management, to determine the program’s effectiveness. The interview consisted of several topics about the 2009 ERIP program, such as the method of program delivery, strengths, weaknesses, and what changes were made to the program. Based on the conversation, the interview guide was revised to include questions more directly focused on satisfaction, nonparticipant data tracking, and aspects of the program the managers thought were most successful. The information received will help our staff develop recommendations to help improve and streamline processes.

There were few changes to the 2009 ERIP program. The incentive levels increased for the 2009 program year. The applications were simplified, however; the onus remained on the customer to accurately fill out the application.

**Program Managers Assessment of 2009 Program**

Program delivery was thought to work well for the 2009 program year. Mr. Bond noted some implementers found and capitalized on their niche. Building on existing relationships and actively developing new relationships with customers and contracts enabled some contractors to increase program participation. The 2009 numbers were achieved primarily through lighting retrofits, and OPA also continued to pursue meeting its targets through nonlighting projects.
Program Strengths and Weaknesses

Program strengths included:

- The OPA program manager thought the application process was straightforward, despite many rules and regulations.
- Familiarity with the program has increased participation.

Program weaknesses included:

- The paper-based system increased the likelihood of mistakes.
- Inconsistencies in the ERIP implementation. Management reported some implementers denied applications, while other implementers approve similar applications. This finding suggests implementer had differing views of program requirements and might benefit from additional training and better communication.
- Checklists aiding customers with the application process were not always distributed.

3.5. Implementer Interviews

We conducted telephone interviews with several program implementers to learn how they oversaw, promoted, and tracked the program. This effort required our staff to revise the interview guides, and schedule and complete interviews with key program staff. The scheduling entailed multiple attempts to contact implementers through calls and e-mail. In some cases, more than five attempts were made. In most cases, 1.5 hours were spent on process interviews, which consisted of approximately 40 questions. The interviews sought to learn about the following program aspects:

- What implementers thought worked well.
- What program aspects could be improved.
- How data were tracked, including nonparticipant information.
- Whether implementers had dedicated sales staff.
- Were channel partners engaged by the implementers, and was program training provided.
- Were customers asking for measures not currently included in the suite of offerings.

What Worked Well with the Program

Several implementers spoke about their relationships with channel partners and the successful growth in program participants. Implementers engaged channel partners through:

- Direct selling
- Breakfast meetings
- Lunch meetings
- Drop-in visits
- Calling
• E-mailing

Implementers felt these efforts successfully engaged new customers. Implementers also noted contractors and distributors promoted the program to drive sales. One implementer requested contractors and vendors in his territory maintain an ERIP expert in their offices to quickly address customers’ questions and streamline processes. Another method an implementer used was to speak to each customer service representative at the local gas company. Engaging the employees and providing each his contact information increased visibility in the community and offered a practical way to get his name out to customers looking for program information. This strategic selling technique sought to increase program participation.

One implementer reported working with three other implementers to achieve economies of scale. They share the costs of quarterly breakfast and lunch information sessions for contractors, distributors, and landlords. The four implementers met quarterly to discuss CDM programs and update each other on program progress. The implementers shared the market, and they worked as a team to increase program participation. These informal exchanges may offer a way to leverage expertise for smaller or less active implementers for future program design.

Two implementers interviewed used outside sales persons to actively sell the program to customers, using their extensive experience and strategic sales techniques to increase program participation. These implementers set forecasts and created detailed sales plans. One implementer stated: “We are speaking with CEO and CFO’s to see if we can get projects on their capital plans.” Both implementers met or exceeded their goals early in the program year.

Many implementers stated it was necessary to have someone on staff, other than the manager, able to address questions as they came in. Implementers with inside sales staff or support staff thought that this was a selling point for customers. As the application process could be confusing, having a staff person available to answer questions increased program satisfaction.

Possible Program Improvements

We asked a series of questions to determine program aspects not working efficiently. A brief overview of implementer responses follows.

Competing Programs. A few implementers stated the number of programs available in the market (BOMA, BBP, BIP, MEER and ERIP) caused confusion for customers and contractors. Two implementers did not promote the MEER program. While these programs worked to reduce consumption and demand, they introduced unnecessary complexity and competition in the multiresidential market. An implementer noted:

“The MEER incentives are good for the customer, but there is no money to promote the program, the incentive dollars to the implementers was very low. As a result ERIP, fits us nicely, and we really work to promote ERIP. MEER has been farmed out to another company that is out promoting it, but it has a tight timeline as well, so this year we’ve only completed a half dozen applications because of it.”

Application Form. Each implementer stated they filled out more than 75 percent of applications coming in. Applications were confusing to program participants and thought to be a participation barriers. Implementers all noted the applications were easy for them to fill out, given their exposure. However, the applications were cumbersome, with some items that could be
streamlined. For example, implementers needed to enter their names in excess of 20 times on applications.

**Changes in OPA Staffing.** Changes in program managers at the OPA produced uncertainty with implementers. One implementer stated, over the past two years, he had four different program managers. Implementers stated it took time build good relations with project managers, and internal organizational changes disrupted relations between implementers and OPA program managers. Though organizational changes are inevitable, working to retain key staff will help the program run smoothly, and decrease risks of gaps in program management.

**Communication.** Some implementers noted communications with the OPA were strained. One implementer did not know the OPA provided incremental funding to implementers exceeding their targets. Another implementer was not sure who to call, and did not receive updated phone lists or organizational charts. One person commented he did not know who to speak to regarding the following items:

- Payments
- Contracts
- Technology
- Marketing
- Overall questions

**Head Office Model.** The head office model—the current practice—allowed implementers to complete projects in multiple jurisdictions. However, this created a problem in that out-of-area implementers completing work on a project only received nominal funding. The host utility received a large percentage of the funding. Customers also had to interact with multiple implementers (rather than one). An implementer stated: “It would be reasonable if the host utility received $100, and the utility that is completing the administrative tasks received the rest.” One implementer had projects totaling 5.5MW out of jurisdiction. Implementers felt they were penalized for promoting the program to customers who managed multifamily buildings across the province.

Two implementers mentioned they did not know how their program performance compared to other implementers. Therefore, we recommend sending out a quarterly memo that graphs percentage of targets for all implementers and overall kW and kWh savings could bring about some amiable competition and further drive efforts and motivation.

**Data Tracking.** Most program streams interviewed had well-defined project participant tracking systems in place. Three implementers were instituting client relationship management (CRM) component into their data tracking. CRMs would track program inquires to the call center and the e-mail message center. One implementer worked with BOMA to redesign a SQL-based program.

When asked about tracking nonparticipant contact data, only one implementer captured such data. This information helped develop the survey sample for the active nonparticipant survey effort conducted. The other implementers stated they did not see the value of tracking the data or did not have a way to effectively obtain the information.
**Work with Channel Partners.** A majority of the implementers worked with channel partners to increase program participation. The implementers acknowledged the value of educating and building relationships with the channel partners. Relationships between implementers and channel partners were equally beneficial. Channel partners reportedly promoted the program to drive sales, and identified customers who needed upgrades to facilities for equipment offered through the program. Channel partners were also able to assist customers with the application process, thus increasing program satisfaction.

**Additional Measures not Offered Currently.** The measures below have been requested by customers, but are not currently offered through the program:

- Building envelope
- Windows
- Induction lighting
- LED lighting
- U-shaped efficient lighting
- Efficient circular tube fluorescents

### 3.6. Participant Survey Results

Key participant survey data collection findings are analyzed below. Findings have been organized into the following sections:

- Reasons for participation
- Ease of the application process.
- Measures customers would like to have installed, but were not program offerings.
- The program’s influence on installing additional energy-efficient equipment.
- Overall satisfaction with program.
- Suggestions for improvements.
- Savings realized after program participation (scaled response).

**Reasons for Participation**

When asked about key motivators for program participation, 38 percent of respondents wanted to save money, 34 percent wanted to save electricity, 19 percent valued receipt of rebate monies, and other respondents thought the payback was reasonable, liked the make or model of the equipment, wanted to help the environment, or had current equipment needed to be upgraded. A majority of the respondents (59 percent) had participated in previous energy saving programs.

**Satisfaction with Application Process**

We wanted to learn about overall satisfaction with the application process. Respondents were asked a series of questions focused on the following process areas:

- Who completed the application.
- How many respondents filled out the application.
- Was the application easy to fill out.
- Satisfaction with amount of time taken for application approval.
- Satisfaction with time taken to complete a project.
- Overall satisfaction with time taken to receive payment.

The majority of applications were filled out by contractors or engineers (67 percent). In some instances, building staff other than the respondent completed applications (14 percent). A few respondents were not sure who completed the application, and the remaining 17 percent of applications were completed by suppliers or consultants at the utility.

In total, 19 respondents completed the application and were able to speak to the ease of the filling out the application. A majority (12) reported it was either easy or very easy to fill out. Several respondents (6) thought it was somewhat easy to fill out, and one person was unable to remember the application process. These results are not atypical of commercial rebate programs and do not rise to the level of a program issue.

When asked about satisfaction with length of time required to receive project approval, responses were divided. The majority of participants were satisfied or extremely satisfied with the time required. As shown in Figure 9, a small portion of participants were not satisfied.

**Figure 9. Satisfaction with Time Taken to Receive Project Approval**

When asked about the time it took to receive the incentive, most respondents were satisfied with the time required. However, 11 participants were not satisfied. As shown in Figure 10, most ERIP program participants (84 percent) were very satisfied with the rebate process. One comment received was: “It took six months to get incentive check.”
Program Influence

We asked a few questions focused on the programs’ influence on installing energy-efficient measures. When respondents were asked how influential the program incentive was on their decision to install efficient equipment, 63 percent reported it was very influential. Remaining participants deemed the incentive a small influence or not an influence at all.

ERIP and GreenSaver program participants were much less influenced by the incentive compared to participants from the other two streams. GreenSaver participants stated the program was very influential 17 percent of the time. ERIP responses were close, with participants stating the program was very influential 21 percent of the time. City of Toronto and Toronto Hydro were both rated much higher, at 67 percent and 66 percent, respectively.

Spillover can be measured by determining the proportion of program participants who installed additional energy saving measures without financial assistance and strongly attributed this action to the program. Among Multifamily program participants, 19 of 52 (37 percent) fit this description (seven participants responded “Don’t know” and were not included in this proportion). Within this group of 19, 11 (58 percent) responded with a value of 6 or higher when asked if they agreed with the statement: “My experience with the City of Toronto program in 2009 influenced me to install additional high efficiency equipment on my own.”

This group reported installing the following measures shown below.
Table 24. Participants that Installed Equipment without a Rebate and Claimed to be Influenced by Program

<table>
<thead>
<tr>
<th>Installed Energy Saving Equipment</th>
<th>Number of Mentions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient Lighting</td>
<td>4</td>
</tr>
<tr>
<td>Boiler</td>
<td>1</td>
</tr>
<tr>
<td>Energy Management Systems</td>
<td>1</td>
</tr>
<tr>
<td>Elevators</td>
<td>1</td>
</tr>
<tr>
<td>Fans</td>
<td>1</td>
</tr>
<tr>
<td>Photocell switch</td>
<td>1</td>
</tr>
<tr>
<td>Motors</td>
<td>1</td>
</tr>
<tr>
<td>Space radiant heating</td>
<td>1</td>
</tr>
<tr>
<td>Timer</td>
<td>1</td>
</tr>
<tr>
<td>Chiller</td>
<td>1</td>
</tr>
</tbody>
</table>

Measures Customers would like to have Installed but were not Part of Program Offerings

Customers would like the following items included in program offerings:

- Underground lighting
- “Smaller sized T12s”
- Solar energy
- Windows

Program Influence on Installing Additional Energy-Efficient Equipment

When participants were asked if they had installed additional measures since participating in the program, 19 percent reported installing energy-efficient equipment. Measures installed included:

- Boilers
- Motors
- Lighting
- Fans
- Timers
- Space radiant heating

Equipment installed was more efficient than that which participants would have installed prior to participating in the program. Apart from the City of Toronto, over 40 percent of participants consistently said they installed energy-efficient equipment without receiving a rebate. A small number of City of Toronto participants (20 percent) stated they had installed energy-efficient equipment without receiving a rebate. Measures cited were mostly lighting measures.

Participant Satisfaction with the Program

Participants were asked a series of questions about program satisfaction. Almost all of those surveyed (67) stated they would participate in the program again. These participants would also recommend the program to others. The one person who would not participate stated: “I had
received information about energy savings and did not find it to be true.” In this case, savings assumptions proved greater than results. Many participants (52) saw savings in their energy bills due to the efficient measures installed.

A majority of participants (72 percent) felt energy efficiency was widely accepted by multifamily building managers. A few did not think energy efficiency was accepted due to cost, lack of knowledge, or lack of time to learn about measures available.

**OPA and Program Implementer Awareness**

Awareness of OPA and program offerings was limited-to-low among participants. There were high “don’t Know” ratings for ERIP and GreenSaver customers (70 percent and 100 percent, respectively), and substantial “Don’t Know” ratings for ERIP (35 percent) and for Toronto Hydro (39 percent).

Clear differences arose when participants were asked about their interactions with program implementers. A majority of ERIP participants (63 percent) and Toronto Hydro (61 percent) participants said they were very satisfied with this interaction. Only 33 percent of participants for the other two implementers, the City of Toronto and GreenSaver, indicated they were very satisfied with their interactions. Low satisfaction ratings were accompanied by relatively high “Don’t Know” ratings of 43 percent and 33 percent, suggesting program implementer roles were not as well-defined or clear to participants for City of Toronto and GreenSaver programs as they were for ERIP and Toronto Hydro.

**Suggestions for Improvements**

The program aspects participants would like changed or improved included:

- Increased marketing to raise increase program visibility.
- Increased incentives.
- Broadened program, including windows, building insulation, and heating systems.
- Simplifying prescriptive and custom project applications.
- Clarified the prescriptive and custom programs.
- Accelerating the project approval and rebate process.

**3.7. Active and True Nonparticipant Survey Results**

The active nonparticipant and true nonparticipant survey effort proved to be challenging. We received contact data from GreenSaver for active nonparticipants, but the other implementers did not track this information. This resulted in increased research time to collect contact data for multifamily buildings. Contacts collected were used for both active and true nonparticipant survey efforts. As noted, a survey population of 638 contacts resulted in 57 completed surveys. The majority of completed surveys (38 of the 57) came from active nonparticipant contacts GreenSaver provided.

Data collection results for active nonparticipants and true nonparticipant surveys are presented on the following pages. Findings have been organized into the following sections:
Reasons why people did not participate.
• Measures not part of the program offerings that customers would like to have installed.
• Satisfaction with the application process.
• Previous participation in energy-efficiency programs.
• Energy-efficient measures installed without incentives.
• Participation barriers.
• Overall satisfaction with the program.
• Satisfaction with the incentive structure.
• Suggestions for improvements.

Reasons for Nonparticipation
Our questions sought to determine why respondents chose not to participate in the program. Respondents to the active nonparticipant survey included building owners, property managers, and consultants. When asked their main reasons for not participating, answers included:

• The application was too complicated or had too many questions.
• Thought the program was terminated.
• Did not know about the program.
• The project was in progress or they were working to fill out the paperwork.
• Other, higher-priority projects needed to be completed.

Measures Outside of Program Offerings that Customers would like to have Installed
In looking forward to future program design, questions were asked to determine measures customers would like to have added to the program offerings. Only one person responded, requesting domestic hot water systems were added to program offerings; two respondents did not know measures to add to program offerings.

Satisfaction with the Application Process
Program implementers noted the application process was thought to be a participation barrier. Questions were targeted to learn about the application process from the perspective of the active nonparticipants. Questions were designed to determine: how many respondents filled out the application; if other parties filled out the applications; satisfaction with the application process; and difficulties with the applications. A small portion (11) of nonparticipants filled out the applications. Applications were completed by:

• Building owners
• Other office staff
• Consultants
• MEER
• Contractors
• Engineers
As shown in Figure 11, for respondents filling out the application: two thought the application was very easy to fill out; two rated it easy; four thought the application was somewhat easy; two stated it was difficult; and the remaining four refused to answer or did not know.

**Figure 11. Ease of Application Process**

Respondents offered the following comments regarding difficulty with filling out the application:

- “*I had to jump through hoops to find information.*” “*It repeated itself quite a bit. There seemed to be a lot of duplication.*”
- “*It’s way too complicated and has way too many questions. It takes time to do it and when I’m very busy I don’t have the time to do it. They asked a whole lot of questions that weren’t relevant.*”
- “*To know which section I should apply in, to know what I’m eligible for in what amount. I know I am eligible for something. But I don’t know which sector I’m eligible in. I have to call to finish.*”

**Previous Participation in Energy-Efficiency Programs**

Respondents for both active and true nonparticipants groups were asked if they had participated in any other energy-saving programs. Nonparticipants were equally split, with half participating and half not. The majority (11) of true nonparticipants had not participated in an energy-saving program.

Respondents cited previously participating in the following programs:

- GreenSaver’s Multifamily Energy-Efficiency Rebate Program
- The City of Toronto’s Better Buildings Partnership Multifamily Energy-Efficiency Rebate Program
- The City of Toronto’s Better Buildings Partnership—New Construction Program
- OPA’s Electricity Retrofit Incentive Program
• OPA’s High Performance New Construction Program
• OPA’s Power Saving Blitz
• Enbridge Gas Incentive Programs
• Union Gas Incentive Programs
• Natural Resources Canada’s Energy Retrofit Assistance Program
• Natural Resources Canada’s ecoEnergy Retrofit Program
• Peterborough Green-Up

A few respondents could not recall the names of programs, but identified measures received. Measures noted included: lighting, HVAC, weatherproofing, and water-saving showerheads and toilet systems.

**Energy-Efficient Measures Installed without Incentives**

Overall, 57 percent of active and true nonparticipants reported installing measures without financial assistance. This percentage increased to 64 percent for active nonparticipants alone. True nonparticipants reported much lower installation rates, with only 27 percent (4 of 11) saying they installed energy-saving equipment without assistance.

From the nonparticipant population we surveyed, Table 25 shows energy-saving equipment installed in multifamily buildings.

**Table 25. Nonparticipant Self-Install Equipment**

<table>
<thead>
<tr>
<th>Installed Energy Saving Equipment</th>
<th>Number of Mentions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient Lighting</td>
<td>13</td>
</tr>
<tr>
<td>Boiler</td>
<td>5</td>
</tr>
<tr>
<td>Efficient Water Heaters</td>
<td>4</td>
</tr>
<tr>
<td>Low Water Flow Devices</td>
<td>4</td>
</tr>
<tr>
<td>Furnace</td>
<td>4</td>
</tr>
<tr>
<td>Energy Saving Appliances</td>
<td>3</td>
</tr>
<tr>
<td>Toilets</td>
<td>3</td>
</tr>
<tr>
<td>Programmable Thermostats</td>
<td>2</td>
</tr>
<tr>
<td>Geothermal</td>
<td>1</td>
</tr>
<tr>
<td>Chiller</td>
<td>1</td>
</tr>
<tr>
<td>Controls</td>
<td>1</td>
</tr>
<tr>
<td>Roofing</td>
<td>1</td>
</tr>
<tr>
<td>Motors</td>
<td>1</td>
</tr>
<tr>
<td>Air Makeup Unit</td>
<td>1</td>
</tr>
<tr>
<td>Insulation</td>
<td>1</td>
</tr>
</tbody>
</table>

*Other nonspecific mentions not included.

**Barriers to Installing Efficient Equipment**

True nonparticipants and active nonparticipants were asked a series of questions to identify what prevented them from installing energy-efficient equipment. The questions covered: cost, education about program, marketing of programs, time, and whether facility managers thought
they would save money. Table 26 and Table 27 show results received from true nonparticipants and active nonparticipants. The majority of respondents from both surveys stated cost was the most significant barrier to program participation. One comment received was:

“The proof is in the bill I receive. Maybe the marketing needs to be simpler. How much is it really saving me, and where is that savings. I need proof.”

Table 26. True Nonparticipant Barriers to Installation of Efficient Equipment

<table>
<thead>
<tr>
<th>Prevents Other Building Owners from Installation of Efficient Equipment</th>
<th>Yes</th>
<th>No</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>12</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Marketing</td>
<td>5</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Time</td>
<td>8</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Facility managers not believe they will save money</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Table 27. Active Nonparticipant Barriers to Installation of Efficient Equipment

<table>
<thead>
<tr>
<th>Prevents Other Building Owners from Installation of Efficient Equipment</th>
<th>Yes</th>
<th>No</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>9</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Education</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Marketing</td>
<td>5</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Time</td>
<td>7</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>Do not believe they will save money</td>
<td>6</td>
<td>8</td>
<td>1</td>
</tr>
</tbody>
</table>

Overall Satisfaction with Program

Active nonparticipants were asked a series of questions to assess program satisfaction. Areas covered included satisfaction with the following: implementers, interaction with the OPA, types of equipment offered, and overall program satisfaction. We also gauged program satisfaction by asking whether respondents would recommend the program to other multifamily building owners.

A majority of respondents reported satisfaction with their interactions with program staff. Over half of the active nonparticipants (23) were satisfied to extremely satisfied with their interactions with the program implementers, while eight people reported being unsatisfied.

When asked about overall satisfaction with the program, half of the respondents were satisfied to very satisfied with the program.

Respondents were asked if they would recommend the program to others in the multifamily sector. Most of those who responded (30) would recommend the program, which indicates overall program satisfaction among respondents. Eight people would not recommend the program for the following reasons:

- “Have not participated, will recommend once I’ve completed program.”
- “It doesn’t work.”
- “The cost involved.”
- “Unprofessionally done—program cancelled.”
• “Contacted months ago and never heard anything since.”

Satisfaction with the Incentive Structure
Incentive structure responses were varied, as shown in Figure 12, with a significant portion of respondents declining to answer or answering “Don’t Know.” Of the remaining respondents, 43 percent stated they were satisfied to very satisfied with the program incentive structure. One person expressing dissatisfaction with the program apparently had not received incentives offered.

![Figure 12. Satisfaction with Incentive Structure](image)

Suggestions for Improvement
Respondents were forthcoming with ideas for program improvements. Several people commented on the application process being complicated and administratively burdensome. A few comments addressed the need for increased marketing and promotion. Others noted an increase in education was needed. The following additional comments were received:

- “Make it so that a person who is not an engineer can fill out the application.”
- “I think that you need to do the rebates a little faster, or at least communicate as to why with the recipient a little faster.”
- “One-on-one education. Someone can come to my building and say, ‘this can do this, and this can do that.’”

3.8. Marketing Evaluation
We reviewed marketing and communications developed to promote participation and educate target audiences on program details.

3.8.1. Goals and Methodology
This analysis included a comprehensive assessment of relative marketing-related activity impacts on program participation. The list below highlights the various data inputs used for assessing marketing efforts from each stream. A detailed review of each can be found in Appendix G.
These aggregate findings allowed us to identify both “bright spots” and opportunities for improvements.

- Marketing materials and messaging review, including:
  - Collateral (e.g., promotional brochures, trade show information)
  - Presentation decks
  - Online elements
  - Advertising
  - Marketing mix and schedule
- Interviews of program staff from each stream.
- Metrics review and analysis.
- Participant and nonparticipant surveys.

3.8.2. Findings
Apart from survey data, much of our findings and recommendations are qualitative due to the minimal granular metric tracking by most implementers. This qualitative and anecdotal data, however, proved useful in creating recommendations. The following list represents general successes and improvement opportunities; Appendix G provides greater detail.

**Market confusion** regarding multifamily programs appeared to have decreased, but it still limited marketing-driven participation. Survey data and program stakeholder interviews included participants’ desiring clearer messages and simpler program information. In some cases, implementers and potential participants experienced split incentives and competition due to program design. These split incentives complicated messaging addressing advantages and participation barriers.

**Market characteristics influenced success strategies.** In smaller markets, such as Peterborough, advertisements in local papers delivered leads for possible participation. Other implementation channels, reported little success with broadcast advertising, with most of it occurring most in larger markets. For these managers, one-to-one efforts proved more successful. To increase program participation, OPA could encourage strategies and best practices specific to region size.

**Service and education-intensive efforts drive participation:** Most target participants were very busy and overwhelmed by stressors including vacancy rates, limited capital, and budget timing challenges. Successful program managers recognized this customer characteristic, and followed long-term outreach and best practice sales tactics. Consequently, broad marketing became less important. Co-branded presentation decks and similar “sales tools” proved to be of more value. Further “tool box” details can be found in Appendix G.

**Trade-associated word-of-mouth drives participation.** Contractor, supplier, and manufacturer communication remains a key source for program information. OPA and other stakeholders can leverage these opportunities to provide co-marketing message distribution and increase program knowledge through the supply chain. Successful program implementers trained vendors to deliver a clear and consistent program messages.
OPA support impacts LDC performance. Interviewees indicated mixed results regarding contact success with OPA. Having a single OPA point of contact for all LDC questions was highlighted as helpful regarding applications, processes, and other program elements. Some LDCs, having few staff members, have compromised abilities to manage the high-touch sales process level necessary for success and energy reduction goals. OPA could consider staff resources to support the LDC effort through proactive lead generation and process aid. Additionally, OPA education events can be recorded and offered online for LDCs at great distances.

3.8.3. Recommendations and Discussion

The bullets below address conclusions found in the analysis above. They also integrate social marketing and outreach best practices, drawn from prior evaluations and experiences specific to regional CDM programs. We believe that, while program design will drive specific marketing strategies, building these concepts into marketing implementation wherever possible will maximize program potential and drive energy savings. Appendix G contains detail on each of these recommendations.

Integrate and unify brands. Consumers are easily overwhelmed by multiple acronyms and similar-seeming programs. In the presence of too much choice, consumers often opt not to act at all. A single contact and call to action could be easier to remember and increase participation by many stakeholders.

Maintain simple and steady messages. Ideally, all marketing vehicles will carry the same brand, messaging, and call to action. This increases the opportunities for multiple impressions to act cumulatively on behavior.

Utilize marketing economies of scale. Many implementation managers used the personalized marketing information to reduce redundancies and “reinvention of the wheel.” Providing electronic boilerplate for implementers would provide value and free implementation time for the one-to-one interactions, which has proven most effective in driving program participation.

Market through the supply chain. Surveys and interviews indicated that contractors and other trade allies were a key link to MF decision makers. A specific Ontario-wide strategic plan reaching contractors would benefit all LDCs, and drive program participation at the point of choice/purchase. Grassroots strategies piggybacked on vendor target contacts would provide co-marketing benefits with low distribution costs.

Build strategic relationships with marketing and education. “One to many” opportunities, such as road shows and lunch and learns would foster relationships by delivering program benefit information and providing education. Additionally, a strategic plan designed to reach the 20 percent of property managers owning 80 percent of multifamily units would influence long-term capitalization plans and deliver maximum return on investment for energy savings.

Leverage social networks/Influence social norms. Messaging appropriate for social network distribution could be provided both online and in-person. These groups (such as stakeholder trade associations, community networks, Chambers of Commerce, LinkedIn groups, and multifamily e-mail networks) would provide low-cost, high-volume information distribution vehicles.
Allay concerns and address participation barriers. All messaging should lead with key messages speaking to participation barriers and addressing concerns. In our findings, barriers consistently identified include: lack of time, lack of money, and concerns about ease of participation.

Capitalize on social media outreach. Worldwide, Toronto is the seventh-highest rated city on Twitter. Many program targets can be reached through LinkedIn and participate in online groups, where information can be distributed. Further, key online influencers can share program benefits in a structured, meaningful way. Appendix G provides a sample social media “road map.”

All of the above recommendations can be shared with program designers as well as tested in interviews with participating and nonparticipating customers. Consumer segmentation and insight can identify preferred contact methods, increasing communication efficiency, message retention, and final returns on marketing investments.

3.9. Process Evaluation Findings and Recommendations

3.9.1. Findings

The following list describes the major findings of the process evaluation.

- **Inconsistent branding of programs leads to customer confusion.** Target participator-facing brand associations explored in this process evaluation include GreenSavers, multiple LDC brands, ERIP, MEER, BBP, and the OPA itself. Notwithstanding the intentional program design by the OPA and its channel partners, end users continue to experience confusion and uncertainty around program benefits and calls to actions. Both survey data and program stakeholder interviews include participant desires for clearer messages and simpler program information.

  Additionally, in some cases implementers and potential participants experienced split incentives and competition via program design. These split incentives complicated brand communication messages about advantages and barriers to participation, limiting marketing and education outreach ability to prime the pump and “push” participation. In most cases, successful LDC activity required leverage of relationships along with a “high touch” educational and consultative approach. This approach, while effective, can be very time intensive and did not benefit from the inbound lead support marketing outreach can provide.

- **Contractors/installers were not specifically integrated into the programs.** Contractors generally operated as “free-agents,” bring customers to the programs. This resulted in what might be called “smash and grab” participation, whereby lighting contractors (with the least incentive to employ comprehensive auditing) led the way in recruitment. Without some integration into the program process, be that training or qualifying standards, contractors are unaware or choose to ignore the underlying program goals.

- **Lack of complete, consistent data from program databases.** Determining contact information was difficult as all databases had radically different formatting and content, and project details were different, such as some projects encompassing several buildings
worth of retrofits whereas others listed each building separately. Most implementers did not keep central records of the contractors that participated in the program. Most implementers could not provide records of participants who started into the process but did not complete projects (active nonparticipants).

- **Spillover measures were not extensive**, but were real. Eleven of sixty eight participant survey respondents did claim additional measure installation without rebate and stated the program sufficiently influenced their decision to do so.

- **Program participants were generally satisfied with the programs, across all streams.** Participants they would recommend to others.

- **Implementers thought there was a breakdown in communication** between them and the OPA, likely triggered by frequent staff turnover and lack of feedback about changes.

### 3.9.2. Recommendations

The evaluation produced several recommendations we advocate to aid in the implementation and effectiveness of future multifamily energy efficiency programs.

- **Consistent and leaner branding** will help customer understanding about programs. The importance of intelligent integration of marketing planning with program design cannot be overstated. Targets for program participation, whether business or residential, have extensive time demands and experience information overload from all directions. Few enjoy the level of energy efficiency and conservation program knowledge those “in the trenches” may expect. Therefore, identifying a clear and consistent branding “point of entry” allows marketing and education outreach programs to become much more effective and efficient.

Additionally, funneling customer experience in this way allows for the kind of consistent metrics tracking and ROI analysis lacking in the current program. ROI analysis functions both to evaluate pieces of the program that are working best, but also to fine tune targeting efforts and maximize the results from outreach budget while the program is running. OPA’s aggressive goals will be more likely achieved with the addition of ongoing metrics evaluation and channel stream support as described in our process evaluation recommendation.

- **More comprehensive, standardized databases**, including nonparticipant data. Implementer databases requirements should be specified. These data should include information on customers from the time they are contacted. Data should also include contractor contact information.

- **Integrate contractors into the program process.** This may include training, qualification requirements and marketing assistance.

- **Recognizing that “one size doesn’t fit all,”** provide examples of successful implementation strategies that LDCs can use, going forward. Implementation methods varied which proved recruiting and marketing should continue to be tailored to different participant markets. For example, some LDCs utilized a trained sales staff to promote and
sell the program offerings. The staff was recruited from outside the LDCs and outside of the energy efficiency discipline and proved to be quite effective.

- Provide staff to help participants with the application and implementation process. Having designated customer contacts to help with questions on the application will bolster participation.

- Target property management firms. Some property management firms took advantage of the program offerings across the province. Properly leveraging these opportunities could significantly increase program savings as well as program comprehensiveness.
4. Comprehensiveness

4.1. Introduction

4.1.1. Definition
For this evaluation, we defined comprehensiveness as the entire program's overall mix of different measure types. Program comprehensiveness can be examined by reviewing audit reports for individual projects; in this case, however, the number of comprehensive audits proponents submitted was very small. The number of projects implementing multiple types of measures in 2009 was also very small. Consequently, we began looking at the whole program, seeking to understand the distribution of the 2009 measure types, and to determine how comprehensiveness can be improved moving forward.

4.1.2. Updated Idealized Measure Checklist
The 2008 interim evaluation report included developing an “idealized comprehensiveness measure list” to identify measures that should have been looked at by applicants for an individual project to be as comprehensive as possible. Our project experiences and industry best practices were used to develop the list. Moving forward, the idealized measure checklist can serve as a framework for understanding where opportunities lie within the MFB sector and to examine the program's overall comprehensiveness.

For 2009, we have condensed the list to reflect conditions and opportunities observed in the MFB retrofit market. Through the 2009 site audits, we have evaluated many differing measure types across a broad range of buildings. Most buildings in the 2009 study each implemented one or two measure types.

A number of energy conservation measures have been particularly applicable to multifamily buildings. These include (in alphabetical order):

-Appliance replacements
- Cooling retrofits (if applicable)
- Carbon monoxide (CO) control of parking lot fans
- Electric heating replacements (if applicable)
- Envelope measures (windows/doors/weather stripping)
- Lighting
- Variable frequency drives

Typically, most of these measures can result in short paybacks. For example, lighting paybacks can be achieved in one or two years. Envelope measures, on the other hand, may take 15 years or more. One intent of the MFB initiative has been to encourage and incent savings across all measure types. To that end, we evaluated how well program streams performed regarding comprehensiveness, and, for the City of Toronto, we compared 2009 performance to 2008. We also suggested future program comprehensiveness improvements.
4.2. Results
To examine drivers of overall program comprehensiveness, we performed the following analyses:

- Breakdown of measure types for the entire program to determine how the program was structured as a whole.
- Year-over-year comparison of City of Toronto measure types to determine how the mix within this program stream changed from 2009.
- Review of submitted comprehensive audits to determine how service providers have presented energy conservation projects.
- Review of multiple-measure projects to determine how many proponents have implemented multiple measures.
- Review of measures submitted by each energy management firm (EMF) to determine how different EMFs dealt with comprehensiveness

4.2.1. Breakdown of Measure Types
For the 2009 program year, a total of 439 distinct measures were applied across 395 projects. Breakdowns of different measure types are provided below, collectively and by program stream.

Figure 13. Breakdown of All 2009 Measures by Type
Across all program streams, lighting measures comprised the largest majority of 2009 projects. It should be noted the “General Mechanical” category included measures such as electric heating replacements. The “Other” category included measures not clearly identified in the respective program stream databases and not included in our sample audit.

Table 28 presents the relative prevalence of measure types varying by stream. For example, the relative prevalence of lighting measures varied from only 53 percent for GreenSaver to 90 percent for Toronto Hydro.

Table 28. 2009 Measure Types by Program Stream

<table>
<thead>
<tr>
<th>Measure Type</th>
<th>City of Toronto</th>
<th>ERIP</th>
<th>GreenSaver</th>
<th>Toronto Hydro</th>
<th>All Streams</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Qty</td>
<td>%</td>
<td>Qty</td>
<td>%</td>
<td>Qty</td>
</tr>
<tr>
<td>Lighting Measure</td>
<td>77</td>
<td>59%</td>
<td>196</td>
<td>86%</td>
<td>10</td>
</tr>
<tr>
<td>VFD</td>
<td>34</td>
<td>26%</td>
<td>1</td>
<td>0%</td>
<td>10</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>1%</td>
<td>26</td>
<td>11%</td>
<td>0</td>
</tr>
<tr>
<td>Chiller Retrofit</td>
<td>6</td>
<td>5%</td>
<td>2</td>
<td>1%</td>
<td>5</td>
</tr>
<tr>
<td>CO Control</td>
<td>8</td>
<td>6%</td>
<td>0</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>General Mechanical</td>
<td>4</td>
<td>3%</td>
<td>2</td>
<td>1%</td>
<td>1</td>
</tr>
<tr>
<td>Energy Star Appliances</td>
<td>0</td>
<td>0%</td>
<td>3</td>
<td>16%</td>
<td>0</td>
</tr>
<tr>
<td>Grand Total</td>
<td>130</td>
<td></td>
<td>227</td>
<td></td>
<td>19</td>
</tr>
</tbody>
</table>

This dataset clearly shows lighting measures were the dominant measure type for all program streams. For the remaining measure types, we drew the following high-level observations at the program stream level:

- The City of Toronto appears to have had the most comprehensive distribution of measure types compared to other program streams. In terms of the relative prevalence of these measures, there were significantly more VFD projects implemented by the City of Toronto than any other program stream. This partly explains why the relative prevalence of lighting was the lowest of all program streams.

- ERIP had the largest number of “Other” projects, which were not clearly identified. This mainly indicated administrative issues inherent in the ERIP database compilation process.

- GreenSaver was the only program stream to have ENERGY STAR appliance applications. Furthermore, the program had a much higher percentage of chillers than the other programs.

- Toronto Hydro was largely a lighting-only program stream for 2009.

4.2.2. Year-Over-Year Comparison

As this is the second year of analysis, 2009 projects’ comprehensiveness could be compared to the 2008 projects. Though the total population of 2009 projects could be compared to 2008 projects, it proved more meaningful to compare only City of Toronto projects as the 2008 interim evaluation exclusively looked at City of Toronto projects.
As expected, the total number of measures increased from 2008. In addition to increases in VFD measures (as discussed in the previous subsection), the other noteworthy change was an increase in the number of measure types installed. For 2009, we can conclude the City of Toronto program, as a whole, became much more comprehensive.

### 4.2.3. Review of Submitted Comprehensive Audits

From all 395 projects, we only identified four multi-measure feasibility studies in available documentation. These feasibility studies were prepared by two different service providers, and all were conducted for City of Toronto projects.

These audits were reviewed in detail, and measures suggested in each were compared to the idealized list cited above. The accompanying document presents specific details of our findings. Although the four audits examined several measures, the characterization of building systems and development of proposed measures were not conducted with a high degree of rigor.

All four audits used simple paybacks as the exclusive financial metric, and most measures suggested and implemented had simple paybacks of less than five years. In one file, two longer payback items - chillers and CO sensors - were included in the package of measures implemented. This provided the only evidence we found of shorter-payback items being used to supplement longer-payback items.

From the limited number of energy audits we conducted, most applicants did not undertake comprehensive energy audits before installing energy conservation measures. Furthermore, comprehensive audits were not part of the planning process for GreenSaver, ERIP, or Toronto Hydro.

### 4.2.4. Multiple-Measure Projects

In addition to the small number of comprehensive audits identified above, only 11 projects out of 395 (3 percent) in 2009 consisted of two or more distinct measure types:

- In eight files, the incentive paid for a combination of lighting and mechanical measures, such as variable-frequency drives.
- The remaining three projects featured mechanical items, such as CO parking lot ventilation controls and chillers.
Nine of the multiple-measure projects were for two measures.

The remaining two projects had four measures each.

One multiple-measure project applied for incentives for one measure under the Toronto Hydro program and two other measures under the City of Toronto. The small number of multiple-measure projects indicated the MFB initiative effectively operated as a single-measure program, which had following impacts on the MFB sector:

Building owners largely did not use short payback measures (such as lighting) to subsidize longer-payback items (such as window replacements). Therefore, potential opportunities were not realized. Ideally, shorter-term payback projects would be used to supplement longer-term payback items; this ensured energy savings occurred over a longer period of time. Analysis of the 2009 projects indicated such payback subsidization does not appear to be occurring.

Given the lack of comprehensive audits, a energy-efficiency culture has not been cultivated; therefore, the potential for meaningful market transformation effects has been missed.

4.2.5. Measures Submitted By Energy Management Firm

The City of Toronto was the only provider tracking EMFs’s names in their database. From 2008 to 2009, the total number of the firms submitting projects to the program increased from nine to 26. Twenty-eight projects (not to be mistaken with measures) were submitted in 2008; 90 were submitted in 2009.

The following figure shows the relative proportion of projects implemented by single-measure (lighting) EMFs, compared to projects implemented by EMFs capable of recommending multiple measure projects.
Compared to the other programs, more contractors participated in the City of Toronto’s program, though the relative proportion of projects completed by single-measure EMFs decreased from last year. In many cases, lighting service providers continued to approach building owners and condominium boards with packages of low-payback measures, ignoring other possible, longer-payback savings measures. This barrier prevented owners from having a reasonable opportunity at implementing comprehensive projects.

As EMFs were not tracked by the other program streams, we were unable to draw broader conclusions at the MFB sector level.

4.3. Recommendations

Our comprehensiveness analysis identified the following program barriers to comprehensiveness; subsequent recommendations address these barriers:

- Single-measure EMFs and a lack of comprehensive EMFs and/or inability for comprehensive EMFs to reach the market;
- Costs of comprehensive energy audits;
- Condominium boards vs. property managers, and knowledge of decision makers; and
- Simple payback period of measure.
Require a Comprehensive Energy Audit

Experiences from 2008 and 2009 have shown comprehensive measures were not presented to a building owner unless a comprehensive audit was completed. In many cases, lighting service providers approached building owners and condominium boards with packages of low-payback measures, ignoring other possible, longer-payback savings measures. Further, many sampled projects ignored interactive effects in electrically-heated buildings. Building owners performed lighting retrofits and expected a certain level of savings, not realizing many savings would be made up in electric heat. A comprehensive audit would have identified the interactive effects and tailored the recommendations appropriately.

For the program to be more comprehensive, it must begin with audits that present a menu of choices to building owners. Otherwise, individual contractors will directly solicit building management. We further recommend energy auditors present alternate financial metrics to building owners. By solely utilizing a simple payback period, entire classes of measures will not be selected by condominium boards. Alternative (and more technically correct) metrics such as Net Present Value (NPV), account for the duration of energy savings and cost; this would allow accurate evaluation of all measures, and factor in the duration over which savings occur. Envelope measures often save both money and energy (even though they have a long payback) because their savings occur over a long timeframe.

Provide Funding and Direction for Comprehensive Audits

Comprehensive audit providers were on unequal footings due to the inherent extra cost of providing a truly comprehensive study. To help applicants afford comprehensive feasibility studies, we recommend considering offering a portion of the incentive up front to fund feasibility studies. The applicant would only be eligible for this incentive if preapproved. For example, 50 percent of their incentive could be preapproved up to a given threshold. We further recommend developing guidelines to define what the program seeks in a comprehensive audit.

Follow-up with Single-Measure Recipients (Market the Program and Customer Relationship Management)

Given budget restrictions and capital replacement cycles, building owners may not afford implementing an entire suite of energy conservation measures within a single year. They may, however, be able to implement a lighting retrofit one year, and then implement mechanical measures in the next. After receiving an incentive for the lighting measure, building decision makers would likely be more receptive to further upgrades.

Thus, program managers should follow-up with incentive recipients to ensure they consider the program in future years, as this will build the program’s comprehensiveness over time. We recommend marketing comprehensive measures directly to applicants, rather than waiting for EMFs to approach them. For example, a mailing could be sent detailing case studies of successful mechanical and envelope measures.

Impose a Minimum Payback Period

While the incentive is currently limited to 40 percent of the project cost, this still allows the program to fund projects with extremely short payback periods. Imposition of a minimum payback period would decrease freeridership.
Lower Lighting Incentive Levels
Previous experience with incentive programs has shown the current $400 funding level is higher than necessary to drive these projects to completion. We recommend reducing the incentive on lighting retrofits to $250/kW, which more closely matches other existing ratepayer-funded programs. In interviews with decision makers, we determined projects with payback periods of three years or less would have likely been implemented regardless of the incentive.

Another option would be to pay incentives for lighting measures only when bundling them with at least one other measure type.

Establish Targets for Comprehensiveness
We recommend setting targets for program comprehensives. These targets should be based on market studies of the available conservation potential of the various measure types within the multifamily building sector.
5. Ancillary Studies

In addition to the impact and process evaluation components, direct green jobs and resident education programs were assessed for program year 2009.

5.1. Direct Jobs

5.1.1. Methodology

The direct job creation study was an ancillary component of the OPA MF 2009 Interim evaluation. The study addressed direct job creation in the local contractor job market due to project work incentivized through the OPA MF program. Job creation manifested itself in new hires as well as jobs retained. The cost of creating a job was defined as the project work necessary to employ a full-time employee for a year. The study attempted to provide estimates for both field and support staff, as it was assumed their costs to the company in terms of project costs were not comparable. To provide job creation estimates at the program stream and program levels, project cost data from program tracking databases were combined with costs of job creation estimates obtained through interviews.

Contractor Sampling

Only one of the four program streams—the City of Toronto—tracked the contractors performing work on projects incentivized through the program in 2009. This was verified during process interviews with program staff. To supplement lists of contractors for surveys, evaluation staff conducting site visits for the evaluation’s impact component gathered names, phone numbers, and contact names of contractors performing the work at each site. Unfortunately, significant overlap occurred within and across the two lists. In addition, several sites visited claimed to have performed the work themselves, or could not easily identify contractors who performed the work. A final number of 36 potential contacts was identified for interviews. Table 30 outlines how these were distributed.

Table 30. Distribution of Potential Contacts

<table>
<thead>
<tr>
<th>City of Toronto</th>
<th>Identified With Site Visit</th>
<th>Overlap</th>
<th>Total Contacts For Interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>31</td>
<td>11</td>
<td>36</td>
</tr>
</tbody>
</table>

Interviews

Almost half of the 36 contacts (17) identified having completed interviews with evaluation staff. The low response rate was largely due to poor contact information and contacts turning out to be suppliers rather than contractors. No contractors contacted refused to be interviewed.

Two interview guides were written for the study. All contractors were interviewed using the interview guide found in Appendix H. Preliminary survey analysis revealed the need for additional clarification from contractors. Follow-up calls were made using the supplemental interview guide found in Appendix I. Fourteen (14) contractors were reached and completed a follow-up interview. Interviews are presented in Table 31.
Table 31. Surveys Completed

<table>
<thead>
<tr>
<th>Total Contacts for Interview</th>
<th>Contacts that Completed General Interview</th>
<th>Contacts that Completed Clarification Interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>17</td>
<td>14</td>
</tr>
</tbody>
</table>

**Analysis**

Analysis of interview results was conducted using two steps. First, from interviews providing estimates, the dollar value of work necessary to support a single, full-time employee (field and support staff) for a year was calculated. Because of the small number of contractors interviewed, one estimate for each type of employee was generated for all program streams. This estimate was then applied to project cost data in the program tracking databases. This provided job creation estimates at the program stream and program levels. Figure 15 provides a graphic representation of this process.

**Figure 15. Analysis Procedure**

5.1.2. Results

**Jobs Created**

Evaluation of interview results combined with total project costs in the program tracking databases resulted in an estimated 64 field staff jobs created. Due to the general inability of contacts to estimate the job cost of support staff, estimates could only be addressed qualitatively. Field staff tended to fall into one of two categories, depending on the nature of the business: auditor/energy-efficiency professional; or general contractor.
Firms hiring the former cited higher full-time employee costs (generally around $400,000), as these employees were more experienced, trained, and generally required capital investments, such as offices and trucks.

Firms hiring the latter generally cited lower full-time employee costs (generally around $100,000), as these individuals tended to be younger and paid less. Table 32 shows costs per full-time employee, jobs created per program stream, and total job creation estimate. The average FTE cost estimate was derived by averaging the responses of the respondents who felt comfortable providing an estimate.

Table 32. Total Jobs Created

<table>
<thead>
<tr>
<th>Total 2009 Project Cost (By Program Stream)</th>
<th>Average FTE Cost Estimate</th>
<th>Estimated Jobs Created by Each Stream in 2009</th>
<th>Total Jobs Created by 2009 OPA MF Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>$ 4,794,057</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GreenSaver</td>
<td>$ 1,998,226</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERIP</td>
<td>$ 3,914,210</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>$ 4,206,745</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$ 233,333(^7)</td>
<td></td>
<td>64</td>
</tr>
</tbody>
</table>

Outlook of Jobs Created and Respondent Characteristics

Overall, the type of work contractors performed in OPA-incentivized projects did not represent a new line of work for them. Only two contractors identified energy-efficient retrofits as a new line of work, and all contractors anticipated growth in the sector. Almost half of interviewees (8) identified work in the multifamily sector as the majority (over 90 percent) of their total work. All interviewees identified work in the multifamily sector as at least a large part of the work they performed. Most contractors interviewed expected this to continue for the foreseeable future. The only trend some contractors identified along these lines was a movement away from the light commercial sector in recent years into the multifamily sector.

In terms of full-time employees, most interviewees represented small companies. The average size of firms (for the 15 respondents feeling comfortable providing an answer) was 12.6, but the median was seven. Table 33 provides the distribution of full-time employees and respondents.

Table 33. Number of Full-Time Employees by Respondent

<table>
<thead>
<tr>
<th>Number of Full-Time Employees</th>
<th>Number of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
</tr>
</tbody>
</table>

\(^7\) One contractor mentioned the general rule for his company was: project work equaled 2.2 times a perspective employee’s salary, before hiring them.
In large part, the small size of most contractors was due to their role in the contracting process. Most companies identified themselves as project design, energy consulting, or project management firms, which generally subcontracted the actual work of installing measures. Twelve interviewees felt comfortable providing an estimate of the value of the work they performed on incentivized projects in 2009. On average, interviewees estimated they worked on projects worth roughly 1.5 million dollars that received some form of incentive funds, either through the OPA, manufacturer incentives, or other sources.

Work on projects incentivized through the OPA MF program formed the impetus for eight companies to hire new employees. On average, firms hiring because of work on incentivized projects in 2009 hired 3.5 full-time administrative, sales, or field employees. However, the average was skewed upward by one contractor, which hired co-op students from various college programs, and then later brought them on full-time. The median number of full-time employees firms hired was 2.5. Only one company was forced to reduce staff (two FTEs) in 2009.

**Process Findings**

Respondent’s sentiments toward all program streams were overwhelmingly positive. Most believed program rebates helped them make sales because of lower costs to perspective customers, and their ability to show prospective customers that energy savings from a particular measure or installation were real and verifiable. The most common feedback contractors most provided was for the process to be more streamlined. Most felt many program names, measures, and steps could be difficult for them and their customers to understand.

The second most common comment was to keep the programs going. Many customers had invested time learning the processes, and leveraged this experience when making sales. Two contractors expressed the need for faster rebate repayments, and two expressed frustration at the length and scope of some verification work performed on their projects. One contract mentioned increasing rebates for lower-income customers, and one mentioned trouble obtaining measures, specifically T5 lighting from suppliers, who were consistently sold out because of increased demand generated by the program. Finally, one was interested in inclusion of gas measures into program measure offerings.

**5.1.3. Conclusions and Recommendations**

The direct job creation study provided several important insights into the way OPA MF rebate funds have influenced the local job market. Overall, we the 2009 multifamily building retrofit programs were responsible for creating or retaining 64 jobs. The study also offered an opportunity to gather information on contractor opinions on the program and suggestions for improvements or changes. Drawn from study results, we offer the following three recommendations.

**Track the contractors performing work on projects receiving incentive funds.** The City of Toronto was the only program stream tracking this information. This significantly limited the study’s scope and detail. Moreover, it significantly reduced the ability of program staff to target
contractors to effectively focus on marketing the program, soliciting feedback, identifying program participants who are struggling in the program, and so on.

**Perform regular contractor training.** From interviews with the contractors, it appears, for most customers, the contractor served as the program face. Therefore, it is in the program’s best interest to ensure contractors remain aware of program changes and program staff expectations. Such gatherings also offer contractors an opportunity to convey issues or problems they have with the program, and serve as an important feedback loop for program staff.

### Discussion of Study Findings

Overall, it appears the 2009 OPA MF program provided 64 contractors with permanent employment. In addition, it provided a more favorable economic environment for these generally smaller companies. Interviewees were happy with the program, which provided most with an effective sales tool, reducing costs to their clients and providing verifiable energy savings. Most contractors had been in the energy-efficient retrofit line of work for many years, but expected the work to continue growing.

#### 5.2. Resident Education

In the MEER program, participating buildings save energy when building owners or managers retrofit the building with major measures, such as efficient lighting, chillers, building automation systems, and variable speed motors. These major measures are typically installed in the buildings’ common areas. Additional savings opportunities are available from the institution of energy-efficient behaviors in individual housing suites; however, there are barriers to accessing the residents of these suites.

In Ontario, approximately one million housing suites are in master-metered buildings. Building owners recoup energy-use costs in various ways, such as a flat fee embedded in tenants’ monthly rents or through condominium maintenance fees. Residents of master-metered buildings have little incentive to engage in efficient electricity use as they do not receive a monthly electric bill. In addition, materials on energy-efficient practices sent to residential account holders from local utility companies or the OPA will not reach these residents. The Resident Education option of the MEER program has been designed to address these information availability and access barriers.

The Resident Education offerings are an optional MEER service, available to residents of participating buildings, at the participant’s discretion. It provides a 10 percent benefit through the final Energy Savings Rebate, awarded to a project to offset costs of eligible resident education activities and materials provided by the delivery agent.

The MEER program did not operate at full-scale in 2009, and no Resident Education activities were conducted in 2009. Current activities by the three program delivery agents—the City of Toronto, Toronto Hydro, and GreenSaver—are varied.

The City of Toronto’s BBP Website states a Resident Education Rebate of 10 percent of the final Energy Savings Rebate awarded to a project is available. The City of Toronto’s MEER application includes a checkbox for those “interested in providing energy efficiency information to the residents in my building.” The City of Toronto has indicated it would like to provide Resident Education to MEER participants in the future, but no activities have occurred to date.
Toronto Hydro’s BIP Website does not include any references to Resident Education, and the BIP application includes no references to the program.

GreenSaver has actively implemented the Resident Education program since June 2010. During the first two quarters of 2010, GreenSaver developed program materials and activities, and hired a program specialist to oversee the Resident Education program implementation. They hired nine Conservation Ambassadors as part of a green jobs strategy to represent and promote MEER Resident Education in different geographic areas, effectively promoting the MEER program as well. Candidates for the Conservation Ambassador positions were recruited from local colleges in GreenSaver’s market territory; all received training via a Webinar designed by the program specialist. The Ambassadors work from home and meet with local community organizations to market the Resident Education program.

GreenSaver recently changed its MEER application to make Resident Education an implicit part of the program rather than an opt-in program segment. For participating buildings, GreenSaver offers a three-tiered program, based upon the amount of the Energy Savings Rebate the building will receive:

- **Tier 1.** All residents receive a reusable shopping bag with energy-efficiency awareness materials inside. These can be distributed by GreenSaver staff, which is the preferred method, or by the landlord or building manager.

- **Tier 2.** All residents receive a reusable shopping bag with energy-efficiency awareness materials inside. GreenSaver hosts a table in a building common area for residents to speak with GreenSaver team members about energy efficiency.

- **Tier 3.** All residents receive a reusable shopping bag with energy-efficiency awareness materials inside. GreenSaver hosts a table in a building common area for residents to come and talk with GreenSaver team members about energy efficiency. GreenSaver hosts a barbecue event where they talk to residents about energy efficiency.

To date, we have conducted interviews with program staff of the City of Toronto and GreenSaver, and has received program materials from GreenSaver. In the third and fourth quarters of 2010, the evaluators will review the GreenSaver participant database, and survey participant and nonparticipant residents to establish a baseline level of energy-efficiency awareness. In addition, our staff will attend one of the meetings with local organizations and interview additional program staff.
6. **Overall Findings and Recommendations**

Evaluation findings and recommendations have been presented throughout each of the chapters in this report. Presented here are broad, overarching findings and recommendations for the programs and the evaluation itself.

**Program Findings and Recommendations:**

- There must be common assumptions throughout the programs, such as consistent deemed savings for prescriptive measures and a specified peak kW definition. Implementers and OPA do not necessarily have a consistent, common definition about demand definitions, and this creates inconsistent reporting across streams.

- The current incentive structure favors quick, walk-through audits and lighting only projects. The incentive structure should be changed to foster non-lighting measures. This method of auditing and project planning do not lend themselves to more comprehensive project types as they stand now.

- Recordkeeping should be re-worked for consistency and completeness. Project costs, contact information, incremental costs, measure level information, installer and contractor information were not consistent or present in all of the streams.

- The new database, Icon, should have a field that distinguishes the number of buildings in each project application. Project contact information, savings reported, project costs, and measure information should be mandatory in project tracking databases, as it is essential for rigorous evaluation and proper long-term record keeping.

- Property management firms should be targeted. One property management firm fully utilized the program across the province. Further effort should be taken to understand why this particular property management firm understood and participated in the program to the extent they did, and how OPA can entice others to participate.

**Evaluation Findings and Recommendations:**

- Each program database was very different in content and format and thus created barriers to a clear understanding of claimed savings. Therefore, recordkeeping should be re-worked for consistency and completeness. Project costs, contact information, incremental costs, measure level information, installer and contractor information were not consistent or present in all of the streams.

- Implementers and OPA do not necessarily have a consistent, common definition about demand, which was a hindrance in the evaluation. Clear definitions will help LDCs understand how to meet savings goals in the coming year’s programs.

- Many project applications ended up having several buildings worth of projects, sometimes with different measures. Explicit statement of number of locations and measure types and counts would enable more precise assessment.

- Implementers should be brought into the evaluation process earlier and in a transparent way. This could foster more streamlined communication and relationships that will aid in
gathering information for the evaluation and may also help the implementers feel more involved.
Appendix A. Pre- and Post-Retrofit Load Shapes

In addition to the aggregate savings load shapes, we developed pre- and post-retrofit load shapes for the most significant measure types. All load shapes below were based on savings load shapes developed to calculate summer on-peak demand savings.

**Lighting**
CO Detector

Chiller

Summer Season
Shoulder Season

![Graph showing % of Full Baseline Load for Pre-retrofit and Post-retrofit](image-url)
VFD

VFD installed on a make-up air unit
Appendix B. Project Level Savings Verification

Chiller: Verifying Savings at the Project Level

To illustrate how we calculated verified savings at the project level for chiller measures, we selected a facility from our sample set where a new rotary screw chiller replaced an old centrifugal chiller. The chiller plant in this facility was used to cool make-up air supplied to the corridors and for space cooling in building suites. The example is divided into the following sections:

- Review of background documentation and collection of site data
- Independent savings calculation
- Comparison of findings

Review of Background Documentation and Collection of Site Data

Background Documentation

The project evaluator verified the following savings:

- Consumption: 55,974.4 kWh

Supporting documentation included in the project file indicated the applicant calculated consumption savings using employing the following equation:

\[
\frac{[\text{Rated Capacity (tons)} \times \text{Load Factor (\%)} \times \text{Operating Hours (hrs)}]}{[\text{NPLV}_{\text{baseline}} (\text{kW/ton}) - \text{NPLV}_{\text{post-retrofit}} (\text{kW/ton})]}\]

The following values used were based on equipment specifications and operating design conditions:

- \(\text{Rated Capacity} = 228 \text{ tons}\)
- \(\text{Load Factor} = 80\%\)
- \(\text{NPLV}_{\text{post-retrofit}} = 0.544 \text{ kW/ton}\)

The following assumptions were made:

- \(\text{NPLV}_{\text{baseline}} = 0.851 \text{ kW/ton}\)
- \(\text{Operating hours} = 1,000 \text{ hrs}\)

Site Data

While on site, we collected and confirmed the following information:

- Start-up and shut-down dates for the facility’s chiller plant: on average, the chiller was started mid-May and was shut down mid-October every year.
- The part-load efficiency profile for the new chiller (this was provided by the project service provider):
Independent Savings Calculation

For chiller projects, we employed a four-step approach to calculate savings:

1. **Input high-level data on the baseline and new chiller equipment.** In this case, we used the same values as the project evaluator as we confirmed the values were reasonable.

   **Baseline Chiller**

<table>
<thead>
<tr>
<th>Plant Description</th>
<th>Size (tons)</th>
<th>Load Factor</th>
<th>Full Load Efficiency (kW/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x 228 ton Carrier R-11 centrifugal chiller</td>
<td>228</td>
<td>80%</td>
<td>0.851</td>
</tr>
</tbody>
</table>

   **New Chiller**

<table>
<thead>
<tr>
<th>Plant Description</th>
<th>Size (tons)</th>
<th>Load Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x 228 ton Trane Helical Rotary Chiller</td>
<td>228</td>
<td>80%</td>
</tr>
</tbody>
</table>

2. **Input data on the baseline operating profile:**
   a) In the first two columns on the left, we input results of our temperature bin data analyses, which were based on typical meteorological year data for Toronto. Assuming a balance point temperature of 65°F, bin data indicate a typical multiunit residential facility chiller plant operated approximately 1,600 hrs a year.
   b) The “Estimated Building Load” and “Cooling Load” data were calculated by assuming the building load varied in proportion to the change in delta T (ambient temperature – balance point temperature). Note this simplified cooling load profile assumption applied to multiunit residential facilities, where 100% make-up air was supplied. A typical office facility has a base-load cooling component that must be accounted for.
c) The part-load chiller efficiency data were calculated by applying the rated full-load efficiency for the old chiller (0.851 kW/ton) to a typical constant speed centrifugal chiller efficiency profile.\(^8\)

d) Finally, chiller consumption input values were calculated using the “Cooling Load,” “Chiller Efficiency,” and “Hours” data for each temperature bin.

<table>
<thead>
<tr>
<th>Ambient Temperature</th>
<th>Bin Data</th>
<th>Estimated Building Load</th>
<th>Cooling Load</th>
<th>Chiller Efficiency</th>
<th>Chiller Input</th>
<th>Chiller Input</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fahrenheit</td>
<td>Hours</td>
<td>Percent</td>
<td>Tons</td>
<td>kW/ton</td>
<td>kW</td>
<td>kWh</td>
<td></td>
</tr>
<tr>
<td>65F to 70F</td>
<td>674</td>
<td>20%</td>
<td>36</td>
<td>1.358</td>
<td>50</td>
<td>33,389</td>
<td></td>
</tr>
<tr>
<td>70F to 75F</td>
<td>440</td>
<td>26%</td>
<td>48</td>
<td>1.219</td>
<td>59</td>
<td>25,755</td>
<td></td>
</tr>
<tr>
<td>75F to 80F</td>
<td>317</td>
<td>44%</td>
<td>80</td>
<td>0.993</td>
<td>79</td>
<td>25,171</td>
<td></td>
</tr>
<tr>
<td>80F to 85F</td>
<td>149</td>
<td>61%</td>
<td>112</td>
<td>0.913</td>
<td>102</td>
<td>15,244</td>
<td></td>
</tr>
<tr>
<td>85F to 90F</td>
<td>53</td>
<td>79%</td>
<td>144</td>
<td>0.877</td>
<td>126</td>
<td>6,692</td>
<td></td>
</tr>
<tr>
<td>90F to 95F</td>
<td>1</td>
<td>100%</td>
<td>182</td>
<td>0.851</td>
<td>155</td>
<td>155</td>
<td></td>
</tr>
</tbody>
</table>

### 3. Input data on the new operating profile:

a) The first four columns were populated using the same approach described under steps 2a and 2b.

e) The part-load chiller efficiency data were input based on the new chiller’s efficiency curve.

f) Finally, chiller consumption input values were calculated using the “Cooling Load,” “Chiller Efficiency,” and “Hours” data for each temperature bin.

<table>
<thead>
<tr>
<th>Ambient Temperature</th>
<th>Bin Data</th>
<th>Estimated Building Load</th>
<th>Cooling Load</th>
<th>Chiller Efficiency</th>
<th>Chiller Input</th>
<th>Chiller Input</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fahrenheit</td>
<td>Hours</td>
<td>Percent</td>
<td>Tons</td>
<td>kW/ton</td>
<td>kW</td>
<td>kWh</td>
<td></td>
</tr>
<tr>
<td>65F to 70F</td>
<td>674</td>
<td>9%</td>
<td>16</td>
<td>0.662</td>
<td>11</td>
<td>7,139</td>
<td></td>
</tr>
<tr>
<td>70F to 75F</td>
<td>440</td>
<td>26%</td>
<td>48</td>
<td>0.662</td>
<td>32</td>
<td>13,981</td>
<td></td>
</tr>
<tr>
<td>75F to 80F</td>
<td>317</td>
<td>44%</td>
<td>80</td>
<td>0.613</td>
<td>49</td>
<td>15,550</td>
<td></td>
</tr>
<tr>
<td>80F to 85F</td>
<td>149</td>
<td>61%</td>
<td>112</td>
<td>0.507</td>
<td>57</td>
<td>8,462</td>
<td></td>
</tr>
<tr>
<td>85F to 90F</td>
<td>53</td>
<td>79%</td>
<td>144</td>
<td>0.516</td>
<td>74</td>
<td>3,941</td>
<td></td>
</tr>
<tr>
<td>90F to 95F</td>
<td>1</td>
<td>100%</td>
<td>182</td>
<td>0.585</td>
<td>107</td>
<td>107</td>
<td></td>
</tr>
</tbody>
</table>

### 4. Calculate the chiller savings. The differences between consumption data derived under Steps 2 and 3 were calculated for each temperature bin. Results for each temperature bin were totaled to determine the project’s annual consumption savings.

---

Therefore, calculated consumption savings for this example were:

- Consumption: 57,226 kWh

**Comparison of Findings**

The following table compares our verified savings to those reported by the project evaluator:

<table>
<thead>
<tr>
<th>Ambient Temperature</th>
<th>Old Chiller Input kWh</th>
<th>New Chiller Input kWh</th>
<th>Savings kWh</th>
<th>Old Chiller Input kW</th>
<th>New Chiller Input kW</th>
<th>Savings kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>65F to 70F</td>
<td>33,389</td>
<td>7,139</td>
<td>26,250</td>
<td>49.5</td>
<td>10.6</td>
<td>38.9</td>
</tr>
<tr>
<td>70F to 75F</td>
<td>25,755</td>
<td>13,981</td>
<td>11,774</td>
<td>58.5</td>
<td>31.8</td>
<td>26.8</td>
</tr>
<tr>
<td>75F to 80F</td>
<td>25,171</td>
<td>15,550</td>
<td>9,620</td>
<td>79.4</td>
<td>49.1</td>
<td>30.3</td>
</tr>
<tr>
<td>80F to 85F</td>
<td>15,244</td>
<td>8,462</td>
<td>6,782</td>
<td>102.3</td>
<td>56.8</td>
<td>45.5</td>
</tr>
<tr>
<td>85F to 90F</td>
<td>6,692</td>
<td>3,941</td>
<td>2,751</td>
<td>126.3</td>
<td>74.3</td>
<td>51.9</td>
</tr>
<tr>
<td>90F to 95F</td>
<td>155</td>
<td>107</td>
<td>49</td>
<td>155.2</td>
<td>106.7</td>
<td>48.5</td>
</tr>
</tbody>
</table>

| Total Consumption Savings (kWh) | 57,226 |

**Discussion**

- Consumption savings calculated were very close to those reported by the project evaluator (within 3%). Therefore, we verified the claimed consumption savings were reasonable.

**Lighting: Verifying Savings at the Project Level**

To illustrate how we calculated verified savings at the project level for lighting measures, we selected a facility from our sample set where T8 fixtures for parking garage lighting were replaced with T12 fixtures. The example is divided into the following sections:

- Review of background documentation and collection of site data
- Independent savings calculation
- Comparison of findings
Review of Background Documentation and Collection of Site Data

Background Documentation
The project evaluator verified the following savings:
- Consumption: 470,692 kWh

Supporting documentation included in the project file outlined the scope of work and how the applicant performed their savings calculations.

Scope of Work

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Post-Retrofit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Qty</td>
<td>New Measure</td>
</tr>
<tr>
<td><strong>Common Area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-lamp 8ft T12 (HO)</td>
<td>268</td>
<td>4-lamp 4ft T8</td>
</tr>
<tr>
<td>1-lamp 8ft T12 (HO)</td>
<td>220</td>
<td>2-lamp 4ft T8</td>
</tr>
</tbody>
</table>

Savings Calculation
The applicant calculated project savings by subtracting post-retrofit consumption from the baseline consumption. Consumption values were calculated by multiplying the quantity of each fixture type by its respective wattage. The following fixture input wattage assumptions were made:
- 2-lamp 8ft high-output T12: 252 watts
- 1-lamp 8ft high-output T12: 140 watts
- 4-lamp 4ft T8: 118 watts
- 2-lamp 4ft T8: 59 watts

Site Data
While on site, we collected and confirmed the following information:
- Quantity of installed four-lamp and two-lamp fixtures. We confirmed claimed quantities were accurate (268 four-lamp and 220 two-lamp).
- Type of installed four-lamp and two-lamp fixtures. We confirmed claimed fixtures types were accurate (four-lamp 4-foot T8 fixtures with electronic ballasts and two-lamp 4-foot T8 fixtures with electronic ballasts).

Independent Savings Calculation
For lighting projects, we employed a four-step approach to calculate savings:

1. Assessment of baseline and post-retrofit fixture wattages. For each baseline and post-retrofit fixture, we reviewed the input wattage claims the applicant put forth and compared these to published data. If the claims were reasonable, we used wattages claimed; if not, we used published data. We first attempted to compare fixture wattages to assumptions listed in the OPA’s 2010 Quasi-Prescriptive Measures and Assumptions.
document.\textsuperscript{9} If the fixture type was not listed, we referenced Philips’ online lighting catalogue.\textsuperscript{10} For this example, we determined the wattages claimed by the applicant were reasonable.

2. Determination of fixture operating hours. The method for determining operation hours depended on the facility and scope of work. In this case, the retrofit took place in a parking garage where lights stayed on 24/7.

3. Calculation of significant electrical interactive effects (increased heating energy). As efficient lighting releases less heat, retrofits can increase demand on a facility’s heating system. When applicable, the following assumptions have been applied to calculate increases in electrical heating energy:

- Heating source and efficiency: electrical, 100% efficient.
- Length of heating season: seven months.
- Average heat loss from retrofitted lighting fixtures to facilities’ conditioned spaces: 100% (for example, a typical 100W lighting fixture in a multiunit residential suite releases 100W of heat to the conditioned space).

For this example, the parking garage was not heated; therefore, no significant interactive effects occurred.

4. Calculate the chiller savings. We calculated the consumption savings using the same approach as the applicant, except we explicitly ruled out significant interactive effects.

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Post-Retrofit</th>
<th>Hours/day</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing Equipment</td>
<td>Connecte d watts</td>
<td>Qty</td>
<td>New Measure</td>
</tr>
<tr>
<td>Common Area</td>
<td>2-lamp 8ft T12 (HO)</td>
<td>252</td>
<td>268</td>
<td>4-lamp 4ft T8</td>
</tr>
<tr>
<td></td>
<td>1-lamp 8ft T12 (HO)</td>
<td>140</td>
<td>220</td>
<td>2-lamp 4ft T8</td>
</tr>
<tr>
<td></td>
<td>Sub-total (kWh)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elec Heating Penalty</td>
<td>No</td>
<td>%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Therefore, calculated consumption savings for this example were:

- Consumption: 470,692 kWh

\textsuperscript{9} Ontario Power Authority. 2010. 2010 Quasi-Prescriptive Measures and Assumptions. 
\url{http://www.powerauthority.on.ca/Storage/113/16071_2010_Quasi-Prescriptive_List_01Feb2010.pdf} - date accessed: June 2010

\textsuperscript{10} \url{http://www.advance.philips.com/ecatalog/FLB_LookUp.asp} - date accessed: June 2010
Comparison of Findings
The following table compares our verified savings to those reported by the project evaluator.

<table>
<thead>
<tr>
<th></th>
<th>Reported by Project Evaluator</th>
<th>Verified by Marbek</th>
<th>Project-Specific Realization Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption Savings (kWh)</td>
<td>470,692</td>
<td>470,692</td>
<td>1</td>
</tr>
</tbody>
</table>

Discussion
- Consumption savings we calculated matched those reported by the project evaluator.

VFD: Verifying Savings at the Project Level
To illustrate how we calculated verified savings at the project level for VFD measures, we selected a facility from our sample set that installed a variable frequency drive (VFD) on its makeup air unit (MUA). The example is divided into the following sections:
- Review of background documentation and collection of site data
- Independent savings calculation
- Comparison of findings

Review of Background Documentation and Collection of Site Data

Background Documentation
The project evaluator verified the following savings:
- Consumption: 19,607 kWh

Supporting documentation in the project file outlined how the savings calculation was performed as follows:
1. The applicant proposed operating their 15 hp MUA supply fan on the following schedule: 8 hours at 90% fan speed; 8 hours at 80% fan speed and 8 hours at 70% fan speed.
2. They did not apply the centrifugal fan affinity laws, with \( \frac{\text{power1}}{\text{power2}} \) proportional to \( \frac{\text{speed1}}{\text{speed2}} \). Rather, they assumed a linear relationship between fan motor power and fan speed, where, at 80% fan speed, the fan motor would draw 80% of its full load power.
3. No savings were claimed for the reduction in electrical cooling energy resulting from the reduction in supply air.
Site Data
While on site, we collected and confirmed the following information:

- The motor size was 15 hp.
- The VFD operated according to the proposed schedule, and there were no complaints about the building being under-pressurized (for example, smells, doors slamming, or inability to cool properly in the summer).
- The makeup air was cooled during summer months with a direct expansion (DX) cooling system.
- The MUA supplied 11,500 cfm at full load.

Independent Savings Calculation
For VFD projects, we employed a four-step approach to calculate savings:

1. Input high-level data on the fan motor and the new drive. In this case, we assumed a motor efficiency of 90% and a drive efficiency of 96%. The project evaluator did not incorporate motor or drive efficiencies in their calculations.

<table>
<thead>
<tr>
<th>Size (hp)</th>
<th>Size (kW)</th>
<th>Motor Eff</th>
<th>VSD Eff</th>
<th>Hrs of Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>11.2</td>
<td>0.9</td>
<td>0.96</td>
<td>8760</td>
</tr>
</tbody>
</table>

2. Input data on the operating profile. In the first two columns on the left, we input the operating profile confirmed during our site visit. In the third column from the left, we input a motor load of 80% (this was assumed based on the MUA’s full-load supply air flow of 11,500 cfm). The project evaluator did not incorporate motor load in their calculations. Finally, the right column calculates new motor power resulting from the reduction in fan speed. For example, at 90% flow, the motor power would be $(0.9 \text{ speed ratio})^3 \times (0.8 \text{ motor load}) = 58\%$ of its full-load power.

<table>
<thead>
<tr>
<th>% of System Flow</th>
<th>Operating Time</th>
<th>Percent of Full Input Power</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Existing</td>
</tr>
<tr>
<td>90%</td>
<td>34.0%</td>
<td>80%</td>
</tr>
<tr>
<td>80%</td>
<td>33.0%</td>
<td>80%</td>
</tr>
<tr>
<td>70%</td>
<td>33.0%</td>
<td>80%</td>
</tr>
</tbody>
</table>

3. Calculate the fan motor savings. The first two columns on the left show the baseline and post-retrofit motor powers we calculated using the percent input power data from Step 2, along with the motor and drive efficiency data specified under Step 1. Hours per year were derived from the operating time input under Step 2.
### Motor Input Power (kW)

<table>
<thead>
<tr>
<th>Existing</th>
<th>Proposed VSD</th>
<th>Savings kW</th>
<th>Hours Per Year</th>
<th>Savings kWh/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.9</td>
<td>7.6</td>
<td>2.4</td>
<td>2,978</td>
<td>7,126</td>
</tr>
<tr>
<td>9.9</td>
<td>5.3</td>
<td>4.6</td>
<td>2,891</td>
<td>13,413</td>
</tr>
<tr>
<td>9.9</td>
<td>3.6</td>
<td>6.4</td>
<td>2,891</td>
<td>18,473</td>
</tr>
</tbody>
</table>

Sub-Total Consumption Savings (kWh) 39,012

4. Calculate heating and/or cooling savings. In this case, the MUA cooled the supply air during the summer months using a DX cooling system. We calculated the reduction in supply air, 1,831 cfm, and assumed a cooling efficiency of 2.64 COP and a cooling season of 1,600 hrs to estimate the reduction in cooling electricity consumption.

<table>
<thead>
<tr>
<th>Interactive Effects</th>
<th>Applicable</th>
<th>Fan CFM</th>
<th>CFM Reduction</th>
<th>Heating Eff</th>
<th>Cooling Eff</th>
<th>Impact (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Heating</td>
<td>No</td>
<td>n/a</td>
<td>0</td>
<td>1.0</td>
<td>n/a</td>
<td>0</td>
</tr>
<tr>
<td>Cooling</td>
<td>Yes</td>
<td>11,500</td>
<td>1,831</td>
<td>n/a</td>
<td>2.64</td>
<td>2,771</td>
</tr>
</tbody>
</table>

Sub-Total Interactive Effects (kWh) 2,771

Therefore, verified savings for this example were:
- Consumption: 39,012 kWh + 2,771 kWh = 41,783 kWh

### Comparison of Findings

The following table compares our verified savings to savings reported by the project evaluator.

<table>
<thead>
<tr>
<th>Consumption Savings (kWh)</th>
<th>Reported by Project Evaluator</th>
<th>Verified by Marbek</th>
<th>Project-Specific Realization Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>19,607</td>
<td>41,783</td>
<td>2.13</td>
</tr>
</tbody>
</table>

### Discussion
- Consumption savings we calculated were much larger than those reported by the project evaluator. This was unsurprising, given the following: the project evaluator did not employ the fan affinity laws in their calculations; and they did not account for cooling savings.
Appendix C. Confidence and Precision

The savings were reported by 395 customers and are reported in kilowatt hours. We selected a sample of customers from each program stream and verified the savings each achieved from one or more measures. We then computed a realization rate for the sample for each program stream, which is defined as:

\[ R_h = \frac{\sum_i K_{vh_i}}{\sum_i K_{rh_i}} \]

where:

- \( R_h \) = Realization rate for program stream \( h \)
- \( K_{vh_i} \) = Verified savings for program stream \( h \), in kilowatt hours
- \( K_{rh_i} \) = Reported savings for program stream \( h \), in kilowatt hours

In each program stream, the variance of the realization rate is given by Cochran\(^{11}\):

\[ v(R_h) = \frac{1 - f_h}{n_h K_{rh}^2} \left( s_{K_{vh}}^2 + R_h^2 s_{K_{rh}}^2 - 2 R_h s_{K_{vh}K_{rh}} \right) \]

where:

- \( f_h \) = Sampling fraction for stream \( h \) (equal to \( n/N \))
- \( S_{K_{vh}} \) = Standard deviation of verified savings for program stream \( h \)
- \( S_{K_{rh}} \) = Standard deviation of reported savings for program stream \( h \)
- \( S_{K_{vh}K_{rh}} \) = Covariance between verified and reported savings for program stream \( h \)
- \( n_h \) = Sample size for program stream \( h \)
- \( K_{rh} \) = Average reported savings for program stream \( h \)

The ratio estimator of the total verified savings in each program stream is equal to:

\[ \hat{K}_{vh} = R_h \sum_{i=1}^{N_i} K_{hri} \]

The variance of the estimated total verified savings is given by:

\[ V(\hat{K}_{vh}) = \left( \sum_{i=1}^{N_i} K_{hri} \right)^2 v(R_h) \]

There are two ways to estimate the total verified across program streams. One is to sum each stratum’s estimate. The variance of this estimate is the sum of the variance in each stratum. The second approach is a combined ratio estimate, which is a weighted average of the ratios across strata.

\[ \hat{K}_{vc} = \frac{\sum_h N_h K_{vh}^2}{\sum_h N_h K_{rh}^2} \frac{\sum_{i=1}^{N} K_{ri}}{\sum_{i=1}^{N} K_{ri}} \]

---

The variance of this combined estimator is:

\[ V(\hat{K}_v) = \sum_h \frac{N_h (1 - f_h)}{n_h} \left( \sigma_{K_{h\alpha}}^2 + R^2 \sigma_{K_{h\beta}}^2 - 2 R \rho \sigma_{K_{h\alpha}} \sigma_{K_{h\beta}} \right) \]

The confidence limits for the ratio and estimated total are given by:

7) \[ R \pm z \sqrt{v(R)} \]

8) \[ \hat{K}_v \pm z \sqrt{v(\hat{K}_v)} \]

Exhibit 1 shows the sample size and number of customers by project stream.

<table>
<thead>
<tr>
<th>Project Stream</th>
<th>Sample Size</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>21</td>
<td>90</td>
</tr>
<tr>
<td>ERIP</td>
<td>23</td>
<td>224</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>11</td>
<td>18</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>18</td>
<td>63</td>
</tr>
<tr>
<td>All</td>
<td>73</td>
<td>395</td>
</tr>
</tbody>
</table>

Exhibit 2 shows the estimated realization rate by stratum in the first column. The half-width of the 90 percent confidence interval is shown in parentheses as a percentage of the ratio. The second column shows the estimate of the total verified savings. The half width of the 90 percent confidence interval is shown in relative terms in parentheses. The combined estimate is used to compute the total verified savings with a precision of ±18.5 percent at 90 percent confidence.

<table>
<thead>
<tr>
<th>Program Stream</th>
<th>Realization Rates</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Toronto</td>
<td>1.006 (±7.6%)</td>
<td>13,024 (±7.6%)</td>
</tr>
<tr>
<td>ERIP</td>
<td>0.812 (±21.0%)</td>
<td>28,839 (±21.0%)</td>
</tr>
<tr>
<td>GreenSaver</td>
<td>0.912 (±18.1%)</td>
<td>1,599 (±18.1%)</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>1.509 (±40.8%)</td>
<td>12,840 (±40.8%)</td>
</tr>
<tr>
<td>All</td>
<td>0.980 (±18.5%)</td>
<td>57,546 (±18.5%)</td>
</tr>
</tbody>
</table>

We also can use the sample to estimate realization rates for a number of sub-categories of customers. Exhibit 3 shows the realization rate and relative 90 percent confidence interval for several classes of customers.
### Exhibit 3. Realization Rates (Ratio of Verified and Reported Savings) Relative Confidence Intervals in Parentheses

<table>
<thead>
<tr>
<th></th>
<th>City of Toronto</th>
<th>ERIP</th>
<th>GreenSaver</th>
<th>Toronto Hydro</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Private</strong></td>
<td>1.015 (± 8.9%)</td>
<td>N/A</td>
<td>0.911 (± 18.3%)</td>
<td>N/A</td>
<td>1.003 (± 8.1%)</td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td>0.957 (± 2.0%)</td>
<td>N/A</td>
<td>1.000 (± 0.0%)</td>
<td>N/A</td>
<td>0.957 (± 2.0%)</td>
</tr>
<tr>
<td><strong>Custom</strong></td>
<td>1.017 (± 7.9%)</td>
<td>1.476 (± 39.2%)</td>
<td>0.905 (± 20.8%)</td>
<td>1.509 (± 40.8%)</td>
<td>1.295 (± 23.0%)</td>
</tr>
<tr>
<td><strong>Prescriptive</strong></td>
<td>0.815 (± 4.3%)</td>
<td>0.733 (± 22.2%)</td>
<td>0.916 (± 25.6%)</td>
<td>N/A</td>
<td>0.739 (± 21.2%)</td>
</tr>
<tr>
<td><strong>Lighting + Other</strong></td>
<td>0.997 (± 5.9%)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>0.997 (± 5.9%)</td>
</tr>
<tr>
<td><strong>Lighting Only</strong></td>
<td>0.928 (± 11.5%)</td>
<td>0.806 (± 21.7%)</td>
<td>0.916 (± 25.6%)</td>
<td>1.617 (± 42.0%)</td>
<td>0.975 (± 21.6%)</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>1.166 (± 11.7%)</td>
<td>0.976 (± 50.2%)</td>
<td>0.905 (± 20.8%)</td>
<td>0.773 (± 41.7%)</td>
<td>1.014 (± 15.9%)</td>
</tr>
<tr>
<td><strong>All</strong></td>
<td>1.006 (± 7.6%)</td>
<td>0.812 (± 21.0%)</td>
<td>0.912 (± 18.1%)</td>
<td>1.509 (± 40.8%)</td>
<td>0.980 (± 18.5%)</td>
</tr>
</tbody>
</table>
Appendix D. Freeridership and Spillover Questions

Section 1: Freeridership Battery

The following questions are to learn more about the (MEASURE[s]) you installed through the Multifamily program.

1. First, would you have installed the same (MEASURE[s]) without the program?
   1. Yes
   2. No [IF ‘NO’, SKIP TO Q6]
   98. Don’t know
   99. Refused

2. Let me make sure I understand. When you say you would have installed (MEASURE[s]), would you have installed (one[s]) that (was/were) just as energy efficient?
   1. Yes
   2. No
   98. Don’t know
   99. Refused .............................................................

3. (Ask only for lighting, VSDs, motors) And would you have installed the same quantity of (MEASURE[s])?
   1. Yes
   2. No
   98. Don’t know
   99. Refused

4. And would you have installed the (MEASURE[s]) …
   1. Within the same year?
   2. Within one to two years?
   3. Within three to five years?
   4. In more than five years?
   98. Don’t know
   99. Refused

5. Before participating in the program, had you ever installed any of the same type of [MEASURE] that you installed through the program?
   1. Yes
   2. No [Skip to section 2: Spillover]
   98. Don’t know
99. Refused

6. Let me make sure I understand. When you say you would not have installed the same (MEASURE[s]), do you mean you would not have (replaced/installed) the (MEASURE[s]) at all?

   1. Yes [Skip to next section]
   2. No
       98. Don’t know
       99. Refused .................................................................

7. Again, help me understand. Would you have put in the same type of [MEASURE] but (it/they) would have been at a lower level of efficiency?

   1. Yes
   2. No
       98. Don’t know
       99. Refused

8. *(For Lighting/VSDs/Motors only)* Would it have been the same [MEASURE] but fewer of them?

   1. Yes
   2. No
       98. Don’t know
       99. Refused

9. And finally, would you have installed the same [MEASURE(s)]. . .

   5. In the same year?
   6. In one to two years?
   7. In three to five years?
   8. More than five years out?
       99. Don’t know
       99. Refused

10. Before participating in the program, had you ever installed any of the same type of [MEASURE] that you installed through the program?

    1. Yes
    2. No
        98. Don’t know
        99. Refused
Section 2: OPA Spillover Battery

11. Since participating in the program, have you installed any energy-efficient equipment where you did not receive a program rebate?
1 No [Skip Next Section (or terminate for Marbek- please inform respondent of follow up call- In Closing)]
2 Yes
3 Don’t Know

What measures were they?

Type 1: ________________________  Quantity 1: ________
Type 2: ________________________  Quantity 2: ________
Type 3: ________________________  Quantity 3: ________

12. {ASK FOR EACH TYPE OF EQUIPMENT} Was this equipment more efficient than you would have installed before participating in the program or about the same level of efficiency?
Type 1: More efficient  About the same  Don’t Know
Type 2: ______________________________________________________
Type 3: ______________________________________________________

13. Now, I’m going to read a statement about this equipment we’ve been discussing:

On a scale from 0-10, with 0 indicating you strongly disagree and 10 indicating you strongly agree, please rate this statement.

My experience with the [program] in 2009, influenced me to install additional high-efficiency equipment on my own.

{Record Response (0-10)} ________
98. Don’t Know
99. Refused
100 Skipped
Appendix E. Standardized Process Flows
CT receives application from applicant
CT reviews application to ensure that application is complete
Is application complete?
CT works with customer to complete application
EPR reviews application for verification, engineering, completeness
Documents Approved?
CT works with customer to revise project
Notify TSM
PE assigned
Updates database
PE
- Contacts applicant
- Books post-work site visit
- Completes M&V
- Engineering diligence
Diligence Done?
EPR files pre install evaluation
- Project go ahead letter sent to client
Applicant completes project sends supporting documents to CT
EPR
- Files post implementation evaluation
- Updates database
- Prepares and prints incentive calculator, and project completion report
Approval of PRC
- Letter sent to client confirming incentive
Documents prepared - sent for invoicing to OPA - paperwork verified by TSM
- Incentive check and letter sent to client
- Updates to all databases
End

Legend
CT City of Toronto
EPR Energy Project Reviewer
TSM Technical Services Manager
PE Project Evaluator
PRC Project Completion Report
Hydro Ottawa - ERIP

Hydro Ottawa receives completed application from participant

- HOL reviews application for measures being installed and value of incentive
  - Prescriptive
  - Custom

Is application prescriptive or custom?

- Yes: HOL sends application to Marbek
  - Marbek reviews measures being installed and value of incentive

- No: HOL assists customer to revise application

Is application complete?

- Yes:
  - Notify customer project pre-approved
  - HOL assists customer to revise application

- No:
  - HOL sends application to Marbek
  - Marbek assists customer to revise application

Is application complete?

- Yes:
  - Does replacement have EE savings?

- No:
  - HOL assists customer to see about other EE savings

Does replacement have EE savings?

- Yes:
  - HOL verifies percentage of measures installed
  - Customer completes project and submits invoices

- No:
  - Does customer have any other projects?

Does customer have any other projects?

- Yes: HOL verifies percentage of measures installed

- No: Project complete?

Does project complete?

- Yes: Incentive check sent to customer

- No:
  - HOL contacts customer regarding deficiencies

Marbek assists customer to revise application

- Yes: HOL sends application to Marbek
  - Marbek assists customer to see about other EE savings

- No: HOL verifies percentage of measures installed

End

End
GreenSaver – MEER

Phase 1

- Call center
- Lead Generation Private - Direct Contact
- Lead Generation (Other - TBD)

Phase 2

- Prescriptive Projects
- Custom Projects

Phase 2a: Application Prescriptive

Phase 2b: Application Custom

Phase 3

- Retrofit Completion

Phase 4

- Phase 4a: Verification Prescriptive
- Phase 4b: Verification Custom

Phase 4

- Payment

Phase 5

- OPA
- Reporting
- Data System Management

Client
End (BIP)

Customer completes online calculator and application

Will project save at least KW or qualify for $450?

Building 25,000 or larger?

Customer notified in writing that project does not qualify

Larger than 350 KW?

TH notifies customer in writing that project approved

Copy filed

TH contacts OPA for Approval

TH legal department to send letter of OPA’s decision

Did OPA approve request?

Has start date been entered within 90 days?

Applicant is informed in writing that project was canceled.

Documents are filed

Has the project stared within 90 days?

Billing Process

Applicant is informed in writing that project has been canceled

Approved PJF is forwarded to RR and legal

End

End

End
Appendix F. Original Process Flows
GreenSaver Process Flow
City of Toronto Process Flow

1. Applicant
   - Sends application and support docs to Program mailbox.

2. Support Assistant
   - Checks application and supporting docs. for eligibility and completeness.
     - Assigns project number
     - Updates Apply BBP folder-cabinet
     - Updates the G-Drive and Goldmine

3. Support Assistant
   - Sends acceptance notice to applicant (copy PM)

4. Energy Project Reviewer
   - Reviews support docs for relevance, completeness, general engineering standards etc.

5. Tech Services Mgr
   - Assigns PE
   - Energy Project Reviewer
   - Sends entire pkg to PE
   - Updates Database

6. Pre-Impl Eval Assigned

7. Pre-Impl Eval Accepted
1. Project Evaluator
   - Contacts Applicant, books site visit
   - Completes M&V, engineering diligence

2. Project Evaluator
   - Completes, prints, signs, stamps, Pre-Implementation Evaluation
   - Ensures applicant signs; scans original to PDF, emails file to TS

3. Energy Project Reviewer
   - files executed Pre-Implementation Evaluation in Project file;
   - files PDF scan to electronic file in G-Drive
   - sends standard email authorizing Project go-ahead to Applicant (copies PM)

4. Applicant
   - Implements Project
   - sends construction completion notice and supporting docs to Program Mailbox.

5. Project Completion docs

6. Implementation Completed

Pre-Impl Eval Accepted

Pre-Impl Eval completed

App Approved for Implementation

Post-Impl Eval assigned
Toronto Hydro Process Flow
Appendix G. Marketing Evaluation Summary Support Detail

Detail: Stream-Based Marketing Materials

Note: Comments and recommendations vary per specific piece or site, but all recommendations and user-experience best practices can be applied to strategy, messaging, and collateral for the remainder of 2010. Additionally, this best practice information can inform strategy and material creation for OPA’s next program launch in 2011.

City of Toronto

Marketing Collateral

- Better Business Partnership MF Brochure
  - Messaging: \textit{Collective action pays off}
  - Comments: Instructions are fuzzy. The text explains the process but not in detail. The business ROI could be stronger.
  - Recommendations: A stronger and simpler call to action. Answer for the user: Why and how should I participate?

- OPAP Magazine (large overview)
  - Messaging: \textit{OPAP program overview, with extensive MF section and includes project manager interviews.}
  - Comments: Text heavy format.
  - Recommendations: Add more compelling photographs and a stronger call to action, formatting could be tweaked in order to pull out important information (e.g.: bullets, side boxes, etc), add a table of contents to guide users to the correct information. Compress text where possible; direct reader to website or phone.

- OPAP Breakfast Workshop Invite
  - Messaging: \textit{Come hear the news}
  - Comments: Invites people to hear all the updates surrounding the program. Why does this matter to ‘me’?
  - Recommendations: Personalize the invitation to the specific audience addressing their specific needs to encourage attendance

- MEER application
  - Excellent introduction including application benefits.

- Incentives Sheet
o Messaging: *Do more, with more!!* The Better Buildings Partnership offers attractive energy conservation incentives and rebates for City of Toronto buildings. Act now to maximize your benefits.

o Comments: Good call to action, but missing a sense of urgency.

o Recommendations: Include information about the money already distributed. This creates both a sense of urgency and provides social norming pressure.

- **Website** ([http://OPAptoronto.ca/get-started-2/multifamily/](http://OPAptoronto.ca/get-started-2/multifamily/))
  - Note: Review compromised because by missing 2009 screenshot.
  - Comments: Currently, the website includes a clear call to action and lists action items about the fold, both best practice tactics.

**Marketing Objectives (via marketing plan)**

1) Awareness-raising – help people hear and learn about OPAP to generate new opportunities

2) Customer engagement – help new and existing customers actively participate in OPAP programs with confidence of success

3) Build on success – increase and perpetuate awareness and credibility

**Finding**

**Recommendation**

- Marketing pieces include inconsistent calls to action
  - Clarify and distill brand messaging for use by all channels

- Testimonials are mostly text-based
  - Include pre and post photos for case studies

- General look and feel is very generic, plain, and uses same graphics throughout
  - Include creative formatting, call out boxes, graphics for a easier scanning

- The program is relatively “faceless”
  - Create a character or brand personality to permeate all brand messaging

**Toronto Hydro**

**Marketing Collateral**
• Toronto Hydro Electric System- BIP Incentive Program Brochure (PDF)
  o Messaging: *Substantial Incentives Mean a Great Investment Opportunity*
  o Comments: Great layout, look and feel. Overall, a great piece. What does ‘think BIP’ exactly mean? Also, this instruction is lost throughout the brochure.
  o Recommendations: State benefits explicitly and clearly. Add photos of real people who’ve used the program. Highlight the amount saved to showcase real dollar benefits. Place the phone number more prominently for increased conversion.

• Toronto Hydro Website:
  o Note: Review compromised by missing 2009 screen shot.
  o Comments: Existing website looks great. User experience is interactive and includes multimedia elements such as case study videos. Quality information includes in drill down architecture.

**GreenSavers**

*Note:* GreenSavers did not launch full-scale marketing in 2009. The pieces below were the only items used by GreenSavers in marketing outreach.

Marketing Collateral

• One page brochure (front and back)
  o Messaging: *Take advantage of $30 million in rebates*
  o Comments: Overall great piece, nice look and feel and professionally presented. More findings included in recommendations listed below, along with recommendations.
  o Recommendations: (bulleted below)
    ▪ Describe the website benefits, such as additional information, e.g. case studies, and interactive content.
    ▪ The top banner is visually misleading. Most of the buildings look like large homes and not multifamily units. Because the word “multifamily” does not appear very large at the top of any of these, these pieces could be mistaken for promoting single-family residential rebates.
    ▪ The call-out box/section titled “What’s in it for my building” contains several elements which are unclear, confusing or contradictory:
• Wording appears to imply the building owner is responsible for “projecting electricity savings (i.e. “If you project electricity savings at 350,000 kWh/year…)
• What constitutes “resident education” needs to be made more explicit otherwise there is no perceived benefit when the customer reads: “If you sign up for Resident Education, You get Resident Education.”
  ▪ Suggest adding messaging with a sense of urgency. ‘Applications are already coming in.’ Are they suggesting that the funding won’t last? Need to clarify for consumers. This could become a point of urgency for participators.

• PowerPoint Presentation
  o Messaging: Program Overview
  o Comments: The presentation does not carry any of the GreenSavers MEER branding elements as displayed on the website or brochures. Images and branding will help them refer back to the program when they see it in the future. This could include screen shots of the website or advertisements. It’s very text heavy, which may be hard for people to see it when blown up on a large screen.
  o Recommendations: (bulleted below)
    ▪ Use at least 30-point type. Make sure to test the slides in the right size room and make certain they are readable. Remember, less is more.
    ▪ Add an initial slide in the stating what the presentation is about. Bring up the key take away points then restate at the end.
    ▪ Depending on availability, it may be powerful to invite a past participant of the program showcase their savings. This also allows also allows attendees to directly relate and ask questions, and be helpful in creating an ambassador program if it becomes a part of the 2011 marketing strategy plan.
    ▪ Make the website url and key contents more prominent. The MEER website is well-written, well-presented and contains more compelling information than individually printed pieces can contain, such as video customer testimonials (“Success Stories”), “How to Apply” guidance, a comprehensive list of partners and important links to other information.
    ▪ Explicitly direct readers should be to the website for “more information” or to see specific elements of it such as the video testimonials. Use the website as a sales tool versus a library.
Highlight GreenSaver benefits such as free staff assistance with application paperwork and “rebates in as little as 6 weeks”.

Global Recommendation: Metrics and ROI

The importance of collecting marketing metrics for accurate ROI analysis cannot be overstated. The following text outlines the kind of metrics which OPA can consider crucial, and make mandatory, as applicable. Keeping an eye on these data points will not only help identify “bright spots” for replication, but also allow for subtle shift in focus to maximize program success and savings impacts. Marketing evaluations typically include all associated metrics for a 360-degree view of all program communication and outreach efforts. These are listed below.

Pre- and Post-Campaign Public Awareness, Understanding and Affinity
- Interviews
- Focus Groups
- Random Sampling (Survey market targets prior to and during the campaign. For example, potential groups could include those with particularly high or low participation rates collected from past initiatives.)
- Broadcast-generated impressions (Represents the total number of eyeballs that register the brand message, based on reach of traditional print, radio, outdoor, sponsorship, and TV marketing)
- Social Media data analysis*

Customer Engagement/CRM Report
- Online metrics via Google analytics**
- Conversion rates ((When codes are used and data is available, metrics provide analysis and recommendations based on performance of call-to-action offers included in any off or online marketing collateral))
- Self-reported experience ((Customers provide unsolicited feedback on programs services via online posts and forum conversation. (See Social Media Unstructured Data) A social media analysis tool will collect this anecdotal data.))

**Online Activity Metrics:
- Off site: Potential online audience, share of voice, and buzz (each relative to the internet as a whole)
- On site: Traffic data, visits/unique visitors, total impressions, time on site, page views per visit, click path (how a visitor gets to a site), bounce rate, page exit percentage, and any other relevant data points
The metric approaches used will depend on the extent and type of OPA outreach. Required deliverables from channel partners or LDCs can include metrics overview, quantification of tactical ROI (including conversion rates), along with key anecdotal feedback. Resulting data and insights help assess marketing-driven efficiencies for the program, as well as provide information to adjust the strategy as appropriate for the following:

- Marketing materials (on and offline)
- Creative and messaging platform
- Marketing media mix

**Detail: Social Media/Web 2.0 Program Opportunity**

Note: This plan is intended to provide detail and inspiration for both the remainder of the current program period as well as to inform planning for 2011-2015. All tactics can be applied at any time and concurrently, but will also greatly benefit from thoughtful and strategic integration with “traditional” marketing tactics. Cadmus is currently contracted with such integration practice in Ontario County, and is available for additional information per OPA needs.

**Objective:** Leverage traditional and cost-effective Web 2.0 marketing methods for OPA program branding, exposure, and participation

**Goals:**
- Support interest and participation in OPA program
- Deliver “warm” leads to call center (if applicable); build prospect lists
- Communicate OPA program vision and mission effectively and consistently
- Market, promote, and differentiate OPA interactive portal as “online hub” for best-in-class program information, community, and engaging user-generated-content
- Increase OPA brand social network connections
- Build promotional partner list
- Identify and act on opportunities as they become apparent

**Social Media Success Framework: Ongoing and Concurrent**

**Listen:** Track and assess current online conversation
- **Learn/Use:** Identify influencers and conversational themes
- **Engage/Moderate:** Get connected and join the conversations!
- **Audit:** Evaluate and Build Assets as Needed
**Please also see following representative images in this appendix including:**
Ontario-specific LinkedIn groups, Facebook group member numbers, and Twitter
influencers; Microsoft tagging; and both general and region-specific social media usage data

**Representative Outreach Examples:**
Note: The ideas below are just a few concepts for OPA and channel partner outreach. Final list **tailored to program objectives** can develop out brand strategy meetings with stakeholders. Please see screenshots for examples of potential lists and social media networks primed for outreach.

- Provide response to an Ontario energy blogger writing “How can I make a
difference?” or “What do I do now?” or “How can I save money?”
- Promote user-generated video contest: “What did I do with the money I saved
with my OPA program savings?”
- Create recognition programs for retrofit participants that “recruit” other OPA
participants via Facebook and/or LinkedIn outreach
- Daily Twitter Contest to “WIN a free comprehensive audit” or “Retrofitter of the
Day” feature
- Twitter “Day of Award Discounts” at local retailers for any Ontario citizen who has
completed a retrofit
- Provide electronic call to action content along with OPA program teaser/elevator
pitches; easy send for Online Ambassadors and Influencers
- Create program LinkedIn Group for dialogue and energy retrofit information-
share among business owners
- Turnkey educational/informational templates in word and text html partners can
use to communicate easily with own email lists
- Prepare and share editorial blog content for brand representative accounts

I. Listen
Use social media analytic vendors to track key words and conversations. Key citizen
insight and penetration data is accessible via social media “Listen.”

II. Learn/Use (also see Asset Creation above)
- Aggregate trend data from “Listen”
- Identify key blog and twitter influencers with large followings and use for
engagement-collect lists for promotion and marketing
- Comment on posts/Answer questions
- Monitor “competitive” programs for intelligence and marketing ideas. Don’t be
afraid to grab other lists!
III. Collect Assets and Have Them Handy (See Asset Lists Above)

IV. Engage: Create OPA Program Brand Social Network Presence.
   Key concepts: Educate, Engage, and Share
   Success methods: Maintain a presence, join conversations, answer questions, comment, and promote others’ content on OPA engagement portal

Action Items Numbered Below:
1. Create OPA social media accounts: each of these will link to the OPA site and each other
   • Micro blogging= Twitter
   • Business Profile=Linked In
   • Personal Social/Business Group Profile=Facebook
2. Connect Accounts: Ping.fm and through the sites themselves
3. Set up time saving Twitter tools
4. BE SOCIAL:
   • Set a schedule to check accounts
   • Read, comment, and post on related blogs
   • Tweet about articles of interest and OPA announcements/partners
   • Retweet to gain positive regard
   • Always drive folks to or highlight OPA program benefits

Network Specific Tactics:

Linked In: Create accounts for each program stakeholder and key team members

Attractive Link Targets:
1. Ontario influencers
2. Related groups (Via LI search, see screenshots below)
3. Individuals
   a. Business leaders
   b. Municipal leaders
   c. Energy-related thought-leaders in Ontario and Canada.

Twitter: Twitter works for exposure, relationship building, and short links to OPA program brand and partner sites. A twitter account and staff attention can be a critical avenue for flash announcements, special offers, and to create exponential outreach with minimal staff time input. See wefollow.com images below for tag search results.

Social Media Images:
Green Drinks Toronto has over 1,300 members on both Facebook and Twitter.
Audit Poll results can be published on Twitter and Facebook feeds, and also provide data capture if constructed to do so.
Ongoing web and social media-specific analytics can provide information to assess online presence for various initiatives and brands.
Linked In members are searchable by location and profession, as well as business association. These lists can be cross referenced with interest groups for further segmentation.
Facebook groups associated with geographical tags are helpful in reaching populations not accessed with typical marketing tactics and also offer a rich opportunity for information-share.
Services like Wefollow.com include lists of “Most Influential” and “Most Followers” with twitter accounts tagged with relevant items.
“Most Followers” tweeters self-tagged with Ontario number more than 20,000

Facebook groups also give access to thousands of Toronto residents. While less targeted than “high touch” outreach, this kind of effort can product ambassadors for programs and increases pass along.
Appendix H. Participant Interview Guide—Contractor

OPA Multifamily Building Program

Participant Interview Guide – Contractor

Hello, my name is _______ from The Cadmus Group; I am calling on behalf of the OPA. Could I please speak with <FNAME> <LNAME> (or "with the person who knows about the energy efficient multifamily building program implemented by [ENTER PROGRAM STREAM]" in 2009?

Our records show that you completed some projects that received an incentive through [ENTER PROGRAM STREAM].

IF NEEDED: OPA is evaluating its energy efficient multifamily building program and our records indicate that you completed some projects that received funds through this program. Your input will be helpful and provide valuable insights. This survey is for research purposes only and this is not a marketing call. Your responses will remain confidential.

REINTRODUCE IF NECESSARY AND CONTINUE: The OPA is gathering information regarding the province-wide economic impacts of the multifamily program. Do you have 3-5 minutes to answer some questions?

IF NO, ARRANGE CALL-BACK

Respondent Name:
Respondent Company Name:
Phone numbers:
Date:
Interviewer:

Introduction

1. As you may know, the OPA is working with different organizations to get more energy efficient equipment -- such as Lighting and HVAC -- installed in apartment buildings and condominiums. The OPA is working with The City of Toronto, GreenSaver, ERIP and Toronto Hydro as well as other LDCs to deliver these services. You also might know these organizations by names such as MEER, BBP, or BIP. These organizations, in turn, work with contractors and multifamily business owners so that the improvements can be made.

2. Our records indicate that you made energy efficiency improvements in some multifamily buildings associated with [ENTER PROGRAM STREAM HERE]. Is this accurate?

3. In addition to providing services for [INSERT PROGRAM NAME HERE] did you provide services under any of the other agents previous mentioned? [READ LIST AGAIN IF NECESSARY]
Green Job Creation

4. Do you remember approximately how many projects you completed under this (these) program(s) in 2009?

5. Thinking about all of the jobs you completed in 2009, could you estimate the volume of work you completed under these delivery agents? [IN DOLLARS]

6. Once again, thinking about all of the energy efficiency installations you completed under the program in 2009, has participation in these initiatives caused you to hire any new employees?

[IF 6 = NO] Skip to question 13

7. If yes, how many

8. How many were full-time? (if they don’t number, ask for a general percentage)

9. What percentage were administrative positions, as opposed field staff?

10. Can you give me some indications as to what the job descriptions were of these new employees? Ex: engineers, marketing staff, etc.

11. If you had not participated in these programs, would you have still needed to hire these additional employees?

12. [IF 11 = YES] Why is that?

General Characteristics [OPEN ENDED]

13. Again, just focusing on the projects you did as part of the multifamily program; please tell me if you developed your own lists of potential customers to contact or if the organization you were working with provided you with a list of contacts.

14. Thinking about your overall experience with this energy efficiency program targeted to apartment buildings and condominiums, do you have any suggestions of how to improve the program?

15. Was providing energy efficiency improvements a regular part of your business before you got involved with the multifamily program, or is this a new line of business for you?

16. Do you only do this type of work on multifamily building or other types of buildings as well?
17. Finally, how many full-time employees did you have employed while performing this work in 2009?

[OBTAIN NAME AND TITLE IF NECESSARY]

[THANK AND TERMINATE]
Appendix I. Participant Interview Guide—Contractor

OPA Multifamily Building Program
Participant Interview Guide (Additional Questions) – Contractor

Hello, my name is ________ from The Cadmus Group; I am calling on behalf of the OPA. Could I please speak with [Respondent from Previous Survey]?

[If No] Is there a better time [Previous Respondent] Can be reached?

[If Yes/Already on the Phone] Hello, my name is ________ from The Cadmus Group; I am calling on behalf of the OPA, we spoke briefly on [Insert date]. I have a couple of follow-up questions based on our conversation. Do you have a minute or two?

[If No] Is there a better time to call back?

[If Yes] Great! You mentioned that in 2009 you worked on roughly [Insert Amount] in projects that received incentive funds through the OPA multifamily program. As I said before we’re interested in estimating how many jobs might have created in 2009. The last time we talked you mentioned that you [Did/Did Not] hire new employees because of work incentivized by the OPA. Now I’m interested in the effect this work might have had on companies you subcontract to.

1. If you had to estimate, how much in project work do you need to work on to employ one fully-loaded full-time employee for a year? [If necessary] by fully-loaded I mean including healthcare benefits, retirement contribution, etc.

2. [If 1<> Don’t Know] Is this the same for office staff?

3. Do you regularly hire subcontractors to work on your projects?

[If 1=No, Thank and Terminate]

4. What types of subcontractors do you typically hire? [Electricians, engineers, etc.]

5. Do you remember hiring subcontractors on those projects you worked on in 2009 that received incentive money through the multifamily program?

6. If you had to estimate, how much in project work do you need to subcontract to employ one fully-loaded full-time subcontractor for a year?

[Thank and Terminate]

Respondent Name:
Respondent Company Name:
Phone numbers:
Date:
Interviewer: