Evaluation Report (Final):

2007 HOT AND COOL SAVINGS PROGRAMS

Presented to

Ontario Power Authority™

120 Adelaide Street West, Suite 1600
Toronto, Ontario  M5H 1T1

JULY 31, 2008

Navigant Consulting Inc.
1 Adelaide Street East, Suite 2601
Toronto, ON  M5C 2V9
416.927.1641
www.navigantconsulting.com
“Copyright of the Ontario Power Authority. This report may not be copied or reproduced in whole or in part without the prior written permission of the Ontario Power Authority.” [This report may be used solely for informational purposes, and should not be relied on by third parties. The OPA makes no representation, warranty or guarantee as to the accuracy or correctness of this report.]
EXECUTIVE SUMMARY

Background and Program Overview

The Hot Savings Rebate and Cool Savings Rebate Programs are province-wide energy efficiency initiatives that target nearly 2.2 million residential electricity consumers with existing central space heating and space cooling systems. Originally launched in 2006, the programs are delivered through heating, ventilation and air conditioning (HVAC) contractors across the province and are managed by the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI). Any HVAC contractor in Ontario can participate in the program, at no cost, upon successful completion of the mandatory program training developed to inform contractors on how to appropriately administer the program and market the benefits of energy efficient HVAC equipment to potential participants.

The original version of the Cool Savings Rebate Program ran from April to September 2006, and was designed to encourage homeowners to:

- Tune-up their air-conditioning system prior to the cooling season (July and August);
- Replace their existing central cooling system with an Energy Star® qualified air conditioning system (which exceeds current regulatory efficiency standards); and
- Purchase and have installed by the contractor a programmable thermostat.

The Hot Savings Rebate Program ran from October 2006 to March 2007, and focused on promoting:

- Replacement of existing furnaces with high-efficient furnaces equipped with an electronically commutated motor (ECM);
- Replace their existing central cooling system with an Energy Star® qualified air conditioning system (which exceeds current regulatory efficiency standards); and
- Purchase and have installed by the contractor a programmable thermostat.

A secondary benefit to the Hot Savings Rebate Program was the environmentally friendly manner in which old mercury based thermostats are decommissioned.

The 2007 Cool Savings Rebate Program built upon the objectives of the previous programs, to save energy and reduce demand in residential sector by:

- Increasing the number of participants installing high or mid-efficiency furnace equipped with an ECM when replacing existing equipment;
- Increasing the number of programmable thermostats installed to control space heating and cooling;
Encouraging homeowners to purchase an Energy Star® qualified cooling system when the existing unit requires replacement; and

Encouraging homeowners to have their cooling system maintained on a regular basis prior to the start of the cooling season.

The recent Program ran from April 2007 to March 2008.

Program Impact

The estimated gross and net energy and demand savings for the 2007 HCSP program is summarized below.

Table 1: HCSP Net Energy and Peak Demand Impact

<table>
<thead>
<tr>
<th>Measure</th>
<th>Annual GWh</th>
<th>Lifetime GWh</th>
<th>Winter Demand Savings (MW)</th>
<th>Summer Demand Savings (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Savings: Energy Star CAC</td>
<td>0.5</td>
<td>8.3</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Hot Savings: Programmable Thermostat</td>
<td>0.2</td>
<td>2.5</td>
<td>0.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Hot Savings: Furnace with ECM</td>
<td>6.0</td>
<td>89.6</td>
<td>1.0</td>
<td>3.5</td>
</tr>
<tr>
<td>Cool Savings: Energy Star CAC</td>
<td>2.4</td>
<td>43.6</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>Cool Savings: Programmable Thermostat</td>
<td>0.5</td>
<td>7.9</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>Cool Savings: Furnace with ECM</td>
<td>19.6</td>
<td>294.1</td>
<td>3.3</td>
<td>11.6</td>
</tr>
<tr>
<td>Cool Savings: CAC Tune Ups</td>
<td>1.0</td>
<td>5.2</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30.2</strong></td>
<td><strong>451.1</strong></td>
<td><strong>4.4</strong></td>
<td><strong>19.8</strong></td>
</tr>
</tbody>
</table>

Based on results from Navigant Consulting’s Monte Carlo simulation of the potential variability in key input parameters, there is 80% probability that the net annual energy savings for the HCSP program fall within the range of 27.2 GWh to 36.7 GWh. Likewise, NCI has 90% confidence that the net annual energy savings for the program were at least 27.2 GWh.

Similarly, there is an 80% probability that the net annual summer demand savings for HCSP fall within the range of 17.9 MW to 23.9 MW. Based on this analysis, NCI has 90% confidence that the net annual summer demand savings for the program were at least 17.9 MW.
Recommendations

The following key findings and recommendations provide a distillation of Navigant’s recommendations to the OPA based on our evaluation of the HCSP.

1. **Develop and maintain an effective governance structure**
   The HCSP could benefit from a better defined governance and accountability structure between each of the key stakeholders, in particular between the OPA and HRAI. Suggestions include:
   i. The establishment of a clear mission statement that identifies the key objectives of the HCSP;
   ii. Definition of roles and responsibilities;
   iii. The reinforcement of good practices and elimination of poor ones;
   iv. Involvement of senior management in regular (possibly monthly) Executive Review Meetings;
   v. Ensuring meetings are meaningful and productive – Brief (30 minutes or less) weekly meetings, supported by a robust meeting format and supporting written template(s).

2. **Establish and ratify a series of program related processes and procedures**
   Clear process maps to identify and clarify the processes and accountabilities involved with the following (in addition to any other identified processes) will add an additional layer of clarity to the program:
   i. Preparation of rebate levels/assumptions;
   ii. Preparation and distribution of program materials;
   iii. Contractor enrolment and training;
   iv. Marketing and advertising campaign development/management;
   v. Rebate submission, processing, recording and payment;
   vi. General program enquiries (contractors and homeowners);
   vii. Rebate exception handling;
   viii. Rebate audit mechanisms (internal and external);
   ix. Program review and refinement.

3. **Automation of rebate process – proceed with caution!**
   There has been much discussion as to the virtues of transitioning the rebate process to an online platform. While Navigant agrees that the rebate process could be improved,
it is difficult to see how such a complex rebate process could be enhanced *simply* through automation. The complexity of the rebate information required, and the value of the rebates in question suggest that automating the rebate process could result in even more frustration on the part of contractors and encourage dishonest or inaccurate rebate submissions. Navigant suggests that the OPA consider implementing some additional checks and measures to ensure that rebate automation does not result in an erosion of program integrity.

4. **Establish a robust tracking and reporting mechanism. If it can be measured, it can be managed...**

The program would benefit from a more formal operational and financial reporting mechanism for the HCSP that centrally tracks and reports program costs, performance and benefits/impacts. If readily accessible and accurate, this information would facilitate an enhanced analysis of program information and make it easier to identify successful and less successful actions, providing transparency and aiding program refinement. A series of logical and agreed metrics would also enhance clarity and granularity around specific stakeholder responsibilities and performance.

5. **Enhance the existing marketing and advertising campaigns**

HRAI has had quite limited involvement in the development of creative themes and messages for the HCSP program. While the OPA has expressed a willingness to devolve this activity to HRAI once they are able to demonstrate the necessary competency, the program would benefit from greater advertising exposure. It is also apparent that some contractors are mishandling and mischaracterizing the program through their independent promotion of it. Some suggestions to remedy this include:

i. Assigning responsibility for marketing and promotion of the program to an experienced individual at HRAI;

ii. Establishing a campaign budget and defined series of clear objectives for HRAI against which promotion performance will be tracked;³

iii. Preparing a robust marketing program and advertising campaign, targeting both homeowners and contractors, with a view towards building awareness, understanding and participation in the HCSP³;

---

² In 2007 the OPA advertising budget for the HCSP totalled $565K + objectives. However, should responsibility for marketing and advertising become the remit of HRAI going forward, the OPA should require agreed mechanisms and accountabilities to be put in place.

³ In 2007, the OPA prepared newspaper advertising to cover 98 community newspapers in summer peaking areas. These 2 insertions were sent to HRAI for comment. The OPA also prepared a Direct Mail piece, which was cross promoted with a coupon in October 2007 and targeted 4.5M households. Again, these were sent to HRAI for comment.
iv. Producing marketing collateral that can be used by contractors to ensure that a consistent and accurate message is being communicated and that brand standards are upheld; ⁴; and

v. Tracking program performance against the various components of the marketing and advertisement campaigns to assist in the expedient resolution of any issues that might become apparent.

6. Retain ownership over audit and control mechanisms and enforce compliance and program rules with penalties if required

While Navigant accepts that the OPA would prefer to delegate much of the program management and administration to a third party, HRAI’s involvement poses a somewhat unique challenge which the OPA should be careful to address appropriately. Some suggestions include:

i. Retaining control over the auditing of installed measures and holding HRAI accountable for addressing any anomalies that are observed;

ii. Performing frequent spot investigations of rebate applications that raise ‘red flags’ by the rebate processor; and

iii. Ensuring that as anomalies are addressed, necessary adjustments to processes and procedures are made, recorded and communicated to all involved parties.

Navigant also recommends that the OPA adjust the rules of rebate eligibility to ensure that recipients agree to a home visit (in principal) in order to qualify for their rebate – thus ensuring that the OPA can perform a more targeted check of installed measures if needed be - therefore circumventing the issue that may have hindered the value of home-visits conducted for this evaluation – namely that anyone knowingly engaged in fraudulent activity would be highly unlikely to agree to a home verification visit. In order to not unnecessarily inconvenience rebate recipients, Navigant recommends that the OPA stipulate that home visits will be conducted within three-months of the rebate being issued in cases identified for verification of installed measures. Verification of between 1-3% of installed measures (skewed towards CACs and ECM equipped furnaces) is recommended.

7. Enhance contractor enrolment and training

Per our findings from the contractor interviews (presented in a subsequent section of this report), nearly half of those surveyed reported that they had never received any program training. Given this fact and the complexity of the program rules and rebate

---

⁴ In 2007, the OPA prepared a promotional brochure for contractors to distribute. This was sent to HRAI for comment but its ultimate distribution was not widespread. Also, the OPA prepared a Contractor Flash (pre-approved image + copy to include in contractor advertising) and consulted with HRAI on June 19 for final input.
process, it is not surprising that there is a very high (approximately 25%) incidence of incorrectly submitted rebate paperwork, something which has hindered the efficiency of the rebate process. It is therefore essential that:

i. All participant contractors complete a training session to ensure that they have the necessary knowledge to participate in and promote the program. The OPA should insist that HRAI develops and adheres to a robust contractor training strategy, including the preparation of participant handbooks, checklists and in-person training sessions. NOTE: The online training module prepared and hosted by HRAI, while providing an acceptable level of information and instruction, is too susceptible to completion by peripheral contracting company personnel (i.e. administrative assistants/office managers) and should not, therefore, be relied upon as the sole vehicle for program education and training.

ii. HRAI develops an outreach program to educate non-participant contracts on the merits of enrolling in the program.

iii. Minimum expectations for contractor conduct are communicated and enforced. The program should be repositioned, through training and program materials as an OPA (as opposed to HRAI) program, which is dependent on contractor adherence to program rules for its success. Contractor non-compliance with program rules should be addressed quickly and with an appropriate response, ranging from additional training to, if absolutely necessary, dismissal from the program.

iv. HRAI conducts an annual contractor eligibility review. Non-HRAI members are required to provide HRAI with proof of insurance and professional credentials as a requirement for enrolment in the HCSP. However, existing HRAI members are not required to do the same since their membership in HRAI is contingent on meeting these requirements. There is an issue however – HRAI members are only required to prove that they have adequate insurance and have maintained their professional credentials once every three years, which means that the HRAI is currently unable to ensure that all enrolled contractors have adequate insurance and professional licences. An annual review of contractor insurance and licenses will remedy this.
CONTENTS

EXECUTIVE SUMMARY................................................................. I
  Background and Program Overview ..................................................... i
  Program Impact ........................................................................ ii
  Recommendations .................................................................. iii

INTRODUCTION............................................................................. 11
  2007 Hot and Cool Savings Program Description ........................................ 11
  Report Overview ....................................................................... 13
  Abbreviations and Acronyms ............................................................. 14

ANALYSIS OF PARTICIPANT / NON-PARTICIPANT BEHAVIOUR............. 15
  Approach and Sample ................................................................ 15
  Demographics .......................................................................... 20
  Participant Survey: Overview of Key Findings ..................................... 20
  Non-Participant Survey: Overview of Key Findings ............................ 36
  Customer Segmentation: Responses to Attitudinal Questions ............... 41

PROGRAM PROCESS REVIEW AND RECOMMENDATIONS FOR PROGRAM ENHANCEMENTS... 43
  Key Findings and Recommendations ................................................. 43
  Approach ................................................................................... 46
  Interviews with OPA staff ............................................................. 47
  Interviews with CF&R Services, Inc. .................................................. 49
  Interviews with HRAI .................................................................. 52
  Review of Call Centre Statistics ........................................................ 54
  Review of Program Tracking Data ...................................................... 57
  Audit and Verification of Installed Measures ......................................... 59
  Audit of Mercury-Based Thermostat Decommissioning Process ............ 63
  Interviews with Participant and Non-Participating Contractors ............ 66

REVIEW AND REFINEMENT OF PRESCRIPTIVE INPUT ASSUMPTIONS FOR THE HCSP .... 75
  Approach ................................................................................... 75
  Key Revisions .......................................................................... 76

GROSS ENERGY AND PEAK DEMAND IMPACT.................................... 80
  Key Findings ........................................................................... 80
  Confidence Interval for Gross Energy and Demand Savings ................. 81

NET-TO-GROSS ANALYSIS.................................................................. 86
**LIST OF TABLES**

Table 1: HCSP Net Energy and Peak Demand Impact  
Table 2: Overview of Tasks and Key Research Objectives  
Table 3: Program Participation Rate and Rebate Values  
Table 4: Sample Plan  
Table 5: Key demographics of surveyed HCSP participants  
Table 6: Explanation of notation used for non-participant results  
Table 7: Customer segmentation based on OPA attitudinal questions  
Table 8: Hot and Cool Savings – Call Centre Activity, Calls Answered/Abandoned  
Table 9: Refinement of PIAs based on Survey Results  
Table 10: Hot and Cool Savings Program Key Measure Assumptions  
Table 11: Total Number of Rebates Issued for HCSP (by product)  
Table 12: Hot and Cool Savings Program Gross Energy and Peak Demand Impact  
Table 13: Input Parameters and Range of Uncertainty for Gross Energy and Summer Demand Savings Monte Carlo Simulations  
Table 14: Summary of Free-Ridership Determination for Programmable Thermostats Customers  
Table 15: Distribution of Full, Partial and Zero Free-Ridership among Programmable Thermostat Purchasers  
Table 16: Summary of Calculated Free-Ridership of all HCSP Measures  
Table 17: Summary of Net-to-Gross Ratios for all the HCSP Measures  
Table 18: HCSP Net Energy and Peak Demand Impact  
Table 19: Input Parameters and Range of Uncertainty for Net Energy and Net Summer Demand Savings Monte Carlo Simulations  
Table 20: Included Participant Survey Responses  
Table 21: HCSP Net Energy and Peak Demand Impact
LIST OF FIGURES

Figure 1: Program Logic 12
Figure 2: How did you first become aware of the rebate program? 21
Figure 3: What factors were most important to you when you decided to install the programmable thermostat in your home? 23
Figure 4: Why did you decide to purchase a replacement furnace/air handler equipped with an ECM? 25
Figure 5: Why did you decide to purchase an Energy Star® rated central air conditioner? 30
Figure 6: What factors were most important to you when you decided to get your central air conditioner tuned up? 32
Figure 7: How did you find the contractor who ultimately performed the work? 34
Figure 8: How long did you have to wait before receiving your rebate? 35
Figure 9: How did Non-participants first become aware of the program? 37
Figure 10: Hot and Cool Savings – Call Center Activity, Motivation Behind Call 55
Figure 11: Cool Savings – Call Center Activity, Answer Speed and Call Duration 56
Figure 12: On-Site Visit Checklist 61
Figure 13: On-Site Visit Findings 62
Figure 14: Expected Range of Annual Gross Energy Savings (GWh) 84
Figure 15: Expected Range of Gross Summer Demand Gross Savings (MW) 85
Figure 16: Expected Range of Net Energy Savings (GWh) 97
Figure 17: Expected Range of Net Summer Demand Savings (MW) 97
Figure 18: Estimates for South-western Ontario Utility HCSP Program Participants 101
INTRODUCTION

2007 Hot and Cool Savings Program Description

This report presents the results of Navigant Consulting’s evaluation of the Ontario Power Authority’s (OPA) 2007 Hot and Cool Savings Program.

Program Theory and Evaluation Approach

The program logic model, represented in the figure below, demonstrates the program’s theory and the planned relationships between the program objective, program elements and how they, in theory, have worked together to facilitate achievement of the program’s goals. The program logic model can also be used to identify breaks in this delivery chain and their impacts on the programs ability to achieve success.
The specific role these components play in enabling program participation are reviewed and discussed throughout this evaluation which focused on eight tasks as listed in Table 2 below. These tasks were structured so as to achieve the Key Deliverables requested by the OPA.
Table 2: Overview of Tasks and Key Research Objectives

1. Finalize and Submit Final Evaluation Plan, including:
   o Prepare Draft Final Evaluation Plan
   o Solicit Feedback from the OPA on Draft Final Evaluation Plan
2. Review Prescriptive Input Assumptions
3. Conduct Participant / Non-Participant Survey
4. Program Process Review
5.- 7. Analyze Data (and additional data collection, as required) to:
   o Conduct conditional demand analysis of participants / non-participants
   o Refine PIAs
   o Determine gross and net energy savings
   o Determine cost-effectiveness
   o Review program processes
8. Submit Final Evaluation Report, including:
   o Submit Interim Progress Report on Research Deliverables
   o Prepare and Submit Draft Evaluation Report and revise based on comments from the OPA
   o Submit and Present Power Point Presentation of Key Findings

Report Overview

The subsequent sections of the report (this Introduction is the first) are organized as follows:

  o Analysis Of Participant / Non-Participant Behaviour
  o Program Process Review And Recommendations For Program Enhancements
  o Review And Refinement Of Prescriptive Input Assumptions For The HCSP
  o Gross Energy And Peak Demand Impact
  o Net-To-Gross Analysis
  o Net Energy And Peak Demand Impact
  o Billing Analysis
  o Conclusions And Recommendations
Appendices:

- Appendix A: Hot And Cool Savings Program Measures Prescriptive Input Assumptions
- Appendix B: Hot And Cool Savings Detailed Calculations
- Appendix C: Hot And Cool Savings Program Telephone Surveys
- Appendix D: Hot And Cool Savings Program Contractor Interview Guides

Abbreviations and Acronyms

The following abbreviates and acronyms are used throughout this report:

CAF  The Clean Air Foundation, (charged with managing the decommissioning of mercury thermostats as they are removed by contractors)

CF&R  CF&R Services Inc, (the rebate processing company tasked with handling Hot and Cool Savings Program rebate applications and processing)

CSR  Call Centre Representative

ECM  Electronically commutated motor

FSA  The FSA Group (the company providing outsourced contact centre services for the HCSP and other OPA conservation programs)

HCSP  Hot and Cool Savings Program (used generically in reference to the Hot Savings and Cool Savings programs inclusive of all iterations through March 2008)

HRAI  Heating Refrigeration and Air Conditioning Institute of Canada (the Program Manager for the Hot and Cool Savings Program)

OPA  Ontario Power Authority

PIA  Prescriptive Input Assumption
ANALYSIS OF PARTICIPANT / NON-PARTICIPANT BEHAVIOUR

Approach and Sample

NCI conducted surveys of program participants and non-participants in order to:

1) Update / revise Prescriptive Input Assumptions (PIAs);

2) Inform the process review (discussed further in subsequent sections of this report); and

3) Identify non-participants for billing analysis (discussed further in subsequent sections of this report).

Information provided by the OPA indicates program participation rates to March 2008 as shown in the Table 3 below.

Table 3: Program Participation Rate and Rebate Values

<table>
<thead>
<tr>
<th>Measure</th>
<th>Rebates</th>
<th>Rebate Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Savings: Energy Star® CAC</td>
<td>5,864</td>
<td>$2,932,000</td>
</tr>
<tr>
<td>Hot Savings: Programmable Thermostat</td>
<td>11,409</td>
<td>$855,675</td>
</tr>
<tr>
<td>Hot Savings: ECM Furnace</td>
<td>12,344</td>
<td>$1,234,400</td>
</tr>
<tr>
<td>Cool Savings: Energy Star® CAC</td>
<td>18,912</td>
<td>$6,676,050</td>
</tr>
<tr>
<td>Cool Savings: CAC Tune Ups</td>
<td>28,048</td>
<td>$1,402,400</td>
</tr>
<tr>
<td>Cool Savings: ECM Furnace</td>
<td>31,244</td>
<td>$7,230,950</td>
</tr>
<tr>
<td>Cool Savings: Programmable Thermostat</td>
<td>35,580</td>
<td>$1,779,000</td>
</tr>
<tr>
<td>Cool Savings: Combined ECM Furnace and AC</td>
<td>8,402</td>
<td>$6,301,500</td>
</tr>
<tr>
<td>Other/Misc Rebates</td>
<td>354</td>
<td>$84,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>152,157</strong></td>
<td><strong>$28,496,475</strong></td>
</tr>
</tbody>
</table>

Our participant sample plan (covering 384 decisions for each individual measure) provides a 95% confidence that the reported findings for each measure are accurate to within +/- 5%. Following our billing analysis task (particularly the variability of consumption by customer and expected savings by measure), we have been able to identify the range of uncertainty for program results with 90% confidence. Note that a larger sample size would have reduced the range of uncertainty for results taken from the survey, but other inputs for our estimate of program impacts have greater relative ranges of uncertainty. Per our expectations from the outset, we found that factors independent of sampling error are the primary contributor to uncertainty in the stated results and we have taken every effort to minimize this uncertainty per our approach.
Note that the surveys also identified the participant’s household equipment stock (e.g., water heating energy source) and other information to support the billing analysis.

Similarly, the survey of non-participants was required to:

1) Identify the appropriate non-participant types from among the population of all customers; and

2) Identify the participant’s household equipment stock and other information that was used in our billing analysis.

It is desirable to have as much “post-installation” consumption history as possible for both participants and non-participants so the billing analysis focussed, to the degree possible, on participants and non-participants from earlier in the program period rather than later.

Further details of the participant and non-participant survey are provided in the sections that follow.

**Table 4: Sample Plan**

<table>
<thead>
<tr>
<th></th>
<th><strong>Hot Savings</strong></th>
<th><strong>Cool Savings</strong></th>
<th><strong>Total Sample</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Program Period</strong></td>
<td><strong>2006/2007</strong></td>
<td><strong>2007</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>10/06 - 3/07</strong></td>
<td><strong>4/07 - 4/08</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Participants</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAC System Tune-ups</td>
<td></td>
<td></td>
<td>384</td>
</tr>
<tr>
<td>Programmable Thermostats</td>
<td></td>
<td></td>
<td>192</td>
</tr>
<tr>
<td>ECM Furnace or Air Handler</td>
<td></td>
<td></td>
<td>192</td>
</tr>
<tr>
<td>Energy Star CAC Systems</td>
<td></td>
<td></td>
<td>192</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>1,536</td>
</tr>
<tr>
<td><strong>Non Participants</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAC System Tune-ups</td>
<td>100</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Programmable Thermostats</td>
<td>100</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>ECM Furnace or Air Handler</td>
<td>100</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Energy Star CAC Systems</td>
<td>100</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>400</td>
</tr>
</tbody>
</table>

**Participant Surveys**

NCI surveyed participating customers, including participants for each of the program measures and individuals who received more than one rebate in cases where multiple actions were taken. As shown in Table 4, NCI aimed to complete surveys with up to:

- 384 central AC replacement rebate recipients;
- 384 furnace replacement rebate recipients;
- 384 HVAC tune-up rebate recipients; and
- 384 programmable thermostat rebate recipients.

These measure-specific quotas were selected so as to provide 95% confidence that the reported findings for each measure type are accurate within +/- 5%.

Note that because many participants have participated in more than one program component (e.g., participants receiving a rebate for both an ECM and a programmable thermostat), the total number of surveys required to achieve the measure-specific quotas will be less than 1,536 (e.g., 384 x 4). Based on the combination of multiple equipment purchasers in both the Hot Savings and Cool Savings program, we conducted surveys with 1,111 participants.

Beyond the 384 CAC tune-up participants which were made available to us in a separate participant list by the OPA, the remaining survey participants were evenly split between the various possible combinations of single, double and triple equipment purchases and between the Hot Savings component of the program and the Cool Savings component of the program to provide maximum discrimination between the two campaigns for the given sample size.

The sample for participants (and non-participants) was also split as evenly as possibly between the service territories of the three LDCs that generously offered to provide customer consumption history for the billing analysis on a confidential basis to NCI. Together, these service territories provide coverage of South-western Ontario, the Greater Toronto Area (GTA) and Eastern Ontario.

Since the number of participants in the three LDCs’ service territories is finite, we found that the available sample of participants in the service territories was exhausted before the measure-specific quotas were realized. Therefore, as discussed in our Evaluation Plan, we augmented the sample with participants in other locations of Ontario.

Decisions to buy HVAC equipment occur infrequently for any individual consumer. Although consumers are the ultimate decision-makers with respect to the efficiency of the HVAC equipment they purchase, sometimes that decision is left largely to the HVAC contractor (either explicitly or implicitly). However, consumers are the ultimate decision-makers regarding participation in the program. Decisions regarding HVAC tune-ups and programmable thermostats do lie with the customer (though the contractor may influence this decision if it occurs at the time of equipment replacement).

---

1 While three utilities initially offered to provide consumption data for HCSP rebate recipients, only two finally provided said data. Of these, only one provided monthly consumption data which ultimately proved most useful for our billing analysis.
The customers’ perspective is valuable in informing the PIA and process review as follows:
  
  o Free-ridership related questions (i.e. what they would have done in the absence of the program) and extent to which, and effectiveness with which, contractors promoted the various program elements to them;
  
  o Awareness of and perceived value of materials provided to them by contractors;
  
  o Awareness of and perceived value of other program promotional or educational materials they received or to which they were exposed;
  
  o Primary motivations in participating in the program, including impact of other programs such as Summer Savings in their participation decision (valuable for free-ridership and spillover estimation);
  
  o Ease of finding a contractor and deciding between contractors;
  
  o Satisfaction with contractor that was used;
  
  o Ease of the participation process and timeliness of rebate processing;
  
  o Satisfaction with and effects of any interactions they had with the program through telephone or other contacts;
  
  o Extent to which they made the decision regarding equipment efficiency, use of ECMs in furnace (if furnace participant), installation of programmable thermostat, and tune-up, including the various influences they perceive affected their decisions;
  
  o Effectiveness of incentives provided, including the level of these incentives; and
  
  o Overall satisfaction with the program and its primary components.

It should be noted that the participant survey also provides us with insights into the motivation and behaviour of a distinct sub-set of respondents of “partial non-participants”, namely those how participated in the rebate program for one action/measure but not for others. For example, someone who purchased a rebate eligible Energy Star® CAC (and claimed said rebate) but also purchased a non-rebate eligible furnace during the program period. The behaviour of these respondents is interesting since it shows a willingness to participate in certain, but not all, aspects of the program.

Non-Participant Surveys

A similar approach was developed for our non-participant survey. As shown in Table 4, NCI aimed to survey up to 400 nonparticipants with many of the same questions used in the participant survey as well as some additional questions, focused on:

  o Program and energy efficiency awareness;
  
  o Reasons for not participating in the program;
  
  o Expected future behaviour and decision-making when HVAC equipment needs to be replaced;


- Primary barriers to participation for each program component;
- Types and levels of incentives needed to garner participation;
- Circumstances under which non-participants would participate, etc.

There are essentially two types of non-participants who we were interested in for this survey:

1. Those who purchased rebate-ineligible equipment; and
2. Those who purchased rebate-eligible equipment but did not claim the rebate.

Our analysis of individuals who purchased rebate eligible equipment but did not apply for the rebate includes an assessment of why they did not participate in the program and what might have made them alter their decision. For those who purchased non-rebate eligible equipment and were therefore not eligible for a rebate, such as individuals who installed a furnace with no ECM during the rebate period or those who installed a non-Energy Star® CAC during the rebate period, our analysis includes an assessment of why they chose not to opt for rebate eligible equipment and what might have made them alter their decision.

Additionally, non-participant data has used been for billing analysis purposes. We do not anticipate that there will be any reduction in consumption for non-participants who installed a furnace with a conventional motor, so we did not set a specific quota for 2006 non-participants from this group.

The incidence rate of customers who have recently purchased new central air conditioning or new furnaces is quite small. Our assumptions were that about half of the population have central air conditioning, and that those making purchases of central AC or gas furnaces should be about 6% of the population (the inverse of the typical lifetime of such units).

Given their relatively low incidence rate (approximately 6%) among the general population, NCI planned to identify full non-participants through random calls and based on the customer records of contractors – whom we hoped might provide information on customers who installed non-rebate eligible equipment during the program period.

However, as expected, HVAC contractors protect their customer data vary carefully and while several were prepared to provide us with some customer records, our non-participant quota was filled mainly through random calls and supplemental partial non-participant data as detailed earlier.

Presented below is an overview of the key findings from the participant and non-participant surveys conducted by NorthStar Research Partners. A complete set of results have been provided to the OPA in a separate document and a copy of the surveys have been attached in APPENDIX C: HOT AND COOL SAVINGS PROGRAM TELEPHONE SURVEYS.
Demographics

Table 5 provides a comparison of key demographics for the surveyed participants and the non-participants. As indicated, there is very little disparity between both surveyed groups, with the greatest divergence being the difference in length of time households have been living at their current residence and level of completed education.

Table 5: Key demographics of surveyed HCSP participants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Participants</th>
<th>Non-Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households living in a single family detached home</td>
<td>77%</td>
<td>75%</td>
</tr>
<tr>
<td>Households living at current residence longer than 10 years</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>Households who own their home</td>
<td>99%</td>
<td>95%</td>
</tr>
<tr>
<td>Size of home between 1,500 and 2,000 sq ft</td>
<td>27%</td>
<td>26%</td>
</tr>
<tr>
<td>Average number of household residents in 2007</td>
<td>2.88</td>
<td>3.24</td>
</tr>
<tr>
<td>Households with central air conditioner</td>
<td>95%</td>
<td>91%</td>
</tr>
<tr>
<td>Households with at least a university/college degree</td>
<td>61%</td>
<td>41%</td>
</tr>
<tr>
<td>Household income above $60,000</td>
<td>53%</td>
<td>54%</td>
</tr>
</tbody>
</table>

Participant Survey: Overview of Key Findings

Program Awareness and Usage

Key Findings (Participants):

<table>
<thead>
<tr>
<th>Survey Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness of Hot and Cool Savings Program</td>
<td>86% were aware</td>
</tr>
<tr>
<td>Main source of awareness</td>
<td>Contractor: 32%</td>
</tr>
<tr>
<td>Period when they became aware of program</td>
<td>After April 2007: 44%</td>
</tr>
<tr>
<td>Recall receiving a rebate under the program</td>
<td>78%</td>
</tr>
</tbody>
</table>

Although all of the 1,111 surveyed participants should have received a rebate under the Hot or Cool Savings Program based on the purchase data provided by CF&R, only 86% stated they were aware of the program and 78% of respondents recall receiving a rebate under the program. These results are likely due to the fact that:

- Some participants received their rebate over a year ago and may not remember the program; or
The individual surveyed was not the person most knowledgeable about the heating and cooling system in their home.

Of 951 individuals who were aware of the program, just under half said they first became aware of the program after April 2007 (Cool Savings 2007 Program). As shown in Figure 2, 32% of participants asserted that contractors first made them aware of the program, followed by newspaper advertisements and equipment suppliers.

**Figure 2: How did you first become aware of the rebate program?**

![Bar Chart: How did you first become aware of the rebate program?](chart.png)
Programmable Thermostats

Key Findings (Participants):

<table>
<thead>
<tr>
<th>Survey Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most important factor in purchasing decision</td>
<td>Programmable functions: 25%</td>
</tr>
<tr>
<td>Specifically planning on installing a programmable thermostat</td>
<td>76%</td>
</tr>
<tr>
<td>Likelihood of spending an additional $50/$75 on installation of programmable thermostat</td>
<td>Extremely Likely: 47%</td>
</tr>
<tr>
<td>Customers who would have made exact same purchase decision if the rebate had not been available</td>
<td>57%</td>
</tr>
<tr>
<td>Previously had a programmable thermostat installed in their current home</td>
<td>46%</td>
</tr>
<tr>
<td>For those who previously had a programmable thermostat:</td>
<td></td>
</tr>
<tr>
<td>Previously programmed during winter/summer months</td>
<td>87%</td>
</tr>
<tr>
<td>New programmable thermostat is currently programmed</td>
<td>91%</td>
</tr>
<tr>
<td>Person who programmed the thermostat</td>
<td>Household member: 70%</td>
</tr>
<tr>
<td>If contractor programmed thermostat: Comfortable programming thermostat on their own</td>
<td>78%</td>
</tr>
<tr>
<td>Contractor explained how to program thermostat</td>
<td>85%</td>
</tr>
<tr>
<td>Contractor left operating manual for the programmable thermostat</td>
<td>97%</td>
</tr>
<tr>
<td>Contractor suggested appropriate temperature settings</td>
<td>45%</td>
</tr>
</tbody>
</table>

Of the 1,111 who took part in the participant survey, 373 customers recalled receiving a rebate for their programmable thermostat. As shown in Figure 3, the ability to program the temperature setting of their home was one of the main factors in their decision to install a programmable thermostat.
Figure 3: What factors were most important to you when you decided to install the programmable thermostat in your home?

Results indicate that the vast majority, 91%, of participants currently have their new thermostat programmed, representing a 5% increase over the provincial average. This is likely a testament to the contractors since 85% of participants stated that their contractor explained to them how to use the programmable thermostat and just under half suggested appropriate temperature settings to maximise energy savings.

Although the program rules clearly indicate that customers are only eligible for a programmable thermostat rebate if they replace an existing non-programmable thermostat with a programmable thermostat, 46% admitted to previously having a programmable thermostat installed in their home. Furthermore, survey results indicate that 87% of those who previously had a PT installed in their home used the programmable functions to automatically adjust the temperature during the heating and cooling season. Ultimately, these findings were used in identifying a subset of participants that cannot be expected to realize any savings and hence would not contribute to the net savings realized by the program (please refer to the Exclusions section of the Net-to-Gross Analysis for more information).

\[^2\] A 2006 Statistics Canada Households and the Environment Survey indicates that 86% of Ontario residents with a programmable thermostat actually use the programmable functions.
ECM Furnaces and Air Handlers

Key Findings (Participants):

<table>
<thead>
<tr>
<th>Survey Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most important factor in purchasing decision</td>
<td>Energy efficiency: 54%</td>
</tr>
<tr>
<td>Reason for purchasing ECM</td>
<td>Energy savings: 69%</td>
</tr>
<tr>
<td>Recall having a choice between traditional furnace motor and an ECM</td>
<td>73%</td>
</tr>
<tr>
<td>Likelihood of spending an additional $100/$250 on ECM furnace</td>
<td>Extremely Likely: 34%</td>
</tr>
<tr>
<td>Customers who would have made exact same purchase decision if the rebate had not been available</td>
<td>49%</td>
</tr>
<tr>
<td>Customers who have switched from non-continuous to continuous fan usage due to ECM</td>
<td>5%</td>
</tr>
</tbody>
</table>

According to the 504 participants who recalled receiving a rebate for their ECM furnace or air handler, over half stated that energy efficiency was the most important factor when they decided on their purchase. Likewise, customers were primarily motivated by the potential energy savings for their ECM purchase (69%) as seen in Figure 4, however 12% of participants stated that the contractor influenced their decision to purchase an ECM.
Figure 4: Why did you decide to purchase a replacement furnace/air handler equipped with an ECM?

Although ‘customer fan usage’ behaviour was principally used for the PIAs, it is interesting to note that 5% of customers changed their behaviour from running their furnace fan intermittently (non-continuously) to running it continuously as a result of the ECM. This change in behaviour significantly reduces their energy savings, and depending on the age of their home, the fuel source and whether or not they have a central air conditioner, may in fact result in an increase in electricity consumption, (please refer to Develop and maintain an effective governance structure

The HCSP could benefit from a better defined governance and accountability structure between each of the key stakeholders, in particular between the OPA and HRAI. Suggestions include:

i. The establishment of a clear mission statement that identifies the key objectives of the HCSP;
ii. Definition of roles and responsibilities;
iii. The reinforcement of good practices and elimination of poor ones;
iv. Involvement of senior management in regular (possibly monthly) Executive Review Meetings;
v. Ensuring meetings are meaningful and productive – Brief (30 minutes or less) weekly meetings, supported by a robust meeting format and supporting written template(s).

1. **Establish and ratify a series of program related processes and procedures**
   Clear process maps to identify and clarify the processes and accountabilities involved with the following (in addition to any other identified processes) will add an additional layer of clarity to the program:
   
   i. Preparation of rebate levels/assumptions;
   ii. Preparation and distribution of program materials;
   iii. Contractor enrolment and training;
   iv. Marketing and advertising campaign development/management;
   v. Rebate submission, processing, recording and payment;
   vi. General program enquiries (contractors and homeowners);
   vii. Rebate exception handling;
   viii. Rebate audit mechanisms (internal and external);
   ix. Program review and refinement.

2. **Automation of rebate process – proceed with caution!**
   There has been much discussion as to the virtues of transitioning the rebate process to an online platform. While Navigant agrees that the rebate process could be improved, it is difficult to see how such a complex rebate process could be enhanced simply through automation. The complexity of the rebate information required, and the value of the rebates in question suggest that automating the rebate process could result in even more frustration on the part of contractors and encourage dishonest or inaccurate rebate submissions. Navigant suggests that the OPA consider implementing some additional checks and measures to ensure that rebate automation does not result in an erosion of program integrity.

3. **Establish a robust tracking and reporting mechanism. If it can be measured, it can be managed...**
   The program would benefit from a more formal operational and financial reporting mechanism for the HCSP that centrally tracks and reports program costs, performance and benefits/impacts. If readily accessible and accurate, this information would facilitate an enhanced analysis of program information and make it easier to identify successful and less successful actions, providing transparency and aiding program refinement. A series of logical and agreed metrics would also enhance clarity and granularity around specific stakeholder responsibilities and performance.

4. **Enhance the existing marketing and advertising campaigns**
   HRAI has had quite limited involvement in the development of creative themes and messages for the HCSP program. While the OPA has expressed a willingness to devolve this activity to HRAI once they are able to demonstrate the necessary competency, the
program would benefit from greater advertising exposure. It is also apparent that some contractors are mishandling and mischaracterizing the program through their independent promotion of it. Some suggestions to remedy this include:

i. Assigning responsibility for marketing and promotion of the program to an experienced individual at HRAI;

ii. Establishing a campaign budget and defined series of clear objectives for HRAI against which promotion performance will be tracked;

iii. Preparing a robust marketing program and advertising campaign, targeting both homeowners and contractors, with a view towards building awareness, understanding and participation in the HCSP;

iv. Producing marketing collateral that can be used by contractors to ensure that a consistent and accurate message is being communicated and that brand standards are upheld; and

v. Tracking program performance against the various components of the marketing and advertisement campaigns to assist in the expedient resolution of any issues that might become apparent.

5. Retain ownership over audit and control mechanisms and enforce compliance and program rules with penalties if required

While Navigant accepts that the OPA would prefer to delegate much of the program management and administration to a third party, HRAI’s involvement poses a somewhat unique challenge which the OPA should be careful to address appropriately. Some suggestions include:

i. Retaining control over the auditing of installed measures and holding HRAI accountable for addressing any anomalies that are observed;

ii. Performing frequent spot investigations of rebate applications that raise ‘red flags’ by the rebate processor; and

iii. Ensuring that as anomalies are addressed, necessary adjustments to processes and procedures are made, recorded and communicated to all involved parties.

Navigant also recommends that the OPA adjust the rules of rebate eligibility to ensure that recipients agree to a home visit (in principal) in order to qualify for their rebate – thus ensuring that the OPA can perform a more targeted check of installed measures if needs be - therefore circumventing the issue that may have hindered the value of home-visits conducted for this evaluation – namely that anyone knowingly engaged in fraudulent activity would be highly unlikely to agree to a home verification visit. In order to not unnecessarily inconvenience rebate recipients, Navigant recommends that the OPA stipulate that home visits will be conducted within three-months of the rebate being issued in cases identified for verification of installed measures. Verification of between 1-3% of installed measures (skewed towards CACs and ECM equipped furnaces) is recommended.

6. Enhance contractor enrolment and training
Per our findings from the contractor interviews (presented in a subsequent section of this report), nearly half of those surveyed reported that they had never received any program training. Given this fact and the complexity of the program rules and rebate process, it is not surprising that there is a very high (approximately 25%) incidence of incorrectly submitted rebate paperwork, something which has hindered the efficiency of the rebate process. It is therefore essential that:

i. All participant contractors complete a training session to ensure that they have the necessary knowledge to participate in and promote the program. The OPA should insist that HRAI develops and adheres to a robust contractor training strategy, including the preparation of participant handbooks, checklists and in-person training sessions. NOTE: The online training module prepared and hosted by HRAI, while providing an acceptable level of information and instruction, is too susceptible to completion by peripheral contracting company personnel (i.e. administrative assistants/office managers) and should not, therefore, be relied upon as the sole vehicle for program education and training.

ii. HRAI develops an outreach program to educate non-participant contracts on the merits of enrolling in the program.

iii. Minimum expectations for contractor conduct are communicated and enforced. The program should be repositioned, through training and program materials as an OPA (as opposed to HRAI) program, which is dependent on contractor adherence to program rules for its success. Contractor non-compliance with program rules should be addressed quickly and with an appropriate response, ranging from additional training to, if absolutely necessary, dismissal from the program.

iv. HRAI conducts an annual contractor eligibility review. Non-HRAI members are required to provide HRAI with proof of insurance and professional credentials as a requirement for enrolment in the HCSP. However, existing HRAI members are not required to do the same since their membership in HRAI is contingent on meeting these requirements. There is an issue however – HRAI members are only required to prove that they have adequate insurance and have maintained their professional credentials once every three years, which means that the HRAI is currently unable to ensure that all enrolled contractors have adequate insurance and professional licences. An annual review of contractor insurance and licenses will remedy this.

APPENDIX A: HOT AND COOL SAVINGS PROGRAM MEASURES PRESCRIPTIVE INPUT ASSUMPTIONS). Although most contractors recommend their customers with ECMs to continuously run their furnace fans to keep an even distribution of warm/cool air throughout their home, on average 69% of respondents with an ECM continue to run their furnace fan intermittently.
Energy Star® Central Air Conditioners

Key Findings (Participants):

<table>
<thead>
<tr>
<th>Survey Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most important factor in purchasing decision</td>
<td>Energy efficiency: 49%</td>
</tr>
<tr>
<td>Reason for purchasing Energy Star® CAC</td>
<td>Energy savings: 67%</td>
</tr>
<tr>
<td>Recall having a choice between a non-Energy Star® CAC and an Energy Star® CAC</td>
<td>59%</td>
</tr>
<tr>
<td>Likelihood of spending an additional $350/$500 on Energy Star® CAC</td>
<td>Extremely Likely: 29%</td>
</tr>
<tr>
<td>Customers who would have made exact same purchase decision if the rebate had not been available</td>
<td>46%</td>
</tr>
<tr>
<td>Net customers who now set their thermostat 2 degrees higher in the summer</td>
<td>24%</td>
</tr>
<tr>
<td>Customers who received a rebate for their Energy Star® CAC which was NOT a replacement CAC</td>
<td>23%</td>
</tr>
</tbody>
</table>

A total 359 participants who recalled receiving a rebate for their Energy Star® CAC were surveyed on their purchase decision. Similar to the ECM rebate recipients, just under half the respondents stated that having an energy efficient air conditioner was the most important factor in deciding to purchase their CAC and 67% were motivated by the potential energy savings associated with the Energy Star® standard, as shown in Figure 5. It is interesting to note that, unlike the ECM measure, the rebate was more influential than the contractor’s recommendation in their decision to purchase Energy Star® CAC.
Figure 5: Why did you decide to purchase an Energy Star® rated central air conditioner?

Furthermore, based on the analysis of the survey results, it was determined that 24% of participants who purchased an Energy Star® rated CAC now set their thermostat two degrees higher in the summer than they previously did with their old CAC unit. This is likely due to the fact that their replacement Energy Star® unit cools down their home more effectively, allowing residents to be more comfortable at a higher temperature setting.

Although the program rules clearly state that only customers who are replacing their central air conditioner with an Energy Star® CAC are eligible for the rebate, 23% of the customers revealed that their Energy Star® CAC was not a replacement CAC. It remains unclear if these individuals would have installed a conventional central air conditioner in the absence of the rebate program or, indeed, if they would have installed any central air conditioner.
Central Air Conditioner Tune Up

Key Findings (Participants):

<table>
<thead>
<tr>
<th>Survey Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most important factor in purchasing decision</td>
<td>Properly functioning CAC: 20%</td>
</tr>
<tr>
<td>Customers already planning on tuning up CAC</td>
<td>73%</td>
</tr>
<tr>
<td>Customers who were not aware of rebate when decided to get their CAC tune up</td>
<td>59%</td>
</tr>
<tr>
<td>Customers who have tuned up their CAC before</td>
<td>78%</td>
</tr>
<tr>
<td>Customers who tune up their CAC every year</td>
<td>80%</td>
</tr>
<tr>
<td>Likelihood of spending an additional $50 on tune up</td>
<td>Extremely Likely: 59%</td>
</tr>
<tr>
<td>Customers who would have made exact same purchase decision if the rebate had not been available</td>
<td>57%</td>
</tr>
</tbody>
</table>

According to the 334 participants who recalled receiving a rebate for their CAC tune up, 20% agreed that having a properly functioning CAC was the most important factor in their decision to tune up their CAC. As show in Figure 6, 18% of participants said that their warranty required them to tune up their CAC, while the rebate incentive and recommendations from their contractor where less significant.
Figure 6: What factors were most important to you when you decided to get your central air conditioner tuned up?

Unfortunately, based on the survey results, it appears that individuals who previously tuned up their central air conditioner primarily benefited from the rebate program. Seventy-eight percent of the CAC tune-up participants surveyed indicated that they had tuned up their central air conditioner in the past. Of these, 80% reported that they tune up their central air conditioner every year, either as part of a preventative maintenance plan or as part of their warrantee requirements. These results led to the exclusion of a subset of participants from the net savings analysis since Navigant does not expect any significant energy savings from tune-ups completed on an annual basis (please refer to the Exclusions section of the Net-to-Gross Analysis for more information).
**Contractor Assistance and Efficiency**

**Key Findings (Participants):**

<table>
<thead>
<tr>
<th>Survey Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most common source of finding a contractor</td>
<td>Previous contractor: 34%</td>
</tr>
<tr>
<td>Contractor encouraged participant to purchase equipment/services eligible for a rebate</td>
<td>63%</td>
</tr>
<tr>
<td>Overall influence of contractor in decision</td>
<td>Very influential: 31%</td>
</tr>
<tr>
<td>Number of separate contractor quotes received</td>
<td>One: 36%</td>
</tr>
<tr>
<td>Satisfaction of contractor’s work</td>
<td>Very Satisfied: 59%</td>
</tr>
<tr>
<td>Contractor’s clarity when explaining the rebate program</td>
<td>Excellent: 47%</td>
</tr>
<tr>
<td>Customer was contacted by contractor after completing work to complete/check information required for rebate form</td>
<td>24%</td>
</tr>
<tr>
<td>Customers stating that contractor was helpful when it came to completing the rebate paperwork</td>
<td>88%</td>
</tr>
<tr>
<td>If not helpful: Main area of improvement</td>
<td>Communicating when they would be receiving rebate: 14%</td>
</tr>
<tr>
<td>Length of waiting time for rebate</td>
<td>2 months or less: 52%</td>
</tr>
<tr>
<td>Customer satisfied with speed of receiving rebate</td>
<td>79%</td>
</tr>
</tbody>
</table>

All of the 1,111 participants were surveyed on the performance and efficiency of the contractor’s work or services they received for the rebate program. As seen in Figure 7, participants tended to use contractors who they previously used to perform the work or service, followed by recommendations from a friend or relative and searching in the local listing directory. Surprisingly, very few participants took advantage of the HRAI/OPA’s website which lists all of the participating contractors in the program by city or postal code.
Figure 7: How did you find the contractor who ultimately performed the work?

![Bar chart showing responses to finding contractors](chart)

It is clear that contractors played a vital role in promoting the rebate program. Based on survey responses, 63% of participants believe that the contractor encouraged them to purchase equipment or undertake services that were eligible for a rebate with almost 70% stating that they either went with the contractor’s recommendation or considered the contractor’s recommendation along with their own independent research. Likewise, participants rated contractors, on average, a 6 out of 7 in terms of their clarity when explaining the rebate program and 88% of participants believe their contractor was helpful as they could have been when it came to completing the paperwork for the rebate. Of those who indicated that the contractor was not very helpful in completing the rebate form, the main areas for improvement were identified as follows:

- Communicating when they would be receiving rebate - 14%;
- Filling out the paper work sooner - 13%;
- Communicating the process more clearly -13%, and
- Keeping them updated on the rebate application -11%.

In terms of the speed for receiving their rebate, approximately half of the participants claimed that they received their rebate in less than two months, as shown in Figure 8. According to those participants who received their rebate, almost 80% were satisfied with the processing and rebate receipt time-frame.
Figure 8: How long did you have to wait before receiving your rebate?

<table>
<thead>
<tr>
<th>Survey Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recent participation in other energy savings program</td>
<td>21%</td>
</tr>
<tr>
<td>Most commonly recently participated energy savings program</td>
<td>Every Kilowatt Counts: 54%</td>
</tr>
<tr>
<td>Customers who received ECM rebate who also participated in Enbridge/Union Gas Energy Star® high-efficiency furnace program</td>
<td>10%</td>
</tr>
<tr>
<td>Customers who received programmable thermostat rebate who also participated in Enbridge / Union Gas Programmable Thermostat program</td>
<td>9%</td>
</tr>
</tbody>
</table>

Approximately 21% of all the participants surveyed stated that they recently participated in other energy savings program. Of the 229 who acknowledged their participation in other conservation programs, just over half, 54%, participated in the Every Kilowatt Counts program, followed by the Government energy audit program (ecoENERGY Retrofit) at 46%.

It should be noted that of the participants who received a rebate for their ECM furnace, 10% said to have participated in the Enbridge / Union gas Energy Star® high-efficiency furnace program, thereby likely receiving two rebates for the same purchase. Similarly, 9% of
participants who received a programmable thermostat rebate under HCSP also participated in the Enbridge / Union Gas programmable thermostat program, again likely receiving a second rebate for their purchase.

Although the HCSP rules do not stipulate that customers are not able to participate in other energy saving programs, the OPA might consider looking into ways to reduce situations where customers receive double rebates.

Non-Participant Survey: Overview of Key Findings

The HCSP participant survey was designed to not only evaluate a participant’s decision to purchase an energy efficient measure through the rebate program but also to evaluate the reasons why they did not participate in other rebate eligible measures. Therefore, results for both partial-participants (e.g. those individuals who participated in the program but did not get a specific measure) and full non-participants (e.g. those individuals who received no rebates from the program) may be analyzed.

The following table represents the notation used to differentiate between the results presented below for each group.

Table 6: Explanation of notation used for non-participant results

<table>
<thead>
<tr>
<th>Notation</th>
<th>Group</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>Partial non-participants</td>
<td>Received a rebate for one measure in the program but not another</td>
</tr>
<tr>
<td>**</td>
<td>Full non-participants</td>
<td>Received no rebates from the program</td>
</tr>
<tr>
<td>***</td>
<td>Combined non-participants</td>
<td>Combined responses of partial and full non-participants</td>
</tr>
</tbody>
</table>

Program Awareness and Usage

Key Findings (Non-Participants):

<table>
<thead>
<tr>
<th>Survey Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness of Hot and Cool Savings Program</td>
<td>39%** were aware</td>
</tr>
<tr>
<td>Main source of awareness</td>
<td>Newspaper: 27%**</td>
</tr>
</tbody>
</table>

Awareness of the Hot and Cool Savings Program among the 200 non-participants surveyed was 39%. As shown in Figure 9, newspaper advertisements were the main source of public awareness regarding the program, followed by friends or relatives, radio and television. Not surprisingly, local utilities play a significant role in endorsing the program by providing information to their customers on their billing statements or on separate inserts.
It is interesting to note that the HCSP website and HVAC contractors remain only a minor source of public awareness. However, the OPA’s other marketing activities in 2007 appear to have yielded some positive results. Some examples of this media campaign include:

1. Union Gas Magazine ad titles “Best Things” – circulation 750,000;
2. Promotional brochure for contractors to distribute;
3. Newspaper advertising – 98 community newspapers in summer peaking areas, 2 insertions;
4. Direct mail – cross promoted with coupon in October (4.5M households);
5. Contractor flash (pre-approved image + copy to include in contractor advertising); and

Figure 9: How did Non-participants first become aware of the program?
Programmable Thermostats

Key Findings (Non-Participants):

<table>
<thead>
<tr>
<th>Survey Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness of programmable thermostat rebate</td>
<td>Yes - 57%*, 27%**</td>
</tr>
<tr>
<td>For those who were aware of program: Main reason for not participating</td>
<td>Didn’t want one – 34%***</td>
</tr>
<tr>
<td>Likelihood of installing a programmable thermostat within next year</td>
<td>37%**</td>
</tr>
</tbody>
</table>

For the surveyed HCSP participants who currently do not have a programmable thermostat installed in their home (e.g., they received a rebate for either an Energy Star® CAC, a furnace with an ECM or a CAC tune up), and chose not to upgrade their existing non-programmable thermostat, 57% were aware of the rebate for a programmable thermostat.

Similarly, even though 27% of the non-participants were aware of the rebate for a programmable thermostat, they opted not to participate in the program. Of both partial and full non-participants who were aware of the rebate, the main reasons for not participating in the program and upgrading their non-programmable thermostat were the fact that they did not want one, 34%, and that they found them to be too expensive, 13%. Some of the notable ‘verbatim’ responses received included:

- “Because everything works fine the way it is now”
- “We have a high efficiency furnace and we thought it wouldn’t make a difference to get a programmable thermostat installed”
- “Someone is home all day to program the thermostat”

It is also interesting to note that 37% of surveyed households with a non-programmable thermostat stated that they are likely to install a new programmable thermostat within the next year.
ECM Furnaces and Air Handlers

Key Findings (Non-Participants):

<table>
<thead>
<tr>
<th>Survey Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>For those who purchased a furnace without an ECM: Recall having a choice for an ECM</em></td>
<td>24%***</td>
</tr>
<tr>
<td>Main reason for not getting an ECM</td>
<td>Uninformed on ECMs: 20%***</td>
</tr>
<tr>
<td><em>For those who purchased a furnace with an ECM but did not participate in program: Awareness of ECM rebate</em></td>
<td>53%***</td>
</tr>
</tbody>
</table>

Approximately 159 partial non-participants and full non-participants who recently replaced their furnace in their home were interviewed on their purchase decision. Only 1 in 4 recall ever having the choice to install an ECM over the conventional Permanent Split Capacitor (PSC) motor. For those individuals who recall having the choice but decided not to install an ECM, the main reasons for their decision was:

- They didn’t understand ECMs - 20%;
- Were not prepared to pay for the additional cost - 17%; and
- Do not believe an ECM was worth the potential energy savings -17%.

The large number of respondents who stated either that “they don’t recall having a choice for an ECM”, or those who did have a choice but stated that “they didn’t understand them or did not have an opinion on the matter” indicates a general lack of understanding of ECM technology, and the potential for significant opportunity if product awareness can be increased.

In terms of those individuals who recently installed a furnace with an ECM but did not participate in the program, over half of them were aware of the program but chose not to participate. Although NCI attempted to determine the reasons why they chose not to participate in the program, no conclusions could be drawn since the sample size was small and variation in responses not statistically significant.
Central Air Conditioners

Key Findings (Non-Participants):

<table>
<thead>
<tr>
<th>Survey Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>For those who purchased a non Energy Star® CAC: Recall having a choice for an Energy Star® CAC</td>
<td>22%***</td>
</tr>
<tr>
<td>For those who purchased an Energy Star® CAC but did not participate in program: Awareness of Energy Star® CAC rebate</td>
<td>51%***</td>
</tr>
<tr>
<td>For those who purchased an Energy Star® CAC but did not participate in program: Main reason for not participating</td>
<td>Was not eligible: 15%***</td>
</tr>
</tbody>
</table>

Approximately 54 households who recently installed a non-Energy Star® CAC in their home were interviewed about their purchase decision. Only 22% of respondents recall having a choice between an Energy Star® CAC and a non-Energy Star® CAC. NCI made every effort to determine their reasons for not participating in the program and rebate levels which may have persuaded them to purchase and Energy Star® CAC, however the sample size was too small to draw any significant conclusions.

For the 162 individuals interviewed who recently purchased an Energy Star® CAC but did not receive a rebate, over half of them were aware of the program. Although there were numerous reasons why people did not participate in the program, one of the main reasons was because they were not eligible for the program (e.g., they were installing a new CAC rather than replacing one, their CAC unit was not eligible, etc.). A number of respondents indicated that they did in fact participate in the program but are still waiting for their rebate.

Central Air Conditioning Tune-ups

Key Findings (Non-Participants):

<table>
<thead>
<tr>
<th>Survey Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness of CAC tune up rebate</td>
<td>6%**</td>
</tr>
<tr>
<td>Respondents who have never tuned up CAC before</td>
<td>68%**</td>
</tr>
<tr>
<td>Proportion with CAC over 15 years of age</td>
<td>25%**</td>
</tr>
<tr>
<td>Most common minimum rebate level which would persuade them to get CAC tuned up</td>
<td>$50 - 23%**</td>
</tr>
<tr>
<td>For those who purchased a CAC tune up but did not participate in program: Awareness of CAC tune up rebate?</td>
<td>10%**</td>
</tr>
</tbody>
</table>

Approximately 124 full non-participants with central air conditioners were interviewed about their CAC tune-up behaviour. Almost 70% of respondents have never tuned up their CAC before and only 6% were aware that a rebate was available. Again, the sample size was too small for NCI draw any significant conclusions as to reasons why those individuals who were aware of the rebate did not participate in the program.
The proportion of older CACs is greater among the non-participants than the participants surveyed; a quarter of the non-participants have a CAC older than 15 years of age, while only 15% of participants who received a CAC tune up rebate have units older than 15 years.

The established rebate level for tune ups during the 2007 HCSP appears to be adequate given that $50 was the most common response when given the choice on minimum rebate levels which would persuade them to tune up their CAC.

Of the 36 individuals interviewed who recently tuned up their CAC but did not receive a rebate, only 10% were aware of the tune up rebate. Unfortunately, NCI could not effectively determine the reasons why those who were aware of the rebate decided not to participate in the program due to the sample size.

Other Programs

Key Findings (Non-Participants):

<table>
<thead>
<tr>
<th>Survey Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recent participation in other energy savings program</td>
<td>12%**</td>
</tr>
<tr>
<td>Most commonly recently participated energy savings program</td>
<td>Every Kilowatt Counts: 48%**</td>
</tr>
</tbody>
</table>

Approximately 12% of the full non-participants surveyed stated that they recently participated in other energy savings program. Not surprisingly, this equates to about half the participation rate for the HCSP customers. Of the 23 who acknowledged their participation in other conservation programs, just under half participated in the Every Kilowatt Counts program.

Customer Segmentation: Responses to Attitudinal Questions

In order to better understand the type of consumers who are participating in the HCSP, a shortened version of the battery of attitudinal questions used by the OPA to establish the key attitudinal/behavioural segments was used in the participant and non-participant surveys.

Respondents were segmented according to their responses to this battery of questions using the same regression coefficients used by the OPA in its original attitudinal/behavioural segmentation exercise. The four possible segments that a respondent could fall into were:

- “Live for Today”
- “Budget Driven”
- “Pragmatic Conservers”
- “Green Champions”

Results from the surveys are presented in Table 7.
Table 7: Customer segmentation based on OPA attitudinal questions

<table>
<thead>
<tr>
<th>Customer Segmentation</th>
<th>Participants</th>
<th>Non-Participants</th>
<th>General Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Live for Today”</td>
<td>6%</td>
<td>7%</td>
<td>12%</td>
</tr>
<tr>
<td>“Budget Driven”</td>
<td>11%</td>
<td>18%</td>
<td>34%</td>
</tr>
<tr>
<td>“Pragmatic Conservers”</td>
<td>81%</td>
<td>71%</td>
<td>31%</td>
</tr>
<tr>
<td>“Green Champions”</td>
<td>2%</td>
<td>4%</td>
<td>23%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
PROGRAM PROCESS REVIEW AND RECOMMENDATIONS FOR PROGRAM ENHANCEMENTS

Key Findings and Recommendations

The following key findings and recommendations provide a distillation of Navigant’s recommendations to the OPA based on our process evaluation of the HCSP. The sections that follow provide a great deal more detail around each of these recommendations.

1. **Develop and maintain an effective governance structure**
   The HCSP could benefit from a better defined governance and accountability structure between each of the key stakeholders, in particular between the OPA and HRAI.
   Suggestions include:
   i. The establishment of a clear mission statement that identifies the key objectives of the HCSP;
   ii. Definition of roles and responsibilities;
   iii. The reinforcement of good practices and elimination of poor ones;
   iv. Involvement of senior management in regular (possibly monthly) Executive Review Meetings;
   v. Ensuring meetings are meaningful and productive – Brief (30 minutes or less) weekly meetings, supported by a robust meeting format and supporting written template(s).

2. **Establish and ratify a series of program related processes and procedures**
   Clear process maps to identify and clarify the processes and accountabilities involved with the following (in addition to any other identified processes) will add an additional layer of clarity to the program:
   i. Preparation of rebate levels/assumptions;
   ii. Preparation and distribution of program materials;
   iii. Contractor enrolment and training;
   iv. Marketing and advertising campaign development/management;
   v. Rebate submission, processing, recording and payment;
   vi. General program enquiries (contractors and homeowners);
   vii. Rebate exception handling;
   viii. Rebate audit mechanisms (internal and external);
   ix. Program review and refinement.

---

3 Navigant Consulting, Inc. has made specific recommendations in each section of this report. Please review this document in its entirety for specific examples of current practices and recommendations as to how these might be enhanced.
3. **Automation of rebate process – proceed with caution!**
   There has been much discussion as to the virtues of transitioning the rebate process to an online platform. While Navigant agrees that the rebate process could be improved, it is difficult to see how such a complex rebate process could be enhanced *simply* through automation. The complexity of the rebate information required, and the value of the rebates in question suggest that automating the rebate process could result in even more frustration on the part of contractors and encourage dishonest or inaccurate rebate submissions. Navigant suggests that the OPA consider implementing some additional checks and measures to ensure that rebate automation does not result in an erosion of program integrity.

4. **Establish a robust tracking and reporting mechanism. If it can be measured, it can be managed...**
   The program would benefit from a more formal operational and financial reporting mechanism for the HCSP that centrally tracks and reports program costs, performance and benefits/impacts. If readily accessible and accurate, this information would facilitate an enhanced analysis of program information and make it easier to identify successful and less successful actions, providing transparency and aiding program refinement. A series of logical and agreed metrics would also enhance clarity and granularity around specific stakeholder responsibilities and performance.

5. **Enhance the existing marketing and advertising campaigns**
   HRAI has had quite limited involvement in the development of creative themes and messages for the HCSP program. While the OPA has expressed a willingness to devolve this activity to HRAI once they are able to demonstrate the necessary competency, the program would benefit from greater advertising exposure. It is also apparent that some contractors are mishandling and mischaracterizing the program through their independent promotion of it. Some suggestions to remedy this include:
   i. Assigning responsibility for marketing and promotion of the program to an experienced individual at HRAI;
   ii. Establishing a campaign budget and defined series of clear objectives for HRAI against which promotion performance will be tracked4;
   iii. Preparing a robust marketing program and advertising campaign, targeting both homeowners and contractors, with a view towards building awareness, understanding and participation in the HCSP5;

---

4 In 2007 the OPA advertising budget for the HCSP totalled $565K + objectives. However, should responsibility for marketing and advertising become the remit of HRAI going forward, the OPA should require agreed mechanisms and accountabilities to be put in place.

5 In 2007, the OPA prepared newspaper advertising to cover 98 community newspapers in summer peaking areas. These 2 insertions were sent to HRAI for comment. The OPA also prepared a Direct Mail piece, which was cross-promoted with a coupon in October 2007 and targeted 4.5M households. Again, these were sent to HRAI for comment.
iv. Producing marketing collateral that can be used by contractors to ensure that a consistent and accurate message is being communicated and that brand standards are upheld;\(^6\); and

v. Tracking program performance against the various components of the marketing and advertisement campaigns to assist in the expedient resolution of any issues that might become apparent.

6. Retain ownership over audit and control mechanisms and enforce compliance and program rules with penalties if required
While Navigant accepts that the OPA would prefer to delegate much of the program management and administration to a third party, HRAI’s involvement poses a somewhat unique challenge which the OPA should be careful to address appropriately. Some suggestions include:

i. Retaining control over the auditing of installed measures and holding HRAI accountable for addressing any anomalies that are observed;

ii. Performing frequent spot investigations of rebate applications that raise ‘red flags’ by the rebate processor; and

iii. Ensuring that as anomalies are addressed, necessary adjustments to processes and procedures are made, recorded and communicated to all involved parties.

Navigant also recommends that the OPA adjust the rules of rebate eligibility to ensure that recipients agree to a home visit (in principal) in order to qualify for their rebate – thus ensuring that the OPA can perform a more targeted check of installed measures if needs be - therefore circumventing the issue that may have hindered the value of home-visits conducted for this evaluation – namely that anyone knowingly engaged in fraudulent activity would be highly unlikely to agree to a home verification visit. In order to not unnecessarily inconvenience rebate recipients, Navigant recommends that the OPA stipulate that home visits will be conducted within three-months of the rebate being issued in cases identified for verification of installed measures. Verification of between 1-3% of installed measures (skewed towards CACs and ECM equipped furnaces) is recommended.

7. Enhance contractor enrolment and training
Per our findings from the contractor interviews (presented in a subsequent section of this report), nearly half of those surveyed reported that they had never received any program training. Given this fact and the complexity of the program rules and rebate process, it is not surprising that there is a very high (approximately 25%) incidence of

\(^6\) In 2007, the OPA prepared a promotional brochure for contractors to distribute. This was sent to HRAI for comment but its ultimate distribution was not widespread. Also, the OPA prepared a Contractor Flash (pre-approved image + copy to include in contractor advertising) and consulted with HRAI on June 19 for final input.
incorrectly submitted rebate paperwork, something which has hindered the efficiency of the rebate process. It is therefore essential that:

i. All participant contractors complete a training session to ensure that they have the necessary knowledge to participate in and promote the program. The OPA should insist that HRAI develops and adheres to a robust contractor training strategy, including the preparation of participant handbooks, checklists and in-person training sessions. NOTE: The online training module prepared and hosted by HRAI, while providing an acceptable level of information and instruction, is too susceptible to completion by peripheral contracting company personnel (i.e. administrative assistants/office managers) and should not, therefore, be relied upon as the sole vehicle for program education and training.

ii. HRAI develops an outreach program to educate non-participant contracts on the merits of enrolling in the program.

iii. Minimum expectations for contractor conduct are communicated and enforced. The program should be repositioned, through training and program materials as an OPA (as opposed to HRAI) program, which is dependent on contractor adherence to program rules for its success. Contractor non-compliance with program rules should be addressed quickly and with an appropriate response, ranging from additional training to, if absolutely necessary, dismissal from the program.

iv. HRAI conducts an annual contractor eligibility review. Non-HRAI members are required to provide HRAI with proof of insurance and professional credentials as a requirement for enrolment in the HCSP. However, existing HRAI members are not required to do the same since their membership in HRAI is contingent on meeting these requirements. There is an issue however – HRAI members are only required to prove that they have adequate insurance and have maintained their professional credentials once every three years, which means that the HRAI is currently unable to ensure that all enrolled contractors have adequate insurance and professional licences. An annual review of contractor insurance and licenses will remedy this.

**Approach**

Navigant’s program process review was designed to assess the program design, administration, implementation/delivery, delivery contractor, and market impacts. NCI worked with the OPA’s market research team to conduct a thorough review of the existing market research regarding the program and then made a determination as to the extent to which additional primary research was needed. In addition to the results from the participant and non-participant surveys, NCI used several sources of information to conduct the process review. These included:

1. Key stakeholders at the OPA;
2. Key stakeholders at HRAI;
3. Key stakeholders at CF&R;
4. A number of participating and non-participating contractors;
5. Review of call centre statistics;
6. Review of program tracking data;
7. Audit and verification of installed measures; and
8. Audit of mercury-based thermostat decommissioning process.

The information gathered was used to inform our assessment of program participation and outreach, design and market effects, including:

- The accuracy and effectiveness of the program theory and the types and levels of program incentives and the extent to which program systems and staffing levels are sufficient to effectively administer the program;
- The effectiveness of the program’s delivery system, including the roles played by HRAI, CF&R and the Clean Air Foundation, related marketing and trade HVAC outreach and training effectiveness, and quality control measures being taken;
- The impact of the program on the HVAC contractor community and its typical practices, as well as market satisfaction with program components and incentive types/levels; and
- Recommendations for improving the program in future years.

Our findings from each of these lines of enquiry are detailed in the sections that follow.

**Interviews with OPA staff**

**Approach**

Our interviews with key stakeholders at the OPA were key to obtaining an accurate and comprehensive understanding of the program and its elements, including the value of existing market research for the program’s process evaluation. These interviews also provide insight into how the program, its monitoring, effectiveness and management, might be enhanced.

NCI conducted interviews with the following individuals at the OPA:

- Bill Wylie - Manager, OPA Programs, Mass Markets and Conservation Awareness
- Farrah Bourre - Program Analyst, Conservation and Sector Development
- Lauren Penney - Former Program Analyst
o Linda Filippi - Call Centre Manager, Corporate Communications

o Bob Collins - Market Research Manager

o Kathryn Quail - Manager

o Jackie Coffey - External Consultant and Former Acting HCS Program Manager

Many of the issues raised during NCI’s interviews with the OPA were echoed in interviews with other stakeholders. This serves to underscore the fact that issues impacting the program are generally acknowledged by all – although, as would be expected, each stakeholder has a slightly different perspective as to the root cause for each issue.

So as to maintain the confidentiality of individual responses, NCI has summarized our key findings below.

**Legacy Issues**

It was pointed out by several of those interviewed that the Hot Savings program was established in a very short time period in 2006 and that in so doing, many of the structural foundations, checks and measures that would normally be expected in a program of this nature were not fully developed. Examples include:

- Under-developed Service Level Agreements (SLAs) with third party organizations, most notably, HRAI;

- Under-developed governance, accountability and defined roles and responsibilities both within the OPA and third party organizations;

- Under-developed process and procedure documentation to identify the various ‘hand-offs’ in the rebate process;

- Under-developed performance measures and metrics against which program performance could be tracked;

- Under-developed audit and control measures to ensure that rebates are being accurately applied for and paid out; and

- Poor clarity around program marketing/advertising development and roll-out.

It is Navigant’s view that these legacy issues should be addressed/resolved and that doing so will positively impact the program’s operation and effectiveness.

These issues are considered in further detail in the sections that follow.
Ongoing Operational Issues

Our interviews with the OPA identified several ongoing operational issues that should be readily addressed/resolved. These can be broadly summarized as follows:

1. **Operational and administrative short-comings at HRAI**
   The OPA expressed concern that HRAI is yet to show that they can effectively manage and administer the HCSP. This is attributed in large part to the following:
   i. Program management – The OPA cited HRAI’s slow appointment of a dedicated program manager (a situation remedied in March 2008) as a key barrier to HRAI’s effective administration of the HCSP; and
   ii. Program resources – The OPA also cited the need for an adequate number of dedicated, well qualified and suitably trained staff at HRAI to assist with the administration of the program.

As a result, the OPA has been required to extend its involvement in various administrative tasks, including budget tracking and invoicing - tasks which it hopes will, as appropriate changes are made to the administration of the program, will be managed by HRAI as “Program Manager”.

2. **Lack of uniformly accepted processes and procedures**
   While there appears to have been an attempt during the early stage development of the HCSP to record, map and ratify the various processes and corresponding procedures associated with the program, this essential work was never completed. This has resulted in some confusion around roles, responsibilities and rules surrounding program management and rebate processing. This, in turn, has impacted the ability of stakeholders to enhance the program, either through more effective management and control or through the robust application of a uniform approach to rebate processing, and in particular, exception handling.

3. **Communication between stakeholders**
   Communications between the OPA, HRAI and CF&R sometimes lack clarity and well structured content, resulting in questions around accountability and ‘next steps’. This, in turn, has impacted program development. As a result of this, the once ‘weekly’ meeting between the OPA, HRAI, CF&R and FSA is now held twice monthly. The OPA remains committed to the need for HRAI to provide it with the information required to better monitor the program.

Interviews with CF&R Services, Inc.

**Approach**

CF&R’s role has been to provide rebate processing services and program materials to contractors. NCI interviewed key CF&R staff, to better understand the organization’s role in the program, especially the processes and timing associated with the provision of program...
materials and the processing of rebate applications. NCI also spent several hours being ‘walked-through’ the rebate process and reviewing its various steps.

NCI conducted interviews with the following individuals at CF&R:

- Phrancis MacInnis – Vice President
- Jacqueline Peacock – Production Manager

CF&R is the second rebate processing company to be involved with the HCSP, taking over from “The Rebate Company” in fall 2006. Consequently, CF&R was not involved with the initial program establishment activities and discussions between the OPA and HRAI. However, this has not rendered the company immune to the shared frustrations of other key stakeholders.

**Ongoing Operational Issues**

Our interviews with CF&R identified several ongoing operational issues:

1. **Rebate handling processes for ‘exceptions’**
   CF&R expressed some concerns over the number of ‘exceptions’ and ‘push backs’ being generated by the program – close to 25% of received rebate applications. While they acknowledge that the vast majority of these are due to incorrectly filled out contractor paperwork, and are ultimately paid, they suggested the following as a means to enhancing the exception handling process:
   i. More robust contractor training – CF&R believes that in many cases, particularly for the larger contracting firms, the online training provided by HRAI is not completed by all contractors enrolled in the program which increases the number of incorrectly filled out forms and thus the number of ‘exceptions’ and ‘push-backs’ in the system. They believe that enhanced contractor training would have a significant positive impact on rebate processing times and contractor/rebate recipient satisfaction; and
   ii. A clear ‘exception handling’ process – CF&R believes that having a clear and accepted process for exception handling would provide well-needed clarity to the rebate process and reduce the need to involve HRAI and the OPA in the majority of the ‘exceptions’ that are identified.

2. **Enhanced audit and control measures to ensure that rebates are being accurately applied**
   CF&R is fully supportive of installing additional checks and measures to ensure that the integrity of the rebate program is not compromised by unscrupulous contractor behaviour and believe that while the OPA is keen to make the rebate process as smooth as possible for all concerned, some more attention could be paid to ensuring that only valid rebate claims are ultimately paid. They contend that this role should either rest with the OPA or an independent body.
3. Improved interactions with HRAI
Largely as a result of the number of ‘exceptions’ and ‘push-backs’ being generated, CF&R frequently requires either HRAI or the OPA to weigh in to assist in determining the eligibility of particular rebate applications. CF&R commented that the program would benefit from a quicker response to their rebate queries.

4. Program materials
CF&R noted that while it mails program materials to contractors, these materials are supplied to CF&R by the OPA and that on several occasions, these rebate material have been incorrectly printed. CF&R noted that it would be happy to handle the production of program materials and that so doing would not only resolve the formatting issues but also speed up the dispatch of materials to contractors. It should also be noted that CF&R has raised concerns about contractors who infrequently submit rebate applications but continue to order large quantities of program materials, noting that this is not only costly, but also underscores their suspicion that contractors may be using rebate forms for other purposes or leaving them with customers as a form of marketing collateral.

5. Improved communications around contract renewal
CF&R’s contract renewal was not discussed in the final weeks of the Cool Savings Program that ended March 31st 2008. This led to some confusion as to their role going forward and also compounded delays with the ordering and dispatch of revised program materials to contractors.

6. Greater focus on program cut off dates for rebate applications
CF&R revealed that a number of rebates have been paid well after the cut-off dates stipulated for each iteration of the HCSP. They assert that such leniencies result in the program costing more and greater confusion over the rebate amounts to be paid. They also assert that contractors, aware of the OPA’s leniencies in this regard, are less likely to submit their rebate paperwork in a timely manner, resulting in longer rebate processing times and increasing the likelihood of calls from homeowners to the OPA enquiring as to the status of their rebate.

7. Gap between ‘perception and reality’ of rebate entry and processing times
CF&R expressed concern that their counterparties in the program might be placing more credence on contractor complaints around rebate processing lookup issues and processing times than is fair and reasonable. CF&R asserts that, on average, rebate applications are entered into the system within 3 days of receipt by CF&R and rebates processed and checks cut, assuming no push backs, within 20 days of receipt.
Interviews with HRAI

Approach

Although HRAI is designated as the “Program Manager” for the Hot and Cool Savings Program, its role has largely consisted of outreach and enrolment of HVAC contractors into the program, as well as providing some program training to these contractors.

NCI interviewed key HRAI staff associated with the program to gain a more comprehensive understanding of HRAI’s role, the contractor recruitment and training methods used, how the program could be improved in the future, and other related issues, including but not limited to, their interactions with the other key stakeholders.

NCI conducted interviews with the following individuals at HRAI:

- Martin Luymes - Vice President
- Andrew Hall – Director, Energy Conservation/Demand Management (CDM) Programs

Legacy Issues

As detailed previously, the OPA has gradually taken on more of the administrative tasks associated with the HCSP.

HRAI recognizes a number of issues which have resulted in them falling short, in operational and administrative terms, of the OPA’s expectations. They attribute this in large part to the following:

- Lack of experience with CDM programs;
- A need to get the program to market as quickly as possible;
- Insufficient clarity over roles and responsibilities in initial contract;
- Staff turnover at HRAI and difficulty in finding a dedicated program manager;
- Staff transitions at the OPA;
- Rising expectations of the OPA – with each iteration of the HCSP;
- Contractor orientation/training and scale of program enrolment;
- New program stakeholders (namely CF&R); and
- Manual and inefficient rebate processing.
Ongoing Operational Issues

Our interviews with HRAI highlighted many of the short-comings noted by the OPA and CF&R and confirmed that while HRAI may indeed be well intentioned and dedicated to ensuring that the HCSP is as successful as possible, they have, to date, lacked the resources and expertise required to translate these good intentions into a robust, well managed and efficient program management role.

It should be noted that HRAI appears to be taking steps to address its weaknesses and their proposal to the OPA, submitted in March, 2008, outlined the following approach to resolving many of the recurring issues that are highlighted throughout this Evaluation, namely:

1. Appointment of a dedicated Program Manager
   Andrew Hall was retained by HRAI in March 2008 in the position of “Director, Energy Conservation/Demand Management (CDM) Programs”. His mandate is to:
   “a) implement operational efficiency improvements in the program; b) evaluate staffing resource gaps and to implement appropriate solutions; c) oversee the program marketing plan and guide implementation; d) solidify/establish relationships with client (OPA) and current and future suppliers; and e) solicit/develop new program concepts and convert these into business proposals for consideration by OPA and/or other funding partners.”

2. Development of program concepts, strategies and tactics
   HRAI is keen to point to its involvement in refining program strategies for optimal performance and maximum benefit, citing, among other successes, its modified contractor training and enrolment program (online, versus in-person) and its involvement in the development of a benchmark for conducting a “legitimate” (i.e. effective) air conditioning tune-ups.

3. Rebate process improvements
   HRAI believes that the answer to improving the rebate process lies in the development of an on-line rebate submission process. It has recommended that this option be further explored and a solution implemented by August 1, 2008.

4. Program marketing
   HRAI is in support of a broader marketing campaign for the HCSP and is in agreement that the OPA should drive any initial activities (focussed initially on CAC tune-ups and replacements) in tandem with other OPA EKC related programs. In the mid-term, HRAI recognizes that it must develop some in-house resources and to this end, it has appointed a junior staff member to begin to develop some understanding and expertise in program marketing to enable HRAI to take more of a lead in this area in future.

7 Source: HRAI
5. **Contractor monitoring and performance**

HRAI has proposed a strategy for contractor auditing to the OPA which involves random phone surveys of rebate recipients asking about satisfaction with the program and the performance of their contractor; a random selection of in-home audits, which would involve a more detailed review of the equipment installation, to ensure compliance with program specifications; and employment by HRAI of a “special investigator” to follow up, where necessary, on complaints deemed worthy of further investigation by HRAI and the OPA.

6. **Reporting frequency and content**

HRAI has proposed that reporting on program progress should occur monthly and concentrate on progress towards the measurable targets of the program with a final program report submitted to the OPA within two months of the program’s completion. It has asserted that the responsibility for meeting these requirements should be assigned to the program manager, Andrew Hall.

7. **Ensuring that deadlines are met**

HRAI acknowledges that it has had some difficulty in meeting many of the deadlines specified by the program to date. It is in favour of specifying performance targets, including deadlines, in contracts and has suggested financial rewards and penalties for achieving or not achieving these deadlines.

If HRAI is able to address each of these issues effectively, there is no question that the HCSP will benefit. It is incumbent on the OPA to carefully monitor and promote positive change by HRAI to ensure that progress is made.

**Review of Call Centre Statistics**

**Approach**

NCI reviewed the call centre activity statistics (dated between June 2007 and the beginning of May 2008) provided by the OPA. This data provided a summary of calls received and abandoned as well as the average speed of answer and call durations, among other metrics.

**Key Findings**

- FSA (call centre subcontractor) received approximately 25,000 calls relating to the HCSP during the period of review;
- Nearly 61% of the calls received by FSA were to enquire about the status of rebates, followed by ‘general program enquiries’ at almost 23% of calls;
Figure 10: Hot and Cool Savings – Call Center Activity, Motivation Behind Call

- Approximately 75% of all calls were reported as being Hot Savings program related, representing over 18,000 calls. Approximately 47% of all calls to the call centre relating to the Hot Savings program were abandoned by callers – an exceptionally high number and eleven times greater than the OPA’s performance target for this measure. It should be noted that the high call abandon rate for the Hot Savings program appears to be concentrated during the month of July 2007. The OPA has advised Navigant that the reason for this spike is due to unusually high call volume related to the “Great Refrigerator Roundup” program that was being promoted during the same period. In response to the capacity constraints highlighted during said period, the OPA took appropriate action to ensure that the call center would be able to handle similar call spikes more efficiently in the future i.e. adding more lines and augmenting the staffing levels.

- FSA received over 6,200 calls relating to the Cool Savings program, or roughly 25% of all the HCSP calls. The abandon rate for these calls was much lower than for the Hot Savings program, at just over 3%, outperforming the OPA’s target.
Table 8: Hot and Cool Savings – Call Centre Activity, Calls Answered/Abandoned

<table>
<thead>
<tr>
<th></th>
<th>Cool Savings</th>
<th>Hot Savings</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Calls Answered</td>
<td>Calls Abandoned</td>
<td>Calls Answered</td>
<td>Calls Abandoned</td>
</tr>
<tr>
<td>Q2 2007</td>
<td>0</td>
<td>0</td>
<td>1,648</td>
<td>88</td>
</tr>
<tr>
<td>Q3 2007</td>
<td>0</td>
<td>0</td>
<td>15,540</td>
<td>7,148</td>
</tr>
<tr>
<td>Q4 2007</td>
<td>2,803</td>
<td>91</td>
<td>514</td>
<td>25</td>
</tr>
<tr>
<td>Q1 2008</td>
<td>2,715</td>
<td>81</td>
<td>631</td>
<td>28</td>
</tr>
<tr>
<td>Q2 2008</td>
<td>710</td>
<td>20</td>
<td>80</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,228</strong></td>
<td><strong>192</strong></td>
<td><strong>18,413</strong></td>
<td><strong>7,296</strong></td>
</tr>
</tbody>
</table>

For both programs, it is interesting to note that average call durations (‘talk time’) have fallen quarter on quarter. This trend is in line with Navigant’s expectations for Call Centre Representative (CSR) performance, reflecting the enhanced comfort level, speed and accuracy of CSRs in fielding calls on a particular issue over time.

Figure 11: Cool Savings – Call Center Activity, Answer Speed and Call Duration

As part of Navigant’s review of call centre performance, we conducted a number of calls over a 4 week period (April-May, 2008) to review the HCSP knowledge of FSA’s CSRs. In general, we found the CSRs to be well informed, helpful and courteous and in most instances, able to provide accurate information in response to our questions. However, there was an observable
decline in CSR knowledge and performance during the latter part of May 2008 – which might be attributable to the on boarding of new CSRs in preparation for the summer months.

**Recommendations**

Based on its review, NCI has three key call centre related recommendations for the OPA:

1. **FSA must ensure that it is adequately staffed for higher call volume periods**
   Call volumes fluctuate based on a number of factors, including time of day, time of year, and the status of advertising campaigns (to name a few variables). With this in mind, the OPA should work with FSA to ensure that their call centre is adequately staffed and trained to respond to fluctuations in call volumes. Specific activities could include:
   i. Advising FSA well in advance of any planned advertising campaigns to ensure that the call centre is staffed appropriately and that the CSRs are well informed and ready to field related calls; and
   ii. Ensuring that FSA scales its staffing resources to correspond with the higher rebate activity periods (spring and fall).

2. **Develop an online ‘rebate checking’ facility**
   With over 60% of calls to FSA relating to the status of a pending rebate, the OPA should encourage HRAI to develop an online facility that will allow rebate recipients to check the status of their rebates. Navigant is aware that the OPA is currently exploring an online rebate checking facility as one component of its broader objective of automating the rebate process. Irrespective of the accomplishment of this broader goal, the establishment of an online rebate checking portal, and its promotion to rebate applicants, will have a dramatic and positive impact on call centre volumes.

**Review of Program Tracking Data**

**Approach**

NCI reviewed the program tracking data sent to Navigant on June 22nd, 2008 by CF&R. This data provides contact information for all individuals who received a rebate for the HCSP, including which rebates they received, the model number and brand name of the replacement equipment, as well as the contact information for the contractor(s) who performed the work.

**Key Findings**

- The data was provided to Navigant in three separate files (Hot Savings data, Cool Savings data and Cool Savings Tune-up data), each with distinctive table headings and data formatting. It is unclear as to why the rebates for the tune up data was entered into a separate file and why there were an additional 1,647 rebates for programmable thermostat included in this same file.
Many customers have incomplete data for specific fields relating to the replacement equipment. For example, in terms of the Hot Savings program data file, of those customers who received a replacement central air conditioner, 32% of records were missing the name of the CAC manufacturer. These numbers dropped substantially, to below 5%, in the Cool Savings data file.

Although the data files indicate which measure each customer received under the program, only the total rebate amount issued for each customer is indicated, with no breakdown of the rebate amounts received for each measure.

No dates for equipment installation or rebate processing are included in the tracking data.

Internal rebate ID numbers were created by CF&R for each customer in the Hot Savings program, however rather than continuing this numbering scheme for the customers in Cool Savings program, the rebate ID numbers are restarted from the beginning, thus creating duplicate rebate ID numbers.

Recommendations

Based on our review, NCI has the following recommendations for the OPA/CF&R:

1. **Develop a clear, consistent and user-friendly spreadsheet that to record all essential information for each customer rebate.** CF&R should refine their customer tracking spreadsheet to ensure consistent reporting of each stage of the program. Some key amendments might include:

   i. Generation of unique ID numbers for each customer who receives a rebate – to eliminate confusion between customers and facilitate clear tracking and reporting.

   ii. Inclusion of both the installation date of the measure and the rebate processing date – to enable the OPA to review the performance metrics of CF&R against best practices and ensure measures are installed within the timeframe stipulated under the program rules.

   iii. Separation of rebate amounts issued for each measure (rather than having only a total rebate amount) - to reduce uncertainty as to the value of each rebate issued for each measure.

2. **Complete all required fields in the spreadsheet.** Rather than leaving an input blank, specific codes could be used for fields that cannot be completed (e.g., use “IL” for illegible responses, “DNP” for inputs that the customer did not provide, “NA” for
inputs that are not applicable, etc.). This will increase the transparency of the data and shed light on problems areas so that they can be duly addressed.

Ultimately, if the rebate process was ever to be fully automated, the tracking data entry and reporting process could be streamlined, eliminating some manual inputs and allowing for outputs to be manipulated consistently and per program rules to suit any reporting requirements. However, in the interim, CF&R should consider developing an interface for data input, allowing users to pick from drop down menus (where applicable) to ensure that all fields are entered in a consistent manner.

Audit and Verification of Installed Measures

Approach

To confirm that measures for which rebates have been issued have actually been installed, NCI planned to undertake up to 200 on-site visits of program participants. NCI surveyed approximately 1,100 program participants, meaning that approximately 20% of the survey participants needed to agree to an on-site visit – a higher rate than would generally be expected.

To simplify logistics and expedite the overall evaluation process, the on-site visits were scheduled during the participant survey calls. During the early stages of the participant surveying period, it became clear that meeting this 20% target could be problematic and, in consultation with the OPA, potential candidates for a home visit were offered entry into a draw for a $1,000 gift card, redeemable at various Ontario retailers, in return for agreeing to and completing a home visit.

While this helped boost participation, all told, 136 survey participants ultimately agreed to a home visit, of which 113 were actually completed. These home visits (constituting 188 installed measures: 51 Central Air Conditioners, 78 Furnaces equipped with ECMs, and 57 Programmable Thermostats) were conducted between May 16th, and May 28th, 2008.

Prior to the commencement of fieldwork, NCI prepared an on-site visit checklist, per Figure 12 below. NCI also met with and trained the home verification team, provided by BBW International, to ensure that they had the information, familiarity and knowledge required to complete the verification task accurately.

Per our earlier conversations with the OPA, these on-site visits were designed to confirm that the homeowners had installed the measures for which a rebate was paid. This precluded any confirmation of CAC tune-ups, since these cannot be visually confirmed. We were also precluded from verifying the installation of home furnaces equipped with ECMs since the ECM is not viewable without interfering with the unit to some extent – not something the OPA was comfortable instructing BBW to undertake given the potential liability issues involved. While BBW did collect furnace model numbers, the database supplied to Navigant by CF&R and the
OPA does not contain furnace model number information, which further precluded our verification of this measure.

The home verification team was instructed on which pieces of equipment to inspect based on data provided to them for each individual home visit undertaken. For example, in the case of a homeowner who received a rebate for a replacement CAC and Programmable Thermostat, the home verifier knew to inspect these two pieces of equipment. In the case of the replacement CAC, they visually inspected the unit and recorded the serial number from either the unit itself or the instruction manual for said unit. In the case of the Programmable Thermostat, the home verifier visually inspected the unit to ensure that it was indeed a programmable thermostat. This information was recorded manually on the forms used by the home verification team and signed by both the homeowner and verifier to confirm that the visit had occurred.

These forms were then delivered to Navigant’s research partner, NorthStar Research for entry into an electronic database which was then sent to Navigant, along with each original hard copy form. Navigant will be happy to supply the OPA with the completed forms upon request.

Navigant cross referenced the information recorded on these forms with the database of installed measures/rebates that was supplied to us by CF&R and the OPA in order to establish what proportion of installed measures match the corresponding rebates received.
**Figure 12: On-Site Visit Checklist**

<table>
<thead>
<tr>
<th>Pre-Visit Information</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Screener Name:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date of Scheduled Visit:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time of Scheduled Visit:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CUSTOMER DETAILS</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name CAC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Address 1 Furnace</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Address 2 Programmable Thermostat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>City/Town</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postal Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer Telephone #</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unique Customer ID - CID Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Contact #</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Central Air Conditioner Replacement</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand Name:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model Number:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serial Number:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition - New/Old?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractor Name?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractor Company?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other observations</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Furnace Replacement</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand Name:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model Number:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serial Number:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition - New/Old?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractor Name?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractor Company?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other observations:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Programmable Thermostat</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand Name:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit Model Number:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation Date?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition - New/Old?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractor Name?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractor Company?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other observations:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Who Supplied Thermostat (contractor or self)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are you using the programmable features (yes, no, not sure)?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional Comments:

---

**Findings**

Per Figure 13 below, NCI was able to match 92% of model numbers and/or serial numbers with CF&R data for the replacement CACs. Four percent of the CACs were unverifiable due to CF&R not having recorded the model number for the units in question in their database and
another four percent of the CAC units inspected did not match the CF&R database. This could be due to data entry issues on the part of CF&R or the home verifier or an indication of fraudulent installations. However, NCI does not have sufficient information to provide the OPA with a conclusive reason for this mismatch.

All of the Programmable Thermostats inspected by BBW were verified as being installed and operational.

**Figure 13: On-Site Visit Findings**

<table>
<thead>
<tr>
<th>Energy Star CAC</th>
<th>Programmable Thermostat</th>
</tr>
</thead>
<tbody>
<tr>
<td>92%</td>
<td>100%</td>
</tr>
<tr>
<td>4%</td>
<td>4%</td>
</tr>
</tbody>
</table>

**Recommendations**

Based on this review, NCI has two key recommendations for the OPA:

1. **More robust verification procedures should be implemented by the OPA**
   The home visits conducted for this evaluation provide some measure of reassurance that the measures for which rebates are being claimed are being installed. However, the unverifiable nature of certain measures without expert knowledge or specific engineering skills (i.e. Furnaces with ECMs), coupled with the fact that Tier II CACs require the correct matching of specific coils and evaporators in addition to being
adequately ‘sized’ for particular homes in order to achieve optimal energy efficiency gains, points to the fact that the OPA should insist that a certain proportion of rebate recipient installations are verified in more detail in order to ensure contractor and rebate recipient compliance with the program rules.

2. The OPA should design the program to allow for the OPA to request that rebate recipients agree to a home visit in order to qualify for the rebate
Navigant also recommends that the OPA adjust the rules of rebate eligibility to ensure that recipients agree to a home visit (in principal) in order to qualify for their rebate – thus ensuring that the OPA can perform a more targeted check of installed measures if needs be - therefore circumventing the issue that may have hindered the value of home-visits conducted for this evaluation – namely that anyone knowingly engaged in fraudulent activity would be highly unlikely to agree to a home verification visit. In order to not unnecessarily inconvenience rebate recipients, Navigant recommends that the OPA stipulate that home visits will be conducted within three-months of the rebate being issued in cases identified for verification of installed measures. Verification of between 1-3% of installed measures (skewed towards CACs and ECM equipped furnaces) is recommended.

Audit of Mercury-Based Thermostat Decommissioning Process

Approach

As part of the program evaluation, NCI undertook a review of the Clean Air Foundation’s (CAF) mercury-based thermostat “Switch the ‘Stat” decommissioning program, against environmental and public safety best practices, so as to better understand the process and any special issues regarding the disposal of non-programmable thermostats.

Navigant conducted several meetings with CAF staff members, participant contractors and other involved parties to address these issues. Our key findings are outlined below.

Key Findings

1. Non-enforcement results in contractor non-compliance and mixed results
   All participating contractors in the HCSP must dispose of their non-programmable thermostats through the CAF’s decommissioning program by returning used non-programmable thermostats to the decommissioning depot (operated by Aevitas Inc.8), via Purolator courier service, in a disposal bin. However, there are currently no

---

8 Aevitas (http://www.aevitas.ca/) is a hazardous waste treatment and recycling facility located in Ayr, Ontario, approximately 80 km east of Toronto. The facility’s mercury retort treatment technology is the first and only such system commercially available in Canada using a triple distillation process which cleans the mercury, thereby making it eligible for reuse rather than landfilling or shipment to the US for treatment.
measures put in place to oblige contractors to collect the non-programmable thermostats and send in their bins to the decommissioning depot. The CAF reports that:

i. Since October 2006, approximately 233 participating contractors have returned bins of non-programmable thermostats for proper decommissioning. These bins, containing approximately 10,500 switches, have transported approximately 5 kg of mercury that has been properly decommissioned through Aevitas, Inc.

ii. In November 2007, the CAF conducted a “full sweep” of the bin recipients by requesting that all participating contractors send in their bins. Approximately 70% of the contractors failed to respond although the CAF is not sure why this is the case.

2. **The CAF has experienced problems with the replacement of returned bins**

   The CAF indicated that they experienced delays in sourcing and deploying new replacement bins for the program. These problems initially centred on bin labelling and subsequently on finding bins that meet UN standards for mercury waste transportation. However, these issues has now been resolved and replacement bins were scheduled to be sent out during the third week of June 2008. Furthermore, an additional 210 bins will be sent out to participating contractors who have enrolled in the program since the CAF’s “full sweep request” of November 2007.

3. **Staffing constraints at the CAF have constrained program development**

   The program was previously managed as one of several programs under the direction of a single program manager at the CAF. As of Spring 2008, a dedicated program manager has been appointed to the “Switch the ‘Stat” program and the CAF believes it is now in a better position to effectively administer the program. They report that they are currently:

   i. Conducting an evaluation with a view towards improving the overall success of the program;

   ii. Resolving operational lag issues; and

   iii. Planning outreach programs - including attendance of HRAI chapter meetings and phone calls to participating contractors to promote the decommissioning program and to remind them to return their full bins.

4. **Decommissioning process**

   The decommissioning process appears to be robust. The main steps are as follows:

   i. CAF sends bins to contractor;

   ii. Contractor gradually fills bin and then sends it via pre-paid courier service to Aevitas, Inc.;

   iii. Aevitas, Inc. removes the mercury switches and places them in a secure ‘cylinder’;

   iv. The bin is inspected for contamination, decontaminated if required, then sent back to the CAF for redistribution to contractors;
v. Once the cylinder is full, it is placed in a ‘drum’ and stored in a secure facility pending recycling by Bethlehem Apparatus (http://bethlehemapparatus.com/).

Note: The CAF is in negotiation with Bethlehem Apparatus to secure a guarantee that the mercury will only be used in recyclable products and will not be shipped offshore to be used in an unsafe manner. Pending receipt of this guarantee, the mercury remains in the secure custody of Aevitas, Inc.

5. Liability issues

It should be noted that while Aevitas, Inc. holds $5m in liability coverage to protect it in the event of any transportation or storage mishaps, the company considers the mercury switches to be the property of the contractors from whom it is received until such time as it has been fully recycled. This is a nuance that stems from the fact that Canadian Law prohibits the transfer of ownership of hazardous materials.

Recommendations

Based on our review of the program, NCI suggests that:

1. The OPA/HRAI might consider monitoring thermostat replacement metrics and enforcing thermostat returns

Since CF&R reports on the number of programmable thermostats being installed under the program by each participating contractor, HRAI might consider liaising with the CAF to compare the total number of programmable thermostat rebates with the number of non-programmable thermostats that are returned by each contractor. These metrics could be used to:

i. Remind contractors who are not returning the non-programmable thermostats that doing so is a mandatory condition of program participation;

ii. Establish and enforce deadlines around bin returns – irrespective of whether or not they are full. For example, the metrics might show that, on average, bins take contractors 12 weeks to fill, in which case, the HRAI should communicate and enforce a rule that bins must be returned at least once every quarter (or when full – whichever is sooner).

Promoting awareness and encouraging compliance with thermostat collection and bin return is the only way to ensure that old thermostats are being appropriately decommissioned. This offers an additional benefit in that since each contractor will be held accountable to return a non-programmable thermostat for proper disposal for each programmable thermostat rebate they submit, they may be dissuaded from applying (or encouraging their customers to apply) for rebates for ineligible actions, i.e. replacing a programmable thermostat with another programmable thermostat – something which the participant survey suggests is commonplace.

2. The CAF should increase its communication with participating contractors

The CAF should focus on reaching out to all participating contractors to inform them on the status of the program. In particular, the CAF should immediately communicate with
all 233 active participating contractors who previously sent in their bin to advise them of when they will be receiving their replacement bin in an effort to regain their trust and support. As for those contractors who are not sending in their bins, NCI recommends that, in addition to the actions outlined in point 1 above, that the CAF attend HRAI chapter meetings and send out emails and newsletters to reinforce the importance of contractors collecting and properly disposing of old thermostats through the mechanism established by the program.

**Interviews with Participant and Non-Participating Contractors**

**Approach**

Contractors are in a very strong position to provide information on a range of issues key to the process evaluation, such as:

- Motivation for participating or not participating in the program;
- Awareness of the program, its requirements and its incentives/benefits;
- Effectiveness of outreach and training efforts performed by HRAI, of HRAI’s role in the program, and of HRAI in general;
- Effectiveness and timeliness of program materials, forms and rebates provided through CF&R Services, Inc.;
- Ease of interactions with the Clean Air Foundation, regarding disposal of non-programmable thermostats;
- Content and frequency of HVAC system tune-ups rebated through the program, as well as performed outside of the program and prior to the program;
- Effectiveness and value of specific program design components, and perceptions regarding previous changes in the program that have been made;
- Customers’ perceived value of each program activity (tune-up, ECM furnace replacement, Energy Star® central AC, and programmable thermostats) and of incentive levels;
- Customers’ perceived value of the Energy Star® label;
- Customers’ primary motivations for participating in the program;
- Understanding of program/participation process, and of how to “sell” high-efficiency equipment;
- High-efficiency equipment availability;
- Perception of the value and cost-effectiveness of high-efficiency equipment;
- Perceived value of different types and levels of incentives to motivate contractors (coop advertising, rebates, logo licensing, etc.) and customers;
- Perceptions regarding program component that consumers be required to use “program” contractors;
Extent to which the program training performed by HRAI resulted in higher customer satisfaction than otherwise would have been the case; and

Ways to improve the program process and program participation.

In addition, contractors typically play a key role in most HVAC system efficiency decisions by consumers. This phenomenon has implications for free-ridership and spillover, with respect to what actions would have occurred in the absence of the program. For this reason, Navigant asked contractors to report on a number of issues, including the range of equipment efficiencies, the extent to which ECMs are used in their furnace installations, the extent to which they automatically install programmable thermostats when installing replacement air conditioners and furnaces and so on. This information was valuable in providing information that was used to triangulate a net-to-gross estimate for each part of the program (please refer to the relevant section of this evaluation for more information).

NCI prepared a sample of approximately 50 participant contractors per LDC service territory as follows:

- The top 10 to 15 most active contractors in the program;
- A random sample of 30 - 40 participant contractors who processed a minimum of 5 rebates;
- 4 contractors, identified by HRAI, who were likely sources of more in-depth opinions and additional customer behaviour data; and
- 2-3 contractors who have repeatedly submitted questionable or incorrectly filled-out rebate paperwork to CF&R Services, Inc.

NCI also prepared a sample of approximately 33 non-participant contractors per LDC service territory as follows:

- HRAI members who have not registered for the HCSP; and
- A random sample of non-HRAI contractors in the GTA who have not registered for the HCS program;

Our findings from these interviews are discussed below.

**Participant Contractor Survey Findings**

Participant contractor surveys were conducted between May 5th and May 12th, 2008. In total, 33 participating contractors were interviewed, 29 of whom were HRAI members and 4 of whom were non-HRAI members.

Some key takeaways from the participant contractor survey are as follows:
1. **Satisfaction with HRAI training and workshops**
   Most contractors who participated in either the online training or attended a training workshop agreed that they have received adequate training from HRAI. Approximately half of the contractors confirmed that the training they received from HRAI has resulted in higher customer satisfaction than otherwise would have been the case without the training. Specifically, one contractor commented on their satisfaction with a training workshop led by Gordon Cook, specifically how beneficial it was to help market and sell energy efficient HVAC equipment.

2. **Strong support of “registered contractors only” program rule**
   All interviewed contractors support the program rule that customers are required to use only contractors who are registered in the Hot and Cool Savings program. Some contractors even suggested that HRAI should strengthen the rules of eligibility for contractors to ensure that the credibility of the participating contractors is upheld and that they aren’t competing with “substandard” contractors.

3. **Satisfaction with promotion of the rebate program to both members and non-members of HRAI**
   Just over 70% of interviewed HRAI member contractors agreed that HRAI and the OPA were effective at promoting the rebate program to both members and non-members of HRAI. In addition, all four non-HRAI members of the program were satisfied with HRAI’s and/or the OPA’s promotion of the rebate program to the contractors.

4. **The rebate program has helped contractors sell additional products and services**
   Many contractors believe that the rebate program has helped them to sell additional products and services that they would not otherwise have sold without the program (rating the accuracy of this statement as ‘5’ on a 7 point scale).

5. **Rebate incentives have increased demand for energy efficient equipment**
   Most contractors agreed that the incentives offered through the program have helped encourage customers to purchase more energy efficient equipment, specifically furnaces with ECMs. Based on the average of the contractor’s responses, once the contractor explained the rebate and potential energy savings of an ECM, almost 90% of customers chose to purchase a furnace with an ECM due to the rebate, whereas they estimate only 60% of customers would make that same decision if there was no rebate available. In terms of Energy Star® central air conditioners, 80% of the customers are choosing Energy Star® once the contractor has explained the details of the rebate and unit’s potential energy savings, in comparison to roughly 50% of customers who would otherwise make the same purchase without a rebate incentive. A few contractors commented on how the attitude of the customers is generally “how much” rather than “how efficient”.

---

Evaluation Report: 2007 Hot and Cool Savings Program
6. **Contractors are generally satisfied with any support or assistance they might require from HRAI, less so with CF&R**

Contractors responded by rating their satisfaction with the support and/or assistance they might require from HRAI during the rebate program a 6 out of 7. However, contractors are generally less satisfied with CF&R, rating them a 5 out of 7.

The participant contractor interviews also provide a number of other interesting observations:

1. **Promotion**
   i. Over half the contractors interviewed believe that the program has not been effectively promoted to the general public by the OPA or HRAI with only half recalling ever seeing any promotions.
   ii. Contractor frustration over the absence of promotion has likely resulted in lower participation and correspondingly fewer installations of energy efficient equipment.
   iii. All of the participating contractors interviewed actively promote the program to their customers, with many reporting that they mail/post flyers and leaflets to their customers in order to promote the rebate program.

2. **Training**
   i. Just over half of the surveyed participant contractors stated that they have received no formal training from HRAI on the Hot and Cool Savings rebate program.
   ii. Of those who reportedly receiving training from HRAI, over 75% believe that the training they received resulted in higher customer satisfaction than otherwise would have been the case without the training.
   iii. Contractors who participated in the training, for the most part, agreed that HRAI provided adequate training for the program (on average rating it a 6 on a 7 point scale).

3. **Rebate processing**
   i. Over 80% of the participant contractors surveyed responded that they have had rebate forms returned to them from CF&R requesting additional information. Although many contractors have said that they are now having fewer problems.
   ii. Many contractors complained that CF&R has been too “demanding” or “picky” with regards to ARI numbers or model numbers and some contractors are having difficulty reaching CF&R by phone to help resolve the issue.
   iii. Contractors reportedly complete and mail approximately 80% of the rebate forms on behalf of the customer – citing an ‘onerous process that is too confusing for consumers’ as the main reason for so doing.
   iv. Many contractors feel that CF&R should not mail a letter to both the contractor and the customer if a rebate form has been incorrectly submitted, believing this creates confusion and unnecessary concern for the customer. Contractors instead suggest that a letter should first be mailed to the contractor, and if CF&R does not hear anything from the contractor, only then should the customer be contacted.
4. Program materials
   A number of contractors expressed frustration over delays in receiving additional/updated forms throughout the program. Contractors contend that this resulted in a backlog of forms and paperwork and a corresponding delay in the issuance of rebate cheques to customers.

5. Changing rebate levels
   i. Almost all of the participant contractors surveyed expressed disappointment with the decreasing level of rebates they are able to offer their customers.
   ii. A number of contractors reported that some of the energy efficient equipment (mostly the ECMs and the Energy Star® CACs) are becoming increasingly more difficult to sell since the rebate levels provide less of an incentive to customers to install higher efficiency equipment.
   iii. Well over half of the interviewed contractors believe the rebate levels are currently set too low, with the rebate level for the ECM being the incentive that they contend should be increased most, followed by the Energy Star® CAC.
   iv. A number of contractors reported that the change in rebate levels has caused confusion and frustration for both the customers and the contractors alike, with some of the interviewed contractors being unaware of the recent changes in rebate levels.

Other key takeaways:

1. The top three reasons for contractors joining the program were:
   i. To meet customer demand for rebate eligible purchases;
   ii. To attract more customers; and
   iii. The ability to offer their customers rebate incentives.

2. Mixed reviews on online vs. paper format for the rebate form
   Two-thirds of the interviewed contractors are in favour of the rebate forms moving to an online format, whereas the remaining contractors would like the rebate forms to remain in the current paper format. Although many contractors expressed a desire to, at a minimum, to have the option of online submission, contractors still expressed concern about how the OPA/HRAI would keep a “paper trail” of the rebate forms.

3. Contractors are properly disposing of non-programmable thermostats, however some contractors are not having their bins returned to them
   i. Although approximately 85% of the interviewed contractors dispose of their non-programmable thermostats with the CFA through their “Switch the ‘Stat” program, a number of contractors have reported that the CFA has never returned the disposal bins that they returned to them following the first mail-in of old thermostats. Consequently, most if these contractors have been stockpiling old thermostats at their office/depot pending receipt of the replacement bin.
ii. Overall, the contractors rated their ease of interaction with the CFA a 5 out of 7.

4. Request to include ‘new construction/installations’ in rebate incentives
   A number of contractors expressed concern that the program rules only offer rebates for replacement equipment and not new installations, specifically in new homes. Many believe that the OPA is missing out on a large portion of the residential market since the majority of the newly installed furnaces and central air conditioners only meet minimum efficiency levels.

5. A large proportion of the contractors’ sales and services are rebate eligible
   On average, a program rebate was issued to almost 80% of the interviewed contractors’ replacement furnace sales, 70% of their CAC sales, 85% of their programmable thermostat sales and 75% of their CAC tune ups.

6. Overall, contractors are satisfied with the program
   Contractors report being generally satisfied with the program. All of the contractors scored the program a minimum of 5 out of 7, with the average rating being 6 out of 7.

Recommendations

NCI’s key recommendations are as follows:

1. Increase training and workshops for participating contractors
   Since the program rules stipulate that only one employee is required to participate in the online training per contracting company, many individual contractors participating in the program may not be adequately trained to promote the rebate program and the individual products and services eligible for rebates. Also, since larger companies (such as Direct Energy) generally have a sales person make the sale and an installer fit the equipment, training both sales staff and installers is important. NCI suggests that HRAI revise its training program to include workshops for the participating installers and sales staff. Furthermore, HRAI should be encouraged to consider either developing in-house or partnering with a group (such as the Energy Efficiency Contractors Network) to offer a 1 day energy efficiency workshop to enhance the value of its contractor training activities.

2. Provide third party literature and studies on energy efficient HVAC equipment to contractors and content for promotional materials
   i. As suggested by one contractor, the OPA or HRAI might consider providing participating contractors with third party literature or studies on the potential energy savings of the rebate-eligible equipment so that they may use it as a selling point for their customers. Many contractors only have basic knowledge on potential energy savings (mostly from past experience), however the ability to pass along legitimate facts to their customers as proof of potential energy savings will add credence to the rebate program and aid in its effective promotion.
ii. It is recommended that the OPA or HRAI provide promotional material for the rebate program to contractors who wish to promote the program to their customers. This would ensure that the OPA can manage both the content and the overall message they wish to promote to the general public and thereby ensure consistency and quality.

3. **Improve and reinforce contractor communication channels**
   i. The OPA should encourage HRAI to ensure that contractors are aware of the different program stakeholders and are clear on who to call in the event of an issue or question. It is incumbent on HRAI to provide program participants with clear information on whom they should contact in the event of issues or questions.
   ii. NCI also recommends that a monthly newsletter be distributed to participating contractors to keep them informed on relevant program updates, rebate form submission tips, publications or studies on energy efficient HVAC equipment, upcoming training events, relevant contact information and finally, any changes to rebate levels. Keeping contractors informed and providing regular updates will limit confusion and encourage program compliance. Hosting monthly draws could also help ensure that the newsletter is being distributed to and read by a larger proportion of participating contractors.

4. **Use contractor feedback to enhance the program**
   The OPA and HRAI need to ensure that there is open dialogue between the project managers and the participating contractors with a view towards improving the effectiveness of the program. Since contractors have the greatest level of interaction with potential rebate recipients, they are best suited to comment on the effectiveness of the program and suggest improvements. HRAI and the OPA should create a forum for program participants to share their opinions and suggestions on the program (internet based, town hall meetings, etc) to assist with its refinement.

**Non-participating Contractor Survey Findings**

The non-participant contractor surveys were conducted between May 13th and May 28th, 2008. Interviews were attempted with over 75 non-participant contractors, however since many of the non-participant contractors tend to be smaller sized contractors with limited available time (or inclination) to participate in telephone interviews, only 16 of the proposed 30-35 non-participant contractor surveys were conducted. In total, 14 non-participant contractors identified themselves as HRAI members and 2 identified themselves as non-HRAI members.

Some key takeaways from the non-participant contractor survey are as follows:

1. **Non-participant contractors are aware of the program**
   The majority of non-participant contractors interviewed are aware of the rebate program. The most common reasons why these contractors are not enrolled are that: (i) they never considered enrolling and (ii) they do not see the value in enrolling.
2. Improved incentives and promotions could persuade more contractors to enrol in program
   When asked what might persuade non-participant contractors to enrol in the program, the main responses included: (i) providing incentives for contractors, (ii) having more customers asking for the rebates, and (iii) improving the rebate levels.

3. Non-participant contractors have preconceived notions or inaccurate information about the program
   Many non-participants contractors are misinformed or do not have sufficient information about program.

4. Non-participant contractors believe they lack the time or resources necessary to participate in program
   A number of the non-participant contractors interviewed believe they do not have the time or resources to complete all of the required paperwork for the rebates since they believe the process will be too cumbersome and lengthy.

5. Lack of promotion of program to both contractors and public
   A third of the interviewed non-participant contractors believe that HRAI has been ineffective at promoting the rebate program to contractors. Just under half believe that the program has been insufficiently promoted to the general public.

6. Strong support of “registered contractors only” program rule
   Two thirds of the non-participant contractors interviewed agree with the program rule that rebate eligible customers must only use contractors who are registered in the program.

7. Non-participant contractors continue to sell energy efficient HVAC equipment
   Non-participant contractors responded that, on average, just over half of their customers who replaced their furnace over the past 12 months purchased one with an ECM. In terms of central air conditioner replacements, roughly 75% of their customers purchased an Energy Star® certified unit.

**Recommendations**

NCI’s key recommendations are as follows:

1. Increase awareness amongst non-participant contractors – particularly smaller firms
   Since many of the non-participant contractors have misconceptions about the program, HRAI should increase the breadth of the program’s promotional outreach within the HVAC community. Based on results obtained from HRAI, approximately one third (1,000) of all residential HVAC contractors in Ontario have enrolled in the program. HRAI has been particularly successful in enrolling the medium sized (20-100 technicians) and larger contracting firms (100-500 technicians), having enrolled over 80%
of those registered with the TSSA⁹. The OPA and HRAI should now focus their attention on enrolling smaller HVAC firms (less than 20 technicians) since only a third of these have so far registered in the program. NCI suggest that HRAI create a pamphlet which clearly outlines the program’s objectives, details how to enrol and communicates the benefits of participation. This should be sent to all non-participant HVAC contractors in Ontario.

2. **Showcase the benefits of being enrolled in the program**
   
   As mentioned earlier, one of the reasons many contractors are not currently enrolled is that they do not recognize the value of participating in the program. However, interviews with participating contractors suggest that the program has enabled them to sell additional products and services they would not have otherwise sold. Therefore, NCI recommends that HRAI showcase successful participating contractors, in the form of case studies/profiles or at industry forums in order to demonstrate the value of the program to non-participant contractors.

---

⁹ Email correspondence with Martin Luymes, HRAI, June 2nd, 2008.
Approach

NCI adopted a five-stage approach to the review of the underlying Prescriptive Input Assumptions (PIAs) for each of the technologies covered in the 2007 HCSP, as follows:

1. Review of OPA’s PIA for the HCS equipment and measures;
2. In-depth review of PIAs and evaluations for similar equipment and measures in other jurisdictions;
3. Refinement of HCSP Equipment and Measures PIAs based on analysis of the survey responses from the participant / non-participant surveys;
4. Analysis and comparison of the consumption history of participants and non-participants through a conditional demand analysis (described in the “Billing Analysis” section of this report); and
5. Analysis of other factors identified through this process which may result in significant impacts to the PIAs (described in the “Gross Energy Savings” section of this report).

Review of the OPA’s Existing PIAs

NCI reviewed PIA related information provided by the OPA for some of the measures covered in the Hot and Cool Savings Program to determine any gaps or outdated assumptions and/or sources which might falsely influence the overall impact of the program. The PIAs related to the Hot and Cool Savings Program measures were as follows:

- Energy Star® Central Air Conditioner, Programmable Thermostat (Space Cooling and Forced-Air Electric Heating);
- Furnace Equipment with Electronically Commutated Motor (ECM) – (Heating and Cooling Existing Homes);
- Furnace Equipment with Electronically Commutated Motor (ECM) – (Heating Existing Homes);
- Furnace Equipment with Electronically Commutated Motor (ECM) – (Heating and Cooling New Homes); and
- Furnace Equipment with Electronically Commutated Motor (ECM) – (Heating New Homes).
Review of PIAs from other Evaluations and Technical Studies in other Jurisdictions

NCI’s extensive database of CDM programs, current PIAs, evaluations and technical studies for similar equipment and measures undertaken in other jurisdictions facilitated a further comparison of the OPA’s PIAs against the assumptions and results used in other CDM programs and studies was undertaken to enhance and refine the PIAs used in the HCSP and presented to the OPA for internal review.

Notable references included studies by the Canadian Centre for Housing and Technologies (The Effects of Thermostat Set-back and Set-up on Seasonal Energy Consumption, Surface Temperatures and Recovery Times at the CCHT Twin House Facility\(^{10}\) and Final Report on the Effects of ECM Furnace Motors on Electricity and Gas Use: Results from the CCHT Research Facility and Projections\(^{11}\)), Statistics Canada (Household and the Environment Survey\(^{12}\)), the Maryland Utility Energy Star\(^{®}\) Partnership Program, and The American Council for an Energy Efficient Economy (Residential Energy Efficiency Program Design Recommendations\(^{13}\)).

Refinement of HCSP Equipment and Measures PIAs

NCI further refined the initial PIA assumptions based on additional information from the participant and contractor survey results, and the billing analysis results. This information provided further insight into Ontario-specific free-ridership, spillover, take-back (e.g. lowering temperature setpoint for a more efficient CAC), actual consumer behaviour (e.g. programming of the programmable thermostat) and actual contractor service and installation practices.

Key Revisions

Key revisions to the PIAs are presented below.

\(^{10}\) Canadian Centre for Housing Technologies, The Effects of Thermostat Set-back and Set-up on Seasonal Energy Consumption, Surface Temperatures and Recovery Times at the CCHT Twin House Facility, March 2007 (http://irc.nrc-cnrc.gc.ca/pubs/fulltext/nrcc48361/nrcc48361.pdf)

\(^{11}\) Canadian Centre for Housing Technologies, "Final Report on the Effects of ECM Furnace Motors on Electricity and Gas Use: Results from the CCHT Research Facility and Projections", NRCC-38500, August 2003


Table 9: Refinement of PIAs based on Survey Results

<table>
<thead>
<tr>
<th>Measure</th>
<th>Significant Revisions based on Survey Results</th>
</tr>
</thead>
</table>
| **Energy Star® CAC**            | o  Addition of net energy savings from subset of customers who now set their thermostat at a higher temperature vs. a lower temperature setting in the summer, (average of 2 degrees higher), – resulting in additional savings of 103 kWh/year).  
   o  Increase in penetration of CACs in private residences (from 69% to 95%)  
   o  Revised incremental cost.                                                                                   |
| **Programmable Thermostats**    | o  Revision of actual post program behaviour for summer and winter set back temperatures.  
   o  Revision of base CAC energy usage to take account of percentage of programmable thermostats being installed in conjunction with Energy Star® CACs.  
   o  Exclusion of customers who previously had a programmable thermostat installed in their home which was programmed during the heating and/or cooling season (43% of programmable thermostat rebate customers).  
   o  Revised incremental cost.                                                                                  |
| **Furnace with ECM**            | o  Revision of continuous fan usage vs. auto fan usage statistics both pre and post-program.  
   o  Addition of subset of individuals who changed their furnace fan behaviour since installing the ECM (e.g., 5% increase in continuous furnace fan usage with ECMs).  
   o  Revision of continuous fan usage for winter and summer months only, using non-continuous furnace fan savings for shoulder months.  
   o  Revision of new vs. existing homes (from 33% new homes - to 54% new homes).  
   o  Revised incremental cost.                                                                                  |
| **CAC Tune Up**                 | o  Exclusion of customers who previously tuned up the air conditioner on an annual basis (63%).  
   o  Revised age of CAC units for customers (from 35% of CACs over 15 years old to 15%).  
   o  Revised incremental cost.                                                                                  |
Furthermore, the peak demand impacts of each of the measures were recalculated based on the coincident demand methodology as defined in Appendix A of the OPA Measures and Assumptions List (Feb. 2008).

Based on the methodology described in this OPA document, the winter and summer peak impact of a measures are to be determined based on the average demand in the Winter Peak Period and Summer Peak Period multiplied by the Winter or Summer coincidence factor specific to the end-use of the measure.

For example, in Table 10 a furnace with an ECM is estimated to save 75.9 kWh in the Winter Peak Period and 110.82 kWh in the Summer Peak Period. The duration of these two periods are 602 and 502 hours, respectively. The coincidence factor (CF2 = ratio of demand at top ten system peak hours to average peak demand) for a residential furnace fan is 1.103 for Winter and 2.286 for Summer. As shown, the Winter Peak demand impact for a furnace with an ECM is thus:

Winter Peak Demand Impact = Average Demand in Winter Peak Period x Winter Coincidence Factor
= 75.9 kWh x 1.103
= 602 hours
= 126 W x 1.103
= 139 W (or x 0.14 kW)

Similarly, the Summer Peak Demand Impact for furnace with an ECM is thus:

= 110.8 kWh x 2.286
= 522 hours
= 212 W x 2.286
= 485 W (or 0.49 kW)

A similar approach was used in the determination of the peak impacts for other measures included in the program.

Table 10: Hot and Cool Savings Program Key Measure Assumptions

<table>
<thead>
<tr>
<th>Measure Name</th>
<th>Annual Energy Savings (kWh)</th>
<th>Peak Demand Saving (kWh)</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Winter</td>
<td>Summer</td>
<td>Natural Gas (m³/year)</td>
</tr>
<tr>
<td>Hot Savings: Energy Star CAC</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Hot Savings: Programmable Thermostat</td>
<td>3.9</td>
<td>4.0</td>
<td>34.9</td>
</tr>
<tr>
<td>Hot Savings: Furnace with ECM</td>
<td>75.9</td>
<td>207.6</td>
<td>130.8</td>
</tr>
<tr>
<td>Cool Savings: Energy Star CAC</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Cool Savings: Programmable Thermostat</td>
<td>3.9</td>
<td>4.0</td>
<td>39.5</td>
</tr>
<tr>
<td>Cool Savings: Furnace with ECM</td>
<td>77.5</td>
<td>212.2</td>
<td>113.3</td>
</tr>
<tr>
<td>Cool Savings: CAC Tune Ups</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Further details underlying these key assumptions are provided in Appendix A: Hot And Cool Savings Program Measures Prescriptive Input Assumptions.
GROSS ENERGY AND PEAK DEMAND IMPACT

Key Findings

The gross energy savings presented below in Table 11 and Table 12 below reflect the number of rebates issued and demand savings estimates for each measure as provided in Table 10 in the previous chapter. Note that the gross energy savings presented below do not reflect NCI’s estimate of the net-to-gross ratio for these various products – these results are presented in the subsequent chapter of this report.

Table 11: Total Number of Rebates Issued for HCSP (by product)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Rebates Issued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Savings: Energy Star CAC</td>
<td>5,864</td>
</tr>
<tr>
<td>Hot Savings: Programmable Thermostat</td>
<td>11,409</td>
</tr>
<tr>
<td>Hot Savings: ECM Furnace</td>
<td>12,344</td>
</tr>
<tr>
<td>Cool Savings: Energy Star CAC*</td>
<td>27,314</td>
</tr>
<tr>
<td>Cool Savings: CAC Tune Ups</td>
<td>28,048</td>
</tr>
<tr>
<td>Cool Savings: ECM Furnace*</td>
<td>39,646</td>
</tr>
<tr>
<td>Cool Savings: Programmable Thermostat</td>
<td>35,580</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>160,205</strong></td>
</tr>
</tbody>
</table>

*Includes those customers who received combined ECM and Energy Star® CAC rebates

The total number of rebates issued differs slightly from Table 3 because:

- 8,402 customers who received rebates for a combined ECM and Energy Star® CAC were added to both the final count of the Cool Savings Energy Star® CAC measure rebates and the Cool Savings ECM Furnace measure rebates;

- 354 “Other/Miscellaneous” rebates listed in Table 3 were not included in Table 11 for the purposes of determining the impact of the program since these rebates did not result in incremental demand or energy savings.

Once the total number of rebates issued for each measure has been determined, the gross annual energy savings can therefore be calculated. For example, the gross annual energy savings for an Energy Star® CAC during the Hot Savings Program is determined using the following methodology:

\[
\text{Gross Annual Energy Savings} = \text{Annual Energy Savings} \times \text{Rebates Issued}
\]

\[
= 136.83 \text{ kWh} \times 5,864
\]

\[
= 802,371 \text{ kWh (0.802 GWH)}
\]
Similarly, the Gross Lifetime Energy Savings for Energy Star® CACs is thus:

\[
\text{Gross Lifetime Energy Savings} = \text{Annual Energy Savings} \times (\text{Effective Useful Life}) \\
= 0.802 \text{ GWh/year} \times 18 \text{ years} \\
= 14.4 \text{ GWh}
\]

The gross summer peak demand impact for Energy Star® CACs is calculated in the same manner, with the gross summer peak energy savings (0.150 kW) multiplied by the total number of rebates issued (5,864), resulting in a total annual summer peak energy savings of 852 kWh, or 0.9 MWh.

The same approach was used in the determination of the Gross Annual, Lifetime and Peak Energy Savings for each measure included in the program with complete calculations provided in APPENDIX B: HOT AND COOL SAVINGS DETAILED CALCULATIONS.

As shown in Table 12, the estimated gross annual energy savings from the entire Hot and Cool Savings Program is 57.4 GWh, with winter and summer gross demand impact of approximately 7.7 MW and 39.7 MW respectively. As discussed, these results do not reflect free-riders and other factors affecting the net-to-gross ratio for each of the HCSP measures.

**Table 12: Hot and Cool Savings Program Gross Energy and Peak Demand Impact**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Annual GWh</th>
<th>Lifetime GWh</th>
<th>Winter Demand Savings (MW)</th>
<th>Summer Demand Savings (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Savings: Energy Star CAC</td>
<td>0.8</td>
<td>14.4</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Hot Savings: Programmable Thermostat</td>
<td>0.6</td>
<td>9.2</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>Hot Savings: Furnace with ECM</td>
<td>10.1</td>
<td>151.7</td>
<td>1.7</td>
<td>6.0</td>
</tr>
<tr>
<td>Cool Savings: Energy Star CAC</td>
<td>4.2</td>
<td>76.2</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>Cool Savings: Programmable Thermostat</td>
<td>1.9</td>
<td>28.6</td>
<td>0.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Cool Savings: Furnace with ECM</td>
<td>33.2</td>
<td>497.6</td>
<td>5.6</td>
<td>19.7</td>
</tr>
<tr>
<td>Cool Savings: CAC Tune Ups</td>
<td>6.6</td>
<td>33.0</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>57.4</strong></td>
<td><strong>810.6</strong></td>
<td><strong>7.7</strong></td>
<td><strong>39.7</strong></td>
</tr>
</tbody>
</table>

**Confidence Interval for Gross Energy and Demand Savings**

In a mass market program such the Hot and Cool Savings Program, there is no way to know, with absolute certainty, all of the myriad factors affecting the program’s gross and net energy and demand savings and program cost-effectiveness. The results presented above and in the
subsequent sections of this report represent NCI’s best estimate based on the available information. The actual results may differ from these estimates.

In an effort to quantify the confidence interval or potential range of uncertainty around the key program results presented herein, NCI undertook a Monte Carlo simulation analysis in which the key input parameters that have the most significant impact on results were randomly varied within a specified range informed by survey results and other information. Up to 5,000 simulations of the gross energy and demand savings, net energy and demand savings or program cost-effectiveness were undertaken and the confidence interval based upon the resultant range for the result in question.

In terms of the ECM furnace, this measure accounted for 75% and 63% of the program’s gross energy and summer demand savings respectively. Much of these energy savings are dependent on whether or not customers run their furnace fans continuously (set to “on”) or non-continuously (set to “auto”). As previously mentioned, the percentage of customers who run their furnace fan continuously was estimated to be 31% based on the survey results. However, almost all the contractors interviewed stated that they recommend their customers with an ECM run their furnace fan continuously so as to maintain a constant temperature and continuous air flow throughout their home. On the other hand, a 1997 study by Unies14 indicates that approximately 20% of Canadians run their furnace fans continuously. Thus, it is possible that the percentage of customers who run their furnace fans continuously could be higher than estimated by NCI based on contractor suggestions, however, it is more likely to be slightly lower based on the national average. To account for the potential impact of this uncertainty, NCI undertook a Monte Carlo simulation with the percentage of ECM purchasers who continuously run their furnace fan falling anywhere between 21% and 41% using a triangular distribution.

In addition to the ECM measure, NCI undertook similar simulations with varying assumptions for the remaining three measures. The range of variability and rationale for the range used in the Monte Carlo analysis are discussed below, followed by a summary table of the inputs and variability used.

- For the Energy Star® CACs, the gross impact savings are highly dependant on the base case SEER rating of the replacement air conditioner that would have been installed in the absence of the program. Greater savings would be expected for those purchasers who would likely have otherwise installed a 10 SEER CAC instead of an Energy Star® unit versus those purchasers who would likely have otherwise installed a 13 SEER CAC. Although the minimum standard for CACs in Ontario has been 13 SEER since February 2006, manufacturers were able to sell-off their existing inventory of 10 SEER units after

---

this date, which would have resulted in some 10 SEER sales post-February 2006. Based on survey responses and discussions with contractors, NCI has assumed that 10% of HCSP CAC participants would have otherwise purchased 10 SEER CACs, however, simulations varying the estimated 10 SEER penetration rate among program participants in the absence of the program by +/- 10% using a log normal distribution were undertaken. The lognormal distribution results in a somewhat asymmetric distribution with a relatively long “tail” towards higher penetration rates.

○ As previously discussed, almost 25% of all surveyed participants who replaced their Energy Star® CAC stated that they now set the temperature, on average, 2 higher, resulting in increased savings. It is uncertain whether or not these same participants would have set their CAC temperatures higher if they had replaced their CAC with a non-Energy Star® unit. Given this uncertainty, NCI has attributed half of these savings to the program (on the assumption that the other half of the savings would have been realized anyway if the participant had purchased a non-Energy Star® unit). To capture the potential impact of the uncertainty, simulations varying the percentage recognized by the program by +/- 12% normally distributed about the 50% base assumption were included in the analysis.

○ Based on the results of the survey, NCI determined that 10% of the programmable thermostat participants with central air conditioners modified their behaviour and increased the temperature setting by 3 when they are away from home, 20% increased the temperature setting by 1-2 and 70% have not changed their temperature setting behaviour. This distribution is slightly lower than the provincial average, therefore simulations varying the mean of 1 by a standard deviation of 0.3 using a log normal distribution were undertaken.

○ Given the various factors that come into play in determining the energy savings expected from a CAC tune up (e.g., age of CAC, effectiveness of tune up, variability among contractors, etc.) and lack of robust secondary research, NCI believes that the estimated savings of 17% could vary considerably for each tune up – depending on age of the units, period since previous tune-up and the relative thoroughness of the tune-up. Therefore, NCI believes that the 17% savings may represent a best case scenario. Given this, simulations varying the estimated savings uniformly between 12% and 18% were included in the Monte Carlo analysis.

The five key input parameters that were varied in the gross energy and demand savings sensitivity analysis are summarized below in Table 13.
Table 13: Input Parameters and Range of Uncertainty for Gross Energy and Summer Demand Savings Monte Carlo Simulations

<table>
<thead>
<tr>
<th>Key Parameter</th>
<th>Base Value</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM fan usage (continuous vs non-continuous)</td>
<td>31%</td>
<td>Triangular distribution 21%-41%</td>
</tr>
<tr>
<td>SEER 10 CAC market penetration</td>
<td>10%</td>
<td>Log normal distribution 10% standard deviation</td>
</tr>
<tr>
<td>Program effects of temperature set up from Energy Star CAC</td>
<td>50%</td>
<td>Normally distributed 12% standard deviation</td>
</tr>
<tr>
<td>Full temperature set up using programmable thermostat</td>
<td>10%</td>
<td>Log normal distribution 30% standard deviation</td>
</tr>
<tr>
<td>Energy Savings from CAC tune up</td>
<td>17%</td>
<td>Uniform distribution 12%-18%</td>
</tr>
</tbody>
</table>

The results of this simulation the gross energy and demand savings are shown in Figure 14 and Figure 15. The results of this simulation indicate that there is an 80% probability that the gross energy savings for HCSP fall within the range of 50.7 GWh to 63.0 GWh (i.e., the range covered by the blue bars in Figure 14). Another way of expressing this is that NCI has 90% confidence that the gross energy and demand savings are at least 50.7 GWh (i.e., ignoring the 10% of results below 50.7 GWh).

Figure 14: Expected Range of Annual Gross Energy Savings (GWh)
Similarly, as shown in Figure 15, there is an 80% probability that the gross summer demand savings for the HCSP fall within the range of 35.1 MW to 43.2 MW. Based on this analysis, NCI has 90% confidence that the gross summer demand savings for the program were at least 35.1 MW.
**Net-to-Gross Analysis**

**Introduction**

This section presents the results of Navigant Consulting’s net-to-gross analysis for the Hot and Cool Savings program, reflecting exclusions, free-ridership, and spillover. NCI’s approach and results from the net-to-gross analysis are presented below, including details for excluding customer subsets followed by free-ridership methodology and findings for all the measures in the program.

NCI utilized results from the other components of this evaluation (PIA review, participant/non-participant survey and billing analysis) and other available information to estimate the net to-gross ratio.

**Exclusions**

Based on the results from the participant survey, NCI identified a subset of programmable thermostat and CAC tune-up participants that cannot be expected to realize any savings and hence would not contribute to the net savings realized by the program. The basis for and impact of these exclusions are described below.

*Programmable Thermostat Rebate*

The program rules clearly indicate that customers are only eligible for a programmable thermostat rebate if they replace an existing non-programmable thermostat with a programmable thermostat. However, of the 373 programmable thermostat participants surveyed, 176 (or 46%) reported previously having a programmable thermostat installed in their home.

While it could be argued that if these homeowners did not previously use the programmable functions of their old PT and are now using these features on their newly installed PT, this action could result in energy savings, the survey results indicate that that 87% of those who previously had a PT installed in their home had programmed this thermostat to automatically adjust the temperature during the heating and cooling season. Thus, NCI excluded 40% (46% x 87% = 40%) of the programmable thermostat participants from the net savings estimation analysis on the basis that the new measure would have no impact on their overall energy consumption since their behaviour did not change (i.e., they had a programmed programmable thermostat before participating in the program).
Central Air Conditioner Tune Up Rebate

In terms of the CAC tune up rebates, 78% of the CAC tune-up participants surveyed indicated that they had tuned up their central air conditioner in the past. Of these, 80% reported that they tune up their central air conditioner every year, either as part of a preventative maintenance plan or as part of their warranty requirements. Thus, 63% (78.1% x 80.1% = 62.5%) of the CAC tune-up participants were excluded from the net savings analysis since Navigant Consulting does not expect any significant energy savings from tune-ups completed only one year after the previous tune-up.

Free-Ridership

Estimation of the Ontario specific free-ridership associated with each measure remains a critical factor in determining the overall impact of the program. Hence, Navigant Consulting’s comprehensive analysis and estimation of free-ridership for each measure is required in order to justify the energy savings resulting from the program. Since the methodology in determining the free-ridership is almost identical for each measure, only the free-ridership methodology and approach for programmable thermostats is presented below in full, with variations used in the determination of free-ridership for the other measures noted where appropriate.

Programmable Thermostat

As was the case for each measure, the free-ridership associated with the programmable thermostat measure was estimated primarily from the customer survey responses and, to a lesser extent, the contractor survey responses. Using the customer survey responses, NCI was able to determine whether each respondent (i) had planned on purchasing a programmable thermostat before they heard about the rebate program; (ii) reported that program-related factors were important to their programmable thermostat purchase; and (iii) reported they would have purchased a programmable thermostat even if there had been no program. Specifically, survey questions were used to collect the following information:

- Were respondents planning to purchase a programmable thermostat before they heard of the rebate program or more so after they heard about HCSP?
- Did respondents think that a program-related factor or their contractor’s recommendations were some of the most important factors influencing them to make their decision to install a programmable thermostat?
- If there had been no program, do respondents think they would have paid $50 or $75 more to buy a programmable thermostat at the full price?
- If there had been no program, no discount coupons, and no program advertising, do respondents think they would have made exactly the same purchase decision, not
upgraded their non-programmable thermostat, had a cheaper non-programmable thermostat installed or purchased and installed a programmable thermostat themselves (since the program rules stated that a contractor must perform the installation of the programmable thermostat)?

Respondents were categorized as full, partial or non-free riders based on the information they provided in answering the free-ridership question battery for their programmable thermostat purchase. Free-ridership percentages were assigned to each combination of survey responses.

Respondents were considered 0% free riders if they provided any of the following responses:

- They reported that either a program-related element (e.g. the discount coupon, program advertising, etc.) or contractor recommendation were important factors in their purchase decision.
- They reported that in the absence of the program, they would have been not be very likely or not likely at all to spend an additional $50 or $75 on a programmable thermostat.

This approach is designed to account for the possible “halo” and “self-aggrandizement” effects (respondents providing the answer they believe the surveyor wants to hear, or providing the answer they believe makes them “look good”) by requiring that respondents consistently answer all of several questions as free riders before they are considered free riders.

Similarly, respondents were considered 100% free riders if they provided answers a free rider would typically give to each of the questions in this battery of questions. A respondent providing the following responses (paraphrased from the survey question and answer choices for ease of review) was categorized as a 100% free rider:

- The most important factors in my purchase decision were ...(anything except rebate program, contractor recommendations, utility promotion or HCSP advertising & promotions).
- I was already planning on installing a programmable thermostat.
- I would have been extremely likely to have paid $50 or $75 more to purchase the programmable thermostat (i.e., would still have purchased without the rebate).

Almost 50% of the survey respondents fell into one of these two (0% or 100% free rider) categories.

Those respondents whose responses would not categorize them clearly as either 0% free riders or 100% free riders were assigned partial free-ridership percentages. The matrix presented in Table 14 below provides a summary of this approach. As discussed, a respondent’s free-
ridership percentage was based upon their specific combination of responses to several of the survey questions. Note that in Table 14, the absence of a line between the various answer choices indicates that all of the questions must be answered for a customer to be categorized in that specific free-ridership group. For example, in order to be categorized as a 75% free-rider, a respondent would have had to respond to the survey questions as follows:

- The rebate or contractor recommendation was not a factor in their decision; AND
- They were already planning to install a programmable thermostat; AND
- They were very likely to be spent an additional $50 to $75 on a programmable thermostat in the absence of the program; AND
- They would have made the same purchase decision in the absence of the program.

The presence of a line between responses (e.g., 0% free-ridership) indicates that a customer can be categorized if ANY of the responses are answered (i.e., with an ‘OR’ between the required question responses instead of an ‘AND’ as given in the example above).

**Table 14: Summary of Free-Ridership Determination for Programmable Thermostats Customers**

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>100%</th>
<th>75%</th>
<th>50%</th>
<th>25%</th>
<th>0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>What factors were most important in your programmable thermostat purchase?</td>
<td>Rebate or Contractor was NOT a factor</td>
<td>Rebate or Contractor NOT a factor</td>
<td>Any response except combination of (Rebate NOT a factor AND yes, already planning to buy)</td>
<td>Any Response</td>
<td>Rebate or Contractor WAS an important factor</td>
</tr>
<tr>
<td>Were you already planning on installing a programmable thermostat?</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How likely of spending additional $50/$75 on programmable thermostat?</td>
<td>Extremely Likely</td>
<td>Very Likely</td>
<td>Extremely Likely OR Very Likely</td>
<td>Somewhat Likely</td>
<td>Not Very OR Not at all Likely</td>
</tr>
<tr>
<td>[If not extremely likely] Without program, how would purchase be different?</td>
<td>N/A</td>
<td>Same purchase decision</td>
<td>NOT same purchase decision</td>
<td>Any Response</td>
<td>Any response</td>
</tr>
</tbody>
</table>

Based on the approach described above and the survey responses for participants who received a programmable thermostat rebate (but excluding those individuals who previously had a programmable thermostat installed in their home that was actually programmed), the distribution of full, partial and zero free-ridership among programmable thermostat purchasers is outlined in Table 15.
Table 15: Distribution of Full, Partial and Zero Free-Ridership among Programmable Thermostat Purchasers

<table>
<thead>
<tr>
<th>Free Ridership Percentage</th>
<th>Percentage of Programmable Thermostat Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>21%</td>
</tr>
<tr>
<td>25%</td>
<td>12%</td>
</tr>
<tr>
<td>50%</td>
<td>15%</td>
</tr>
<tr>
<td>75%</td>
<td>15%</td>
</tr>
<tr>
<td>100%</td>
<td>37%</td>
</tr>
<tr>
<td><strong>54%</strong></td>
<td><strong>Weighted Average</strong></td>
</tr>
</tbody>
</table>

Other HCSP Measures

A similar methodology as described above was used to estimate free-ridership for the remaining three measures. All surveyed participants who received an ECM rebate and an Energy Star® CAC rebate were included in the free-ridership analysis, whereas the subset of surveyed CAC tune-up participants who reported tuning up their central air conditioner every year where excluded from the free-ridership analysis (please note the ‘exclusions’ outlined in the section above).

A summary of the resultant weighted average free-ridership for each of the HCSP measures is presented in Table 16.

Table 16: Summary of Calculated Free-Ridership of all HCSP Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Free-Ridership Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Star CAC</td>
<td>48.0%</td>
</tr>
<tr>
<td>Programmable Thermostat</td>
<td>54.0%</td>
</tr>
<tr>
<td>Furnace with ECM</td>
<td>45.8%</td>
</tr>
<tr>
<td>CAC Tune Up</td>
<td>58.1%</td>
</tr>
</tbody>
</table>

Spillover

Spillover refers to energy-efficient equipment installed by an individual due to program influences without any financial or technical assistance from the program. For example, in cases where awareness of the HCSP influenced individuals to install an energy efficient measure but did not result in said individuals applying for/receiving a rebate for their action/installed measure, additional savings can be attributed to the program.
In order to better understand this type of behaviour, the participant survey touched upon the behaviour and decision process for those participants who received a second (or in some cases, a third) energy efficient measure covered under HCSP but, for various reasons, did not receive a rebate for the measure.

An analysis of the survey results suggests that, based on the motivations and influences on the purchasers who did not get a rebate for their ECM purchase, a spillover factor of up to 9.8% could potentially be assigned to this measure. Similarly, the survey results indicate that a spillover factor of up to 10.5% could be applied for Energy Star® CACs. However, given the relatively small sample size and survey length limitations, the survey results do not provide us with enough confidence to categorically apply these spillover factors. Given this uncertainty, NCI suggests that half the maximum spillover factor estimated for both the ECM measure and the Energy Star® CAC measure may be directly attributed to the program. Thus, for every 100 rebated ECM purchases, another 5 ECM purchases that did not receive a rebate may be attributed to the program. Similarly, for every 100 Energy Star® CAC rebates, the an additional 5 Energy Star® CAC purchases that did not receive a rebate may be attributed to the program.

Given the uncertainty in these spillover factors, NCI has included spillover factors results for the ECM and Energy Star® CAC purchases in the Monte Carlo simulation for the net energy and demand savings sensitivity analysis.

**Net-to-Gross Ratio**

Once the exclusions, free-ridership and spillover for each measure were determined, the net-to-gross ratio for each measure was calculated using the following formula:

\[
\text{Net-to-Gross Ratio} = (1 - \text{Exclusions}) \times (1 - \text{Free-Ridership}) + \text{Spillover}
\]

Using the programmable thermostat measure as an example, where 40% of the customers were excluded, a calculated free-ridership of 54% of the remaining participants and a 0% spillover rate, the net-to-gross ratio was estimated as follows:

\[
\begin{align*}
\text{Net-to-Gross Ratio} & = (1 - \text{Exclusions}) \times (1 - \text{Free-Ridership}) + \text{Spillover} \\
& = (1 - 40\%) \times (1 - 54\%) + 0\% \\
& = 60\% \times 46\% \\
& = 27\%
\end{align*}
\]

---

15 Spillover factors were calculated for furnace with ECM and Energy Star CAC measures only. Due to the high free-ridership associated with the programmable thermostats and the CAC tune ups, the spillover factor was not examined.
Therefore, the net-to-gross ratio for the programmable thermostat purchases was estimated to be 27%. The same methodology was applied to the remaining three measures and the results are presented below in Table 17 with full Net-to-Gross Ratio calculations provided in APPENDIX B: HOT AND COOL SAVINGS DETAILED CALCULATIONS.

Table 17: Summary of Net-to-Gross Ratios for all the HCSP Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Exclusions</th>
<th>Free-Ridership</th>
<th>Spillover</th>
<th>Net-to-Gross</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Star CAC</td>
<td>0.0%</td>
<td>48.0%</td>
<td>5.2%</td>
<td>57.2%</td>
</tr>
<tr>
<td>Programmable Thermostat</td>
<td>40.3%</td>
<td>54.0%</td>
<td>0%</td>
<td>27.4%</td>
</tr>
<tr>
<td>Furnace with ECM</td>
<td>0.0%</td>
<td>45.8%</td>
<td>4.9%</td>
<td>59.1%</td>
</tr>
<tr>
<td>CAC Tune Up</td>
<td>62.5%</td>
<td>58.1%</td>
<td>0.0%</td>
<td>15.7%</td>
</tr>
</tbody>
</table>
**Net Energy and Peak Demand Impact**

**Introduction**

This section presents NCI’s findings on the net energy and peak demand impact for the Hot and Cool Savings Program. In simple terms, the net energy and peak demand impact constitutes the gross energy savings, adjusted to reflect the estimated net-to-gross ratio for each of the measures discussed in the previous chapter. Therefore, continuing with the Hot Savings Energy Star® CAC measure used in previous chapters, the net annual energy savings is thus:

\[
\text{Net Annual Energy Savings} = \text{Gross Annual Energy Savings} \times \text{Net-to-Gross Ratio}
\]

\[
= 802,371 \text{ GWh} \times 57%
\]

\[
= 457,351 \text{ kWh (or 0.5 GWh)}
\]

Similarly, the net lifetime energy savings and the net annual winter and summer peak demand impact are calculated using the gross energy savings presented in Table 12 multiplied by the estimated net-to-gross ratio presented in Table 17. As shown in Table 18, the Energy Star CAC measure in the Hot Savings Program results in a lifetime net energy savings of 8.3 GWh and a net summer demand impact of 0.5 GWh.

**Table 18: HCSP Net Energy and Peak Demand Impact**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Annual GWh</th>
<th>Lifetime GWh</th>
<th>Winter Demand Savings (MW)</th>
<th>Summer Demand Savings (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Savings: Energy Star CAC</td>
<td>0.5</td>
<td>8.3</td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Hot Savings: Programmable Thermostat</td>
<td>0.2</td>
<td>2.5</td>
<td>0.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Hot Savings: Furnace with ECM</td>
<td>6.0</td>
<td>89.6</td>
<td>1.0</td>
<td>3.5</td>
</tr>
<tr>
<td>Cool Savings: Energy Star CAC</td>
<td>2.4</td>
<td>43.6</td>
<td>1.0</td>
<td>2.6</td>
</tr>
<tr>
<td>Cool Savings: Programmable Thermostat</td>
<td>0.5</td>
<td>7.9</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>Cool Savings: Furnace with ECM</td>
<td>19.6</td>
<td>294.1</td>
<td>3.3</td>
<td>11.6</td>
</tr>
<tr>
<td>Cool Savings: CAC Tune Ups</td>
<td>1.0</td>
<td>5.2</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30.2</strong></td>
<td><strong>451.1</strong></td>
<td><strong>4.4</strong></td>
<td><strong>19.8</strong></td>
</tr>
</tbody>
</table>

Using a similar methodology for each measure, the net annual energy savings resulting from the entire program is estimated to be 30.2 GWh and the net winter and summer demand savings are estimated to be approximately 4.4 MW and 19.8 MW respectively.
Complete calculations for each measure have been provided in APPENDIX B: HOT AND COOL SAVINGS DETAILED CALCULATIONS.

Confidence Interval for Net Energy and Demand Savings

As discussed in previous sections, it is impossible to determine with absolute certainty all of the factors affecting the program’s net energy savings. The results presented in this section represent NCI’s best estimate based on the available information and our professional judgment.

NCI undertook a similar Monte Carlo simulation analysis, building on the analysis of the confidence interval for the gross program impacts and summer demand savings. Key input parameters having the most significant impact on results were randomly varied within a specified range informed by survey results and other information. Up to 5,000 simulations of the net energy and demand savings were undertaken and the confidence interval was based upon the resultant range for each factor.

The range of variability and rationale for the range used in the Monte Carlo analysis are discussed below, followed by a summary table of the inputs and variability used.

- As discussed, the calculated free-ridership value for the Energy Star® CAC measure was determined to be 48%. Although this remains consistent with the contractor survey results, NCI recognizes that it could vary depending on the actual free-ridership rate for this measure. Given this uncertainty, Monte Carlo simulations were undertaken with the free-ridership value varying by +/- 6% standard deviation under a normal distribution from the estimated free-ridership.

- The calculated free-ridership value for ECM purchasers of 46% is higher than NCI expected given the relative lack of awareness of the general public for this measure and low consumer demand based on feedback from contractors (e.g. on average, only 20% of customers are asking contractors for ECMs before they are aware of the rebate program). Therefore, using triangular distribution to weight the results towards a lower free-ridership, simulations were performed varying the free-ridership between 30% and 50%. Thus, this distribution biased the simulation results towards higher savings than the base estimate.

- Largely due to the exclusion of 40% of programmable thermostat participants (given their reported prior ownership and usage of a programmable thermostat), the net-to-gross ratio for the programmable thermostat measure was relatively low at 27%. However, NCI recognizes that this ratio could depending on the actual exclusion and free-ridership rates for this measures. Therefore Monte Carlo simulations were undertaken to vary the net-to-gross ratio by +/- 4% under a normal distribution.
Similar to the programmable thermostats, over 60% of CAC tune up participants were excluded from the net savings estimation because they reported that they tuned up their CACs annually. This exclusion results in a relatively low net-to-gross ratio of 16%. To address potential uncertainty related to both the exclusion and free-ridership rate for this measure, simulations were performed on the net-to-gross ratio for the CAC tune ups, varying the results from 14% to 25% under a triangular distribution.

As previously mentioned, due to the uncertainty in the spillover factors for both the CAC and the ECM purchases, NCI modelled the potential uncertainty as a triangular distribution between 0% and 10% and centred on 5% for each of these measures in our simulation analysis.

Including those parameters defined in the gross program impacts, all of the key input parameters that were varied in the net energy and demand savings sensitivity analysis are summarized below in Table 19.
### Table 19: Input Parameters and Range of Uncertainty for Net Energy and Net Summer Demand Savings Monte Carlo Simulations

<table>
<thead>
<tr>
<th>Key Parameter</th>
<th>Base Value</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM fan usage (continuous vs non-continuous)</td>
<td>31%</td>
<td>Triangular distribution 21%-41%</td>
</tr>
<tr>
<td>SEER 10 CAC market penetration</td>
<td>10%</td>
<td>Log normal distribution 10% standard deviation</td>
</tr>
<tr>
<td>Program effects of temperature set up from Energy Star CAC</td>
<td>50%</td>
<td>Normally distributed 12% standard deviation</td>
</tr>
<tr>
<td>Full temperature set up using programmable thermostat</td>
<td>10%</td>
<td>Log normal distribution 30% standard deviation</td>
</tr>
<tr>
<td>Energy Savings from CAC tune up</td>
<td>17%</td>
<td>Uniform distribution 12%-18%</td>
</tr>
<tr>
<td>CAC Free-Ridership</td>
<td>48%</td>
<td>Normally distributed 6% standard deviation</td>
</tr>
<tr>
<td>ECM Free-Ridership</td>
<td>46%</td>
<td>Triangular distribution 30%-50%</td>
</tr>
<tr>
<td>Programmable Thermostat Net-to-Gross ratio</td>
<td>27%</td>
<td>Normally distributed 4% standard deviation</td>
</tr>
<tr>
<td>CAC Tune Up Net-to-Gross ratio</td>
<td>16%</td>
<td>Triangular distribution 14%-25%</td>
</tr>
<tr>
<td>CAC Spillover</td>
<td>5%</td>
<td>Uniform distribution 0%-10%</td>
</tr>
<tr>
<td>ECM Spillover</td>
<td>5%</td>
<td>Uniform distribution 0%-10%</td>
</tr>
</tbody>
</table>

The results of the simulation for net energy savings and net summer demand savings are shown in Figure 16 and Figure 17 respectively. These results reflect results from 5,000 simulations with each of the input assumptions given above randomly varying based on the distributions described.

As shown in Figure 16 and based on the assumptions outlined above, there is an 80% probability that the net annual energy savings for the HCSP program fall within the range of 27.2 GWh to 36.7 GWh. Likewise, NCI has 90% confidence that the net annual energy savings for the program were at least 27.2 GWh.
Figure 16: Expected Range of Net Energy Savings (GWh)

Similarly, as shown in Figure 17, there is an 80% probability that the net summer demand savings for HCSP fall within the range of 17.9 MW to 23.9 MW. Based on this analysis, NCI has 90% confidence that the net summer demand savings for the program were at least 17.9 MW.

Figure 17: Expected Range of Net Summer Demand Savings (MW)
BILLING ANALYSIS

Approach

Navigant Consulting developed estimates of electricity savings for those utility customers participating in the Hot and Cool Savings Program by simultaneously analyzing each customer’s historical monthly utility consumption data, and their corresponding survey responses. The results of this analysis were then compared, where possible, to the results for customers who were classified as non-participants, i.e., those customers who had installed at some point, new, but less efficient rebate ineligible equipment.

Data Sets

In total, three sets of utility customer data were analysed, and included:\n
1. Participating customers from a South-western Ontario utility;
2. Non-participating customers from a South-western Ontario utility;
3. Participating customers from a South-eastern Ontario utility.

The most statistically valid set of results was produced by analysing data received for those participating customers within the South-western Ontario utility’s service territory. Monthly consumption data for these South-western Ontario utility’s customers was provided for the period of February 2006 to December 2007. The South-eastern Ontario utility provided Navigant Consulting with customer consumption data recorded on a staggered quarterly basis.

The data set was refined as follows:

- The South-western Ontario utility provided customer consumption data for 3,000 customers;
- Of these, 222 matched the 300 customers for which survey responses were collected;
- This group was filtered to eliminate customers whose records did not contain consumption data for the full 23 months between February 2006 and December 2007, inclusive. This resulted in a sample of 158 customers;

---

16 While three utilities initially offered to provide consumption data for HCSP rebate recipients, only two finally provided said data. Of these, only one provided monthly consumption data which ultimately proved most useful for our billing analysis.
Finally, in order to develop a truly comparable set of customers for analysis, customers with electric heating were eliminated from the sample space, resulting in a final count of 152 customers.

A similar exercise in data matching was conducted for both the South-western Ontario utility’s non-participating customers and the South-eastern utility’s participating customers, resulting in sample sizes of 25 and 30 customers respectively.

Analytical Approach

The analytical approach taken with respect to the combined participant survey responses and monthly historical consumption data set centered on the use of a fixed-effects model - an econometrics/statistical estimator used to develop estimates for the coefficients of time-series cross-sectional data. Since the survey responses vary across time and across customers, the fixed-effects model offers a useful approach for explaining this variability. Further captured in the fixed-effects model, and of most interest, is the “before and after” impact the measures under review have on consumption within customer cases.

Data for each of the samples was converted to a usable time-series format for analysis using an econometrics software package, in this case RATS (Regression Analysis of Time Series) version 7 by Estima Software. RATS is a comprehensive tool that allows for the evaluation of time-series cross-sectional data.

NCI crafted a maximally orthogonal dataset in order to isolate the effect each survey response may have on other responses, i.e., minimizing multicollinearity. Dummy variables were created to reflect the temporal nature of certain survey information where available, i.e., installation dates of measures, seasonal nature of air conditioner usage, etc. In the case of the non-participant survey, some of this install date information was not provided by customers and as such the effect of this is reflected in the set of results.

Dataset variables based on responses to the participant survey were further defined to reflect only instances where a measure was truly a “new” install. For instance, the variable relating to programmable thermostats captures only the date of installation for those respondents who did not previously have a programmable thermostat. Another example includes the central air-conditioner tune-up variable, which indicates only those customers who were tuning up their air-conditioners for the first time versus those who had a tune-up, but do so every year.

Table 20 below lists the set of survey responses that NCI coupled to the monthly historical consumption data for each participating customer. In addition to these, a calculation of heating and cooling degree days for the South-western utility was included for each month over the almost two-year period and was computed based on the difference between the number of days bills were sent to each customer; in effect, normalizing for weather across the varying bill dates for each customer. In order to capture the cross-effect cooling degree days have on a customer’s
cooling-related consumption, the cooling degree day values were next coupled with those variables deemed to be cooling related.

Table 20: Included Participant Survey Responses

<table>
<thead>
<tr>
<th>Measure/Category</th>
<th>Survey Question #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programmable Thermostat</td>
<td>C4</td>
<td>Date of installation</td>
</tr>
<tr>
<td></td>
<td>C9</td>
<td>If previously had PT</td>
</tr>
<tr>
<td></td>
<td>C15</td>
<td>If PT programmed or not</td>
</tr>
<tr>
<td>ECM Furnace</td>
<td>D4</td>
<td>Date of installation</td>
</tr>
<tr>
<td>Energy Star® CAC</td>
<td>E4</td>
<td>Date of installation</td>
</tr>
<tr>
<td>CAC Tune Up</td>
<td>F1</td>
<td>Date of Tune Up</td>
</tr>
<tr>
<td></td>
<td>F8a</td>
<td>Ever tuned up before?</td>
</tr>
<tr>
<td>Other Information</td>
<td>H1</td>
<td>Participated in other EE programs?</td>
</tr>
<tr>
<td></td>
<td>H3</td>
<td>Date participated in Great Fridge Round up</td>
</tr>
<tr>
<td>Demographics</td>
<td>I2a</td>
<td>Number of people in summer 2007</td>
</tr>
<tr>
<td></td>
<td>I2b</td>
<td>Number of people in summer 2006</td>
</tr>
<tr>
<td></td>
<td>I4</td>
<td>Main source of heating</td>
</tr>
<tr>
<td></td>
<td>I5a</td>
<td>Supplementary heating?</td>
</tr>
<tr>
<td></td>
<td>I7</td>
<td>Fuel for heating water</td>
</tr>
<tr>
<td></td>
<td>I9</td>
<td>Source for dryer</td>
</tr>
<tr>
<td></td>
<td>I10b</td>
<td>Number of room AC</td>
</tr>
<tr>
<td></td>
<td>I11a</td>
<td>Do you have pool</td>
</tr>
<tr>
<td></td>
<td>I12a</td>
<td>Hot tub or spa</td>
</tr>
<tr>
<td></td>
<td>I13</td>
<td>Number of refrigerators</td>
</tr>
<tr>
<td></td>
<td>I17</td>
<td>Square footage of home</td>
</tr>
<tr>
<td></td>
<td>I20a</td>
<td>Have cottage?</td>
</tr>
</tbody>
</table>

Key Findings

The results of the billing analysis for participating South-western Ontario utility customers are shown below in Figure 18. Also provided for discussion are standard errors, t-statistic and significance for each of the independent variables modelled.
Figure 18: Estimates for South-western Ontario Utility HCSP Program Participants

Panel Regression - Estimation by Fixed Effects
Dependent Variable CONSUMPTION
Panel (152) of Monthly Data From 1/2006:02 To 12/2007:12
Centered R**2 0.465831 R Bar **2 0.459647
Uncentered R**2 0.875227 T x R**2 3059.794
Mean of Dependent Variable 844.19908467
Std Error of Dependent Variable 466.11751711
Sum of Squared Residuals 405617605.46
Regression F(40,3455) 75.3247
Significance Level of F 0.00000000
Log Likelihood -25344.99271

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coeff</th>
<th>Std Error</th>
<th>T-Stat</th>
<th>Signif</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. HDD</td>
<td>0.2265150</td>
<td>0.0315627</td>
<td>7.17666</td>
<td>0.00000000</td>
</tr>
<tr>
<td>2. PT</td>
<td>20.4574697</td>
<td>17.8956400</td>
<td>1.14315</td>
<td>0.25305392</td>
</tr>
<tr>
<td>3. ECM_FURN</td>
<td>-52.3454061</td>
<td>19.9882886</td>
<td>-2.61880</td>
<td>0.00886242</td>
</tr>
<tr>
<td>4. EE_PARTICIP</td>
<td>-73.6932550</td>
<td>19.9882886</td>
<td>-3.6932550</td>
<td>0.00886242</td>
</tr>
<tr>
<td>5. GREAT_RR</td>
<td>-173.4921817</td>
<td>36.8108329</td>
<td>-4.60526</td>
<td>0.00000254</td>
</tr>
<tr>
<td>6. ELEC_HEATING</td>
<td>0.0000000</td>
<td>0.0000000</td>
<td>0.00000</td>
<td>0.00000000</td>
</tr>
<tr>
<td>7. POOL</td>
<td>548.7501083</td>
<td>30.3516958</td>
<td>18.07972</td>
<td>0.00000000</td>
</tr>
<tr>
<td>8. GRT1_FRIDGE</td>
<td>114.0699236</td>
<td>13.8726229</td>
<td>8.22266</td>
<td>0.00000000</td>
</tr>
<tr>
<td>9. COTTAGE</td>
<td>380.4058379</td>
<td>21.9659974</td>
<td>17.31794</td>
<td>0.00000000</td>
</tr>
<tr>
<td>10. NUM_PEOPLE</td>
<td>91.0305159</td>
<td>21.9659974</td>
<td>17.31794</td>
<td>0.00000000</td>
</tr>
<tr>
<td>11. HOUSE_SIZE</td>
<td>20.4109791</td>
<td>3.5189831</td>
<td>5.80025</td>
<td>0.00000001</td>
</tr>
<tr>
<td>12. ELEC_HOTTUB</td>
<td>392.3631949</td>
<td>38.2590838</td>
<td>10.25543</td>
<td>0.00000000</td>
</tr>
<tr>
<td>13. ELEC_WATERHEATER</td>
<td>319.4381136</td>
<td>19.6446664</td>
<td>16.26081</td>
<td>0.00000000</td>
</tr>
<tr>
<td>14. ADDL_ELECHEATING</td>
<td>137.3773878</td>
<td>23.6614564</td>
<td>5.80596</td>
<td>0.00000001</td>
</tr>
<tr>
<td>15. ELEC_DRYER</td>
<td>58.7141252</td>
<td>19.3694158</td>
<td>3.03128</td>
<td>0.00245325</td>
</tr>
<tr>
<td>16. CDD_CACTUNE2</td>
<td>-6.9332553</td>
<td>3.0062504</td>
<td>-2.30628</td>
<td>0.02115390</td>
</tr>
<tr>
<td>17. CDD_WINDOWAC</td>
<td>1.6225911</td>
<td>1.1856519</td>
<td>1.36852</td>
<td>0.17123762</td>
</tr>
<tr>
<td>18. CDD_OLDAC</td>
<td>7.0927534</td>
<td>0.4759737</td>
<td>14.90157</td>
<td>0.00000000</td>
</tr>
<tr>
<td>19. CDD_ESTARAC</td>
<td>3.3191225</td>
<td>1.4278025</td>
<td>2.30628</td>
<td>0.02115390</td>
</tr>
</tbody>
</table>

R-squared values are generally an overused and overemphasized diagnostic in econometric modelling, in this case an adjusted R-squared value of 0.459 is reasonable and defined to be beyond satisfactory. Explaining 45% of the variance is satisfactory as the level of missing explanatory power not captured by the survey is significant. For example information such as:
refrigerator size; number of daylight hours; and, other factors contributing to household electricity consumption have not been included. The more valid measure for determining the relevance of estimators resulting from this model is the significance of each coefficient.

NCI employed a backward stepwise approach in determining which variables assist in improving the R-squared of the model and have the greatest impact on the significance of the remaining independent variables. This approach involved removing from the model those variables whose significance was well above the 10% confidence level, and whose presence had some measurable impact on the significance of the remaining variables. Further, a correlation matrix of the underlying variables was developed and used extensively to assist with this process.

Next, a plot of the resulting residuals uncovered only a few customers whose monthly consumption values, in some cases, were beyond 1,000 kWh of the modeled estimate. However, as opposed to being extreme outliers, i.e., data entered erroneously, these data may represent households who, for some reason not captured by the survey, have a far higher than average level of monthly electricity consumption.

The results shown in Figure 18 depict the end-result of this iterative refinement process. Specific focus was made to minimize the significance of each of the four measures of interest: programmable thermostat (PT); ECM furnace (ECM_FURN); CAC tune up (CDD_CACTUNE2); and, Energy Star® CAC installation (CDD_ESTARCAC). Our findings are as follows:

- **Programmable Thermostat** - NCI was unable to determine any level of savings in any of the cases evaluated. As shown above, programmable thermostats were calculated to add 20 kWh per month of electricity consumption to those homes had one installed throughout the evaluation period. However, as discussed this result is not significant, as the probability of this occurring by chance is roughly 25%. Results from the review of non-participating South-western Ontario utility’s customers, as well as participating South-Eastern utility customers also yielded statistically insignificant results. Within our sample of customers reviewed, simply including the presence of a programmable thermostat failed to explain its impact on electricity consumption.

- **ECM furnace** - The results show a savings coefficient of -52.39 kWh, or a savings of 52.4 kWh per month in those homes that had an ECM furnace installed. On an annual basis, for those participating South-western Ontario utility customers, the installation of an ECM furnace yielded a savings of 628 kWh per year. The coefficient is significant below the 5%-level, thus providing a level of confidence in this estimate. Initial estimates of this measure were statistically significant and as high as 72 kWh per month or 864 kWh per year. Again, in the South-western Ontario utility non-participant and South-eastern utility participant cases, calculated estimates for this measure proved to be statistically insignificant.
o Energy Star® CAC - In order to evaluate the savings impact an Energy Star® CAC had on the energy consumption of customers, it was first necessary to isolate those customers who first did not install an Energy Star® central air-conditioner but who also had an existing non-Energy Star® central air-conditioner. The difference in consumption between CDD_OLDAC and CDD_ESTARAC is 0.7736 kWh/month per CDD. Over the 23 month analysis period an average of 103 cooling degree days was calculated, this result shows savings of approximately 79.6 kWh/year. Results for the South-western Ontario utility non-participants and South-eastern utility participants showed no statistically significant result relating to this measure.

o Central air-conditioner tune up - The central air-conditioner tune up measure shows savings of 6.93 kWh per month per number of cooling degree days. Given an average of 103 cooling degree days per year over the 23 month period, the expected level of savings in electricity resulting from this analysis shows a savings of 714 kWh between customers who have never had their central air-conditioners tuned-up and those who never have but decided to as a result of this program. Further, the result for the South-western utility customers considered non-participants was valid in this case, and was equal to 4.30 kWh per month per number of cooling degree days or 442 kWh per year. Results for those participating South-eastern customers were statistically insignificant.

Additional Insights

From the analysis of participating South-western Ontario utility customers, a number of other statistically valid insights have been uncovered, including: the impacts of other energy efficiency programs; the Great Refrigerator Roundup Program; as well as having more than one fridge in a household.

From Figure 18, the variable GREAT_RR refers to the Great Refrigerator Roundup Program and shows clearly that those South-western Ontario utility customers who also participated in this program were saving 173 kWh per month compared to those who did not participate.

From variable GREAT1_FRIDGE, in Figure 18, those South-western Ontario utility customers who had more than one refrigerator in their homes were consuming an additional 114 kWh per month compared to those that only have one such appliance.

Finally, participating South-western Ontario utility customers were asked whether or not they had participated in other energy efficiency programs. The variable EE_PARTICIP from Figure 18 shows that these customers were saving upwards of 73 kWh per month. An attempt was made to further uncover insights on the impacts of these other energy efficiency programs; however, the result of this analysis yielded statistically insignificant results combined with impacts on other independent variables. From the participant survey (Section 8, Question 2),
“other energy savings programs” included, from the OPA: Every Kilowatt Counts, Summer Savings Challenge Program; and, Great Refrigerator Roundup.

Recommendations

The effectiveness of the billing analysis, for this review, depended entirely on having:

- An as large as possible sample size;
- Monthly utility consumption data;
- And, survey results paired to the month in which an action was taken, i.e., the install date of a central air-conditioning unit.

Future billing analyses will be most effectively undertaken for those utility service territories where monthly billing data and corresponding survey results are available, as was the case for our analysis with participant and non-participant customers of the South-western Ontario utility.
CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The estimated gross and net energy and demand savings for the 2007 HCSP program is summarized below.

Table 21: HCSP Net Energy and Peak Demand Impact

<table>
<thead>
<tr>
<th>Measure</th>
<th>Annual GWh</th>
<th>Lifetime GWh</th>
<th>Winter Demand Savings (MW)</th>
<th>Summer Demand Savings (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Savings: Energy Star CAC</td>
<td>0.5</td>
<td>8.3</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Hot Savings: Programmable Thermostat</td>
<td>0.2</td>
<td>2.5</td>
<td>0.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Hot Savings: Furnace with ECM</td>
<td>6.0</td>
<td>89.6</td>
<td>1.0</td>
<td>3.5</td>
</tr>
<tr>
<td>Cool Savings: Energy Star CAC</td>
<td>2.4</td>
<td>43.6</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>Cool Savings: Programmable Thermostat</td>
<td>0.5</td>
<td>7.9</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>Cool Savings: Furnace with ECM</td>
<td>19.6</td>
<td>294.1</td>
<td>3.3</td>
<td>11.6</td>
</tr>
<tr>
<td>Cool Savings: CAC Tune Ups</td>
<td>1.0</td>
<td>5.2</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30.2</strong></td>
<td><strong>451.1</strong></td>
<td><strong>4.4</strong></td>
<td><strong>19.8</strong></td>
</tr>
</tbody>
</table>

Based on results from Navigant Consulting’s Monte Carlo simulation of the potential variability in key input parameters, there is 80% probability that the net annual energy savings for the HCSP program fall within the range of 27.2 GWh to 36.7 GWh. Likewise, NCI has 90% confidence that the net annual energy savings for the program were at least 27.2 GWh.

Similarly, there is an 80% probability that the net summer demand savings for HCSP fall within the range of 17.9 MW to 23.9 MW. Based on this analysis, NCI has 90% confidence that the net summer demand savings for the program were at least 17.9 MW.

Recommendations

1. **Develop and maintain an effective governance structure**
   The HCSP could benefit from a better defined governance and accountability structure between each of the key stakeholders, in particular between the OPA and HRAI.
   Suggestions include:
   i. The establishment of a clear mission statement that identifies the key objectives of the HCSP;
   ii. Definition of roles and responsibilities;
iii. The reinforcement of good practices and elimination of poor ones\textsuperscript{17};
iv. Involvement of senior management in regular (possibly monthly) Executive Review Meetings;
v. Ensuring meetings are meaningful and productive – Brief (30 minutes or less) weekly meetings, supported by a robust meeting format and supporting written template(s).

2. Establish and ratify a series of program related processes and procedures
   Clear process maps to identify and clarify the processes and accountabilities involved with the following (in addition to any other identified processes) will add an additional layer of clarity to the program:
   i. Preparation of rebate levels/assumptions;
   ii. Preparation and distribution of program materials;
   iii. Contractor enrolment and training;
   iv. Marketing and advertising campaign development/management;
   v. Rebate submission, processing, recording and payment;
   vi. General program enquiries (contractors and homeowners);
   vii. Rebate exception handling;
   viii. Rebate audit mechanisms (internal and external);
   ix. Program review and refinement.

3. Automation of rebate process – proceed with caution!
   There has been much discussion as to the virtues of transitioning the rebate process to an online platform. While Navigant agrees that the rebate process could be improved, it is difficult to see how such a complex rebate process could be enhanced \textit{simply} through automation. The complexity of the rebate information required, and the value of the rebates in question suggest that automating the rebate process could result in even more frustration on the part of contractors and encourage dishonest or inaccurate rebate submissions. Navigant suggests that the OPA consider implementing some additional checks and measures to ensure that rebate automation does not result in an erosion of program integrity.

4. Establish a robust tracking and reporting mechanism. If it can be measured, it can be managed...
   The program would benefit from a more formal operational and financial reporting mechanism for the HCSP that centrally tracks and reports program costs, performance and benefits/impacts. If readily accessible and accurate, this information would facilitate an enhanced analysis of program information and make it easier to identify successful and less successful actions, providing transparency and aiding program refinement. A

\textsuperscript{17} Navigant Consulting, Inc. has made specific recommendations in each section of this report. Please review this document in its entirety for specific examples of current practices and recommendations as to how processes and procedures might be enhanced to emulate ‘best practices’.
series of logical and agreed metrics would also enhance clarity and granularity around specific stakeholder responsibilities and performance.

5. **Enhance the existing marketing and advertising campaigns**
   HRAI has had quite limited involvement in the development of creative themes and messages for the HCSP program. While the OPA has expressed a willingness to devolve this activity to HRAI once they are able to demonstrate the necessary competency, the program would benefit from greater advertising exposure. It is also apparent that some contractors are mishandling and mischaracterizing the program through their independent promotion of it. Some suggestions to remedy this include:
   
   i. Assigning responsibility for marketing and promotion of the program to an experienced individual at HRAI;
   
   ii. Establishing a campaign budget and defined series of clear objectives for HRAI against which promotion performance will be tracked\(^{18}\);
   
   iii. Preparing a robust marketing program and advertising campaign, targeting both homeowners and contractors, with a view towards building awareness, understanding and participation in the HCSP\(^{19}\);
   
   iv. Producing marketing collateral that can be used by contractors to ensure that a consistent and accurate message is being communicated and that brand standards are upheld;\(^{20}\); and
   
   v. Tracking program performance against the various components of the marketing and advertisement campaigns to assist in the expedient resolution of any issues that might become apparent.

6. **Retain ownership over audit and control mechanisms and enforce compliance and program rules with penalties if required**
   While Navigant accepts that the OPA would prefer to delegate much of the program management and administration to a third party, HRAI’s involvement poses a somewhat unique challenge which the OPA should be careful to address appropriately. Some suggestions include:

---

\(^{18}\) In 2007 the OPA advertising budget for the HCSP totalled $565K + objectives. However, should responsibility for marketing and advertising become the remit of HRAI going forward, the OPA should require agreed mechanisms and accountabilities to be put in place.

\(^{19}\) In 2007, the OPA prepared newspaper advertising to cover 98 community newspapers in summer peaking areas. These 2 insertions were sent to HRAI for comment. The OPA also prepared a Direct Mail piece, which was cross promoted with a coupon in October 2007 and targeted 4.5M households. Again, these were sent to HRAI for comment.

\(^{20}\) In 2007, the OPA prepared a promotional brochure for contractors to distribute. This was sent to HRAI for comment but its ultimate distribution was not widespread. Also, the OPA prepared a Contractor Flash (pre-approved image + copy to include in contractor advertising) and consulted with HRAI on June 19 for final input.
i. Retaining control over the auditing of installed measures and holding HRAI accountable for addressing any anomalies that are observed;

ii. Performing frequent spot investigations of rebate applications that raise ‘red flags’ by the rebate processor; and

iii. Ensuring that as anomalies are addressed, necessary adjustments to processes and procedures are made, recorded and communicated to all involved parties.

Navigant also recommends that the OPA adjust the rules of rebate eligibility to ensure that recipients agree to a home visit (in principal) in order to qualify for their rebate – thus ensuring that the OPA can perform a more targeted check of installed measures if needs be - therefore circumventing the issue that may have hindered the value of home-visits conducted for this evaluation – namely that anyone knowingly engaged in fraudulent activity would be highly unlikely to agree to a home verification visit. In order to not unnecessarily inconvenience rebate recipients, Navigant recommends that the OPA stipulate that home visits will be conducted within three-months of the rebate being issued in cases identified for verification of installed measures. Verification of between 1-3% of installed measures (skewed towards CACs and ECM equipped furnaces) is recommended.

7. Enhance contractor enrolment and training

Per our findings from the contractor interviews (presented in a subsequent section of this report), nearly half of those surveyed reported that they had never received any program training. Given this fact and the complexity of the program rules and rebate process, it is not surprising that there is a very high (approximately 25%) incidence of incorrectly submitted rebate paperwork, something which has hindered the efficiency of the rebate process. It is therefore essential that:

i. All participant contractors complete a training session to ensure that they have the necessary knowledge to participate in and promote the program. The OPA should insist that HRAI develops and adheres to a robust contractor training strategy, including the preparation of participant handbooks, checklists and in-person training sessions. NOTE: The online training module prepared and hosted by HRAI, while providing an acceptable level of information and instruction, is too susceptible to completion by peripheral contracting company personnel (i.e. administrative assistants/office managers) and should not, therefore, be relied upon as the sole vehicle for program education and training.

ii. HRAI develops an outreach program to educate non-participant contracts on the merits of enrolling in the program.

iii. Minimum expectations for contractor conduct are communicated and enforced. The program should be repositioned, through training and program materials as an OPA (as opposed to HRAI) program, which is dependent on contractor adherence to program rules for its success. Contractor non-compliance with program rules should be addressed quickly and with an appropriate response,
ranging from additional training to, if absolutely necessary, dismissal from the program.

iv. HRAI conducts an annual contractor eligibility review. Non-HRAI members are required to provide HRAI with proof of insurance and professional credentials as a requirement for enrolment in the HCSP. However, existing HRAI members are not required to do the same since their membership in HRAI is contingent on meeting these requirements. There is an issue however – HRAI members are only required to prove that they have adequate insurance and have maintained their professional credentials once every three years, which means that the HRAI is currently unable to ensure that all enrolled contractors have adequate insurance and professional licences. An annual review of contractor insurance and licenses will remedy this.
APPENDIX A: HOT AND COOL SAVINGS PROGRAM MEASURES PRESCRIPTIVE INPUT ASSUMPTIONS

See following pages
ENERGY STAR® CENTRAL AIR CONDITIONER

Efficient Equipment and Technologies Description

Energy Star® Central Air Conditioner

Base Equipment and Technologies Description

Current standard for central air conditioner (SEER 13)

Codes, Standards, and Regulations

- According to Canada’s Office of Energy Efficiency, an energy efficiency of central air conditioners are measured by Seasonal Energy Efficiency Ratio (SEER) and Energy Efficiency Ratio (EER) with Energy Star® qualified central air conditioning systems being about 8% more efficient than standard models¹.

Typical residential systems are "split" with a separate indoor evaporator unit in the furnace ducting and an outdoor condenser unit or are "single package" systems that have the evaporator and condenser in one unit.

The following levels must be met or exceeded to qualify for Energy Star®:

<table>
<thead>
<tr>
<th>Type</th>
<th>SEER</th>
<th>EER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split</td>
<td>&gt;= 14.0</td>
<td>&gt;-11.5</td>
</tr>
<tr>
<td>Single Package</td>
<td>&gt;= 14.0</td>
<td>&gt;= 11.0</td>
</tr>
</tbody>
</table>

- Canada’s Energy Efficiency Act regulates minimum heating and cooling standards for permanently installed air-source air-conditioner and heat pumps. Equipment types include air conditioners and heat pumps that are single package and split system, single and three-phase, with rated capacity of less than 19kW (65,000 Btu/h)². Applicable minimum energy performance standards came into effect on November 2006 (under test standard CAN/CSA-C656-05).³

<table>
<thead>
<tr>
<th>Type</th>
<th>SEER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Conditioners (single package &amp; split-system)</td>
<td>13</td>
</tr>
<tr>
<td>Heat Pumps – (single package &amp; split–system)</td>
<td>13</td>
</tr>
</tbody>
</table>

³ Ibid.
• On February 15, 2006 the Ontario Energy Efficiency Act set minimum standard SEER and HSPF values for single and three-phase, single package or split-system air-conditioners and heat pumps that do not exceed 19 kilowatts in cooling or heating capacity. This means that air conditioners with a SEER less than 13.0 and heat pumps with an HSPF (V) less then 6.7, manufactured after February 15, 2006, cannot be offered for sale, sold or leased in the province of Ontario.

<table>
<thead>
<tr>
<th>Decision Type</th>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>New/Replacement</td>
<td>OPA Res Space Cooling - Central</td>
</tr>
</tbody>
</table>

### Resource Savings Assumptions

<table>
<thead>
<tr>
<th>Annual Electricity Savings</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEER 14</td>
<td>71</td>
</tr>
<tr>
<td>SEER 15</td>
<td>167</td>
</tr>
</tbody>
</table>

Annual energy savings were calculated as follows:

\[
\Delta k\text{Wh} = \frac{(\text{SEER}_{\text{EE}} - \text{SEER}_{\text{BASE}})}{(\text{SEER}_{\text{EE}}) \times ((\text{BTU/hr} / (\text{SEER}_{\text{BASE}} \times 1000)) \times \text{Hours}))
\]

\[
\Delta k\text{Wh} = ((14 - 13) / 13) \times ((26,000 / (13 \times 1,000)) \times 500)) = 71.43
\]

\[
\Delta k\text{Wh} = ((15.6 - 13) / 13) \times ((26,000 / (13 \times 1,000)) \times 500)) = 166.67
\]

Where:

- \(\text{SEER}_{\text{EE}}\) = SEER rating for efficient CAC unit = 14, 15.6 (average of Tier 2 Energy Star® SEER Ratings)
- \(\text{SEER}_{\text{BASE}}\) = SEER rating for baseline CAC unit = 13
- BTU/hr = CAC unit size in British thermal units per hour = 26,000 (Average Ontario CAC unit size based on air conditioning shipments data recorded by the HRAI Manufacturing Division)\(^5\)
- Hours = Full-load cooling hours = 500 (EPA Energy Star® Simple Savings Calculator\(^6\) – Toronto Weather - based on ARI Unitary Directory, August 1, 1992 - January 31, 1993\(^7\))

### Average Demand Savings

<table>
<thead>
<tr>
<th>Average Demand Savings</th>
<th>kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEER 14</td>
<td></td>
</tr>
<tr>
<td>Winter On-Peak</td>
<td>0.0000</td>
</tr>
<tr>
<td>Summer On-Peak</td>
<td>0.0349</td>
</tr>
<tr>
<td>SEER 15</td>
<td></td>
</tr>
<tr>
<td>Winter On-Peak</td>
<td>0.0000</td>
</tr>
<tr>
<td>Summer On-Peak</td>
<td>0.0814</td>
</tr>
</tbody>
</table>

---


\(^6\) Source: http://energyexperts.org/ac_calc/
### Coincident Peak Demand Savings

<table>
<thead>
<tr>
<th>SEER 14</th>
<th>Winter On-Peak</th>
<th>0.0000</th>
<th>kW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.0781</td>
<td>kW</td>
</tr>
<tr>
<td>SEER 15</td>
<td>Winter On-Peak</td>
<td>0.0000</td>
<td>kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.1823</td>
<td>kW</td>
</tr>
</tbody>
</table>

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Space cooling - central) and the OPA’s average peak demand savings methodology and coincident factors. For the 14 SEER CAC, the average demand savings were calculated to be 0.0000 kW winter on-peak and 0.0349 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0000 kW winter on-peak and 0.0781 kW summer on-peak. For the 15 SEER CAC, the average demand savings were calculated to be 0.0000 kW winter on-peak and 0.00814 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0000 kW winter on-peak and 0.1823 kW summer on-peak.

### Other Resource Savings

<table>
<thead>
<tr>
<th>Resource</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource #1</td>
<td></td>
</tr>
<tr>
<td>Resource #2</td>
<td></td>
</tr>
<tr>
<td>Resource #3</td>
<td></td>
</tr>
</tbody>
</table>

N/A

### Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th>Measure</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
<th>hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>602</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>25.5%</td>
<td>21.8%</td>
<td>48.5%</td>
<td>1.5%</td>
<td>2.8%</td>
<td></td>
</tr>
</tbody>
</table>

### SEER 14

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>0.00</th>
<th>0.00</th>
<th>0.00</th>
<th>18.21</th>
<th>15.57</th>
<th>34.63</th>
<th>1.04</th>
<th>1.98</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0349</td>
<td>0.0199</td>
<td>0.0213</td>
<td>0.0008</td>
<td>0.0012</td>
<td>kW</td>
<td></td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0000</td>
<td>0.0781</td>
<td>kW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SEER 15

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>0.00</th>
<th>0.00</th>
<th>0.00</th>
<th>42.49</th>
<th>36.34</th>
<th>80.80</th>
<th>2.43</th>
<th>4.62</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0814</td>
<td>0.0464</td>
<td>0.0498</td>
<td>0.0019</td>
<td>0.0028</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0000</td>
<td>0.1823</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

Description / References:
The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Space Cooling – Central load shape and the OPA’s average peak demand savings methodology and coincident factors.9

Other Input Assumptions

<table>
<thead>
<tr>
<th>Effective Useful Life</th>
<th>18</th>
<th>years</th>
</tr>
</thead>
<tbody>
<tr>
<td>The California Database for Energy Efficient Resources (DEER)10 for SEER 14 and 15 split system central air conditioners reports 18 years effective useful life (EUL). The OEB Assumptions and Measures List11 uses 14 years, the EPA Energy Star® Simple Savings Calculator12 uses 15 years. Vermont13 suggests 18 years as a EUL as well as New England State14.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Incremental Cost (Cust. / Contr. Install)

| SEER 14 | $ 475.00 |
| SEER 15 | $ 850.00 |

• Based on results from HCSP Contractor and Participant Survey.

---

10 California Public Utility Commission (CPUC) and California Energy Commission (CEC), 2004-05 Database for Energy Efficient Resources (DEER), Version 2.01 October 26, 2005
### Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ontario Energy Board, Total Resource Cost Guide, October 2006</strong>&lt;sup&gt;15&lt;/sup&gt;</td>
<td>351</td>
<td>0</td>
<td>0.359</td>
<td>14</td>
</tr>
<tr>
<td><strong>Comments:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Based on 25% energy savings from switching to an Energy Star® central air conditioner with a baseline annual energy of 1,403 kW/yr.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>California Database for Energy Efficient Resources (DEER) Version 2.01 October 26, 2005</strong>&lt;sup&gt;16&lt;/sup&gt;</td>
<td>20.53</td>
<td>0</td>
<td>0.0748</td>
<td>18</td>
</tr>
<tr>
<td><strong>Comments:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Based on a 2-ton 14 SEER split system CAC replacing a 13 SEER split system CAC in California climate – based on Quantum Consulting study for Pacific Gas &amp; Electric Company, March 1, 1999&lt;sup&gt;17&lt;/sup&gt;.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NPCC Regional Technical Forum, February 2000</strong>&lt;sup&gt;18&lt;/sup&gt;</td>
<td>200</td>
<td>0</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Comments:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Single Family Dwellings with existing central air conditioning system built between 1980 and 1992, rated SEER 13 or higher. No summer peak demand reduction since Pacific Northwest is winter peaking system.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Entergy Deemed Savings Database (Texas), October 2005</strong>&lt;sup&gt;19&lt;/sup&gt;</td>
<td>410</td>
<td>0</td>
<td>0.27</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Comments:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Energy savings from SEER 13 to a SEER 14, 2.5 ton.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

<sup>15</sup> Ontario Energy Board (OEB), 2006, Total Resource Cost Guide.

<sup>16</sup> California Public Utility Commission (CPUC) and California Energy Commission (CEC), 2004-05 Database for Energy Efficient Resources (DEER), Version 2.01 October 26, 2005


ENERGY STAR® CENTRAL AIR CONDITIONER

**Efficient Equipment and Technologies Description**
Energy Star® Central Air Conditioner with higher thermostat setting (2 degrees Celsius)

**Base Equipment and Technologies Description**
Current standard for central air conditioner (SEER 13)

**Codes, Standards, and Regulations**
- According to Canada’s Office of Energy Efficiency, an energy efficiency of central air conditioners are measured by Seasonal Energy Efficiency Ratio (SEER) and Energy Efficiency Ratio (EER) with Energy Star® qualified central air conditioning systems being about 8% more efficient than standard models.1

Typical residential systems are "split" with a separate indoor evaporator unit in the furnace ducting and an outdoor condenser unit or are "single package" systems that have the evaporator and condenser in one unit.

The following levels must be met or exceeded to qualify for Energy Star®:

<table>
<thead>
<tr>
<th>Type</th>
<th>SEER</th>
<th>EER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split</td>
<td>&gt;= 14.0</td>
<td>&gt;-11.5</td>
</tr>
<tr>
<td>Single Package</td>
<td>&gt;= 14.0</td>
<td>&gt;= 11.0</td>
</tr>
</tbody>
</table>

- Canada’s Energy Efficiency Act regulates minimum heating and cooling standards for permanently installed air-source air-conditioner and heat pumps. Equipment types include air conditioners and heat pumps that are single package and split system, single and three-phase, with rated capacity of less than 19kW (65,000 Btu/h).2 Applicable minimum energy performance standards came into effect on November 2006 (under test standard CAN/CSA-C656-05).3

<table>
<thead>
<tr>
<th>Type</th>
<th>SEER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Conditioners (single package &amp; split-system)</td>
<td>13</td>
</tr>
<tr>
<td>Heat Pumps – (single package &amp; split-system)</td>
<td>13</td>
</tr>
</tbody>
</table>

---

3 Ibid.
On February 15, 2006 the Ontario Energy Efficiency Act set minimum standard SEER and HSPF values for single and three-phase, single package or split-system air-conditioners and heat pumps that do not exceed 19 kilowatts in cooling or heating capacity. This means that air conditioners with a SEER less than 13.0 and heat pumps with an HSPF (V) less then 6.7, manufactured after February 15, 2006, cannot be offered for sale, sold or leased in the province of Ontario.

Decision Type | Load Type
---|---
New/Replacement | OPA Res Space Cooling - Central

<table>
<thead>
<tr>
<th>Resource Savings Assumptions</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEER 14</strong></td>
<td>175</td>
</tr>
<tr>
<td><strong>SEER 15</strong></td>
<td>271</td>
</tr>
</tbody>
</table>

Annual energy savings were calculated as follows:

**SEER 14**
\[
\Delta kWh = \frac{((\text{SEER}_{\text{REE}} - \text{SEER}_{\text{BASE}}))}{\left(\frac{\text{SEER}_{\text{REE}} \times ((\text{BTU/hr}) \times (\text{SEER}_{\text{BASE}} \times 1000)) \times \text{Hours}}{\text{Temp Set Up}_{\text{EE}}}ight)} + \frac{((14-13)/13) \times ((26,000 / (13 \times 1,000)) \times 500))}{103.8} = 175.30
\]

**SEER 15.6**
\[
\Delta kWh = \frac{((\text{SEER}_{\text{REE}} - \text{SEER}_{\text{BASE}}))}{\left(\frac{\text{SEER}_{\text{REE}} \times ((\text{BTU/hr}) \times (\text{SEER}_{\text{BASE}} \times 1000)) \times \text{Hours}}{\text{Temp Set Up}_{\text{EE}}}ight)} + \frac{((15.6-13)/13) \times ((26,000 / (13 \times 1,000)) \times 500))}{103.8} = 270.63
\]

Where:
- \(\text{SEER}_{\text{REE}}\) = SEER rating for efficient CAC unit = 14, 15.6 (average of Tier 2 Energy Star® SEER Ratings)
- \(\text{SEER}_{\text{BASE}}\) = SEER rating for baseline CAC unit = 13
- Temp Set Up\(_{\text{EE}}\) = Energy savings resulting from temperature set up (2 degrees Celsius)
- BTU/hr = CAC unit size in British thermal units per hour = 26,000 (Average Ontario CAC unit size based on air conditioning shipments data recorded by the HRAI Manufacturing Division)

31% of E-Star CAC participants surveyed reported that they now set their thermostat at a higher temperature setting (average of 2 degrees Celsius) in the summer. Conversely, 7% of participants surveyed reported that they lowered the thermostat setting (average of 3 degrees Celsius) Overall, 24% (31%-7%) of E-Star CAC participants set their thermostat approximately 2 degrees higher in the summer. Based on NRCan’s study conducted by the Canadian Centre for Housing Technology, setting the thermostat up by 2 degrees for the entire cooling season (from a base of 22°C to 24°C) is estimated to result in a 23% energy saving. Unfortunately, similar information was not available from the non-participant survey, so it is unknown what percentage if any of non-E-Star CAC purchasers increased their thermostat setting. Navigant Consulting has conservatively assumed that the percentage of non-E-Star CAC purchasers who increased their thermostat setting would be half of that for E-Star CAC purchasers. Based on this assumption and applying the savings to the base energy consumption for a mix of SEER 14 and SEER 15 Energy Star® rated CAC (using the same conditions as above with the SEER mix based on rebate sales data) results in an additional savings of 104 kWh/year.

---

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Space cooling - central) and the OPA’s average peak demand savings methodology and coincident factors. For the 14 SEER CAC, the average demand savings were calculated to be 0.0000 kW winter on-peak and 0.0856 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0000 kW winter on-peak and 0.1917 kW summer on-peak. For the 15 SEER CAC, the average demand savings were calculated to be 0.0000 kW winter on-peak and 0.1321 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0000 kW winter on-peak and 0.2958 kW summer on-peak.

<table>
<thead>
<tr>
<th>SEER 14</th>
<th>Winter On-Peak</th>
<th>0.0000 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.0856 kW</td>
</tr>
<tr>
<td>SEER 15</td>
<td>Winter On-Peak</td>
<td>0.0000 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.1321 kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>Winter On-Peak</td>
<td>0.0000 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.1917 kW</td>
</tr>
<tr>
<td>SEER 14</td>
<td>Winter On-Peak</td>
<td>0.0000 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.1917 kW</td>
</tr>
<tr>
<td>SEER 15</td>
<td>Winter On-Peak</td>
<td>0.0000 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.2958 kW</td>
</tr>
</tbody>
</table>

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Space cooling - central) and the OPA’s average peak demand savings methodology and coincident factors. For the 14 SEER CAC, the average demand savings were calculated to be 0.0000 kW winter on-peak and 0.0856 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0000 kW winter on-peak and 0.1917 kW summer on-peak. For the 15 SEER CAC, the average demand savings were calculated to be 0.0000 kW winter on-peak and 0.1321 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0000 kW winter on-peak and 0.2958 kW summer on-peak.

<table>
<thead>
<tr>
<th>Other Resource Savings</th>
<th>Resource #1</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Resource #2</td>
<td>Units</td>
</tr>
<tr>
<td></td>
<td>Resource #3</td>
<td>Units</td>
</tr>
</tbody>
</table>

N/A

---

7 Source: http://energyexperts.org/ac_calc/
Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th>Measure</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
<th>hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>522</td>
<td>783</td>
<td>1623</td>
<td>1305</td>
<td>1626</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>25.5%</td>
<td>21.8%</td>
<td>48.5%</td>
<td>1.5%</td>
<td>2.8%</td>
<td>%</td>
</tr>
</tbody>
</table>

**SEER 14 – With Temperature Set Up**

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>0.00</th>
<th>0.00</th>
<th>0.00</th>
<th>44.69</th>
<th>38.22</th>
<th>84.98</th>
<th>2.55</th>
<th>4.86</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0856</td>
<td>0.0488</td>
<td>0.0524</td>
<td>0.0020</td>
<td>0.0030</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0000</td>
<td>0.1917</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

**SEER 15 – With Temperature Set Up**

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>0.00</th>
<th>0.00</th>
<th>0.00</th>
<th>68.97</th>
<th>58.98</th>
<th>131.15</th>
<th>3.94</th>
<th>7.49</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.1321</td>
<td>0.0753</td>
<td>0.0808</td>
<td>0.0030</td>
<td>0.0046</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0000</td>
<td>0.2958</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

**Description / References:**

The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Space Cooling – Central load shape and the OPA’s average peak demand savings methodology and coincident factors\(^{10}\).

---

\(^{10}\) Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.
Other Input Assumptions

<table>
<thead>
<tr>
<th>Effective Useful Life</th>
<th>18 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>The California Database for Energy Efficient Resources (DEER)(^{11}) for SEER 14 and 15 split system central air conditioners reports 18 years effective useful life (EUL). The OEB Assumptions and Measures List(^{12}) uses 14 years, the EPA Energy Star® Simple Savings Calculator(^{13}) uses 15 years. Vermont(^{14}) suggests 18 years as a EUL as well as New England State(^{15}).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incremental Cost (Cust. / Contr. Install)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SEER 14</td>
<td>$ 475.00</td>
</tr>
<tr>
<td>SEER 15</td>
<td>$ 850.00</td>
</tr>
</tbody>
</table>

Based on results from HCSP Contractor and Participant Survey.

---

\(^{11}\) California Public Utility Commission (CPUC) and California Energy Commission (CEC), 2004-05 Database for Energy Efficient Resources (DEER), Version 2.01 October 26, 2005

\(^{12}\) Ontario Energy Board (OEB), 2006, Total Resource Cost Guide.

\(^{13}\) EPA (EPA Energy Star® Simple Savings Calculator – Central Air Conditioners, https://energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_CAC.xls


### Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Winter (kW)</td>
<td>Summer (kW)</td>
<td></td>
</tr>
<tr>
<td>Ontario Energy Board, Total Resource Cost Guide, October 2006</td>
<td>351</td>
<td>0</td>
<td>0.359</td>
<td>14</td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Based on 25% energy savings from switching to an Energy Star® central air conditioner with a baseline annual energy of 1,403 kW/yr.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California Database for Energy Efficient Resources (DEER) Version 2.01 October 26, 2005</td>
<td>20.53</td>
<td>0</td>
<td>0.0748</td>
<td>18</td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPCC Regional Technical Forum, February 2000</td>
<td>200</td>
<td>0</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Family Dwellings with existing central air conditioning system built between 1980 and 1992, rated SEER 13 or higher. No summer peak demand reduction since Pacific Northwest is winter peaking system.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entergy Deemed Savings Database (Texas), October 2005</td>
<td>410</td>
<td>0</td>
<td>0.27</td>
<td>NA</td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy savings from SEER 13 to a SEER 14, 2.5 ton.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

17 California Public Utility Commission (CPUC) and California Energy Commission (CEC), 2004-05 Database for Energy Efficient Resources (DEER), Version 2.01 October 26, 2005
ENERGY STAR® CENTRAL AIR CONDITIONER

Efficient Equipment and Technologies Description

Energy Star® Central Air Conditioner

Base Equipment and Technologies Description

Previous minimum standard central air conditioner (SEER 10) (back log)

Codes, Standards, and Regulations

• According to Canada’s Office of Energy Efficiency, an energy efficiency of central air conditioners are measured by Seasonal Energy Efficiency Ratio (SEER) and Energy Efficiency Ratio (EER) with Energy Star® qualified central air conditioning systems being about 8% more efficient than standard models1

Typical residential systems are "split" with a separate indoor evaporator unit in the furnace ducting and an outdoor condenser unit or are "single package" systems that have the evaporator and condenser in one unit.

The following levels must be met or exceeded to qualify for Energy Star®:

<table>
<thead>
<tr>
<th>Type</th>
<th>SEER</th>
<th>EER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split</td>
<td>&gt;= 14.0</td>
<td>&gt;= -11.5</td>
</tr>
<tr>
<td>Single Package</td>
<td>&gt;= 14.0</td>
<td>&gt;= 11.0</td>
</tr>
</tbody>
</table>

• Canada’s Energy Efficiency Act regulates minimum heating and cooling standards for permanently installed air-source air-conditioner and heat pumps. Equipment types include air conditioners and heat pumps that are single package and split system, single and three-phase, with rated capacity of less than 19kW (65,000 Btu/h)2. Applicable minimum energy performance standards came into effect on November 2006 (under test standard CAN/CSA-C656-05).3

<table>
<thead>
<tr>
<th>Type</th>
<th>SEER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Conditioners (single package &amp; split-system)</td>
<td>13</td>
</tr>
<tr>
<td>Heat Pumps – (single package &amp; split–system)</td>
<td>13</td>
</tr>
</tbody>
</table>

---

3 Ibid.
On February 15, 2006 the Ontario Energy Efficiency Act set minimum standard SEER and HSPF values for single and three-phase, single package or split-system air-conditioners and heat pumps that do not exceed 19 kilowatts in cooling or heating capacity. This means that air conditioners with a SEER less than 13.0 and heat pumps with an HSPF (V) less then 6.7, manufactured after February 15, 2006, cannot be offered for sale, sold or leased in the province of Ontario.

### Decision Type

<table>
<thead>
<tr>
<th>Decision Type</th>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>New/Replacement</td>
<td>OPA Res Space Cooling - Central</td>
</tr>
</tbody>
</table>

### Resource Savings Assumptions

<table>
<thead>
<tr>
<th>Annual Electricity Savings</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEER 14</td>
<td>371</td>
</tr>
<tr>
<td>SEER 15</td>
<td>467</td>
</tr>
</tbody>
</table>

Annual energy savings were calculated as follows:

\[
\Delta kWh = \frac{(SEER_{\text{EE}} - SEER_{\text{BASE}})}{(SEER_{\text{EE}} \times (BTU/hr / (SEER_{\text{BASE}} \times 1000)) \times \text{Hours}))}
\]

\[
\Delta kWh = \frac{(14-10)/10 \times ((26,000 / (10 \times 1,000)) \times 500)}) = 371.13
\]

\[
\Delta kWh = \frac{(SEER_{\text{EE}} - SEER_{\text{BASE}})}{(SEER_{\text{EE}} \times (BTU/hr / (SEER_{\text{BASE}} \times 1000)) \times \text{Hours}))}
\]

\[
\Delta kWh = \frac{(15-10)/10 \times ((26,000 / (10 \times 1,000)) \times 500)}) = 466.67
\]

Where:
- SEER_{\text{EE}} = SEER rating for efficient CAC unit = 14, 15
- SEER_{\text{BASE}} = SEER rating for baseline CAC unit = 10
- BTU/hr = CAC unit size in British thermal units per hour = 26,000 (Average Ontario CAC unit size based on air conditioning shipments data recorded by the HRAI Manufacturing Division)\(^5\)
- Hours = Full-load cooling hours = 500 (EPA Energy Star® Simple Savings Calculator – Central Air Conditioners, https://energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_CAC.xls\(^7\))

#### Average Demand Savings

<table>
<thead>
<tr>
<th>Average Demand Savings</th>
<th>kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEER 14 Winter On-Peak</td>
<td>0.0000</td>
</tr>
<tr>
<td>Summer On-Peak</td>
<td>0.1814</td>
</tr>
<tr>
<td>SEER 15 Winter On-Peak</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

---


\(^7\) Source: http://energyexperts.org/ac_calc/
### Evaluation Report: 2007 Hot and Cool Savings Program

<table>
<thead>
<tr>
<th>Coincident Peak Demand Savings</th>
<th>Summer On-Peak</th>
<th>Winter On-Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEER 14</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer On-Peak</td>
<td>0.2279 kW</td>
<td></td>
</tr>
<tr>
<td>Winter On-Peak</td>
<td>0.0000 kW</td>
<td></td>
</tr>
<tr>
<td><strong>SEER 15</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer On-Peak</td>
<td>0.4062 kW</td>
<td></td>
</tr>
<tr>
<td>Winter On-Peak</td>
<td>0.0000 kW</td>
<td>0.5103 kW</td>
</tr>
</tbody>
</table>

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Space cooling - central) and the OPA’s average peak demand savings methodology and coincident factors. For the 14 SEER CAC, the average demand savings were calculated to be 0.0000 kW winter on-peak and 0.1814 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0000 kW winter on-peak and 0.4062 kW summer on-peak. For the 15 SEER CAC, the average demand savings were calculated to be 0.0000 kW winter on-peak and 0.4062 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0000 kW winter on-peak and 0.5103 kW summer on-peak.

<table>
<thead>
<tr>
<th>Other Resource Savings</th>
<th>Resource #1</th>
<th>Resource #2</th>
<th>Resource #3</th>
</tr>
</thead>
</table>

N/A

### Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th>Measure</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
<th>hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>522</td>
<td>783</td>
<td>1623</td>
<td>1305</td>
<td>1626</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>25.5%</td>
<td>21.8%</td>
<td>48.5%</td>
<td>1.5%</td>
<td>2.8%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SEER 14

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>0.00</th>
<th>0.00</th>
<th>0.00</th>
<th>94.69</th>
<th>80.98</th>
<th>180.06</th>
<th>5.41</th>
<th>10.29</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.1814</td>
<td>0.1034</td>
<td>0.1109</td>
<td>0.0041</td>
<td>0.0063</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0000</td>
<td>0.4062</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

---

8 Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.
### SEER 15

<table>
<thead>
<tr>
<th>Description / References:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Space Cooling – Central load shape and the OPA’s average peak demand savings methodology and coincident factors.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>0.00</th>
<th>0.00</th>
<th>0.00</th>
<th>118.97</th>
<th>101.74</th>
<th>226.23</th>
<th>6.80</th>
<th>12.93</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.2279</td>
<td>0.1299</td>
<td>0.1394</td>
<td>0.0052</td>
<td>0.0080</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0000</td>
<td></td>
<td></td>
<td>0.5103</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

---

Other Input Assumptions

<table>
<thead>
<tr>
<th>Effective Useful Life</th>
<th>18 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>The California Database for Energy Efficient Resources (DEER)(^{10}) for SEER 14 and 15 split system central air conditioners reports 18 years effective useful life (EUL). The OEB Assumptions and Measures List(^{11}) uses 14 years, the EPA Energy Star® Simple Savings Calculator(^{12}) uses 15 years. Vermont(^{13}) suggests 18 years as a EUL as well as New England State(^{14}).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incremental Cost (Cust. / Contr. Install)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SEER 14</td>
<td>$1,000</td>
</tr>
<tr>
<td>SEER 15</td>
<td>$1,250</td>
</tr>
</tbody>
</table>

- Based on quotes from HVAC contractors in Ontario.

\(^{10}\) California Public Utility Commission (CPUC) and California Energy Commission (CEC), 2004-05 Database for Energy Efficient Resources (DEER), Version 2.01 October 26, 2005.

\(^{11}\) Ontario Energy Board (OEB), 2006, Total Resource Cost Guide.


### Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Winter (kW)</td>
<td>Summer (kW)</td>
<td></td>
</tr>
<tr>
<td>Ontario Energy Board, Total Resource Cost Guide, October 2006&lt;sup&gt;15&lt;/sup&gt;</td>
<td>351</td>
<td>0</td>
<td>0.359</td>
<td>14</td>
</tr>
<tr>
<td>Comments:</td>
<td>Based on 25% energy savings from switching to an Energy Star® central air conditioner with a baseline annual energy of 1,403 kW/yr.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California Database for Energy Efficient Resources (DEER) Version 2.01 October 26, 2005&lt;sup&gt;16&lt;/sup&gt;</td>
<td>20.53</td>
<td>0</td>
<td>0.0748</td>
<td>18</td>
</tr>
<tr>
<td>Comments:</td>
<td>Based on a 2-ton 14 SEER split system CAC replacing a 13 SEER split system CAC in California climate – based on Quantum Consulting study for Pacific Gas &amp; Electric Company, March 1, 1999&lt;sup&gt;17&lt;/sup&gt;.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPCC Regional Technical Forum, February 2000&lt;sup&gt;18&lt;/sup&gt;</td>
<td>200</td>
<td>0</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Comments:</td>
<td>Single Family Dwellings with existing central air conditioning system built between 1980 and 1992, rated SEER 13 or higher. No summer peak demand reduction since Pacific Northwest is winter peaking system.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entergy Deemed Savings Database (Texas), October 2005&lt;sup&gt;19&lt;/sup&gt;</td>
<td>410</td>
<td>0</td>
<td>0.27</td>
<td>NA</td>
</tr>
<tr>
<td>Comments:</td>
<td>Energy savings from SEER 13 to a SEER 14, 2.5 ton.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

<sup>15</sup> Ontario Energy Board (OEB), 2006, Total Resource Cost Guide.

<sup>16</sup> California Public Utility Commission (CPUC) and California Energy Commission (CEC), 2004-05 Database for Energy Efficient Resources (DEER), Version 2.01 October 26, 2005


ENERGY STAR® CENTRAL AIR CONDITIONER

Efficient Equipment and Technologies Description
Energy Star® Central Air Conditioner with higher thermostat setting (2 degrees Celsius)

Base Equipment and Technologies Description
Previous minimum standard central air conditioner (SEER 10) (back log)

Codes, Standards, and Regulations
• According to Canada’s Office of Energy Efficiency, an energy efficiency of central air conditioners are measured by Seasonal Energy Efficiency Ratio (SEER) and Energy Efficiency Ratio (EER) with Energy Star® qualified central air conditioning systems being about 8% more efficient than standard models1

Typical residential systems are "split" with a separate indoor evaporator unit in the furnace ducting and an outdoor condenser unit or are "single package" systems that have the evaporator and condenser in one unit.

The following levels must be met or exceeded to qualify for Energy Star®:

<table>
<thead>
<tr>
<th>Type</th>
<th>SEER</th>
<th>EER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split</td>
<td>&gt;= 14.0</td>
<td>&gt;-11.5</td>
</tr>
<tr>
<td>Single Package</td>
<td>&gt;= 14.0</td>
<td>&gt;= 11.0</td>
</tr>
</tbody>
</table>

• Canada’s Energy Efficiency Act regulates minimum heating and cooling standards for permanently installed air-source air-conditioner and heat pumps. Equipment types include air conditioners and heat pumps that are single package and split system, single and three-phase, with rated capacity of less than 19kW (65,000 Btu/h)2. Applicable minimum energy performance standards came into effect on November 2006 (under test standard CAN/CSA-C656-05).3

<table>
<thead>
<tr>
<th>Type</th>
<th>SEER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Conditioners (single package &amp; split-system)</td>
<td>13</td>
</tr>
<tr>
<td>Heat Pumps – (single package &amp; split–system)</td>
<td>13</td>
</tr>
</tbody>
</table>

---

3 Ibid.
On February 15, 2006 the Ontario Energy Efficiency Act set minimum standard SEER and HSPF values for single and three-phase, single package or split-system air-conditioners and heat pumps that do not exceed 19 kilowatts in cooling or heating capacity. This means that air conditioners with a SEER less than 13.0 and heat pumps with an HSPF (V) less than 6.7, manufactured after February 15, 2006, cannot be offered for sale, sold or leased in the province of Ontario.

### Decision Type

<table>
<thead>
<tr>
<th>Decision Type</th>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>New/Replacement</td>
<td>OPA Res Space Cooling - Central</td>
</tr>
</tbody>
</table>

### Resource Savings Assumptions

<table>
<thead>
<tr>
<th>Annual Electricity Savings</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEER 14</td>
<td>475 kWh</td>
</tr>
<tr>
<td>SEER 15</td>
<td>571 kWh</td>
</tr>
</tbody>
</table>

Annual energy savings were calculated as follows:

**SEER 14**

\[
\Delta k\text{Wh} = \left(\frac{\text{SEER}_{\text{EE}} - \text{SEER}_{\text{BASE}}}{\text{SEER}_{\text{EE}} \times \left(\frac{\text{BTU/hr}}{\text{SEER}_{\text{BASE}} \times 1000}\right) \times \text{Hours}}\right) + \text{Temp Set Up}_{EE}
\]

\[
\Delta k\text{Wh} = \left(\frac{14-10}{10} \times \left(\frac{26,000}{10 \times 1,000}\right) \times 500\right) + 103.8 = 475.3
\]

**SEER 15**

\[
\Delta k\text{Wh} = \left(\frac{\text{SEER}_{\text{EE}} - \text{SEER}_{\text{BASE}}}{\text{SEER}_{\text{EE}} \times \left(\frac{\text{BTU/hr}}{\text{SEER}_{\text{BASE}} \times 1000}\right) \times \text{Hours}}\right)
\]

\[
\Delta k\text{Wh} = \left(\frac{15-10}{10} \times \left(\frac{26,000}{10 \times 1,000}\right) \times 500\right) + 103.8 = 570.5
\]

Where:

- \(\text{SEER}_{\text{EE}}\) = SEER rating for efficient CAC unit = 14, 15
- \(\text{SEER}_{\text{BASE}}\) = SEER rating for baseline CAC unit = 10
- Temp Set Up\(_{EE}\) = Energy savings resulting from temperature set up (2 degrees Celsius)
- \(\text{BTU/hr}\) = CAC unit size in British thermal units per hour = 26,000 (Average Ontario CAC unit size based on air conditioning shipments data recorded by the HRAI Manufacturing Division)

31% of E-Star CAC participants surveyed reported that they now set their thermostat at a higher temperature setting (average of 2 degrees Celsius) in the summer. Conversely, 7% of participants surveyed reported that they lowered the thermostat setting (average of 3 degrees Celsius) Overall, 24% (31%-7%) of E-Star CAC participants were set their thermostat approximately 2 degrees higher in the summer. Based NRCan’s study conducted by the Canadian Centre for Housing Technology, setting the thermostat up by 2 degrees for the entire cooling season (from a base of 22°C to 24°C) is estimated to result in a 23% energy saving. Unfortunately, similar information was not available from the non-participant survey, so it is unknown what percentage if any of non-E-Star CAC purchasers increased their thermostat setting. Navigant Consulting has conservatively assumed that the percentage of non-E-Star CAC purchasers who increased their thermostat setting would be half of that for E-Star CAC purchasers. Based on this assumption and applying the savings to the base energy consumption for a mix of SEER 14 and SEER 15 Energy Star® rated CAC (using the same conditions as above with the SEER mix based on rebate sales data) results in an additional savings of 104 kWh/year.

---

<table>
<thead>
<tr>
<th>Average Demand Savings</th>
<th>SEER 14</th>
<th>Winter On-Peak</th>
<th>0.0000 kW</th>
<th>Summer On-Peak</th>
<th>0.2321 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SEER 15</td>
<td>Winter On-Peak</td>
<td>0.0000 kW</td>
<td>Summer On-Peak</td>
<td>0.2786 kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>SEER 14</td>
<td>Winter On-Peak</td>
<td>0.0000 kW</td>
<td>Summer On-Peak</td>
<td>0.5197 kW</td>
</tr>
<tr>
<td></td>
<td>SEER 15</td>
<td>Winter On-Peak</td>
<td>0.0000 kW</td>
<td>Summer On-Peak</td>
<td>0.6239 kW</td>
</tr>
</tbody>
</table>

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Space cooling - central) and the OPA’s average peak demand savings methodology and coincident factors\(^9\). For the 14 SEER CAC, the average demand savings were calculated to be 0.0000 kW winter on-peak and 0.2321 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0000 kW winter on-peak and 0.5197 kW summer on-peak. For the 15 SEER CAC, the average demand savings were calculated to be 0.0000 kW winter on-peak and 0.2786 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0000 kW winter on-peak and 0.6239 kW summer on-peak.

<table>
<thead>
<tr>
<th>Other Resource Savings</th>
<th>Resource #1</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Resource #2</td>
<td>Units</td>
</tr>
<tr>
<td></td>
<td>Resource #3</td>
<td>Units</td>
</tr>
</tbody>
</table>


\(^7\)Source: http://energyexperts.org/ac_calc/


## Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th>Measure</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
<th>hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>25.5%</td>
<td>21.8%</td>
<td>48.5%</td>
<td>1.5%</td>
<td>2.8%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SEER 14

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>0.00</th>
<th>0.00</th>
<th>0.00</th>
<th>121.17</th>
<th>103.62</th>
<th>230.42</th>
<th>6.92</th>
<th>13.16</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.2321</td>
<td>0.1323</td>
<td>0.1420</td>
<td>0.0053</td>
<td>0.0081</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0000</td>
<td>0.5197</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

### SEER 15

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>0.00</th>
<th>0.00</th>
<th>0.00</th>
<th>145.45</th>
<th>124.38</th>
<th>276.59</th>
<th>8.31</th>
<th>15.80</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.2786</td>
<td>0.1589</td>
<td>0.1704</td>
<td>0.0064</td>
<td>0.0097</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0000</td>
<td>0.6239</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

### Description / References:
The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Space Cooling – Central load shape and the OPA’s average peak demand savings methodology and coincident factors.\(^\text{10}\).

---

\(^{10}\) Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.
Other Input Assumptions

<table>
<thead>
<tr>
<th>Effective Useful Life</th>
<th>18</th>
<th>years</th>
</tr>
</thead>
<tbody>
<tr>
<td>The California Database for Energy Efficient Resources (DEER)\textsuperscript{11} for SEER 14 and 15 split system central air conditioners reports 18 years effective useful life (EUL). The OEB Assumptions and Measures List\textsuperscript{12} uses 14 years, the EPA Energy Star\textsuperscript{®} Simple Savings Calculator\textsuperscript{13} uses 15 years. Vermont\textsuperscript{14} suggests 18 years as a EUL as well as New England State\textsuperscript{15}.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incremental Cost (Cust. / Contr. Install)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SEER 14</td>
<td>$1,000</td>
<td></td>
</tr>
<tr>
<td>SEER 15</td>
<td>$1,250</td>
<td></td>
</tr>
</tbody>
</table>

Based on quotes from HVAC contractors in Ontario.

Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ontario Energy Board, Total Resource Cost Guide, October 2006\textsuperscript{16}</td>
<td>351</td>
<td>0</td>
<td>0.359</td>
<td>14</td>
</tr>
</tbody>
</table>

Comments:
Based on 25% energy savings from switching to an Energy Star\textsuperscript{®} central air conditioner with a baseline annual energy of 1,403 kW/yr.

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Database for Energy Efficient Resources (DEER) Version 2.01 October 26, 2005\textsuperscript{17}</td>
<td>20.53</td>
<td>0</td>
<td>0.0748</td>
<td>18</td>
</tr>
</tbody>
</table>

\textsuperscript{11} California Public Utility Commission (CPUC) and California Energy Commission (CEC), 2004-05 Database for Energy Efficient Resources (DEER), Version 2.01 October 26, 2005

\textsuperscript{12} Ontario Energy Board (OEB), 2006, Total Resource Cost Guide.

\textsuperscript{13} EPA (EPA Energy Star\textsuperscript{®} Simple Savings Calculator – Central Air Conditioners, \url{https://energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_CAC.xls}


\textsuperscript{16} Ontario Energy Board (OEB), 2006, Total Resource Cost Guide.

\textsuperscript{17} California Public Utility Commission (CPUC) and California Energy Commission (CEC), 2004-05 Database for Energy Efficient Resources (DEER), Version 2.01 October 26, 2005
| NPCC Regional Technical Forum, February 2000 | 200 | 0 | 0 | NA | NA |
| Comments: | Single Family Dwellings with existing central air conditioning system built between 1980 and 1992, rated SEER 13 or higher. No summer peak demand reduction since Pacific Northwest is winter peaking system. |
| Entergy Deemed Savings Database (Texas), October 2005 | 410 | 0 | 0.27 | NA | NA |
| Comments: | Energy savings from SEER 13 to a SEER 14, 2.5 ton. |

---

FURNACE EQUIPPED WITH AN ELECTRONICALLY COMMUTATED MOTOR (ECM) – (Gas Heating and Electric Cooling Existing Homes)

| Efficient Equipment and Technologies Description |  
|________________________________________________|
| Gas furnace with an ECM Motor in an existing home using for both heating and cooling purposes. |  

| Base Equipment and Technologies Description |  
|______________________________________________|
| Gas furnace with a permanent split capacitor (PSC) motor in an existing home using for both heating and cooling purposes. |  

**Codes, Standards, and Regulations**

- Under Ontario's building code, all gas furnaces installed in new residential constructions must meet a minimum condensing efficiency level effective January 1, 2007\(^1\).
- Presently, there is no minimum energy performance standard restricting the electricity consumption of furnace fan blowers.
- NRCan proposes to increase the minimum performance level, the Annual Fuel Utilization Efficiency (AFUE), for gas-fired furnaces with an input rate not exceeding 65.92 kW (225 000 Btu/h) to 90% for December 31, 2009\(^2\).

**Decision Type**

<table>
<thead>
<tr>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement OPA Res Furnace Fan</td>
</tr>
</tbody>
</table>

**Resource Savings Assumptions**

<table>
<thead>
<tr>
<th>Annual Electricity Savings</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage – same behaviour)</td>
<td>2511 () kWh</td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>372 () kWh</td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
<td>107 () kWh</td>
</tr>
</tbody>
</table>

Continuous fan usage and non-continuous fan usage is estimated to be 26% and 69%, respectively, based on customer survey results. An additional 5% of customers were determined to have switched from non-continuous to continuous fan usage as a result of the ECM motor.

A study conducted by the Canadian Center for Housing Technologies\(^3\) determined that the annual electricity savings of an existing home using a gas furnace with an ECM motor for heating only is 2,808 kWh for

---


continuous fan use and 372 kWh for non-continuous fan use. NCI agrees with the CCHT’s electricity savings for continuous fan usage during summer and winter season, however is hesitant to accept the savings during the shoulder season since it is unlikely that a furnace fan is running continuously during the non-heating and cooling months. Therefore, for the shoulder season for continuous fan usage, NCI is using the same electricity savings resulting from a non-continuous fan, resulting in a saving of 2,511 kWh. For individuals who have switched from non-continuous fan usage, a net energy savings of 107 kWh is expected based on the increase in electricity from usage (2,404 kWh) and the savings resultant from the ECM (2,511 kWh).

<table>
<thead>
<tr>
<th>Average Demand Savings</th>
<th>Winter On-Peak</th>
<th>Summer On-Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage - same behaviour)</td>
<td>0.3975 kW</td>
<td>0.6698 kW</td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>0.0527 kW</td>
<td>0.0887 kW</td>
</tr>
<tr>
<td>(Continuous Fan Usage - change in behaviour)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter On-Peak</td>
<td>0.0100 kW</td>
<td>0.0168 kW</td>
</tr>
<tr>
<td>Summer On-Peak</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coincident Peak Demand Savings</th>
<th>Winter On-Peak</th>
<th>Summer On-Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage - same behaviour)</td>
<td>0.4384 kW</td>
<td>1.5311 kW</td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>0.0581 kW</td>
<td>0.2028 kW</td>
</tr>
<tr>
<td>(Continuous Fan Usage - change in behaviour)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter On-Peak</td>
<td>0.0110 kW</td>
<td>0.0384 kW</td>
</tr>
<tr>
<td>Summer On-Peak</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Furnace Fan) and the OPA’s average peak demand savings methodology and coincident factors. For continuous fan usage (same behaviour as before), the average demand savings were calculated to be 0.3975 kW winter on-peak and 0.6698 kW summer on-peak. The coincident peak demand savings were calculated to be 0.4384 kW winter on-peak and 1.5311 kW summer on-peak. For non-continuous fan usage, the average demand savings were calculated to be 0.0527 kW winter on-peak and 0.0887 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0581 kW winter on-peak and 0.2028 kW summer on-peak. For continuous fan usage (change in behaviour), the average demand savings were calculated to be 0.0100 kW winter on-peak and 0.0168 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0110 kW winter on-peak and 0.0384 kW summer on-peak.

<table>
<thead>
<tr>
<th>Other Resource Savings</th>
<th>-80.1 m³</th>
<th>22.6 m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage – same behaviour)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
<td>-0.3 m³</td>
<td></td>
</tr>
</tbody>
</table>

The Canadian Center for Housing Technologies study determined that a gas furnace used for heating and cooling equipped with an ECM motor with continuous fan usage (same usage as before) results in an...
increase in natural gas consumption of 80.1 m$^3$ for an existing home and a saving of 22.6 m$^3$ for non-continuous fan usage. For those individuals who switched from non-continuous fan usage to continuous fan usage, the net natural gas increase with an ECM is 0.3 m$^3$.

Assumptions:
- 11% gas savings from switching from a mid-efficiency furnace to a high-efficiency furnace$^6$
  - Average home with 80% AFUE consumes 1750 m$^3$ in natural gas during heating season$^7$
  - Average high-efficiency furnace penetration rate in Ontario being 75% (Assumed)
    - 2006 Hot Savings increased HE penetration rate by 25%
    - 2007 Cool Savings increased HE penetration by 15% (since 10% of consumers purchased mid-efficiency furnace and 90% of choosing high-efficiency)

### Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th>Measure</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>522</td>
<td>783</td>
<td>1623</td>
<td>1305</td>
<td>1626</td>
</tr>
<tr>
<td></td>
<td>8.5%</td>
<td>8.5%</td>
<td>23.3%</td>
<td>12.5%</td>
<td>10.9%</td>
<td>24.1%</td>
<td>4.4%</td>
<td>7.8%</td>
</tr>
<tr>
<td></td>
<td>hrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Continuous Fan Usage (same behaviour)

<table>
<thead>
<tr>
<th></th>
<th>Energy Savings</th>
<th>Average Demand Savings</th>
<th>Coincident Peak Demand Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>239.30</td>
<td>0.3975</td>
<td>0.4384</td>
</tr>
<tr>
<td></td>
<td>239.54</td>
<td>0.3482</td>
<td></td>
</tr>
<tr>
<td></td>
<td>654.89</td>
<td>0.4058</td>
<td></td>
</tr>
<tr>
<td></td>
<td>349.63</td>
<td>0.6698</td>
<td></td>
</tr>
<tr>
<td></td>
<td>304.87</td>
<td>0.3894</td>
<td></td>
</tr>
<tr>
<td></td>
<td>677.72</td>
<td>0.4176</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.19</td>
<td>0.0124</td>
<td></td>
</tr>
<tr>
<td></td>
<td>29.12</td>
<td>0.0179</td>
<td></td>
</tr>
</tbody>
</table>

### Non-Continuous Fan Usage

<table>
<thead>
<tr>
<th></th>
<th>Energy Savings</th>
<th>Average Demand Savings</th>
<th>Coincident Peak Demand Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>31.70</td>
<td>0.0527</td>
<td>0.0581</td>
</tr>
<tr>
<td></td>
<td>31.73</td>
<td>0.0461</td>
<td></td>
</tr>
<tr>
<td></td>
<td>86.76</td>
<td>0.0538</td>
<td></td>
</tr>
<tr>
<td></td>
<td>46.32</td>
<td>0.0887</td>
<td></td>
</tr>
<tr>
<td></td>
<td>40.39</td>
<td>0.0516</td>
<td></td>
</tr>
<tr>
<td></td>
<td>89.78</td>
<td>0.0553</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.19</td>
<td>0.0124</td>
<td></td>
</tr>
<tr>
<td></td>
<td>29.12</td>
<td>0.0179</td>
<td></td>
</tr>
</tbody>
</table>

---


Continuous Fan Usage (change in behaviour)

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>6.01</th>
<th>6.01</th>
<th>16.44</th>
<th>8.78</th>
<th>7.65</th>
<th>17.02</th>
<th>16.19</th>
<th>29.12 kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.0100</td>
<td>0.0087</td>
<td>0.0102</td>
<td>0.0168</td>
<td>0.0098</td>
<td>0.0105</td>
<td>0.0124</td>
<td>0.0179 kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0110</td>
<td>0.0384</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Description / References:

The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Furnace Fan load shape and the OPA’s average peak demand savings methodology and coincident factors.

Other Input Assumptions

<table>
<thead>
<tr>
<th>Effective Useful Life</th>
<th>15 years</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Incremental Cost (Cust. / Contr. Install)</th>
<th>960 $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on results from HCSP Contractor and Participant Survey.</td>
<td></td>
</tr>
</tbody>
</table>

---

8 Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.

### Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sate of Wisconsin Department of Administration Division of Energy 10</td>
<td>Continuous Fan Use = 3455</td>
<td>N/A</td>
<td>N/A</td>
<td>$400-$600</td>
</tr>
<tr>
<td></td>
<td>Non-Continuous Fan Use = 465</td>
<td>N/A</td>
<td>N/A</td>
<td>$400-$600</td>
</tr>
</tbody>
</table>

**Comments:**
Based on 2001/2002 study of 31 new furnaces (average 94% AFUE) with average annual gas usage of 800 therms, a 2.5-ton air conditioner with airflow of 1,000 cfm and 400 hours of operation per year, using Madison Wisconsin weather data (about 7,600 heating degree days/year) 11.

---


11 ibid
FURNACE EQUIPPED WITH AN ELECTRONICALLY COMMUTATED MOTOR (ECM) – (Gas Heating Existing Homes)

<table>
<thead>
<tr>
<th>Efficient Equipment and Technologies Description</th>
<th>Gas furnace with an ECM Motor in an existing home (heating only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Equipment and Technologies Description</td>
<td>Gas furnace with a permanent split capacitor (PSC) motor in an existing home (heating only)</td>
</tr>
</tbody>
</table>

**Codes, Standards, and Regulations**

- Under Ontario's building code, all gas furnaces installed in new residential constructions must meet a minimum condensing efficiency level effective January 1, 2007\(^1\).
- Presently, there is no minimum energy performance standard restricting the electricity consumption of furnace fan blowers.
- NRCan proposes to increase the minimum performance level, the Annual Fuel Utilization Efficiency (AFUE), for gas-fired furnaces with an input rate not exceeding 65.92 kW (225 000 Btu/h) to 90% for December 31, 2009\(^2\).

**Decision Type**

<table>
<thead>
<tr>
<th>Replacement OPA Res Furnace Fan</th>
</tr>
</thead>
</table>

**Load Type**

<table>
<thead>
<tr>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPA Res Furnace Fan</td>
</tr>
</tbody>
</table>

**Resource Savings Assumptions**

<table>
<thead>
<tr>
<th>Annual Electricity Savings</th>
<th>1387 kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage – same behaviour)</td>
<td></td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>324 kWh</td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
<td>227 kWh</td>
</tr>
</tbody>
</table>

Continuous fan usage and non-continuous fan usage is estimated to be 26% and 69%, respectively, based on customer survey results. An additional 5% of customers were determined to have switched from non-continuous to continuous fan usage as a result of the ECM motor.

A study conducted by the Canadian Center for Housing Technologies\(^3\) determined that the annual electricity savings of an existing home using a gas furnace with an ECM motor for heating only is 1,535 kWh for continuous fan use and 324 kWh for non-continuous fan use. NCI agrees with the CCHT’s electricity savings assumptions.

---


savings for continuous fan usage during summer and winter season, however is hesitant to accept the savings during the shoulder season since it is unlikely that a furnace fan is running continuously during the non-heating and cooling months. Therefore, for the shoulder season for continuous fan usage, NCI is using the same electricity savings resulting from a non-continuous fan, resulting in a saving of 1,387 kWh. For individuals who have switched from non-continuous fan usage to continuous fan usage as a result of installing a furnace with an ECM, a net electricity saving of 227 kWh is expected based on the increase in electricity from usage (1,160 kWh) and the savings resultant from the ECM (1,387 kWh).

<table>
<thead>
<tr>
<th>Average Demand Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter On-Peak</td>
</tr>
<tr>
<td>Summer On-Peak</td>
</tr>
<tr>
<td>Winter On-Peak</td>
</tr>
<tr>
<td>Summer On-Peak</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coincident Peak Demand Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter On-Peak</td>
</tr>
<tr>
<td>Summer On-Peak</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Resource Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter On-Peak</td>
</tr>
<tr>
<td>Summer On-Peak</td>
</tr>
<tr>
<td>Winter On-Peak</td>
</tr>
</tbody>
</table>

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Furnace Fan) and the OPA’s average peak demand savings methodology and coincident factors. For continuous fan usage, the average demand savings were calculated to be 0.2173 kW winter on-peak and 0.3661 kW summer on-peak. The coincident peak demand savings were calculated to be 0.2397 kW winter on-peak and 0.8370 kW summer on-peak. For non-continuous fan usage, the average demand savings were calculated to be 0.0459 kW winter on-peak and 0.0773 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0506 kW winter on-peak and 0.1767 kW summer on-peak. For continuous fan usage (change in behaviour), the average demand savings were calculated to be 0.0302 kW winter on-peak and 0.0508 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0333 kW winter on-peak and 0.1162 kW summer on-peak.

The Canadian Center for Housing Technologies study determined that a gas furnace used for heating and cooling equipped with an ECM motor with continuous fan usage (same usage as before) results in an

---

4 Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.
increase in natural gas consumption of 80.1 m³ for an existing home and a saving of 22.6 m³ for non-
continuous fan usage. For those individuals who switched from non-continuous fan usage to continuous fan
usage, the net natural gas increase with an ECM is 0.3 m³.

Assumptions:
- 11% gas savings from switching from a mid-efficiency furnace to a high-efficiency furnace
  - Average home with 80% AFUE consumes 1750 m³ in natural gas during heating season
  - Average high-efficiency furnace penetration rate in Ontario being 75% (Assumed)
    - 2006 Hot Savings increased HE penetration rate by 25%
    - 2007 Cool Savings increased HE penetration by 15% (since 10% of consumers purchased
      mid-efficiency furnace and 90% of choosing high-efficiency)

### Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th>Measure</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
<th>hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.5%</td>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>522</td>
<td>783</td>
<td>1623</td>
<td>1305</td>
<td>1626</td>
<td></td>
</tr>
</tbody>
</table>

### Continuous Fan Usage (same behaviour)

| Energy Savings   | 130.81      | 130.95     | 358.00          | 191.13      | 166.66     | 370.48          | 14.10        | 25.37        | kWh |
| Average Demand Savings | 0.2173     | 0.1901     | 0.0810          | 0.2506      | 0.1671     | 0.0806          | 0.1002       | 0.0806       | kW  |
| Coincident Peak Demand Savings | 0.2397     | 0.8370     |                  |              |            |                  |              |              | kW  |

### Non-Continuous Fan Usage

| Energy Savings   | 27.61       | 27.64      | 75.56           | 40.34       | 35.18      | 78.20           | 14.10        | 25.37        | kWh |
| Average Demand Savings | 0.0459     | 0.0401     | 0.0171          | 0.0529      | 0.0353     | 0.0170          | 0.0212       | 0.0170       | kW  |
| Coincident Peak Demand Savings | 0.0506     | 0.1767     |                  |              |            |                  |              |              | kW  |
### Continuous Fan Usage (change in behaviour)

<table>
<thead>
<tr>
<th></th>
<th>kWh</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Savings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.16</td>
<td>18.18</td>
<td>49.69</td>
<td>26.53</td>
<td>23.13</td>
<td>51.42</td>
<td>14.10</td>
<td>25.37</td>
</tr>
<tr>
<td>Average Demand Savings</td>
<td>0.0302</td>
<td>0.0264</td>
<td>0.0308</td>
<td>0.0508</td>
<td>0.0295</td>
<td>0.0317</td>
<td>0.0071</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0333</td>
<td>0.1162</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Description / References:**

The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Furnace Fan load shape and the OPA's average peak demand savings methodology and coincident factors.

---

8 Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.
Other Input Assumptions

<table>
<thead>
<tr>
<th>Effective Useful Life</th>
<th>15 years</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Incremental Cost (Cust. / Contr. Install)</th>
<th>960 $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on results from HCSP Contractor and Participant Survey.</td>
<td></td>
</tr>
</tbody>
</table>

Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Winter (kW)</td>
<td>Summer (kW)</td>
<td>N/A</td>
</tr>
<tr>
<td>Sate of Wisconsin Department of Administration Division of Energy</td>
<td>Continuous Fan Use = 3455</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Non-Continuous Fan Use = 465</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Comments:
Based on 2001/2002 study of 31 new gas furnaces (average 94% AFUE) with average annual gas usage of 800 therms, a 2.5-ton air conditioner with airflow of 1,000 cfm and 400 hours of operation per year, using Madison Wisconsin weather data (about 7,600 heating degree days/year).  

11 ibid
FURNACE EQUIPPED WITH AN ELECTRONICALLY COMMUTATED MOTOR (ECM) – (Gas Heating and Electric Cooling New Homes)

<table>
<thead>
<tr>
<th>Efficient Equipment and Technologies Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas furnace with an ECM Motor in a new home using for both heating and cooling purposes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Base Equipment and Technologies Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas furnace with a permanent split capacitor (PSC) motor in a new home using for both heating and cooling purposes.</td>
</tr>
</tbody>
</table>

Codes, Standards, and Regulations

- Under Ontario’s building code, all gas furnaces installed in new residential constructions must meet a minimum condensing efficiency level effective January 1, 2007⁴.
- Presently, there is no minimum energy performance standard restricting the electricity consumption of furnace fan blowers.
- NRCan proposes to increase the minimum performance level, the Annual Fuel Utilization Efficiency (AFUE), for gas-fired furnaces with an input rate not exceeding 65.92 kW (225 000 Btu/h) to 90% for December 31, 2009⁵.

<table>
<thead>
<tr>
<th>Decision Type</th>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement</td>
<td>OPA Res Furnace Fan</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resource Savings Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Electricity Savings</td>
</tr>
<tr>
<td>(Continuous Fan Usage – same behaviour)</td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
</tr>
</tbody>
</table>

Continuous fan usage and non-continuous fan usage is estimated to be 26% and 69%, respectively, based on customer survey results. An additional 5% of customers were determined to have switched from non-continuous to continuous fan usage as a result of the ECM motor.

A study conducted by the Canadian Center for Housing Technologies⁶ determined that the annual electricity savings of a new home using a gas furnace with an ECM motor for heating only is 2,884 kWh for continuous

---


fan use and 266 kWh for non-continuous fan use. NCI agrees with the CCHT’s electricity savings for continuous fan usage during summer and winter season, however is hesitant to accept the savings during the shoulder season since it is unlikely that a furnace fan is running continuously during the non-heating and cooling months. Therefore, for the shoulder season for continuous fan usage, NCI is using the same electricity savings resulting from a non-continuous fan, resulting in a saving of 2,393 kWh. For individuals who have switched from non-continuous fan usage to continuous fan usage as a result of installing a furnace with an ECM, a net electricity increase of 2.15 kWh is expected based on the increase in electricity from usage (2,395 kWh) and the savings resultant from the ECM (2393 kWh).

<table>
<thead>
<tr>
<th>Average Demand Savings</th>
<th>Winter On-Peak</th>
<th>Summer On-Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage – same behaviour)</td>
<td>0.4128 kW</td>
<td>0.6955 kW</td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter On-Peak</td>
<td>0.0459 kW</td>
<td></td>
</tr>
<tr>
<td>Summer On-Peak</td>
<td>0.0773 kW</td>
<td></td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter On-Peak</td>
<td>-0.0056 kW</td>
<td></td>
</tr>
<tr>
<td>Summer On-Peak</td>
<td>-0.0094 kW</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coincident Peak Demand Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Furnace Fan) and the OPA’s average peak demand savings methodology and coincident factors. For continuous fan usage, the average demand savings were calculated to be 0.4128 kW winter on-peak and 0.6955 kW summer on-peak. The coincident peak demand savings were calculated to be 0.4553 kW winter on-peak and 1.5900 kW summer on-peak. For non-continuous fan usage, the average demand savings were calculated to be 0.0459 kW winter on-peak and 0.0772 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0415 kW winter on-peak and 0.1450 kW summer on-peak. For continuous fan usage (change in behaviour), the average demand savings were calculated to be 0.0302 kW winter on-peak and 0.0508 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0333 kW winter on-peak and 0.1162 kW summer on-peak.

<table>
<thead>
<tr>
<th>Other Resource Savings</th>
<th>(Continuous Fan Usage – same behaviour)</th>
<th>-66.8 m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>30.6 m³</td>
<td></td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
<td>103.5 m³</td>
<td></td>
</tr>
</tbody>
</table>

---

4 Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.
The Canadian Center for Housing Technologies\(^5\) study determined that a gas furnace used for heating and cooling equipped with an ECM motor with continuous fan usage (same usage as before) results in an increase in natural gas consumption of 66.8 m\(^3\) for an existing home and a saving of 30.6 m\(^3\) for non-continuous fan usage. For those individuals who switched from non-continuous fan usage to continuous fan usage, the net natural gas saving with an ECM is 103.5 m\(^3\).

Assumptions:
- 11% gas savings from switching from a mid-efficiency furnace to a high-efficiency furnace\(^6\)
  - Average home with 80% AFUE consumes 1750 m\(^3\) in natural gas during heating season\(^7\)
- Average high-efficiency furnace penetration rate in Ontario being 75% (Assumed)
  - 2006 Hot Savings increased HE penetration rate by 25%
  - 2007 Cool Savings increased HE penetration by 15% (since 10% of consumers purchased mid-efficiency furnace and 90% of choosing high-efficiency)

### Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th>Measure</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
<th>hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>522</td>
<td>783</td>
<td>1623</td>
<td>1305</td>
<td>1626</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.5%</td>
<td>8.5%</td>
<td>23.3%</td>
<td>12.5%</td>
<td>10.9%</td>
<td>24.1%</td>
<td>4.4%</td>
<td>7.8%</td>
<td>%</td>
</tr>
</tbody>
</table>

### Continuous Fan Usage (same behaviour)

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>248.50</th>
<th>248.76</th>
<th>680.08</th>
<th>363.08</th>
<th>316.60</th>
<th>703.78</th>
<th>11.58</th>
<th>20.82</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.4128</td>
<td>0.3616</td>
<td>0.4214</td>
<td>0.6955</td>
<td>0.4043</td>
<td>0.4336</td>
<td>0.0089</td>
<td>0.0128</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.4553</td>
<td>1.5900</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

### Non-Continuous Fan Usage

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>22.67</th>
<th>22.69</th>
<th>62.04</th>
<th>33.12</th>
<th>28.88</th>
<th>64.20</th>
<th>11.58</th>
<th>20.82</th>
<th>kWh</th>
</tr>
</thead>
</table>

---


\(^7\) Canadian Center for Housing Technologies, The Effects of Thermostat Set-back and Set-up on Seasonal Energy Consumption, Surface Temperatures and Recovery Times at the CCHT Twin House Facility, March 2007 (http://irc.nrc-cnrc.gc.ca/pubs/fulltext/nrcc48361/nrcc48361.pdf)
### Continuous Fan Usage (change in behaviour)

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>-3.35</th>
<th>-3.36</th>
<th>-9.18</th>
<th>-4.90</th>
<th>-4.27</th>
<th>-9.50</th>
<th>11.58</th>
<th>20.82</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>-0.0056</td>
<td>-0.0049</td>
<td>-0.0057</td>
<td>-0.0094</td>
<td>-0.0055</td>
<td>-0.0059</td>
<td>0.0089</td>
<td>0.0128</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>-0.0061</td>
<td>-0.0215</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

**Description / References:**
The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Furnace Fan load shape and the OPA’s average peak demand savings methodology and coincident factors.\(^8\)

**Other Input Assumptions**

<table>
<thead>
<tr>
<th>Effective Useful Life</th>
<th>15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on the June 2007 study for New England State Program Working Group (SPWG) by GDS Associates, Inc. (^9)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incremental Cost (Cust. / Contr. Install)</th>
<th>960 $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on results from HCSP Contractor and Participant Survey.</td>
<td></td>
</tr>
</tbody>
</table>

---

\(^8\) Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.

### Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Fan Use = 3455</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>$400-$600</td>
</tr>
<tr>
<td>Non-Continuous Fan Use = 465</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>$400-$600</td>
</tr>
</tbody>
</table>

**Comments:**
Based on 2001/2002 study of 31 new gas furnaces (average 94% AFUE) with average annual gas usage of 800 therms, a 2.5-ton air conditioner with airflow of 1,000 cfm and 400 hours of operation per year, using Madison Wisconsin weather data (about 7,600 heating degree days/year)\(^{11}\).  

---

\(^{10}\) Energy Centre Wisconsin, Electricity Use by New Furnaces, Prepared for State of Wisconsin Department of Administration Division of Energy, October 2004, [http://www.doa.state.wi.us/docs_view2.asp?docid=1812](http://www.doa.state.wi.us/docs_view2.asp?docid=1812)

\(^{11}\) ibid
FURNACE EQUIPPED WITH AN ELECTRONICALLY COMMUTATED MOTOR (ECM) – (Gas Heating New Homes)

<table>
<thead>
<tr>
<th>Efficient Equipment and Technologies Description</th>
<th>Gas furnace with an ECM Motor in a new home (heating only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Equipment and Technologies Description</td>
<td>Gas furnace with a permanent split capacitor (PSC) motor in a new home (heating only)</td>
</tr>
</tbody>
</table>

Codes, Standards, and Regulations

- Under Ontario's building code, all gas furnaces installed in new residential constructions must meet a minimum condensing efficiency level effective January 1, 2007.\(^1\)
- Presently, there is no minimum energy performance standard restricting the electricity consumption of furnace fan blowers.
- NRCan proposes to increase the minimum performance level, the Annual Fuel Utilization Efficiency (AFUE), for gas-fired furnaces with an input rate not exceeding 65.92 kW (225 000 Btu/h) to 90% for December 31, 2009.\(^2\)

<table>
<thead>
<tr>
<th>Decision Type</th>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement</td>
<td>OPA Res Furnace Fan</td>
</tr>
</tbody>
</table>

Resource Savings Assumptions

<table>
<thead>
<tr>
<th>Annual Electricity Savings</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage – same behaviour)</td>
<td>1403</td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>207</td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
<td>91</td>
</tr>
</tbody>
</table>

Continuous fan usage and non-continuous fan usage is estimated to be 26% and 69%, respectively, based on customer survey results. An additional 5% of customers were determined to have switched from non-continuous to continuous fan usage as a result of the ECM motor.

A study conducted by the Canadian Center for Housing Technologies\(^3\) determined that the annual electricity savings of a new home using a gas furnace with an ECM motor for heating only is 1,572 kWh for continuous fan use and 207 kWh for non-continuous fan use. NCI agrees with the CCHT’s electricity savings for continuous fan usage during summer and winter season, however is hesitant to accept the savings during the shoulder season since it is unlikely that a furnace fan is running continuously during the non-heating and

---


cooling months. Therefore, for the shoulder season for continuous fan usage, NCI is using the same electricity savings resulting from a non-continuous fan, resulting in a saving of 1,403 kWh. For individuals who have switched from non-continuous fan usage to continuous fan usage as a result of installing a furnace with an ECM, a net electricity saving of 91 kWh is expected based on the increase in electricity from usage (1,312 kWh) and the savings resultant from the ECM (1,403 kWh).

### Average Demand Savings

| (Continuous Fan Usage – same behaviour) | Winter On-Peak | 0.2221 kW |
| (Non-Continuous Fan Usage) | Summer On-Peak | 0.3743 kW |
|                                 | Winter On-Peak | 0.0293 kW |
|                                 | Summer On-Peak | 0.0494 kW |

### Coincident Peak Demand Savings

| (Continuous Fan Usage – change in behaviour) | Winter On-Peak | 0.0106 kW |
| (Continuous Fan Usage) | Summer On-Peak | 0.0179 kW |
| (Non-Continuous Fan Usage) | Winter On-Peak | 0.0293 kW |
|                                 | Summer On-Peak | 0.0494 kW |
| (Continuous Fan Usage – change in behaviour) | Winter On-Peak | 0.0117 kW |
|                                 | Summer On-Peak | 0.0409 kW |

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Furnace Fan) and the OPA's average peak demand savings methodology and coincident factors\(^4\). For continuous fan usage, the average demand savings were calculated to be 0.2221 kW winter on-peak and 0.3743 kW summer on-peak. The coincident peak demand savings were calculated to be 0.2450 kW winter on-peak and 0.8555 kW summer on-peak. For non-continuous fan usage, the average demand savings were calculated to be 0.0293 kW winter on-peak and 0.0494 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0323 kW winter on-peak and 0.1129 kW summer on-peak. For continuous fan usage (change in behaviour), the average demand savings were calculated to be 0.0106 kW winter on-peak and 0.0179 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0117 kW winter on-peak and 0.0409 kW summer on-peak.

### Other Resource Savings

| (Continuous Fan Usage – same behaviour) | -66.8 m³ |
| (Non-Continuous Fan Usage) | 30.6 m³ |
| (Continuous Fan Usage – change in behaviour) | 103.5 m³ |

The Canadian Center for Housing Technologies\(^5\) study determined that a gas furnace used for heating and cooling equipped with an ECM motor with continuous fan usage (same usage as before) results in an increase in natural gas consumption of 66.8 m³ for an existing home and a saving of 30.6 m³ for non-continuous fan usage. For those individuals who switched from non-continuous fan usage to continuous fan usage, the net natural gas savings with an ECM is 103.5 m³.

---

\(^4\) Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.

Assumptions:
- 11% gas savings from switching from a mid-efficiency furnace to a high-efficiency furnace\(^6\)
  - Average home with 80% AFUE consumes 1750 m\(^3\) in natural gas during heating season\(^7\)
- Average high-efficiency furnace penetration rate in Ontario being 75% (Assumed)
  - 2006 Hot Savings increased HE penetration rate by 25%
  - 2007 Cool Savings increased HE penetration by 15% (since 10% of consumers purchased mid-efficiency furnace and 90% of choosing high-efficiency)

### Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th>Measure</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>522</td>
<td>783</td>
<td>1623</td>
<td>1305</td>
<td>1626</td>
</tr>
<tr>
<td></td>
<td>8.5%</td>
<td>8.5%</td>
<td>23.3%</td>
<td>12.5%</td>
<td>10.9%</td>
<td>24.1%</td>
<td>4.4%</td>
<td>7.8%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Continuous Fan Usage (same behaviour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Savings</td>
</tr>
<tr>
<td>Average Demand Savings</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-Continuous Fan Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Savings</td>
</tr>
<tr>
<td>Average Demand Savings</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
</tr>
</tbody>
</table>

---


\(^7\) Canadian Center for Housing Technologies, The Effects of Thermostat Set-back and Set-up on Seasonal Energy Consumption, Surface Temperatures and Recovery Times at the CCHT Twin House Facility, March 2007 (http://irc.nrc-cnrc.gc.ca/pubs/fulltext/nrcc48361/nrcc48361.pdf)
Continuous Fan Usage (change in behaviour)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.0106</td>
<td>0.0093</td>
<td>0.0108</td>
<td>0.0179</td>
<td>0.0104</td>
<td>0.0111</td>
<td>0.0069</td>
<td>0.0100</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0117</td>
<td>0.0409</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

Description / References:

The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Furnace Fan load shape and the OPA’s average peak demand savings methodology and coincident factors.8

Other Input Assumptions

<table>
<thead>
<tr>
<th>Effective Useful Life</th>
<th>15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on the June 2007 study for New England State Program Working Group (SPWG) by GDS Associates, Inc.9</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incremental Cost (Cust. / Contr. Install)</th>
<th>960 $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on results from HCSP Contractor and Participant Survey.</td>
<td></td>
</tr>
</tbody>
</table>

---

8 Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.

Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Winter (kW)</td>
<td>Summer (kW)</td>
<td></td>
</tr>
<tr>
<td>State of Wisconsin Department of Administration Division of Energy</td>
<td>Continuous Fan Use = 3455</td>
<td>N/A</td>
<td>N/A</td>
<td>$400-$600</td>
</tr>
<tr>
<td></td>
<td>Non-Continuous Fan Use = 465</td>
<td>N/A</td>
<td>N/A</td>
<td>$400-$600</td>
</tr>
</tbody>
</table>

Comments:
Based on 2001/2002 study of 31 new furnaces (average 94% AFUE) with average annual gas usage of 800 therms, a 2.5-ton air conditioner with airflow of 1,000 cfm and 400 hours of operation per year, using Madison Wisconsin weather data (about 7,600 heating degree days/year). 

---


11 Ibid
FURNACE EQUIPPED WITH AN ELECTRONICALLY COMMUTATED MOTOR (ECM) – (Electric Heating and Cooling Existing Homes)

<table>
<thead>
<tr>
<th>Efficient Equipment and Technologies Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric furnace with an ECM Motor in an existing home using for both heating and cooling purposes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Base Equipment and Technologies Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric furnace with a permanent split capacitor (PSC) motor in an existing home using for both heating and cooling purposes.</td>
</tr>
</tbody>
</table>

**Codes, Standards, and Regulations**

- Presently, there is no minimum energy performance standard restricting the electricity consumption of furnace fan blowers.

<table>
<thead>
<tr>
<th>Decision Type</th>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement</td>
<td>OPA Res Furnace Fan</td>
</tr>
</tbody>
</table>

**Resource Savings Assumptions**

<table>
<thead>
<tr>
<th>Annual Electricity Savings</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage – same behaviour)</td>
<td>1449</td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>362</td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
<td>-955</td>
</tr>
</tbody>
</table>

Continuous fan usage and non-continuous fan usage is estimated to be 26% and 69%, respectively, based on customer survey results. An additional 5% of customers were determined to have switched from non-continuous to continuous fan usage as a result of the ECM motor.

A study conducted by the Canadian Center for Housing Technologies\(^1\) determined that the annual electricity savings of an existing home using a gas furnace with an ECM motor for heating and cooling is 2,808 kWh for continuous fan use and 372 kWh for non-continuous fan use.

Using this data for an electric furnace, the increase in gas consumption of 6.5% for existing homes (due to the decrease in heat being generated using an ECM motor)\(^2\) for continuous fan usage (0.9% for non-continuous fan usage) is assumed to be transferable for electrically powered furnaces, resulting in an overall savings of 1,600 kWh for continuous fan usage and 362 kWh for non-continuous fan usage. NCI agrees with the CCHT’s electricity savings for continuous fan usage during summer and winter season, however is...
hesitant to accept the savings during the shoulder season since it is unlikely that a furnace fan is running continuously during the non-heating and cooling months. Therefore, for the shoulder season for continuous fan usage, NCI is using the same electricity savings resulting from a non-continuous fan, resulting in a saving of 1,449 kWh. For individuals who have switched from non-continuous fan usage to continuous fan usage as a result of installing a furnace with an ECM, a net increase in electricity of 955 kWh is expected based on the increase in electricity from usage (2,404 kWh) and the savings resultant from the ECM (1,449 kWh).

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Furnace Fan) and the OPA's average peak demand savings methodology and coincident factors\(^3\). For continuous fan usage, the average demand savings were calculated to be 0.2265 kW winter on-peak and 0.3816 kW summer on-peak. The coincident peak demand savings were calculated to be 0.2498 kW winter on-peak and 0.8723 kW summer on-peak. For non-continuous fan usage, the average demand savings were calculated to be 0.0512 kW winter on-peak and 0.0086 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0565 kW winter on-peak and 0.0197 kW summer on-peak. For continuous fan usage (change in behaviour), the average demand savings were calculated to be -0.1611 kW winter on-peak and -0.2714 kW summer on-peak. The coincident peak demand savings were calculated to be -0.1776 kW winter on-peak and -0.6204 kW summer on-peak.

\(^3\) Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.
## Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th>Measure</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>522</td>
<td>783</td>
<td>1623</td>
<td>1305</td>
<td>1626</td>
</tr>
<tr>
<td></td>
<td>8.5%</td>
<td>8.5%</td>
<td>23.3%</td>
<td>12.5%</td>
<td>10.9%</td>
<td>24.1%</td>
<td>4.4%</td>
<td>7.8%</td>
</tr>
</tbody>
</table>

### Continuous Fan Usage (same behaviour)

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>136.33</th>
<th>136.47</th>
<th>373.11</th>
<th>199.19</th>
<th>173.69</th>
<th>386.11</th>
<th>15.74</th>
<th>28.30</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.2265</td>
<td>0.1984</td>
<td>0.2312</td>
<td>0.3816</td>
<td>0.2218</td>
<td>0.2379</td>
<td>0.0121</td>
<td>0.0174</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.2498</td>
<td></td>
<td>0.8723</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

### Non-Continuous Fan Usage

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>30.81</th>
<th>30.84</th>
<th>84.32</th>
<th>45.07</th>
<th>39.25</th>
<th>87.26</th>
<th>15.74</th>
<th>28.30</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.0512</td>
<td>0.0448</td>
<td>0.0522</td>
<td>0.0862</td>
<td>0.0501</td>
<td>0.0538</td>
<td>0.0121</td>
<td>0.0174</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0565</td>
<td></td>
<td>0.1971</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

### Continuous Fan Usage (change in behaviour)

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>-96.96</th>
<th>-97.06</th>
<th>-265.34</th>
<th>-141.66</th>
<th>-123.53</th>
<th>-274.59</th>
<th>15.74</th>
<th>28.30</th>
<th>kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>-0.1611</td>
<td>-0.1411</td>
<td>-0.1644</td>
<td>-0.2714</td>
<td>-0.1578</td>
<td>-0.1692</td>
<td>0.0121</td>
<td>0.0174</td>
<td>kW</td>
</tr>
</tbody>
</table>
### Coincident Peak Demand Savings

<table>
<thead>
<tr>
<th>Description / References:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Furnace Fan load shape and the OPA’s average peak demand savings methodology and coincident factors.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coincident Peak Demand Savings</th>
<th>kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.1776</td>
<td></td>
</tr>
<tr>
<td>-0.6204</td>
<td></td>
</tr>
</tbody>
</table>

### Other Input Assumptions

#### Effective Useful Life

<table>
<thead>
<tr>
<th>Source</th>
<th>15 years</th>
</tr>
</thead>
</table>

#### Incremental Cost (Cust. / Contr. Install)

<table>
<thead>
<tr>
<th>Incremental Cost (Cust. / Contr. Install)</th>
</tr>
</thead>
<tbody>
<tr>
<td>960 $</td>
</tr>
</tbody>
</table>

- Based on results from HCSP Contractor and Participant Survey.

### Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>Winter (kW)</td>
<td>Summer (kW)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State of Wisconsin</td>
<td>3455</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Department of Administration Division of Energy</td>
<td>Continuous Fan Use = 465</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Non-Continuous Fan Use = 465</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

#### Comments:

Based on 2001/2002 study of 31 new gas furnaces (average 94% AFUE) with average annual gas usage of 800 therms, a 2.5-ton air conditioner with airflow of 1,000 cfm and 400 hours of operation per year, using Madison Wisconsin weather data (about 7,600 heating degree days/year).

---

4 Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.


7 Ibid
FURNACE EQUIPPED WITH AN ELECTRONICALLY COMMUTATED MOTOR (ECM) – (Electric Heating Existing Homes)

### Efficient Equipment and Technologies Description
Electric furnace with an ECM Motor in an existing home for heating purposes only.

### Base Equipment and Technologies Description
Electric furnace with a permanent split capacitor (PSC) motor in an existing home for heating purposes only.

### Codes, Standards, and Regulations
- Presently, there is no minimum energy performance standard restricting the electricity consumption of furnace fan blowers.

<table>
<thead>
<tr>
<th>Decision Type</th>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement</td>
<td>OPA Res Furnace Fan</td>
</tr>
</tbody>
</table>

### Resource Savings Assumptions

<table>
<thead>
<tr>
<th>Annual Electricity Savings</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage – same behaviour)</td>
<td>807</td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>317</td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
<td>-354</td>
</tr>
</tbody>
</table>

Continuous fan usage and non-continuous fan usage is estimated to be 26% and 69%, respectively, based on customer survey results. An additional 5% of customers were determined to have switched from non-continuous to continuous fan usage as a result of the ECM motor.

A study conducted by the Canadian Center for Housing Technologies\(^1\) determined that the annual electricity savings of an existing home using a gas furnace with an ECM motor for heating only is 1,535 kWh for continuous fan use and 324 kWh for non-continuous fan use.

Using this data for an electric furnace, the increase in gas consumption of 6.5% for existing homes (due to the decrease in heat being generated using an ECM motor)\(^2\) for continuous fan usage (0.9% for non-continuous fan usage) is assumed to be transferable for electrically powered furnaces, resulting in an overall savings of 875 kWh for continuous fan usage and 317 kWh for non-continuous fan usage. NCI agrees with the CCHT’s electricity savings for continuous fan usage during summer and winter season, however is hesitant to accept the savings during the shoulder season since it is unlikely that a furnace fan is running.

---

\(^1\) The Canadian Center for Housing Technologies, “Final Report on the Effects of ECM Furnace Motors on Electricity and Gas Use: Results from the CCHT Research Facility and Projections” \(http://irc.nrrcnrc.gc.ca/pubs/fulltext/nrcc38500/nrcc38500.pdf\)

\(^2\) ibid
continuously during the non-heating and cooling months. Therefore, for the shoulder season for continuous fan usage, NCI is using the same electricity savings resulting from a non-continuous fan, resulting in a saving of 807 kWh. For individuals who have switched from non-continuous fan usage to continuous fan usage as a result of installing a furnace with an ECM, a net increase in electricity of 354 kWh is expected based on the increase in electricity from usage (1,161 kWh) and the savings resultant from the ECM (807 kWh).

<table>
<thead>
<tr>
<th>Average Demand Savings</th>
<th>Winter On-Peak</th>
<th>0.1238 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage – same behaviour)</td>
<td>Summer On-Peak</td>
<td>0.2086 kW</td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>Winter On-Peak</td>
<td>0.0448 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.0755 kW</td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
<td>Winter On-Peak</td>
<td>-0.0633 kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>Summer On-Peak</td>
<td>-0.1067 kW</td>
</tr>
<tr>
<td>(Continuous Fan Usage)</td>
<td>Winter On-Peak</td>
<td>0.1365 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.4769 kW</td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>Winter On-Peak</td>
<td>0.0495 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.1727 kW</td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
<td>Winter On-Peak</td>
<td>-0.0699 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>-0.2440 kW</td>
</tr>
</tbody>
</table>

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Furnace Fan) and the OPA’s average peak demand savings methodology and coincident factors\(^3\). For continuous fan usage, the average demand savings were calculated to be 0.1238 kW winter on-peak and 0.2086 kW summer on-peak. The coincident peak demand savings were calculated to be 0.1365 kW winter on-peak and 0.4769 kW summer on-peak. For non-continuous fan usage, the average demand savings were calculated to be 0.0448 kW winter on-peak and 0.0755 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0495 kW winter on-peak and 0.1727 kW summer on-peak. For continuous fan usage (change in behaviour), the average demand savings were calculated to be -0.0633 kW winter on-peak and -0.1067 kW summer on-peak. The coincident peak demand savings were calculated to be -0.0699 kW winter on-peak and -0.2440 kW summer on-peak.

<table>
<thead>
<tr>
<th>Other Resource Savings</th>
<th>(Continuous Fan Usage – same behaviour)</th>
<th>0 m(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>0 m(^3)</td>
<td></td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
<td>0 m(^3)</td>
<td></td>
</tr>
</tbody>
</table>

\(^3\) Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.
# Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th>Measure</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
<th>hrs</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>522</td>
<td>783</td>
<td>1623</td>
<td>1305</td>
<td>1626</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.5%</td>
<td>8.5%</td>
<td>23.3%</td>
<td>12.5%</td>
<td>10.9%</td>
<td>24.1%</td>
<td>4.4%</td>
<td>7.8%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Continuous Fan Usage

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>74.53</th>
<th>74.60</th>
<th>203.96</th>
<th>108.89</th>
<th>94.95</th>
<th>211.07</th>
<th>13.78</th>
<th>24.79</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.1238</td>
<td>0.1084</td>
<td>0.1264</td>
<td>0.2086</td>
<td>0.1213</td>
<td>0.1300</td>
<td>0.0106</td>
<td>0.0153</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.1365</td>
<td></td>
<td>0.4769</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

## Non-Continuous Fan Usage

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>26.99</th>
<th>27.02</th>
<th>73.86</th>
<th>39.43</th>
<th>34.39</th>
<th>76.44</th>
<th>13.78</th>
<th>24.79</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.0448</td>
<td>0.0393</td>
<td>0.0458</td>
<td>0.0755</td>
<td>0.0439</td>
<td>0.0471</td>
<td>0.0106</td>
<td>0.0153</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0495</td>
<td></td>
<td>0.1727</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

## Non-Continuous Fan Usage

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>-0.0633</td>
<td>-0.0555</td>
<td>-0.0647</td>
<td>-0.1067</td>
<td>-0.0620</td>
<td>-0.0665</td>
<td>0.0106</td>
<td>0.0153</td>
<td>kWh</td>
</tr>
</tbody>
</table>
Coincident Peak Demand Savings

<table>
<thead>
<tr>
<th>Description / References:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Furnace Fan load shape and the OPA's average peak demand savings methodology and coincident factors.</td>
</tr>
</tbody>
</table>

### Other Input Assumptions

<table>
<thead>
<tr>
<th>Effective Useful Life</th>
<th>15 years</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Incremental Cost (Cust. / Contr. Install)</th>
<th>960 $</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Based on results from HCSP Contractor and Participant Survey.</td>
<td></td>
</tr>
</tbody>
</table>

### Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sate of Wisconsin Department of Administration Division of Energy</td>
<td>Continuous Fan Use = 3455</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Non-Continuous Fan Use = 465</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Comments:**

Based on 2001/2002 study of 31 new gas furnaces (average 94% AFUE) with average annual gas usage of 800 therms, a 2.5-ton air conditioner with airflow of 1,000 cfm and 400 hours of operation per year, using Madison Wisconsin weather data (about 7,600 heating degree days/year).

---

4 Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.


7 [ibid](http://www.doa.state.wi.us/docs_view2.asp?docid=1812)
FURNACE EQUIPPED WITH AN ELECTRONICALLY COMMUTATED MOTOR (ECM) – (Electric Heating and Cooling New Homes)

<table>
<thead>
<tr>
<th>Efficient Equipment and Technologies Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric furnace with an ECM Motor in a new home used for both heating and cooling purposes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Base Equipment and Technologies Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric furnace with a permanent split capacitor (PSC) motor in a new home used for both heating and cooling purposes.</td>
</tr>
</tbody>
</table>

Codes, Standards, and Regulations

- Presently, there is no minimum energy performance standard restricting the electricity consumption of furnace fan blowers.

<table>
<thead>
<tr>
<th>Decision Type</th>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement</td>
<td>OPA Res Furnace Fan</td>
</tr>
</tbody>
</table>

Resource Savings Assumptions

<table>
<thead>
<tr>
<th>Annual Electricity Savings</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage – same behaviour)</td>
<td>1396</td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>257</td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
<td>-1176</td>
</tr>
</tbody>
</table>

Continuous fan usage and non-continuous fan usage is estimated to be 26% and 69%, respectively, based on customer survey results. An additional 5% of customers were determined to have switched from non-continuous to continuous fan usage as a result of the ECM motor.

A study conducted by the Canadian Center for Housing Technologies\(^1\) determined that the annual electricity savings of a new home using a gas furnace with an ECM motor for heating and cooling is 2,916 kWh for continuous fan use and 266 kWh for non-continuous fan use.

Using this data for an electric furnace, the increase in gas consumption of 9.4% for new homes (due to the decrease in heat being generated using an ECM motor)\(^2\) for continuous fan usage (0.9% for non-continuous fan usage) is assumed to be transferable for electrically powered furnaces, resulting in an overall savings of 1,554 kWh for continuous fan usage and 257 kWh for non-continuous fan usage. NCI agrees with the

---


\(^2\) ibid
CCHT’s electricity savings for continuous fan usage during summer and winter season, however is hesitant to accept the savings during the shoulder season since it is unlikely that a furnace fan is running continuously during the non-heating and cooling months. Therefore, for the shoulder season for continuous fan usage, NCI is using the same electricity savings resulting from a non-continuous fan, resulting in a saving of 1,396 kWh. For individuals who have switched from non-continuous fan usage to continuous fan usage as a result of installing a furnace with an ECM, a net increase in electricity of 1176 kWh is expected based on the increase in electricity from usage (2,572 kWh) and the savings resultant from the ECM (1,396 kWh).

<table>
<thead>
<tr>
<th>Average Demand Savings</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(Continuous Fan Usage)</strong></td>
<td><strong>Winter On-Peak</strong></td>
</tr>
<tr>
<td><strong>(Non-Continuous Fan Usage)</strong></td>
<td><strong>Summer On-Peak</strong></td>
</tr>
<tr>
<td><strong>Winter On-Peak</strong></td>
<td>0.0364 kW</td>
</tr>
<tr>
<td><strong>Summer On-Peak</strong></td>
<td>0.0613 kW</td>
</tr>
<tr>
<td><strong>(Continuous Fan Usage – change in behaviour)</strong></td>
<td><strong>Winter On-Peak</strong></td>
</tr>
<tr>
<td><strong>Summer On-Peak</strong></td>
<td>-0.3280 kW</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coincident Peak Demand Savings</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(Continuous Fan Usage – same behaviour)</strong></td>
<td><strong>Winter On-Peak</strong></td>
</tr>
<tr>
<td><strong>Summer On-Peak</strong></td>
<td>0.8474 kW</td>
</tr>
<tr>
<td><strong>(Non-Continuous Fan Usage)</strong></td>
<td><strong>Winter On-Peak</strong></td>
</tr>
<tr>
<td><strong>Summer On-Peak</strong></td>
<td>0.1402 kW</td>
</tr>
<tr>
<td><strong>(Continuous Fan Usage – change in behaviour)</strong></td>
<td><strong>Winter On-Peak</strong></td>
</tr>
<tr>
<td><strong>Summer On-Peak</strong></td>
<td>-0.7498 kW</td>
</tr>
</tbody>
</table>

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Furnace Fan) and the OPA’s average peak demand savings methodology and coincident factors. For continuous fan usage, the average demand savings were calculated to be 0.3604 kW winter on-peak and 0.6072 kW summer on-peak. The coincident peak demand savings were calculated to be 0.3604 kW winter on-peak and 0.8474 kW summer on-peak. For non-continuous fan usage, the average demand savings were calculated to be 0.0364 kW winter on-peak and 0.0613 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0401 kW winter on-peak and 0.1402 kW summer on-peak. For continuous fan usage (change in behaviour), the average demand savings were calculated to be -0.1946 kW winter on-peak and -0.3280 kW summer on-peak. The coincident peak demand savings were calculated to be -0.2147 kW winter on-peak and -0.7498 kW summer on-peak.

<table>
<thead>
<tr>
<th>Other Resource Savings</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(Continuous Fan Usage – same behaviour)</strong></td>
<td>0 m³</td>
</tr>
<tr>
<td><strong>(Non-Continuous Fan Usage)</strong></td>
<td>0 m³</td>
</tr>
<tr>
<td><strong>(Non-Continuous Fan Usage – change in behaviour)</strong></td>
<td>0 m³</td>
</tr>
</tbody>
</table>

---

3 Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.
## Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th>Measure</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
<th>hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>522</td>
<td>783</td>
<td>1623</td>
<td>1305</td>
<td>1626</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.5%</td>
<td>8.5%</td>
<td>23.3%</td>
<td>12.5%</td>
<td>10.9%</td>
<td>24.1%</td>
<td>4.4%</td>
<td>7.8%</td>
<td>%</td>
</tr>
</tbody>
</table>

### Continuous Fan Usage (same behaviour)

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>132.44</td>
<td>132.58</td>
<td>362.47</td>
<td>193.51</td>
<td>168.74</td>
<td>375.10</td>
<td>11.19</td>
<td>20.13</td>
<td></td>
</tr>
<tr>
<td>Average Demand Savings</td>
<td>0.2200</td>
<td>0.1927</td>
<td>0.2246</td>
<td>0.3707</td>
<td>0.2155</td>
<td>0.2311</td>
<td>0.0086</td>
<td>0.0124</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.2427</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

### Non-Continuous Fan Usage

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>21.91</td>
<td>21.94</td>
<td>59.97</td>
<td>32.02</td>
<td>27.92</td>
<td>62.06</td>
<td>11.19</td>
<td>20.13</td>
<td></td>
</tr>
<tr>
<td>Average Demand Savings</td>
<td>0.0364</td>
<td>0.0319</td>
<td>0.0372</td>
<td>0.0613</td>
<td>0.0357</td>
<td>0.0382</td>
<td>0.0086</td>
<td>0.0124</td>
<td>kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0401</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kW</td>
</tr>
</tbody>
</table>

### Continuous Fan Usage (change in behaviour)

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-117.18</td>
<td>-117.30</td>
<td>-320.69</td>
<td>-171.21</td>
<td>-149.29</td>
<td>-331.86</td>
<td>11.19</td>
<td>20.13</td>
<td></td>
</tr>
<tr>
<td>Average Demand Savings</td>
<td>-0.1946</td>
<td>-0.1705</td>
<td>-0.1987</td>
<td>-0.3280</td>
<td>-0.1907</td>
<td>-0.2045</td>
<td>0.086</td>
<td>0.0124</td>
<td>kW</td>
</tr>
</tbody>
</table>
Coincident Peak Demand Savings

|          | -0.2147 |          | -0.7498 |          | kW       |

Description / References:
The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Furnace Fan load shape and the OPA’s average peak demand savings methodology and coincident factors.

Other Input Assumptions

<table>
<thead>
<tr>
<th>Effective Useful Life</th>
<th>15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on the June 2007 study for New England State Program Working Group (SPWG) by GDS Associates, Inc. 5</td>
<td></td>
</tr>
</tbody>
</table>

Incremental Cost (Cust. / Contr. Install) 960 $

Based on results from HCSP Contractor and Participant Survey.

Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Winter (kW)</td>
<td>Summer (kW)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| State of Wisconsin Department of Administration Division of Energy 6 |
| Continuous Fan Use = 3455 | N/A | N/A | N/A | $400-$600 |
| Non-Continuous Fan Use = 465 | N/A | N/A | N/A | $400-$600 |

Comments:
Based on 2001/2002 study of 31 new gas furnaces (average 94% AFUE) with average annual gas usage of 800 therms, a 2.5-ton air conditioner with airflow of 1,000 cfm and 400 hours of operation per year, using Madison Wisconsin weather data (about 7,600 heating degree days/year) 7.

---

4 Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.
7 Ibid
FURNACE EQUIPPED WITH AN ELECTRONICALLY COMMUTATED MOTOR (ECM) – (Electric Heating New Homes)

**Efficient Equipment and Technologies Description**
Electric furnace with an ECM Motor in a new home for heating purposes only.

**Base Equipment and Technologies Description**
Electric furnace with a permanent split capacitor (PSC) motor in a new home for heating purposes only.

**Codes, Standards, and Regulations**
- Presently, there is no minimum energy performance standard restricting the electricity consumption of furnace fan blowers.

**Decision Type** | **Load Type**
--- | ---
Replacement | OPA Res Furnace Fan

**Resource Savings Assumptions**

<table>
<thead>
<tr>
<th>Annual Electricity Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage – same behaviour)</td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
</tr>
</tbody>
</table>

Continuous fan usage and non-continuous fan usage is estimated to be 26% and 69%, respectively, based on customer survey results. An additional 5% of customers were determined to have switched from non-continuous to continuous fan usage as a result of the ECM motor.

A study conducted by the Canadian Center for Housing Technologies\(^1\) determined that the annual electricity savings of a new home using a gas furnace with an ECM motor for heating only is 1,596 kWh for continuous fan use and 207 kWh for non-continuous fan use.

Using this data for an electric furnace, the increase in gas consumption of 9.4% for new homes (due to the decrease in heat being generated using an ECM motor)\(^2\) for continuous fan usage (0.9% for non-continuous fan usage) is assumed to be transferable for electrically powered furnaces, resulting in an overall savings of 1,554 kWh for continuous fan usage and 257 kWh for non-continuous fan usage. NCI agrees with the CCHT's electricity savings for continuous fan usage during summer and winter season, however is hesitant to accept the savings during the shoulder season since it is unlikely that a furnace fan is running.

---


\(^2\) ibid
continuously during the non-heating and cooling months. Therefore, for the shoulder season for continuous fan usage, NCI is using the same electricity savings resulting from a non-continuous fan, resulting in a saving of 768 kWh. For individuals who have switched from non-continuous fan usage to continuous fan usage as a result of installing a furnace with an ECM, a net increase in electricity of 544 kWh is expected based on the increase in electricity from usage (1,312 kWh) and the savings resultant from the ECM (768 kWh).

<table>
<thead>
<tr>
<th>Average Demand Savings</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage- same behaviour)</td>
<td>Winter On-Peak</td>
<td>0.1198 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.2019 kW</td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>Winter On-Peak</td>
<td>0.0286 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.0483 kW</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coincident Peak Demand Savings</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage - same behaviour)</td>
<td>Winter On-Peak</td>
<td>0.1322 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.4616 kW</td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>Winter On-Peak</td>
<td>0.0316 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.1103 kW</td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
<td>Winter On-Peak</td>
<td>-0.1011 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>-0.3531 kW</td>
</tr>
</tbody>
</table>

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Furnace Fan) and the OPA’s average peak demand savings methodology and coincident factors. For continuous fan usage, the average demand savings were calculated to be 0.1953 kW winter on-peak and 0.3291 kW summer on-peak. The coincident peak demand savings were calculated to be 0.2155 kW winter on-peak and 0.7524 kW summer on-peak. For non-continuous fan usage, the average demand savings were calculated to be 0.0483 kW winter on-peak and 0.0483 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0316 kW winter on-peak and 0.1103 kW summer on-peak. For continuous fan usage (change in behaviour), the average demand savings were calculated to be -0.0917 kW winter on-peak and -0.1545 kW summer on-peak. The coincident peak demand savings were calculated to be -0.1011 kW winter on-peak and -0.3531 kW summer on-peak.

<table>
<thead>
<tr>
<th>Other Resource Savings</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continuous Fan Usage – same behaviour)</td>
<td>0 m³</td>
<td></td>
</tr>
<tr>
<td>(Non-Continuous Fan Usage)</td>
<td>0 m³</td>
<td></td>
</tr>
<tr>
<td>(Continuous Fan Usage – change in behaviour)</td>
<td>0 m³</td>
<td></td>
</tr>
</tbody>
</table>

---

3 Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.
## Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th>Measure</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>522</td>
<td>783</td>
<td>1623</td>
<td>1305</td>
<td>1626</td>
</tr>
<tr>
<td></td>
<td>8.5%</td>
<td>8.5%</td>
<td>23.3%</td>
<td>12.5%</td>
<td>10.9%</td>
<td>24.1%</td>
<td>4.4%</td>
<td>7.8%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Continuous Fan Usage (same behaviour)

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>72.13</th>
<th>72.21</th>
<th>197.41</th>
<th>105.39</th>
<th>91.90</th>
<th>204.29</th>
<th>8.81</th>
<th>15.84</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.1198</td>
<td>0.1050</td>
<td>0.1223</td>
<td>0.2019</td>
<td>0.1174</td>
<td>0.1259</td>
<td>0.0067</td>
<td>0.0098</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.1322</td>
<td></td>
<td>0.4616</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Non-Continuous Fan Usage

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>17.24</th>
<th>17.26</th>
<th>47.19</th>
<th>25.19</th>
<th>21.97</th>
<th>48.84</th>
<th>8.81</th>
<th>15.84</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>0.0286</td>
<td>0.0251</td>
<td>0.0292</td>
<td>0.0483</td>
<td>0.0281</td>
<td>0.0301</td>
<td>0.0067</td>
<td>0.0098</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0316</td>
<td></td>
<td>0.1103</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Continuous Fan Usage (change in behaviour)

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>-55.19</th>
<th>-55.24</th>
<th>-151.03</th>
<th>-80.63</th>
<th>-70.31</th>
<th>-156.30</th>
<th>8.81</th>
<th>15.84</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Demand Savings</td>
<td>-0.0917</td>
<td>-0.0803</td>
<td>-0.0936</td>
<td>-0.1545</td>
<td>-0.0898</td>
<td>-0.0963</td>
<td>0.0067</td>
<td>0.098</td>
</tr>
</tbody>
</table>
Coincident Peak Demand Savings

<table>
<thead>
<tr>
<th>Description / References:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Furnace Fan load shape and the OPA’s average peak demand savings methodology and coincident factors⁴.</td>
</tr>
</tbody>
</table>

Other Input Assumptions

<table>
<thead>
<tr>
<th>Effective Useful Life</th>
<th>15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on the June 2007 study for New England State Program Working Group (SPWG) by GDS Associates, Inc.⁵</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incremental Cost (Cust. / Contr. Install)</th>
<th>960 $</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Based on results from HCSP Contractor and Participant Survey.</td>
<td></td>
</tr>
</tbody>
</table>

Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Winter (kW)</td>
<td>Summer (kW)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sate of Wisconsin Department of Administration Division of Energy⁶</td>
<td>Continuous Fan Use = 3455</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Non-Continuous Fan Use = 465</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Comments:
Based on 2001/2002 study of 31 new gas furnaces (average 94% AFUE) with average annual gas usage of 800 therms, a 2.5-ton air conditioner with airflow of 1,000 cfm and 400 hours of operation per year, using Madison Wisconsin weather data (about 7,600 heating degree days/year)⁷.

---

⁴ Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.


⁷ ibid
PROGRAMMABLE THERMOSTATS (Space Cooling and Forced Air Electric)

<table>
<thead>
<tr>
<th>Efficient Equipment and Technologies Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programmable thermostat.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Base Equipment and Technologies Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-programmable thermostat.</td>
</tr>
</tbody>
</table>

Codes, Standards, and Regulations

For a programmable thermostat to receive Energy Star® qualification, it must meet specific criteria such as having at least two different programming periods (for weekday and weekend programming), at least four possible temperature settings and allow for temporary overriding by the user.

In Canada, applicable CSA standards can be found in CSA C828-99- CAN/CSA Performance Requirements for Thermostats used with Individual Room Electric Space Heating Devices.

<table>
<thead>
<tr>
<th>Decision Type</th>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement</td>
<td>OPA Res Space Cooling – Central</td>
</tr>
<tr>
<td></td>
<td>OPA Res Space Heating - SF</td>
</tr>
</tbody>
</table>
Resource Savings Assumptions

<table>
<thead>
<tr>
<th>Annual Electricity Savings</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(Space Cooling Only)</td>
<td>138 kWh</td>
<td></td>
</tr>
<tr>
<td>(Forced-Air Electric Heating Only)</td>
<td>2,063 kWh</td>
<td></td>
</tr>
</tbody>
</table>

A side-by-side housing study conducted by the Canadian Centre for Housing Technology determined seasonal energy savings for a residential unit from a programmable thermostat as follows:

### Gas Furnace*:

<table>
<thead>
<tr>
<th>Temp Set Back</th>
<th>Total Winter Furnace Electricity Consumption (kWh/year)</th>
<th>Seasonal Savings (%)</th>
<th>Total Winter Gas Consumption (MJ)</th>
<th>Seasonal Savings (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>none (22°C)</td>
<td>2314</td>
<td>----</td>
<td>66,131</td>
<td>----</td>
</tr>
<tr>
<td>18°C night-time set back</td>
<td>2295</td>
<td>0.8</td>
<td>61,854</td>
<td>6.5%</td>
</tr>
<tr>
<td>18°C night-time and daytime set back</td>
<td>2270</td>
<td>1.9</td>
<td>59,231</td>
<td>10%</td>
</tr>
<tr>
<td>16°C night-time and daytime set back</td>
<td>2261</td>
<td>2.3</td>
<td>57,241</td>
<td>13%</td>
</tr>
</tbody>
</table>

*Gas furnace = 80% AFUE using standard PCS motor and furnace size of 67,500 BTU/hr with 4761 heating degree hours (18C).

### CAC**:

<table>
<thead>
<tr>
<th>Temp Set Up</th>
<th>Total Summer Furnace and CAC Electricity Consumption (kWh)</th>
<th>Seasonal Savings (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None (22C)</td>
<td>3099</td>
<td>0%</td>
</tr>
<tr>
<td>25 C daytime set back</td>
<td>2767</td>
<td>11%</td>
</tr>
<tr>
<td>24 C daytime set back</td>
<td>2376</td>
<td>23%</td>
</tr>
</tbody>
</table>

** 12 SEER, 2 ton capacity CAC, 362 cooling degree days (18C)

- The OEB Measures and Assumptions Lists reports a value of 8.1% savings for programmable thermostat, a BC Hydro study reports savings between 10% and 15% for 4C set back during night and unoccupied periods, Energy Star® Calculator reports 3% saving per degree for heating season (8.25% for full set back).

- Using the Energy Star® Calculator results for full temperature set back during heating season of 8.25%, and a base electric furnace usage of 25,000 kWh/year, a saving of 2,063 kWh/year is expected for electric furnaces (25,000 x 8.25% = 2,063 kWh/year).

- Space cooling energy savings extrapolated for a calculated base CAC usage of 1257 kWh/year (based on sales mix indicating that 40% of programmable thermostats were installed on new Energy Star® CACs (mix of SEER 14 and SEER 15) and 60% on average standard CAC for Ontario (8.7 SEER) sized at 26,000 BTU). Using the CCHT study results, setting the thermostat 3 degrees higher would save 11%, resulting in 138 kWh/year based on an annual CAC usage of 1,257 kWh/year (1,257 x 11% = 138 kWh/year).

---

### Average Demand Savings

<table>
<thead>
<tr>
<th>Space Heating Only</th>
<th>Winter On-Peak</th>
<th>0.0000 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.0020 kW</td>
</tr>
<tr>
<td>Forced-Air Electric Heating Only</td>
<td>Winter On-Peak</td>
<td>0.5614 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.0000 kW</td>
</tr>
</tbody>
</table>

#### Coincident Peak Demand Savings

<table>
<thead>
<tr>
<th>Space Cooling Only</th>
<th>Winter On-Peak</th>
<th>0.0000 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.1513 kW</td>
</tr>
<tr>
<td>Forced-Air Electric Heating Only</td>
<td>Winter On-Peak</td>
<td>0.6085 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.0000 kW</td>
</tr>
</tbody>
</table>

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Space Cooling – central and OPA Res Space Heating - SF) and the OPA’s average peak demand savings methodology and coincident factors. For space cooling only, the average demand savings were calculated to be 0 kW winter on-peak and 0.0676 kW summer on-peak. The coincident peak demand savings were calculated to be 0 kW winter on-peak and 0.1513 kW summer on-peak. For electric heating only, the average demand savings were calculated to be 0.5614 kW winter on-peak and 0.0020 kW summer on-peak. The coincident peak demand savings were calculated to be 0.6085 kW winter on-peak and 0 kW summer on-peak.

### Other Resource Savings

<table>
<thead>
<tr>
<th>Resource #3</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource #3</td>
<td>Units</td>
</tr>
<tr>
<td>Resource #3</td>
<td>Units</td>
</tr>
</tbody>
</table>

---


## Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th></th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Space Cooling</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure</td>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>528</td>
<td>792</td>
<td>1608</td>
<td>1290</td>
<td>1638</td>
</tr>
<tr>
<td>Energy Savings</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>25.5%</td>
<td>21.8%</td>
<td>48.5%</td>
<td>1.5%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Average Demand Savings</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0676</td>
<td>0.0385</td>
<td>0.0413</td>
<td>0.0015</td>
<td>0.0024</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0000</td>
<td></td>
<td></td>
<td>0.1513</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Space Heating (Electric Forced-Air)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure</td>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>528</td>
<td>792</td>
<td>1608</td>
<td>1290</td>
<td>1638</td>
</tr>
<tr>
<td>Energy Savings</td>
<td>16.4%</td>
<td>17.1%</td>
<td>48.3%</td>
<td>0.1%</td>
<td>0.4%</td>
<td>1.0%</td>
<td>5.6%</td>
<td>11.2%</td>
</tr>
<tr>
<td>Average Demand Savings</td>
<td>337.95</td>
<td>352.10</td>
<td>995.96</td>
<td>1.04</td>
<td>7.72</td>
<td>19.62</td>
<td>116.22</td>
<td>231.88</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.5614</td>
<td>0.5118</td>
<td>0.6171</td>
<td>0.0020</td>
<td>0.0099</td>
<td>0.0121</td>
<td>0.0891</td>
<td>0.1429</td>
</tr>
</tbody>
</table>

**Description / References:**

The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Space Cooling – central, the OPA Res Space Heating - SF and the OPA’s average peak demand savings methodology and coincident factors.\(^7\)

---

\(^7\) Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.
Other Input Assumptions

<table>
<thead>
<tr>
<th>Effective Useful Life</th>
<th>15 years</th>
</tr>
</thead>
</table>
| Average lifetime of thermostat = 15 years

<table>
<thead>
<tr>
<th>Incremental Cost (Cust. / Contr. Install)</th>
<th>$140</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Based on results from HCSP Contractor and Participant Survey.</td>
<td></td>
</tr>
</tbody>
</table>

Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Winter (kW)</td>
<td>Summer (kW)</td>
<td></td>
</tr>
<tr>
<td>Cooling = 159</td>
<td>0</td>
<td>0.163</td>
<td>18</td>
<td>60</td>
</tr>
<tr>
<td>Heating = 1466</td>
<td>1.175</td>
<td>0</td>
<td>18</td>
<td>60</td>
</tr>
</tbody>
</table>

Comments:
OEB’s savings are based on programmable thermostats having 8.1% savings (based on Enbridge source) with base annual energy usage is 1,964 kWh/year (summer) and 18,103 kWh (winter).

---

8 US EPA (EPA Energy Star® Simple Savings Calculator – Programmable Thermostat),
http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorProgrammableThermostat.xls

PROGRAMMABLE THERMOSTATS (Space Cooling and Gas Forced Air Heating)

<table>
<thead>
<tr>
<th>Efficient Equipment and Technologies Description</th>
<th>Programmable thermostat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Equipment and Technologies Description</td>
<td>Non-programmable thermostat.</td>
</tr>
</tbody>
</table>

**Codes, Standards, and Regulations**

For a programmable thermostat to receive Energy Star® qualification, it must meet specific criteria such as having at least two different programming periods (for weekday and weekend programming), at least four possible temperature settings and allow for temporary overriding by the user.

In Canada, applicable CSA standards can be found in CSA C828-99- CAN/CSA Performance Requirements for Thermostats used with Individual Room Electric Space Heating Devices.

<table>
<thead>
<tr>
<th>Decision Type</th>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement</td>
<td>OPA Res Space Cooling – Central</td>
</tr>
<tr>
<td></td>
<td>OPA Res Furnace Fan</td>
</tr>
</tbody>
</table>
Resource Savings Assumptions

<table>
<thead>
<tr>
<th>Annual Electricity Savings</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(Space Cooling Only)</td>
<td>138 kWh</td>
</tr>
<tr>
<td>(Gas Heating Only -furnace fan)</td>
<td>44 kWh</td>
</tr>
</tbody>
</table>

A side-by-side housing study conducted by the Canadian Centre for Housing Technology\(^1\) determined seasonal energy savings for a residential unit from a programmable thermostat as follows:

**Gas Furnace\(^*\):**

<table>
<thead>
<tr>
<th>Temp Set Back</th>
<th>Total Winter Furnace Electricity Consumption (kWh/year)</th>
<th>Seasonal Savings (%)</th>
<th>Total Winter Gas Consumption (MJ)</th>
<th>Seasonal Savings (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>none (22'C)</td>
<td>2,314</td>
<td>----</td>
<td>66,131</td>
<td>----</td>
</tr>
<tr>
<td>18'C night-time set back</td>
<td>2,295</td>
<td>0.8</td>
<td>61,854</td>
<td>6.5%</td>
</tr>
<tr>
<td>18'C night-time and daytime set back</td>
<td>2,270</td>
<td>1.9</td>
<td>59,231</td>
<td>10%</td>
</tr>
<tr>
<td>16'C night-time and daytime set back</td>
<td>2,261</td>
<td>2.3</td>
<td>57,241</td>
<td>13%</td>
</tr>
</tbody>
</table>

\(^*\)Gas furnace = 80% AFUE using standard PCS motor and furnace size of 67,500 BTU/hr with 4761 heating degree hours (18'C).

**CAC\(^**\):**

<table>
<thead>
<tr>
<th>Temp Set Back</th>
<th>Total Summer Furnace and CAC Electricity Consumption (kWh)</th>
<th>Seasonal Savings (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None (22C)</td>
<td>3,099</td>
<td>0</td>
</tr>
<tr>
<td>25 C daytime set back</td>
<td>2,767</td>
<td>11</td>
</tr>
<tr>
<td>24 C daytime set back</td>
<td>2,376</td>
<td>23</td>
</tr>
</tbody>
</table>

\(^**\)12 SEER, 2 ton capacity CAC, 362 cooling degree days (18'C)

- The OEB Measures and Assumptions Lists\(^2\) reports a value of 8.1% savings for programmable thermostat, a BC Hydro study\(^3\) reports savings between 10% and 15% for 4C set back during night and unoccupied periods, Energy Star\(^®\) Calculator\(^4\) reports 3% saving per degree for heating season (8.25% for full set back). Using the CCHT study results from a full daytime and night-time set back of 4 degrees, approximately 44 kWh/year savings is expected for the winter season (2,314 – 2,270 = 44 kWh/year).

- Space cooling energy savings extrapolated for a calculated base CAC usage of 1257 kWh/year (based on sales mix indicating that 40% of programmable thermostats were installed on new Energy Star\(^®\) CACs (mix of SEER 14 and SEER 15) and 60% on average standard CAC for Ontario (8.7 SEER) sized at 26,000 BTU\(^5\)). Using the CCHT study results, setting the thermostat 3 degrees higher would save 11%, resulting in 138 kWh/year based on an annual CAC usage of 1,257 kWh/year (1,257 x 11% = 138 kWh/year).

---


### Average Demand Savings

<table>
<thead>
<tr>
<th></th>
<th>Winter On-Peak</th>
<th>Summer On-Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Cooling Only</td>
<td>0.0000 kW</td>
<td>0.0676 kW</td>
</tr>
<tr>
<td>Summer On-Peak</td>
<td>0.0062 kW</td>
<td>0.0105 kW</td>
</tr>
<tr>
<td>Gas Heating Only</td>
<td>Winter On-Peak</td>
<td>Summer On-Peak</td>
</tr>
<tr>
<td>furnace fan</td>
<td>0.0000 kW</td>
<td>0.0105 kW</td>
</tr>
<tr>
<td>Winter On-Peak</td>
<td>0.0062 kW</td>
<td>0.0105 kW</td>
</tr>
<tr>
<td>Gas Heating Only</td>
<td>Winter On-Peak</td>
<td>Summer On-Peak</td>
</tr>
<tr>
<td>furnace fan</td>
<td>0.0000 kW</td>
<td>0.0105 kW</td>
</tr>
</tbody>
</table>

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shapes (OPA Res Space Cooling – central and OPA Res Furnace Fan) and the OPA's average peak demand savings methodology and coincident factors\(^5\). For space cooling only, the average demand savings were calculated to be 0 kW winter on-peak and 0.0676 kW summer on-peak. The coincident peak demand savings were calculated to be 0 kW winter on-peak and 0.1513 kW summer on-peak. For gas heating only, the average demand savings were calculated to be 0.0062 kW winter on-peak and 0.0105 summer on-peak. The coincident peak demand savings were calculated to be 0.0069 kW winter on-peak and 0.0 kW summer on-peak.

### Other Resource Savings

<table>
<thead>
<tr>
<th></th>
<th>Natural Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource #3</td>
<td>182 m(^3)</td>
</tr>
</tbody>
</table>

Based on gas savings from the Canadian Centre for Housing Technology study (see above) for a 80% AFUE gas furnace using standard PCS motor and furnace size of 67,500 BTU/hr, using 4761 heating degree hours (18°C) \((6.2680 \times 10^7 - 5.6140 \times 10^7 = 6,900 \text{ MJ} = 182 \text{ m}^3)\).

---


\(^6\) Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.

### Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th></th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Space Cooling</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure</td>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>528</td>
<td>792</td>
<td>1608</td>
<td>1290</td>
<td>1638</td>
</tr>
<tr>
<td>Energy Savings</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>25.5%</td>
<td>21.8%</td>
<td>48.5%</td>
<td>1.5%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Average Demand Savings</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0676</td>
<td>0.0385</td>
<td>0.0413</td>
<td>0.0015</td>
<td>0.0024</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0000</td>
<td>0.1513</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Space Heating (Gas)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure</td>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>528</td>
<td>792</td>
<td>1608</td>
<td>1290</td>
<td>1638</td>
</tr>
<tr>
<td>Energy Savings</td>
<td>8.5%</td>
<td>8.5%</td>
<td>23.3%</td>
<td>12.5%</td>
<td>10.9%</td>
<td>24.1%</td>
<td>4.4%</td>
<td>7.8%</td>
</tr>
<tr>
<td>Average Demand Savings</td>
<td>3.75</td>
<td>3.95</td>
<td>10.26</td>
<td>5.48</td>
<td>4.78</td>
<td>10.62</td>
<td>1.92</td>
<td>3.44</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0062</td>
<td>0.0064</td>
<td>0.0105</td>
<td>0.0061</td>
<td>0.0065</td>
<td>0.0015</td>
<td>0.0021</td>
<td></td>
</tr>
</tbody>
</table>
| Description / References:  
The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Space Cooling – central, the OPA Res Space Heating - SF and the OPA's average peak demand savings methodology and coincident factors.  

---

8 Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.
Other Input Assumptions

<table>
<thead>
<tr>
<th>Effective Useful Life</th>
<th>15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average lifetime of thermostat = 15 years</td>
<td></td>
</tr>
</tbody>
</table>

Incremental Cost (Cust. / Contr. Install) | $140 $ |

- Based on results from HCSP Contractor and Participant Survey.

Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ontario Energy Board, Total Resource Cost Guide, October 2006</td>
<td>Cooling = 159</td>
<td>0</td>
<td>0.163</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Heating = 1,466</td>
<td>1.175</td>
<td>0</td>
<td>18</td>
</tr>
</tbody>
</table>

Comments:
OEB’s savings are based on programmable thermostats having 8.1% savings (based on Enbridge source) with base annual energy usage is 1,964 kWh/year (summer) and 18,103 kWh (winter).

---

9 US EPA (EPA Energy Star® Simple Savings Calculator – Programmable Thermostat),
http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorProgrammableThermostat.xls

CENTRAL AIR CONDITIONER TUNE-UP

Efficient Equipment and Technologies Description
Tune-up of central air conditioner

Base Equipment and Technologies Description
No tune-up on central air conditioner

Codes, Standards, and Regulations
Test Standard for permanently installed air-source air-conditioner and heat pumps = CAN/CSA-C656-05

<table>
<thead>
<tr>
<th>Decision Type</th>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>OPA Res Space Cooling - Central</td>
</tr>
</tbody>
</table>

Resource Savings Assumptions

<table>
<thead>
<tr>
<th>Annual Electricity Savings</th>
<th>254 kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Average Ontario CAC unit size in British thermal units per hour = 26,000 (based on air conditioning shipments data recorded by the HRAI Manufacturing Division)(^1)</td>
<td></td>
</tr>
<tr>
<td>• Full-load cooling hours = 500 (EPA Energy Star® Simple Savings Calculator(^2) – Toronto Weather - based on ARI Unitary Directory, August 1, 1992 - January 31, 1993(^3))</td>
<td></td>
</tr>
<tr>
<td>• Average SEER rating in Ontario homes = 8.7 SEER (based on data recorded by the HRAI Manufacturing Division)(^4)</td>
<td></td>
</tr>
<tr>
<td>• Estimated savings potentials from CAC tune up (charge/air flow correction) = 17%(^5)</td>
<td></td>
</tr>
<tr>
<td>• Estimated savings potentials from CAC Diagnostics and Repair = 11 to 13%(^6)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average Peak Demand Savings</th>
<th>Winter On-Peak</th>
<th>0.0000 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>Summer On-Peak</td>
<td>0.1241 kW</td>
</tr>
<tr>
<td></td>
<td>Winter On-Peak</td>
<td>0.0000 kW</td>
</tr>
<tr>
<td></td>
<td>Summer On-Peak</td>
<td>0.2778 kW</td>
</tr>
</tbody>
</table>

---

\(^1\) Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI), 2006 Cool Savings Rebate Program, Prepared for the Ontario Power Authority, April 2007.


\(^3\) Source: http://energyexperts.org/ac_calc/


\(^5\) Northeast Energy Efficiency Partnerships, Inc. (NEEP), Maryland Residential HVAC Tune-Up Initiative, http://www.neep.org/files/MD_AttachE_111700.PDF

The average demand savings and the coincident peak demand savings were calculated using the OPA end-use load shape (OPA Res Space cooling - central) and the OPA’s average peak demand savings methodology and coincident factors\(^7\). The average demand savings were calculated to be 0.0000 kW winter on-peak and 0.1241 kW summer on-peak. The coincident peak demand savings were calculated to be 0.0000 kW winter on-peak and 0.2778 kW summer on-peak.

<table>
<thead>
<tr>
<th>Other Resource</th>
<th>Resource #1</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Seasonal Energy Savings Pattern

<table>
<thead>
<tr>
<th>Measure</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Savings</td>
<td>602</td>
<td>688</td>
<td>1614</td>
<td>528</td>
<td>792</td>
<td>1608</td>
<td>1290</td>
<td>1638 hrs</td>
</tr>
<tr>
<td>%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>25.5%</td>
<td>21.8%</td>
<td>48.5%</td>
<td>1.5%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Energy Savings</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>64.76</td>
<td>55.38</td>
<td>123.15</td>
<td>3.70</td>
<td>7.04 kWh</td>
</tr>
<tr>
<td>Average Demand Savings</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.1241</td>
<td>0.0707</td>
<td>0.0759</td>
<td>0.0028</td>
<td>0.0043 kW</td>
</tr>
<tr>
<td>Coincident Peak Demand Savings</td>
<td>0.0000</td>
<td>0.2778</td>
<td>0.2778</td>
<td>kW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Description / References:**

The values given in this table were based on the calculated annual energy savings (see above), the OPA Res Space Cooling – central and the OPA’s average peak demand savings methodology and coincident factors\(^8\).

### Other Input Assumptions

**Effective Useful Life**

<table>
<thead>
<tr>
<th>5 years</th>
</tr>
</thead>
</table>
Based on the June 2007 study for New England State Program Working Group (SPWG) by GDS Associates, Inc.\(^9\)

**Incremental Cost (Cust. / Contr. Install)**

<table>
<thead>
<tr>
<th>115 $</th>
</tr>
</thead>
</table>
Based on results from HCSP Contractor and Participant Survey.

---

\(^7\) Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.

\(^8\) Ontario Power Authority, OPA Measures and Assumptions List, Appendix A: Average Peak Demand Savings Methodology and Coincident Factors, February 2008.

## Measure Assumptions Used by Other Jurisdictions

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual Electricity Savings (kWh)</th>
<th>On-Peak Demand Reduction</th>
<th>Effective Useful Life (yrs)</th>
<th>Incremental Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ontario Energy Board, Total Resource Cost Guide, October 2006&lt;sup&gt;10&lt;/sup&gt;</td>
<td>369</td>
<td>0</td>
<td>0.378</td>
<td>8</td>
</tr>
</tbody>
</table>

**Comments:**

Based on Maryland Residential HVAC Tune-Up Initiative – using 17% saving for charge/air flow correction based on 1999 ACEEE publication<sup>11</sup> (10 SEER)

---

<sup>10</sup> Ontario Energy Board (OEB), 2006, Total Resource Cost Guide.

APPENDIX B: HOT AND COOL SAVINGS
DETAILED CALCULATIONS

See following pages.
### Detailed Results

<table>
<thead>
<tr>
<th>Measure</th>
<th>Hot Savings: Energy Star CAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Annual Energy Savings</td>
<td>136.8 kWh/year</td>
</tr>
<tr>
<td>Estimated Winter Peak Energy Savings</td>
<td>0.0 kWh/year</td>
</tr>
<tr>
<td>Estimated Summer Peak Energy Savings</td>
<td>34.9 kWh/year</td>
</tr>
<tr>
<td>Natural Gas Savings</td>
<td>0.0 (m³/year)</td>
</tr>
<tr>
<td>Effective Useful Life</td>
<td>18 years</td>
</tr>
<tr>
<td>Average Incremental Cost</td>
<td>$567</td>
</tr>
<tr>
<td>Average Incentive</td>
<td>$500</td>
</tr>
<tr>
<td>Gross Units</td>
<td>5,864 units</td>
</tr>
<tr>
<td>Spillover</td>
<td>5%</td>
</tr>
<tr>
<td>Percentage Exclusions</td>
<td>0%</td>
</tr>
<tr>
<td>Free-Ridership</td>
<td>48%</td>
</tr>
<tr>
<td>Winter Peak Hours</td>
<td>602 hours/year</td>
</tr>
<tr>
<td>Summer Peak Hours</td>
<td>522 hours/year</td>
</tr>
</tbody>
</table>

### Average Peak Period Demand Savings

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter Peak Energy Savings / winter peak hours</td>
<td>0.000 kW/year</td>
</tr>
<tr>
<td>Summer Peak Energy Savings / summer peak hours</td>
<td>0.067 kW/year</td>
</tr>
</tbody>
</table>

### Coincident Winter/Summer Peak Demand Savings

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Winter Peak Energy Savings/winter peak hours) x OPA Coincidence Factor</td>
<td>0.000 kW/year</td>
</tr>
<tr>
<td>(Summer Peak Energy Savings/winter peak hours) x OPA Coincidence Factor</td>
<td>0.150 kW/year</td>
</tr>
</tbody>
</table>

### Gross Annual Energy Impact

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Energy Savings x Gross Units</td>
<td>0.8 GWh/year</td>
</tr>
</tbody>
</table>

### Gross Lifetime Energy Impact

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Energy Savings x Effective Useful Life</td>
<td>14.4 GWh</td>
</tr>
</tbody>
</table>

### Gross Annual Winter / Summer Peak Impact

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Winter Peak Energy Savings x Gross Units</td>
<td>0 MW</td>
</tr>
<tr>
<td>Annual Summer Peak Energy Savings x Gross Units</td>
<td>0.9 MW</td>
</tr>
</tbody>
</table>

### Net-to-Gross Ratio

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1-Exclusions) x (1- Free-Riders) + Spillover</td>
<td>57%</td>
</tr>
</tbody>
</table>

### Net Annual Energy Impact

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Annual Impact x Net to Gross</td>
<td>0.5 GWh</td>
</tr>
</tbody>
</table>

### Net Lifetime Energy Impact

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Lifetime Impact x Net to Gross</td>
<td>8.3 GWh</td>
</tr>
</tbody>
</table>

### Net Annual Winter / Summer Peak Impact

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Net Winter Peak Energy Savings x Net to Gross</td>
<td>0 MW</td>
</tr>
<tr>
<td>Annual Net Summer Peak Energy Savings x Net to Gross</td>
<td>0.5 MW</td>
</tr>
</tbody>
</table>
### Hot Savings: Energy Star CAC

**Evaluation Report: 2007 Hot and Cool Savings Program**

#### Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Overall</th>
<th>Per Unit</th>
<th>Winter Peak MW</th>
<th>Winter Mid MW</th>
<th>Winter Off-Peak MW</th>
<th>Summer Peak MW</th>
<th>Summer Mid MW</th>
<th>Summer Off-Peak MW</th>
<th>Shoulder Peak MW</th>
<th>Shoulder Mid MW</th>
<th>Shoulder Off-Peak MW</th>
<th>Annual Total</th>
<th>Winter MWh</th>
<th>Summer MWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>50%</td>
<td>1,677</td>
<td>39</td>
<td>50</td>
<td>111</td>
<td>6</td>
<td>229</td>
<td>0.251</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2008</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2009</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2010</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2011</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2012</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2013</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2014</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2015</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2016</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2017</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2018</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2019</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2020</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2021</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2022</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2023</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2024</td>
<td>100%</td>
<td>3,354</td>
<td>117</td>
<td>100</td>
<td>223</td>
<td>7</td>
<td>13</td>
<td>459</td>
<td>0.502</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2025</td>
<td>50%</td>
<td>1,677</td>
<td>59</td>
<td>50</td>
<td>111</td>
<td>3</td>
<td>6</td>
<td>229</td>
<td>0.251</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2026</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2027</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

#### Gas Water

<table>
<thead>
<tr>
<th>Year</th>
<th>Natural Gas (m³/year)</th>
<th>Water (m³/year)</th>
<th>Operating / Maintenance Savings ($/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2008</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2009</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2010</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2011</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2012</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2013</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2014</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2015</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2016</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2017</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2018</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2019</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2020</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2021</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2022</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2023</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2024</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2025</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2026</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2027</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Total** $869,182 $1,253,677
### Detailed Results

<table>
<thead>
<tr>
<th>Measure</th>
<th>Hot Savings: Programmable Thermostat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Annual Energy Savings</td>
<td>53.6 kWh/year</td>
</tr>
<tr>
<td>Estimated Winter Peak Energy Savings</td>
<td>3.9 kWh/year</td>
</tr>
<tr>
<td>Estimated Summer Peak Energy Savings</td>
<td>7.6 kWh/year</td>
</tr>
<tr>
<td>Natural Gas Savings</td>
<td>39.9 (m³/year)</td>
</tr>
<tr>
<td>Effective Useful Life</td>
<td>15 years</td>
</tr>
<tr>
<td>Average Incremental Cost</td>
<td>$140</td>
</tr>
<tr>
<td>Average Incentive</td>
<td>$75</td>
</tr>
<tr>
<td>Gross Units</td>
<td>11,409 units</td>
</tr>
<tr>
<td>Spillover</td>
<td>0%</td>
</tr>
<tr>
<td>Percentage Exclusions</td>
<td>40%</td>
</tr>
<tr>
<td>Free-Ridership</td>
<td>54%</td>
</tr>
<tr>
<td>Winter Peak Hours</td>
<td>602 hours/year</td>
</tr>
<tr>
<td>Summer Peak Hours</td>
<td>522 hours/year</td>
</tr>
</tbody>
</table>

### Average Peak Period Demand Savings

- Winter Peak Energy Savings / winter peak hours 0.006 kW/year
- Summer Peak Energy Savings / summer peak hours 0.015 kW/year

### Coincident Winter/Summer Peak Demand Savings

- (Winter Peak Energy Savings/winter peak hours) x OPA Coincidence Factor 0.007 kW/year
- (Summer Peak Energy Savings/summer peak hours) x OPA Coincidence Factor 0.028 kW/year

### Gross Annual Energy Impact

- Annual Energy Savings x Gross Units 0.6 GWh/year

### Gross Lifetime Energy Impact

- Annual Energy Savings x Effective Useful Life 9.2 GWh

### Gross Annual Winter / Summer Peak Impact

- Annual Winter Peak Energy Savings x Gross Units 0 MW
- Annual Summer Peak Energy Savings x Gross Units 0.3 MW

### Net-to-Gross Ratio

- (1-Exclusions) x (1- Free-Riders) + Spillover 27%

### Net Annual Energy Impact

- Gross Annual Impact x Net to Gross 0.2 GWh

### Net Lifetime Energy Impact

- Gross Lifetime Impact x Net to Gross 2.5 GWh

### Net Annual Winter / Summer Peak Impact

- Annual Net Winter Peak Energy Savings x Net to Gross 0 MW
- Annual Net Summer Peak Energy Savings x Net to Gross 0.1 MW
# Hot Savings: Programmable Thermostat

**Summary Overall Per Unit Period**  
**Benefits** $602,574 $102,043  
**Costs** $438,292 $140  
**Net Benefits** $164,282 $192

**Winter (MW)**  
**Peak Net MWh Ratio** 1.4  
**Savings (MWh)** 2,518 MW

### Savings (MWh) vs. Costs (MW)

<table>
<thead>
<tr>
<th>Year</th>
<th>% Operational</th>
<th>Units</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Peak</th>
<th>Shoulder Off Peak</th>
<th>Annual Total</th>
<th>Winter</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>50%</td>
<td>1,565</td>
<td>6</td>
<td>6</td>
<td>18</td>
<td>12</td>
<td>10</td>
<td>23</td>
<td>3</td>
<td>6</td>
<td>84</td>
<td>0.011</td>
<td>0.043</td>
</tr>
<tr>
<td>2008</td>
<td>100%</td>
<td>3,131</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>24</td>
<td>21</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>168</td>
<td>0.022</td>
<td>0.086</td>
</tr>
<tr>
<td>2009</td>
<td>100%</td>
<td>3,131</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>24</td>
<td>21</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>168</td>
<td>0.022</td>
<td>0.086</td>
</tr>
<tr>
<td>2010</td>
<td>100%</td>
<td>3,131</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>24</td>
<td>21</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>168</td>
<td>0.022</td>
<td>0.086</td>
</tr>
<tr>
<td>2011</td>
<td>100%</td>
<td>3,131</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>24</td>
<td>21</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>168</td>
<td>0.022</td>
<td>0.086</td>
</tr>
<tr>
<td>2012</td>
<td>100%</td>
<td>3,131</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>24</td>
<td>21</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>168</td>
<td>0.022</td>
<td>0.086</td>
</tr>
<tr>
<td>2013</td>
<td>100%</td>
<td>3,131</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>24</td>
<td>21</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>168</td>
<td>0.022</td>
<td>0.086</td>
</tr>
<tr>
<td>2014</td>
<td>100%</td>
<td>3,131</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>24</td>
<td>21</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>168</td>
<td>0.022</td>
<td>0.086</td>
</tr>
<tr>
<td>2015</td>
<td>100%</td>
<td>3,131</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>24</td>
<td>21</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>168</td>
<td>0.022</td>
<td>0.086</td>
</tr>
<tr>
<td>2016</td>
<td>100%</td>
<td>3,131</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>24</td>
<td>21</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>168</td>
<td>0.022</td>
<td>0.086</td>
</tr>
<tr>
<td>2017</td>
<td>100%</td>
<td>3,131</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>24</td>
<td>21</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>168</td>
<td>0.022</td>
<td>0.086</td>
</tr>
<tr>
<td>2018</td>
<td>100%</td>
<td>3,131</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>24</td>
<td>21</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>168</td>
<td>0.022</td>
<td>0.086</td>
</tr>
<tr>
<td>2019</td>
<td>100%</td>
<td>3,131</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>24</td>
<td>21</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>168</td>
<td>0.022</td>
<td>0.086</td>
</tr>
<tr>
<td>2020</td>
<td>100%</td>
<td>3,131</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>24</td>
<td>21</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>168</td>
<td>0.022</td>
<td>0.086</td>
</tr>
<tr>
<td>2021</td>
<td>100%</td>
<td>3,131</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>24</td>
<td>21</td>
<td>46</td>
<td>6</td>
<td>11</td>
<td>168</td>
<td>0.022</td>
<td>0.086</td>
</tr>
<tr>
<td>2022</td>
<td>50%</td>
<td>1,565</td>
<td>6</td>
<td>6</td>
<td>18</td>
<td>12</td>
<td>10</td>
<td>23</td>
<td>3</td>
<td>6</td>
<td>84</td>
<td>0.011</td>
<td>0.043</td>
</tr>
</tbody>
</table>

### Operating/Maintenance Costs

<table>
<thead>
<tr>
<th>Year</th>
<th>Gas</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>$51,163</td>
<td>$53,210</td>
</tr>
<tr>
<td>2008</td>
<td>$46,664</td>
<td>$52,491</td>
</tr>
<tr>
<td>2009</td>
<td>$44,569</td>
<td>$52,140</td>
</tr>
<tr>
<td>2010</td>
<td>$42,928</td>
<td>$52,229</td>
</tr>
<tr>
<td>2011</td>
<td>$41,042</td>
<td>$51,931</td>
</tr>
<tr>
<td>2012</td>
<td>$39,542</td>
<td>$52,035</td>
</tr>
<tr>
<td>2013</td>
<td>$37,878</td>
<td>$53,912</td>
</tr>
<tr>
<td>2014</td>
<td>$36,536</td>
<td>$53,083</td>
</tr>
<tr>
<td>2015</td>
<td>$35,153</td>
<td>$53,584</td>
</tr>
<tr>
<td>2016</td>
<td>$33,974</td>
<td>$54,393</td>
</tr>
<tr>
<td>2017</td>
<td>$33,194</td>
<td>$54,165</td>
</tr>
<tr>
<td>2018</td>
<td>$32,937</td>
<td>$54,943</td>
</tr>
<tr>
<td>2019</td>
<td>$32,397</td>
<td>$55,403</td>
</tr>
<tr>
<td>2020</td>
<td>$31,799</td>
<td>$56,026</td>
</tr>
<tr>
<td>2021</td>
<td>$31,274</td>
<td>$56,607</td>
</tr>
<tr>
<td>2022</td>
<td>$30,749</td>
<td>$57,183</td>
</tr>
</tbody>
</table>

### Evaluation Report: 2007 Hot and Cool Savings Program

**Page 187**
## Detailed Results

<table>
<thead>
<tr>
<th>Measure</th>
<th>Hot Savings: Furnace with ECM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Annual Energy Savings</td>
<td>819.2 kWh/year</td>
</tr>
<tr>
<td>Estimated Winter Peak Energy Savings</td>
<td>75.9 kWh/year</td>
</tr>
<tr>
<td>Estimated Summer Peak Energy Savings</td>
<td>110.8 kWh/year</td>
</tr>
<tr>
<td>Natural Gas Savings</td>
<td>4.7 (m³/year)</td>
</tr>
<tr>
<td>Effective Useful Life</td>
<td>15 years</td>
</tr>
<tr>
<td>Average Incremental Cost</td>
<td>$960</td>
</tr>
<tr>
<td>Average Incentive</td>
<td>$100</td>
</tr>
<tr>
<td>Gross Units</td>
<td>12,344 units</td>
</tr>
<tr>
<td>Spillover</td>
<td>5%</td>
</tr>
<tr>
<td>Percentage Exclusions</td>
<td>0%</td>
</tr>
<tr>
<td>Free-Ridership</td>
<td>46%</td>
</tr>
<tr>
<td>Winter Peak Hours</td>
<td>602 hours/year</td>
</tr>
<tr>
<td>Summer Peak Hours</td>
<td>522 hours/year</td>
</tr>
</tbody>
</table>

### Average Peak Period Demand Savings

- **Winter Peak Energy Savings / winter peak hours**: 0.126 kW/year
- **Summer Peak Energy Savings / summer peak hours**: 0.212 kW/year

### Coincident Winter/Summer Peak Demand Savings

- \((Winter\ Peak\ Energy\ Savings/\winter\ peak\ hours)\times\text{OPA\ Coincidence\ Factor}\): 0.139 kW/year
- \((Summer\ Peak\ Energy\ Savings/\summer\ peak\ hours)\times\text{OPA\ Coincidence\ Factor}\): 0.485 kW/year

### Gross Annual Energy Impact

- **Annual Energy Savings \times Gross Units**: 10.1 GWh/year

### Gross Lifetime Energy Impact

- **Annual Energy Savings \times Effective Useful Life**: 151.7 GWh

### Gross Annual Winter / Summer Peak Impact

- **Annual Winter Peak Energy Savings \times Gross Units**: 2 MW
- **Annual Summer Peak Energy Savings \times Gross Units**: 6.0 MW

### Net-to-Gross Ratio

- \(((1-\text{Exclusions})\times(1-\text{Free-Riders})+\text{Spillover})\): 59%

### Net Annual Energy Impact

- **Gross Annual Impact \times Net to Gross**: 6.0 GWh

### Net Lifetime Energy Impact

- **Gross Lifetime Impact \times Net to Gross**: 89.7 GWh

### Net Annual Winter / Summer Peak Impact

- **Annual Net Winter Peak Energy Savings \times Net to Gross**: 1 MW
- **Annual Net Summer Peak Energy Savings \times Net to Gross**: 3.5 MW
**Savings (MW)**

<table>
<thead>
<tr>
<th>Year</th>
<th>% Operational</th>
<th>Units</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off-Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off-Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off-Peak</th>
<th>Annual Total</th>
<th>Winter</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>50%</td>
<td>3,448</td>
<td>277</td>
<td>277</td>
<td>797</td>
<td>404</td>
<td>392</td>
<td>784</td>
<td>49</td>
<td>88</td>
<td>2988</td>
<td>3,507</td>
<td>1,770</td>
</tr>
<tr>
<td>2008</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2009</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2010</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2011</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2012</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2013</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2014</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2015</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2016</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2017</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2018</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2019</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2020</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2021</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2022</td>
<td>100%</td>
<td>7,295</td>
<td>553</td>
<td>554</td>
<td>1514</td>
<td>808</td>
<td>703</td>
<td>1567</td>
<td>98</td>
<td>176</td>
<td>34,690</td>
<td>3,540</td>
<td>3,440</td>
</tr>
<tr>
<td>2023</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2026</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2027</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EU Gas / Water**

- Natural Gas (m3/year)
- Water (m3/year)
- Operating / Maintenance Savings ($/year)

**UNIT TBC**

- PV Factor
- Year
- Present Value (Real $)
- Winter Peak
- Winter Mid
- Winter Off-Peak
- Summer Peak
- Summer Mid
- Summer Off-Peak
- Shoulder Mid
- Shoulder Off-Peak
- Annual Total
- Generation
- Transmission
- Distribution
- Natural Gas (/m3)
- Water (/m3)
- Operating / Maintenance Savings ($/year)

**Evaluation Report: 2007 Hot and Cool Savings Program**
### Detailed Results

<table>
<thead>
<tr>
<th>Measure</th>
<th>Cool Savings: Energy Star CAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Annual Energy Savings</td>
<td>154.9 kWh/year</td>
</tr>
<tr>
<td>Estimated Winter Peak Energy Savings</td>
<td>0.0 kWh/year</td>
</tr>
<tr>
<td>Estimated Summer Peak Energy Savings</td>
<td>39.5 kWh/year</td>
</tr>
<tr>
<td>Natural Gas Savings</td>
<td>0.0 (m³/year)</td>
</tr>
<tr>
<td>Effective Useful Life</td>
<td>18 years</td>
</tr>
<tr>
<td>Average Incremental Cost</td>
<td>$636</td>
</tr>
<tr>
<td>Average Incentive</td>
<td>$395</td>
</tr>
<tr>
<td>Gross Units</td>
<td>27,314 units</td>
</tr>
<tr>
<td>Spillover</td>
<td>5%</td>
</tr>
<tr>
<td>Percentage Exclusions</td>
<td>0%</td>
</tr>
<tr>
<td>Free-Ridership</td>
<td>48%</td>
</tr>
<tr>
<td>Winter Peak Hours</td>
<td>602 hours/year</td>
</tr>
<tr>
<td>Summer Peak Hours</td>
<td>522 hours/year</td>
</tr>
<tr>
<td><strong>Average Peak Period Demand Savings</strong></td>
<td></td>
</tr>
<tr>
<td>Winter Peak Energy Savings / winter peak hours</td>
<td>0.000 kW/year</td>
</tr>
<tr>
<td>Summer Peak Energy Savings / summer peak hours</td>
<td>0.076 kW/year</td>
</tr>
<tr>
<td><strong>Coincident Winter/Summer Peak Demand Savings</strong></td>
<td></td>
</tr>
<tr>
<td>(Winter Peak Energy Savings/winter peak hours) x OPA Coincidence Factor</td>
<td>0.000 kW/year</td>
</tr>
<tr>
<td>(Summer Peak Energy Savings/summer peak hours) x OPA Coincidence Factor</td>
<td>0.169 kW/year</td>
</tr>
<tr>
<td><strong>Gross Annual Energy Impact</strong></td>
<td>4.2 GWh/year</td>
</tr>
<tr>
<td>Annual Energy Savings x Gross Units</td>
<td></td>
</tr>
<tr>
<td><strong>Gross Lifetime Energy Impact</strong></td>
<td>76.2 GWh</td>
</tr>
<tr>
<td>Annual Energy Savings x Effective Useful Life</td>
<td></td>
</tr>
<tr>
<td><strong>Gross Annual Winter / Summer Peak Impact</strong></td>
<td>0 MW</td>
</tr>
<tr>
<td>Annual Winter Peak Energy Savings x Gross Units</td>
<td>4.6 MW</td>
</tr>
<tr>
<td>Annual Summer Peak Energy Savings x Gross Units</td>
<td></td>
</tr>
<tr>
<td><strong>Net-to-Gross Ratio</strong></td>
<td>57%</td>
</tr>
<tr>
<td>(1-Exclusions) x (1- Free-Riders) + Spillover</td>
<td></td>
</tr>
<tr>
<td><strong>Net Annual Energy Impact</strong></td>
<td>2.4 GWh</td>
</tr>
<tr>
<td>Gross Annual Impact x Net to Gross</td>
<td></td>
</tr>
<tr>
<td><strong>Net Lifetime Energy Impact</strong></td>
<td>43.6 GWh</td>
</tr>
<tr>
<td>Gross Lifetime Impact x Net to Gross</td>
<td></td>
</tr>
<tr>
<td><strong>Net Annual Winter / Summer Peak Impact</strong></td>
<td>0 MW</td>
</tr>
<tr>
<td>Annual Net Winter Peak Energy Savings x Net to Gross</td>
<td>2.6 MW</td>
</tr>
<tr>
<td>Annual Net Summer Peak Energy Savings x Net to Gross</td>
<td></td>
</tr>
</tbody>
</table>
### Detailed Results

<table>
<thead>
<tr>
<th>Measure</th>
<th>Cool Savings: Programmable Thermostat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Annual Energy Savings</td>
<td>53.6 kWh/year</td>
</tr>
<tr>
<td>Estimated Winter Peak Energy Savings</td>
<td>3.9 kWh/year</td>
</tr>
<tr>
<td>Estimated Summer Peak Energy Savings</td>
<td>7.6 kWh/year</td>
</tr>
<tr>
<td>Natural Gas Savings</td>
<td>39.9 (m³/year)</td>
</tr>
<tr>
<td>Effective Useful Life</td>
<td>15 years</td>
</tr>
<tr>
<td>Average Incremental Cost</td>
<td>$140</td>
</tr>
<tr>
<td>Average Incentive</td>
<td>$50</td>
</tr>
<tr>
<td>Gross Units</td>
<td>35,580 units</td>
</tr>
<tr>
<td>Spillover</td>
<td>0%</td>
</tr>
<tr>
<td>Percentage Exclusions</td>
<td>40%</td>
</tr>
<tr>
<td>Free-Ridership</td>
<td>54%</td>
</tr>
<tr>
<td>Winter Peak Hours</td>
<td>602 hours/year</td>
</tr>
<tr>
<td>Summer Peak Hours</td>
<td>522 hours/year</td>
</tr>
</tbody>
</table>

#### Average Peak Period Demand Savings

- Winter Peak Energy Savings / winter peak hours
- Summer Peak Energy Savings / summer peak hours

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.006 kW/year</td>
</tr>
<tr>
<td></td>
<td>0.015 kW/year</td>
</tr>
</tbody>
</table>

#### Coincident Winter/Summer Peak Demand Savings

- (Winter Peak Energy Savings / winter peak hours) x OPA Coincidence Factor
- (Summer Peak Energy Savings / summer peak hours) x OPA Coincidence Factor

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.007 kW/year</td>
</tr>
<tr>
<td></td>
<td>0.028 kW/year</td>
</tr>
</tbody>
</table>

#### Gross Annual Energy Impact

- Annual Energy Savings x Gross Units

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.9 GWh/year</td>
</tr>
</tbody>
</table>

#### Gross Lifetime Energy Impact

- Annual Energy Savings x Effective Useful Life

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>28.6 GWh</td>
</tr>
</tbody>
</table>

#### Gross Annual Winter / Summer Peak Impact

- Annual Winter Peak Energy Savings x Gross Units
- Annual Summer Peak Energy Savings x Gross Units

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 MW</td>
</tr>
<tr>
<td></td>
<td>1.0 MW</td>
</tr>
</tbody>
</table>

#### Net-to-Gross Ratio

- (1 - Exclusions) x (1 - Free-Riders) + Spillover

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>27%</td>
</tr>
</tbody>
</table>

#### Net Annual Energy Impact

- Gross Annual Impact x Net to Gross

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.5 GWh</td>
</tr>
</tbody>
</table>

#### Net Lifetime Energy Impact

- Gross Lifetime Impact x Net to Gross

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7.9 GWh</td>
</tr>
</tbody>
</table>

#### Net Annual Winter / Summer Peak Impact

- Annual Net Winter Peak Energy Savings x Net to Gross
- Annual Net Summer Peak Energy Savings x Net to Gross

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 MW</td>
</tr>
<tr>
<td></td>
<td>0.3 MW</td>
</tr>
</tbody>
</table>
Cool Savings: Programmable Thermostat
Measure Summary
Benefits
Costs
Net Benefits
Benefit/Cost Ratio

Overall
$1,879,182
$1,366,853
$512,329
1.4

Per Unit
$192
$140
$52
1.4

Period
Winter Peak
Summer Peak
Total MWh

Savings
0.069 MW
0.269 MW
7,851 MWh

Utility Cost Test
Benefits
$1,879,182
Utility Cost
$1,779,000

Savings (MWh)

Savings (MW)

Year

% Operational

Units

Winter
Peak

Winter
Mid

Winter Off
Peak

Summer Peak

Summer
Mid

Summer
Off Peak

Shoulder
Mid

2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027

50%
100%
100%
100%
100%
100%
100%
100%
100%
100%
100%
100%
100%
100%
100%
50%

4,882
9,763
9,763
9,763
9,763
9,763
9,763
9,763
9,763
9,763
9,763
9,763
9,763
9,763
9,763
4,882

19
38
38
38
38
38
38
38
38
38
38
38
38
38
38
19

20
39
39
39
39
39
39
39
39
39
39
39
39
39
39
20

55
110
110
110
110
110
110
110
110
110
110
110
110
110
110
55

37
75
75
75
75
75
75
75
75
75
75
75
75
75
75
37

32
65
65
65
65
65
65
65
65
65
65
65
65
65
65
32

72
144
144
144
144
144
144
144
144
144
144
144
144
144
144
72

9
18
18
18
18
18
18
18
18
18
18
18
18
18
18
9

PV Factor

Year

Present Value

(Real $)

Winter
Peak

Winter
Mid

Winter Off
Peak

Summer
Peak

Summer
Mid

Summer
Off Peak

Shoulder
Mid

1.00
0.96
0.92
0.89
0.85
0.82
0.79
0.76
0.73
0.70
0.68
0.65
0.62
0.60
0.58
0.56
0.53
0.51
0.49
0.47
0.46

2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027

$82,970
$159,558
$152,702
$145,526
$138,994
$133,875
$127,994
$123,316
$122,103
$118,125
$113,942
$109,725
$105,951
$101,033
$97,295
$46,074

$82,970
$165,940
$165,163
$163,697
$162,603
$162,880
$161,953
$162,275
$167,106
$168,129
$168,661
$168,917
$169,631
$168,227
$168,484
$82,977

$2,737
$5,474
$5,042
$4,632
$4,661
$4,691
$4,482
$4,527
$5,347
$5,489
$5,683
$5,653
$5,795
$5,534
$5,534
$2,536

$1,921
$3,843
$3,694
$3,526
$3,410
$3,475
$3,326
$3,352
$4,023
$4,178
$4,327
$4,424
$4,572
$4,295
$4,275
$1,931

$2,467
$4,933
$4,890
$4,933
$4,530
$4,573
$4,430
$4,487
$5,408
$5,595
$5,710
$5,710
$5,954
$5,667
$5,652
$2,582

$344
$687
$704
$659
$630
$606
$599
$630
$878
$894
$876
$927
$948
$806
$979
$382

Shoulder
Annual Total
Off‐Peak
17
35
35
35
35
35
35
35
35
35
35
35
35
35
35
17

262
523
523
523
523
523
523
523
523
523
523
523
523
523
523
262

Winter

Summer

0.034
0.069
0.069
0.069
0.069
0.069
0.069
0.069
0.069
0.069
0.069
0.069
0.069
0.069
0.069
0.034

0.135
0.269
0.269
0.269
0.269
0.269
0.269
0.269
0.269
0.269
0.269
0.269
0.269
0.269
0.269
0.135

Gas

Water

Natural Gas
(m3/ year)

Water
(m3 / year)

194,577
389,154
389,154
389,154
389,154
389,154
389,154
389,154
389,154
389,154
389,154
389,154
389,154
389,154
389,154
194,577
‐
‐
‐
‐
‐

‐

Operating /
Maintenance
Savings
($/year)

‐
‐
‐
‐
‐
‐
‐
‐
‐
‐
‐
‐
‐
‐
‐
‐
‐
‐
‐
‐
‐

UNIT TRC

Total

$1,879,182

$1,359
$2,719
$2,589
$2,315
$2,163
$2,201
$2,148
$2,167
$2,540
$2,597
$2,635
$2,673
$2,722
$2,665
$2,677
$1,249

$1,342
$2,683
$2,613
$2,298
$2,106
$2,290
$2,145
$2,176
$2,589
$2,613
$2,616
$2,687
$2,730
$2,565
$2,660
$1,249

$1,970
$3,940
$3,995
$3,764
$3,543
$3,587
$3,377
$3,410
$4,437
$4,889
$4,933
$4,967
$5,000
$4,591
$4,624
$2,064

Shoulder
Annual Total Generation Transmission
Off‐Peak
Distribution
$509
$1,019
$994
$928
$918
$814
$803
$883
$1,054
$1,043
$1,050
$1,047
$1,078
$1,085
$1,064
$475

$12,649
$25,298
$24,521
$23,055
$21,961
$22,238
$21,311
$21,633
$26,276
$27,298
$27,831
$28,087
$28,800
$27,208
$27,465
$12,468

$10,924
$21,848
$21,848
$21,848
$21,848
$21,848
$21,848
$21,848
$22,037
$22,037
$22,037
$22,037
$22,037
$22,225
$22,225
$11,113

$2,489,612

Evaluation Report: 2007 Hot and Cool Savings Program

Page 193

$458
$916
$916
$916
$916
$916
$916
$916
$916
$916
$916
$916
$916
$916
$916
$458

$566
$1,131
$1,131
$1,131
$1,131
$1,131
$1,131
$1,131
$1,131
$1,131
$1,131
$1,131
$1,131
$1,131
$1,131
$566

Natural Gas
($/m3)
$58,373
$116,746
$116,746
$116,746
$116,746
$116,746
$116,746
$116,746
$116,746
$116,746
$116,746
$116,746
$116,746
$116,746
$116,746
$58,373

Water ($/m3)

Operating /
Maintenance
Savings
($/year)

‐


## Detailed Results

<table>
<thead>
<tr>
<th>Measure</th>
<th>Cool Savings: Furnace with ECM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Annual Energy Savings</td>
<td>836.7 kWh/year</td>
</tr>
<tr>
<td>Estimated Winter Peak Energy Savings</td>
<td>77.5 kWh/year</td>
</tr>
<tr>
<td>Estimated Summer Peak Energy Savings</td>
<td>113.3 kWh/year</td>
</tr>
<tr>
<td>Natural Gas Savings</td>
<td>-15.1 (m³/year)</td>
</tr>
<tr>
<td>Effective Useful Life</td>
<td>15 years</td>
</tr>
<tr>
<td>Average Incremental Cost</td>
<td>$960</td>
</tr>
<tr>
<td>Average Incentive</td>
<td>$235</td>
</tr>
<tr>
<td>Gross Units</td>
<td>39,646 units</td>
</tr>
<tr>
<td>Spillover</td>
<td>5%</td>
</tr>
<tr>
<td>Percentage Exclusions</td>
<td>0%</td>
</tr>
<tr>
<td>Free-Ridership</td>
<td>46%</td>
</tr>
<tr>
<td>Winter Peak Hours</td>
<td>602 hours/year</td>
</tr>
<tr>
<td>Summer Peak Hours</td>
<td>522 hours/year</td>
</tr>
</tbody>
</table>

### Average Peak Period Demand Savings

- Winter Peak Energy Savings / winter peak hours
  - 0.129 kW/year
- Summer Peak Energy Savings / summer peak hours
  - 0.217 kW/year

### Coincident Winter/Summer Peak Demand Savings

- (Winter Peak Energy Savings/winter peak hours) x OPA Coincidence Factor
  - 0.142 kW/year
- (Summer Peak Energy Savings/summer peak hours) x OPA Coincidence Factor
  - 0.496 kW/year

### Gross Annual Energy Impact

- Annual Energy Savings x Gross Units
  - 33.2 GWh/year

### Gross Lifetime Energy Impact

- Annual Energy Savings x Effective Useful Life
  - 497.6 GWh

### Gross Annual Winter / Summer Peak Impact

- Annual Winter Peak Energy Savings x Gross Units
  - 6 MW
- Annual Summer Peak Energy Savings x Gross Units
  - 19.7 MW

### Net-to-Gross Ratio

- (1 - Exclusions) x (1 - Free-Riders) + Spillover
  - 59%

### Net Annual Energy Impact

- Gross Annual Impact x Net to Gross
  - 19.6 GWh

### Net Lifetime Energy Impact

- Gross Lifetime Impact x Net to Gross
  - 294.1 GWh

### Net Annual Winter / Summer Peak Impact

- Annual Net Winter Peak Energy Savings x Net to Gross
  - 3 MW
- Annual Net Summer Peak Energy Savings x Net to Gross
  - 11.6 MW
### Cool Savings: Furnace with ECM

<table>
<thead>
<tr>
<th>Measure Summary</th>
<th>Overall</th>
<th>Per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits</td>
<td>$21,391.65</td>
<td>$972</td>
</tr>
<tr>
<td>Costs</td>
<td>$22,493.35</td>
<td>$960</td>
</tr>
<tr>
<td>Net Benefits</td>
<td>$1,101.70</td>
<td>$480</td>
</tr>
<tr>
<td>Benefit/Cost Ratio</td>
<td>0.9</td>
<td>0.9</td>
</tr>
</tbody>
</table>

| Period | Savings | | Utility Cost Tool |
|--------|---------|------------------|
| Winter Peak | 3.327 MW | Benefits | $21,391.65 |
| Summer Peak | 11.625 MW | Utility Cost | $9,316,616 |
| Total MWk | 294,667 MWk |

<table>
<thead>
<tr>
<th>Unit TRC</th>
<th>Operating Costs ($)</th>
<th>Maintenance Costs ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>11,713</td>
<td>908</td>
</tr>
<tr>
<td>2008</td>
<td>23,431</td>
<td>1817</td>
</tr>
<tr>
<td>2009</td>
<td>23,431</td>
<td>1819</td>
</tr>
<tr>
<td>2010</td>
<td>23,431</td>
<td>1819</td>
</tr>
<tr>
<td>2011</td>
<td>23,431</td>
<td>1819</td>
</tr>
<tr>
<td>2012</td>
<td>23,431</td>
<td>1819</td>
</tr>
<tr>
<td>2013</td>
<td>23,431</td>
<td>1819</td>
</tr>
<tr>
<td>2014</td>
<td>23,431</td>
<td>1819</td>
</tr>
<tr>
<td>2015</td>
<td>23,431</td>
<td>1819</td>
</tr>
<tr>
<td>2016</td>
<td>23,431</td>
<td>1819</td>
</tr>
<tr>
<td>2017</td>
<td>23,431</td>
<td>1819</td>
</tr>
<tr>
<td>2018</td>
<td>23,431</td>
<td>1819</td>
</tr>
<tr>
<td>2019</td>
<td>23,431</td>
<td>1819</td>
</tr>
<tr>
<td>2020</td>
<td>23,431</td>
<td>1819</td>
</tr>
<tr>
<td>2021</td>
<td>23,431</td>
<td>1819</td>
</tr>
<tr>
<td>2022</td>
<td>505</td>
<td>11,713</td>
</tr>
</tbody>
</table>

### Savings (MWk)

<table>
<thead>
<tr>
<th>Year</th>
<th>% Operational</th>
<th>Units</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off-Peak</th>
<th>Annual Total</th>
<th>Winter</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>100%</td>
<td>11,713</td>
<td>908</td>
<td>909</td>
<td>2486</td>
<td>1327</td>
<td>1157</td>
<td>2573</td>
<td>158</td>
<td>283</td>
<td>9802</td>
<td>1.664</td>
<td>5.813</td>
</tr>
<tr>
<td>2008</td>
<td>100%</td>
<td>23,431</td>
<td>1817</td>
<td>1819</td>
<td>4073</td>
<td>2655</td>
<td>2315</td>
<td>5146</td>
<td>315</td>
<td>567</td>
<td>9604</td>
<td>3.329</td>
<td>11.625</td>
</tr>
<tr>
<td>2009</td>
<td>100%</td>
<td>23,431</td>
<td>1817</td>
<td>1819</td>
<td>4073</td>
<td>2655</td>
<td>2315</td>
<td>5146</td>
<td>315</td>
<td>567</td>
<td>9604</td>
<td>3.329</td>
<td>11.625</td>
</tr>
<tr>
<td>2010</td>
<td>100%</td>
<td>23,431</td>
<td>1817</td>
<td>1819</td>
<td>4073</td>
<td>2655</td>
<td>2315</td>
<td>5146</td>
<td>315</td>
<td>567</td>
<td>9604</td>
<td>3.329</td>
<td>11.625</td>
</tr>
<tr>
<td>2011</td>
<td>100%</td>
<td>23,431</td>
<td>1817</td>
<td>1819</td>
<td>4073</td>
<td>2655</td>
<td>2315</td>
<td>5146</td>
<td>315</td>
<td>567</td>
<td>9604</td>
<td>3.329</td>
<td>11.625</td>
</tr>
<tr>
<td>2012</td>
<td>100%</td>
<td>23,431</td>
<td>1817</td>
<td>1819</td>
<td>4073</td>
<td>2655</td>
<td>2315</td>
<td>5146</td>
<td>315</td>
<td>567</td>
<td>9604</td>
<td>3.329</td>
<td>11.625</td>
</tr>
<tr>
<td>2013</td>
<td>100%</td>
<td>23,431</td>
<td>1817</td>
<td>1819</td>
<td>4073</td>
<td>2655</td>
<td>2315</td>
<td>5146</td>
<td>315</td>
<td>567</td>
<td>9604</td>
<td>3.329</td>
<td>11.625</td>
</tr>
<tr>
<td>2014</td>
<td>100%</td>
<td>23,431</td>
<td>1817</td>
<td>1819</td>
<td>4073</td>
<td>2655</td>
<td>2315</td>
<td>5146</td>
<td>315</td>
<td>567</td>
<td>9604</td>
<td>3.329</td>
<td>11.625</td>
</tr>
<tr>
<td>2015</td>
<td>100%</td>
<td>23,431</td>
<td>1817</td>
<td>1819</td>
<td>4073</td>
<td>2655</td>
<td>2315</td>
<td>5146</td>
<td>315</td>
<td>567</td>
<td>9604</td>
<td>3.329</td>
<td>11.625</td>
</tr>
<tr>
<td>2016</td>
<td>100%</td>
<td>23,431</td>
<td>1817</td>
<td>1819</td>
<td>4073</td>
<td>2655</td>
<td>2315</td>
<td>5146</td>
<td>315</td>
<td>567</td>
<td>9604</td>
<td>3.329</td>
<td>11.625</td>
</tr>
<tr>
<td>2017</td>
<td>100%</td>
<td>23,431</td>
<td>1817</td>
<td>1819</td>
<td>4073</td>
<td>2655</td>
<td>2315</td>
<td>5146</td>
<td>315</td>
<td>567</td>
<td>9604</td>
<td>3.329</td>
<td>11.625</td>
</tr>
<tr>
<td>2018</td>
<td>100%</td>
<td>23,431</td>
<td>1817</td>
<td>1819</td>
<td>4073</td>
<td>2655</td>
<td>2315</td>
<td>5146</td>
<td>315</td>
<td>567</td>
<td>9604</td>
<td>3.329</td>
<td>11.625</td>
</tr>
<tr>
<td>2019</td>
<td>100%</td>
<td>23,431</td>
<td>1817</td>
<td>1819</td>
<td>4073</td>
<td>2655</td>
<td>2315</td>
<td>5146</td>
<td>315</td>
<td>567</td>
<td>9604</td>
<td>3.329</td>
<td>11.625</td>
</tr>
<tr>
<td>2020</td>
<td>100%</td>
<td>23,431</td>
<td>1817</td>
<td>1819</td>
<td>4073</td>
<td>2655</td>
<td>2315</td>
<td>5146</td>
<td>315</td>
<td>567</td>
<td>9604</td>
<td>3.329</td>
<td>11.625</td>
</tr>
<tr>
<td>2021</td>
<td>100%</td>
<td>23,431</td>
<td>1817</td>
<td>1819</td>
<td>4073</td>
<td>2655</td>
<td>2315</td>
<td>5146</td>
<td>315</td>
<td>567</td>
<td>9604</td>
<td>3.329</td>
<td>11.625</td>
</tr>
<tr>
<td>2022</td>
<td>50%</td>
<td>11,713</td>
<td>908</td>
<td>909</td>
<td>2486</td>
<td>1327</td>
<td>1157</td>
<td>2573</td>
<td>158</td>
<td>283</td>
<td>9802</td>
<td>1.664</td>
<td>5.813</td>
</tr>
</tbody>
</table>

### Evaluation Report: 2007 Hot and Cool Savings Program

Page 195
### Detailed Results

<table>
<thead>
<tr>
<th>Measure</th>
<th>Cool Savings: CAC Tune Ups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Annual Energy Savings</td>
<td>235.0 kWh/year</td>
</tr>
<tr>
<td>Estimated Winter Peak Energy Savings</td>
<td>0.0 kWh/year</td>
</tr>
<tr>
<td>Estimated Summer Peak Energy Savings</td>
<td>59.9 kWh/year</td>
</tr>
<tr>
<td>Natural Gas Savings</td>
<td>0.0 (m³/year)</td>
</tr>
<tr>
<td>Effective Useful Life</td>
<td>5 years</td>
</tr>
<tr>
<td>Average Incremental Cost</td>
<td>$115</td>
</tr>
<tr>
<td>Average Incentive</td>
<td>$50</td>
</tr>
<tr>
<td>Gross Units</td>
<td>28,048 units</td>
</tr>
<tr>
<td>Spillover</td>
<td>0%</td>
</tr>
<tr>
<td>Percentage Exclusions</td>
<td>63%</td>
</tr>
<tr>
<td>Free-Ridership</td>
<td>58%</td>
</tr>
<tr>
<td>Winter Peak Hours</td>
<td>602 hours/year</td>
</tr>
<tr>
<td>Summer Peak Hours</td>
<td>522 hours/year</td>
</tr>
</tbody>
</table>

### Average Peak Period Demand Savings

- Winter Peak Energy Savings / winter peak hours: 0.000 kW/year
- Summer Peak Energy Savings / summer peak hours: 0.115 kW/year

### Coincident Winter/Summer Peak Demand Savings

- (Winter Peak Energy Savings/winter peak hours) x OPA Coincidence Factor: 0.000 kW/year
- (Summer Peak Energy Savings/winter peak hours) x OPA Coincidence Factor: 0.257 kW/year

### Gross Annual Energy Impact

- Annual Energy Savings x Gross Units: 6.6 GWh/year

### Gross Lifetime Energy Impact

- Annual Energy Savings x Effective Useful Life: 33.0 GWh

### Gross Annual Winter / Summer Peak Impact

- Annual Winter Peak Energy Savings x Gross Units: 0 MW
- Annual Summer Peak Energy Savings x Gross Units: 7.2 MW

### Net-to-Gross Ratio

- (1-Exclusions) x (1- Free-Riders) + Spillover: 16%

### Net Annual Energy Impact

- Gross Annual Impact x Net to Gross: 1.0 GWh

### Net Lifetime Energy Impact

- Gross Lifetime Impact x Net to Gross: 5.2 GWh

### Net Annual Winter / Summer Peak Impact

- Annual Net Winter Peak Energy Savings x Net to Gross: 0 MW
- Annual Net Summer Peak Energy Savings x Net to Gross: 1.1 MW
### Cool Savings: CAC Tune Ups

<table>
<thead>
<tr>
<th>Year</th>
<th>% Operational</th>
<th>Units</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off Peak</th>
<th>Annual Total</th>
<th>Winter</th>
<th>Summer</th>
<th>Natural Gas ($/m³/year)</th>
<th>Water ($/m³)</th>
<th>Operating &amp; Maintenance Savings ($/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>50%</td>
<td>2,201</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2008</td>
<td>100%</td>
<td>4,403</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2009</td>
<td>100%</td>
<td>4,403</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2010</td>
<td>100%</td>
<td>4,403</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2011</td>
<td>100%</td>
<td>4,403</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2012</td>
<td>50%</td>
<td>2,201</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2019</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2021</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2022</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2023</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2024</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2025</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2026</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2027</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### Unit TRC

<table>
<thead>
<tr>
<th>PV Factor</th>
<th>Year</th>
<th>Present Value (Real $)</th>
<th>Winter Peak</th>
<th>Winter Mid</th>
<th>Winter Off Peak</th>
<th>Summer Peak</th>
<th>Summer Mid</th>
<th>Summer Off Peak</th>
<th>Shoulder Mid</th>
<th>Shoulder Off Peak</th>
<th>Annual Total</th>
<th>Generation</th>
<th>Transmission</th>
<th>Distribution</th>
<th>Natural Gas ($/m³)</th>
<th>Water ($/m³)</th>
<th>Operating &amp; Maintenance Savings ($/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>2007</td>
<td>$75,071</td>
<td>$75,071</td>
<td>$6,770</td>
<td></td>
<td>$9,600</td>
<td>$6,770</td>
<td>$9,600</td>
<td>$828</td>
<td>$842</td>
<td>$20,099</td>
<td>$45,874</td>
<td>$1,923</td>
<td>$2,376</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.96</td>
<td>2008</td>
<td>$145,905</td>
<td>$151,742</td>
<td>$13,420</td>
<td></td>
<td>$19,359</td>
<td>$13,420</td>
<td>$17,203</td>
<td>$575</td>
<td>$640</td>
<td>$51,398</td>
<td>$91,747</td>
<td>$3,846</td>
<td>$4,751</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.92</td>
<td>2009</td>
<td>$138,255</td>
<td>$149,356</td>
<td>$12,901</td>
<td></td>
<td>$17,829</td>
<td>$12,901</td>
<td>$17,203</td>
<td>$589</td>
<td>$682</td>
<td>$49,191</td>
<td>$91,747</td>
<td>$3,846</td>
<td>$4,751</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.89</td>
<td>2010</td>
<td>$131,178</td>
<td>$147,857</td>
<td>$12,315</td>
<td></td>
<td>$16,379</td>
<td>$12,315</td>
<td>$17,203</td>
<td>$531</td>
<td>$670</td>
<td>$47,213</td>
<td>$91,747</td>
<td>$3,846</td>
<td>$4,751</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.85</td>
<td>2011</td>
<td>$124,684</td>
<td>$145,820</td>
<td>$11,909</td>
<td></td>
<td>$16,484</td>
<td>$11,909</td>
<td>$15,798</td>
<td>$527</td>
<td>$756</td>
<td>$45,475</td>
<td>$91,747</td>
<td>$3,846</td>
<td>$4,751</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.82</td>
<td>2012</td>
<td>$60,081</td>
<td>$73,098</td>
<td>$6,067</td>
<td></td>
<td>$8,295</td>
<td>$6,067</td>
<td>$7,974</td>
<td>$254</td>
<td>$335</td>
<td>$22,926</td>
<td>$45,874</td>
<td>$1,923</td>
<td>$2,376</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.79</td>
<td>2013</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.76</td>
<td>2014</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.73</td>
<td>2015</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.70</td>
<td>2016</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.68</td>
<td>2017</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.65</td>
<td>2018</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.62</td>
<td>2019</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.60</td>
<td>2020</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.58</td>
<td>2021</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.56</td>
<td>2022</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.53</td>
<td>2023</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.51</td>
<td>2024</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.49</td>
<td>2025</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.47</td>
<td>2026</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.46</td>
<td>2027</td>
<td>$57,942</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Total     |      | $675,938               | $745,624    |             |                |             |           |                 |              |                 |             |           |              |             |                   |             |                      |
APPENDIX C: HOT AND COOL SAVINGS PROGRAM TELEPHONE SURVEYS

See following pages
Hot and Cool Savings Rebate Program Participant Telephone Survey

CUSTOMER DATA from Navigant will include the following information:
A unique identifier of each respondent (Account number or other number assigned by Navigant)

WHICH PRODUCT THEY RECEIVED A REBATE FOR:
1. PROGRAMMABLE THERMOSTAT
2. FURNACE REPLACEMENT
3. CAC REPLACEMENT
4. CAC TUNE UP

THE REBATE LEVEL FOR EACH PRODUCT ($)

THE UTILITY THEY ARE ASSOCIATED WITH (Utility names omitted for confidentiality purposes)

WHICH PROGRAM THEY RECEIVED THE REBATE (COOL SAVINGS, HOT SAVINGS)

SECTION 1: Screener

Good morning/afternoon/evening.

[IF CONTACT NAME IS AVAILABLE] May I please speak with [INSERT NAME]?

[IF CONTACT NAME IS UNAVAILABLE] I’d like to speak with the person most knowledgeable about the heating and cooling system in your home? Would that be you?

[IF NO / REFUSED] Could I please speak with the person that is most knowledgeable about the heating and cooling system in your home?

[If appropriate person is not available, schedule callback]

[ONCE APPROPRIATE PERSON IS ON THE PHONE] My name is______. I’m calling from the Logit Group, a public opinion and marketing research firm, on behalf of your utility company [INSERT UTILITY NAME FROM DATABASE] and the Ontario Power Authority. Our firm has been commissioned to conduct an important survey. The information you provide will help the Ontario Power Authority and your utility company [INSERT UTILITY NAME FROM DATABASE] to evaluate the effectiveness of their current rebate program and improve services to residential customers like you.

Please, be assured that we are not selling anything. Your participation in the study will in no way result in sales or solicitation calls.

1. We are interested in people’s occupations, do you or does anyone in your household, work for any of the following types of companies...?
2. Record gender [DO NOT ASK]

SECTION 2: PROGRAM AWARENESS & USAGE

1a. Do you currently have central air conditioning in your home?

   1  Yes
   2  No

1b. Since September 2006, have you replaced or installed any of the following:

   [ROTATE]

   Yes   No
   ☐     ☐
   ☐

   Forced air furnace or air handler system

   [IF YES at Q1a] Air conditioner

   Thermostat

   Yes   No
   ☐     ☐
   ☐

1c. [IF YES at Q1a] Since September 2006, have you received an air conditioner tune-up?

   1  Yes
   2  No

   [IF NO TO ALL OF Q1b & Q1c PLEASE THANK & TERMINATE]
2a. [IF YES TO “Forced air furnace or air handler system” at Q1b] Specifically, since September 2006 have you replaced an existing forced air furnace or air handler system with one using an electronically commutated motor, ECM system? An Electronically Commutated Motor is a brushless motor technology in forced air heating application, which can reduce the electrical consumption of the furnace motor by as much as 60% over a standard motor.

1  Yes

2  No

2b. [IF YES TO “Thermostat” at Q1b] Specifically, since September 2006 have you installed a programmable thermostat?

1  Yes

2  No

2c. [IF YES TO “Air conditioner” at Q1b] Specifically, since September 2006 have you replaced an existing central air conditioner with an Energy Star® qualified system?

1  Yes

2  No

2d. [IF YES TO “Air conditioner” at Q1b] And since September 2006 have you installed a central air conditioner with an Energy Star® qualified system that was NOT a replacement of an existing central air conditioner?

1  Yes

2  No

Programs run by the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) and the Ontario Power Authority called the “Hot Savings Rebate Program” and the “Cool Savings Rebate Program”, provided customers with rebates of up to $750 for upgrading or replacing their existing central air conditioner or furnace. Under these programs, rebates were available for:

- Replacement of an existing forced air/furnace or air handler system with one using an electronically-commutated motor, or ECM system
- Programmable thermostats
• Replacement of an existing central air conditioner with an Energy Star®-qualified system.

• Central air conditioner tune-ups

3a. Before today, were you aware of this rebate program?

1  Yes

2  No

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

3b. [IF YES AT 3a] How did you first become aware of this rebate program?

[OPEN END, DO NOT READ]

1  Newspaper

2  Radio

3  TV

4  Internet

5  Electric bill

6  Insert in electric bill

7  Letter from electric utility

8  Friend, relative, word of mouth

9  Announcement by public official

10  School, church, community group

11  Contractor

12  Equipment supplier recommended

77  Other (please specify)________________________
3c. [IF YES AT 3a] When did you first become aware of this rebate program?

[OPEN END, DO NOT READ]

1  Before October 2006
2  Between October 2006 and March 2007
3  After April 2007
4  When I received the rebate

88  Refused
99  Don’t know

4. [ASK ALL] Do you recall receiving a rebate under this program?

[OPEN END, DO NOT READ]

1  Yes
2  No
3  Supposed to get one, but haven’t received it yet

88  Refused
99  Don’t know

5a. [IF YES AT Q4 & YES Q2a & Furnace Replacement (col U or AU) = 1] Our records indicate you received a rebate for your replacement furnace / Air handler equipped with an ELECTRONICALLY COMMUTATED MOTOR. Can you confirm you received this rebate?

1  Yes
2  No
5b. [IF YES AT Q4 & YES AT Q2b & Programmable Thermostat (col V or AW) = 1] Our records indicate you received a rebate for your programmable thermostat. Can you confirm you received this rebate?

1. Yes
2. No

5c. [IF YES AT Q4 & YES AT Q2c or Q2d & AC Replacement (col W or AV)= 1] Our records indicate you received a rebate for your Energy Star® central air conditioner. Can you confirm you received this rebate?

1. Yes
2. No

5d. [IF YES AT Q4 & YES AT Q1c & Tune up (col AT) =1] Our records indicate you received a rebate for your Central air conditioner Tune Up. Can you confirm you received this rebate?

1. Yes
2. No

IF YES TO ANY OF Q5, CLASSIFY AS “PARTICIPANT” AND CONTINUE]

[IF NO / REFUSED / DON’T KNOW TO ALL OF Q5, THANK THEM AND TERMINATE SURVEY]

SECTION 3 – THERMOSTATS (PARTICIPANTS ONLY)

1. [IF NO AT S2Q2b, ASK] Do you currently have a programmable thermostat installed in your home?

1. Yes
2. No

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]
2. [ASK TO ALL EXCEPT “YES” AT S2Q5b OR YES AT Q1] Are you aware that the rebate program provided customers with a rebate between $50 and $75 for upgrading a standard non-programmable thermostat to a programmable thermostat?

1 Yes
2 No

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

3a. [IF NO AT Q1 AND YES AT Q2] Why did you choose not to participate in the rebate program by upgrading your existing standard non-programmable thermostat with a new programmable thermostat?

[OPEN END, DO NOT READ]

1 Didn’t want a programmable thermostat
2 Did not understand the program rules
3 Too expensive
4 Wanted to install a programmable thermostat on my own
5 The contractor never mentioned it to me
6 Too much work/time to get the rebate
77 Other (please specify)________
88 Refused
99 Don’t know

3b. [IF “Didn’t want a programmable thermostat” at Q3a]. And why didn’t you want a programmable thermostat?

[OPEN END, DO NOT READ]

1 Existing thermostat works fine
2  I manually change the temperature on my existing thermostat

3  I keep the house relatively constant temperature

4  Too expensive

5  Too complicated to use

6  Other (please specify)______

88  Refused

99  Don’t know

4.  [IF YES at S2Q2b & S2Q5b] We would now like to focus on your decision to install a programmable thermostat through the rebate program. When was your programmable thermostat installed? (PLEASE GET SPECIFIC MONTH AND YEAR)

I had my programmable thermostat installed ________ (mm/yyyy)

5a.  [IF YES at S2Q2b & S2Q5b] What factors were most important to you when you decided to install the programmable thermostat in your home?

[OPEN END, DO NOT READ]

1  Finding a quick replacement thermostat for my furnace

2  The ability to program the temperature setting of my home for when I am sleeping or away from home

3  Receiving the rebate that was offered

4  Recommendation from my contractor

5  Recommendation from a friend/relative/associate

6  Finding a low-cost programmable thermostat

77  Other (Specify): ______________________

88  Refused

99  Don’t know
5b. **[IF MORE THAN ONE RESPONSE AT 5a]** Which factor was most important?

**[OPEN END, DO NOT READ]**

1. Finding a quick replacement thermostat for my furnace
2. The ability to program the temperature setting of my home for when I am sleeping or away from home
3. Receiving the rebate that was offered
4. Recommendation from my contractor
5. Recommendation from a friend/relative/associate
6. Finding a low-cost programmable thermostat
77. Other (Specify): ________________________
88. Refused
99. Don’t know

6a. **[IF YES at S2Q2b & S2Q5b]** When you first decided to install a thermostat in your home, were you specifically planning on installing a programmable thermostat?

1. Yes
2. No
88. Refused [DO NOT READ]
99. Don’t know [DO NOT READ]

6b. **[IF NO AT 6a]** When you chose to install the thermostat in your home, were you aware that it was programmable?

1. Yes
2. No
88. Refused [DO NOT READ]
7a. [IF YES at S2Q2b & S2Q5b] If the rebate had not been available, how likely would you have been to spend an additional [INSERT REBATE LEVEL FOR PROGRAMMABLE THERMOSTAT – COL BA] on the installation of a programmable thermostat? Would you have been:

1. Extremely likely
2. Very likely
3. Somewhat likely
4. Not very likely
5. Not at all likely

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

7b. [IF ANY ANSWER EXCEPT “EXTREMELY LIKELY” AT 7a] If the rebate had not been available, how would your decision to install a programmable thermostat have been different?

[OPEN END, DO NOT READ]

1. Would have made the exact same decision and had the contractor install a programmable thermostat
2. Would not have upgraded my existing NON-programmable thermostat
3. Would not have upgraded my existing programmable thermostat
4. Would have had the contractor install a cheaper non-programmable thermostat
5. Would have installed a programmable thermostat myself

77. Other (please specify)________________________

88. Refused

99. Don’t know
8. **[IF YES at S2Q2b & S2Q5b]** Excluding the [INSERT PROGRAMMABLE THERMOSTAT REBATE AMOUNT] rebate, approximately how much did you pay for the programmable thermostat, including installation?

   I paid $________ and then received a rebate of [INSERT PROGRAMMABLE THERMOSTAT REBATE AMOUNT].

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

9. **[IF YES at S2Q2b & S2Q5b]** Did you previously have a programmable thermostat in your current home?

   1  Yes

   2  No

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

10. **[IF YES at S9]** Was it programmed during the winter months?

    1  Yes

    2  No

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

11. **[IF YES AT Q9 and YES AT S2Q1a]** Was it programmed during the summer months?

    1  Yes

    2  No

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]
12a. [IF YES at S2Q2b & S2Q5b] During the winter months before you installed your new programmable thermostat, at what temperature did you normally keep your home when you were there and awake?

____ [MIN: 0 MAX: 94]

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

12b. [IF A NUMBER IS PROVIDED AT 12A] Is this in Celsius or Fahrenheit?

1  Celsius

2  Fahrenheit

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

13a. [IF YES at S2Q2b & S2Q5b] During the winter months BEFORE you installed your NEW programmable thermostat, at what temperature did you normally keep your home when you were asleep or away?

____ [MIN: 0 MAX: 94]

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

13b. [IF A NUMBER IS PROVIDED AT 13A] Is this in Celsius or Fahrenheit?

1  Celsius

2  Fahrenheit

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

14. [IF YES AT Q10 & Q11] Is your new programmable thermostat programmed the same way as your old one?
15. [IF YES at S2Q2b & S2Q5b – DO NOT ASK TO THOSE SAYING “YES” AT Q14] Is your new programmable thermostat currently programmed?

1 Yes
2 No
88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

16a. [IF YES AT Q15] Who programmed your thermostat?

1 I/household member programmed it
2 Contractor
88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

16b. [IF CONTRACTOR AT Q16a] Are you comfortable programming the thermostat on your own?

1 Yes
2 No
88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

17a. [IF NO AT Q15] Why isn’t your programmable thermostat currently programmed?

[OPEN END, DO NOT READ]
1. Do not know how to use it / too complicated / have not read the manual
2. Have not had the chance to program it yet
3. Prefer to adjust the temperature manually
77. Other (please specify)
88. Refused
99. Don’t know

17b. **[IF 1 OR 2 AT Q17a]** Are you likely to program your thermostat within the next few months?

1. Yes
2. No
88. Refused [DO NOT READ]
99. Don’t know [DO NOT READ]

18a. **[IF YES at S2Q2b & S2Q5b]** During the winter months since you have installed your NEW programmable thermostat, at what temperature do you normally keep your home when you are there and awake? [IF RESPONDENT SAYS THEY HAVE NOT USED THEIR PROGRAMMABLE THERMOSTAT IN WINTER YET, PLEASE ASK THEM WHAT TEMPERATURE THEY WOULD BE LIKELY TO KEEP IT AT]

___ [MIN: 0 MAX: 94]
88. Refused [DO NOT READ]
99. Don’t know [DO NOT READ]

18b. **[IF A NUMBER IS PROVIDED AT 18a]** Is this in Celsius or Fahrenheit?

1. Celsius
2. Fahrenheit
88. Refused [DO NOT READ]
99. Don’t know [DO NOT READ]
19a. [IF YES at S2Q2b & S2Q5b] During the winter months since you have installed your NEW programmable thermostat, at what temperature do you normally keep your home when you are asleep or away? [IF RESPONDENT SAYS THEY HAVE NOT USED THEIR PROGRAMMABLE THERMOSTAT IN WINTER YET, PLEASE ASK THEM WHAT TEMPERATURE THEY WOULD BE LIKELY TO KEEP IT AT]

____ [MIN: 0 MAX: 94]

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

19b. [IF A NUMBER IS PROVIDED AT 19a] Is this in Celsius or Fahrenheit?

1 Celsius

2 Fahrenheit

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

20a. [IF YES at S2Q2b & S2Q5b & YES FOR S2Q1A] During the summer months since you’ve installed your new programmable thermostat, at what temperature do you normally keep your home when you are there? [IF RESPONDENT SAYS THEY HAVE NOT USED THEIR PROGRAMMABLE THERMOSTAT IN SUMMER YET, PLEASE ASK THEM WHAT TEMPERATURE THEY WOULD BE LIKELY TO KEEP IT AT]

____ [MIN: 0 MAX: 94]

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

20b. [IF A NUMBER IS PROVIDED AT 20a] Is this in Celsius or Fahrenheit?

1 Celsius

2 Fahrenheit

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]
21a. **[IF YES at S2Q2b & S2Q5b & YES FOR S2Q1a]** During the summer months since you’ve installed your new programmable thermostat, at what temperature do you normally keep your home when you were AWAY? **[IF RESPONDENT SAYS THEY HAVE NOT USED THEIR PROGRAMMABLE THERMOSTAT IN SUMMER YET, PLEASE ASK THEM WHAT TEMPERATURE THEY WOULD BE LIKELY TO KEEP IT AT]**

____ [MIN: 0 MAX: 94]

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

21b. **[IF A NUMBER IS PROVIDED AT 21a]** Is this in Celsius or Fahrenheit?

1 Celsius

2 Fahrenheit

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

22. **[IF YES at S2Q2b & S2Q5b]** Did the contractor explain to you how to program your new thermostat?

1 Yes

2 No

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

23. **[IF YES at S2Q2b & S2Q5b]** Did the contractor leave you with an operating manual for the programmable thermostat?

1 Yes

2 No

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]
24. [IF YES at S2Q2b & S2Q5b] Did the contractor suggest appropriate temperature settings for the summer and winter to maximize the energy savings in your home?

1 Yes

2 No

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

SECTION 4 – FURNACES & AIR HANDLERS (PARTICIPANTS ONLY)

1a. [IF YES AT S2Q2a] You have indicated that you recently installed a forced air furnace or air handler system using an electronically commutated motor (ECM) system. What factors were most important to you when you decided to purchase the particular furnace/air handler that day?

[OPEN END, DO NOT READ]

1 Finding a replacement furnace/air handler fast

2 Finding an energy efficient replacement furnace/air handler

3 Receiving a rebate from a energy conservation program

4 Recommendation from my contractor

5 Recommendation from a friend/relative/associate

6 Finding a low-cost replacement furnace/air handler

7 Other (Specify): ________________________

88 Refused

99 Don’t know

1b. [IF MORE THAN ONE RESPONSE TO Q6] Which factor was most important?

[OPEN END, DO NOT READ]

1 Finding a replacement furnace/air handler fast
2. Finding an energy efficient replacement furnace/air handler
3. Receiving a rebate from a energy conservation program
4. Recommendation from my contractor
5. Recommendation from a friend/relative/associate
6. Finding a low-cost replacement furnace/air handler
7. Other (Specify): ______________________
88 Refused
99 Don’t know

2. [IF YES AT S2Q2a] Do you recall having the choice between a furnace with a standard furnace motor and a furnace equipped with an ELECTRONICALLY COMMUTATED MOTOR?

1 Yes
2 No
88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

3. [IF YES AT S2Q2a AND YES & Q2] Why did you decide to purchase a replacement furnace equipped with an ELECTRONICALLY COMMUTATED MOTOR?

1 For the potential energy savings
2 Recommendation from my contractor
3 Recommendation from a friend/relative/associate
77 Other (please specify)_______________
88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]
4. [IF YES AT S2Q2a and YES AT S2Q5a] I would now like to focus on your decision to get a replacement furnace/air handler equipped with an Electronically Commutated Motor (ECM) through the rebate program.

When was your furnace/air handler replaced? (PLEASE GET SPECIFIC MONTH AND YEAR)

I had my furnace/air handler replaced in ________ (mm/yyyy)

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

5a. [IF YES AT S2Q2a and YES AT S2Q5a] When you first decided to replace your furnace/air handler, were you planning to buy one with an electronically commutated motor, or ECM?

1  Yes

2  No

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

5b. [IF NO AT Q5a] When you chose your replacement furnace/air handler, were you aware that it was equipped with an electronically commutated motor or ECM?

1  Yes

2  No

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

6a. [IF YES AT S2Q2a and YES AT S2Q5a] If the rebate had not been available, how likely would you have been to spend an additional [INSERT FURNACE REPLACEMENT REBATE AMOUNT (COL AY)] on a furnace / air handler equipped with an ELECTRONICALLY COMMUTATED MOTOR? Would you have been:

1  Extremely likely

2  Very likely
3  Somewhat likely

4  Not very likely

5  Not at all likely

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

6b.  [IF ANY ANSWER EXCEPT “EXTREMELY LIKELY” AT 6a] If the rebate had not been available, how would your furnace/air handler purchase have been different?

1  Would have made exactly the same purchase

2  Would have bought a furnace/air handler without an ELECTRONICALLY COMMUTATED MOTOR

3  Would have bought a furnace/air handler with an ELECTRONICALLY COMMUTATED MOTOR but would have done so at a later date

4  Would not have bought any furnace/air handler

77  Other (Specify): _______________________

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

7.  [IF YES AT S2Q2a and YES AT S2Q5a AND YES AT Q2] If there was no rebate, how much more expensive was the furnace/air handler with the electronically-commutated motor that you bought compared to a furnace/air handler with a conventional or normal motor?

It was more expensive by (try to get a specific number)$__________

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

8.  [IF YES AT S2Q2a and NO AT S2Q5a] You have indicated that you did not receive a rebate for your recently installed forced air furnace or air handler system using an electronically commutated motor.
Were you aware that the rebate programs provided customers with rebates between $100 and $250 for upgrading or replacing their existing furnace with either a mid or high efficiency furnace equipped with an ELECTRONICALLY COMMUTATED MOTOR? [IF NECESSARY, EXPLAIN ELECTRONICALLY COMMUTATED MOTOR – An Electronically Commutated Motor, is a brushless motor technology in forced air heating application, which can reduce the electrical consumption of the furnace motor by as much as 60% over a standard motor]

1  Yes

2  No

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

9a.  [IF YES AT Q8] Why did you decide not to participate in the program?

[OPEN END, DO NOT READ]

1  Was not eligible for the program

2  Did not understand the rules of the program

3  Contractor advised against it

4  It was too much work/time to get the rebate

77  Other (please specify)________

88  Refused

99  Don’t know

9b.  [IF “Was not eligible for the program” AT Q9a] Why were you not eligible for the program?

[OPEN END, DO NOT READ]

1  Missed the program deadline

2  I was not replacing an existing mid or high efficiency furnace

3  Type of replacement furnace did not qualify
4 Contractor was not part of the program

77 Other (please specify)______

88 Refused

99 Don’t know

10. **[IF YES TO “Forced air furnace” AT S2Q1b & NO AT S2Q2a]** You have indicated that you have recently installed a forced air furnace or air handler system that did not use an electronically commutated motor (ECM) system. What factors were most important to you when you decided to purchase the particular furnace/air handler that day?

    **[OPEN END, DO NOT READ]**

    1 Finding a replacement furnace/air handler fast
    2 Finding an energy efficient replacement furnace/air handler
    3 Receiving a rebate from a energy conservation program
    4 Recommendation from my contractor
    5 Recommendation from a friend/relative/associate
    6 Finding a low-cost replacement furnace/air handler
    7 Other (Specify): ______________________
    88 Refused
    99 Don’t know

11. **[IF MORE THAN ONE RESPONSE TO Q10]** Which factor was most important?

    **[OPEN END, DO NOT READ]**

    1 Finding a replacement furnace/air handler fast
    2 Finding an energy efficient replacement furnace/air handler
    3 Receiving a rebate from a energy conservation program
4 Recommendation from my contractor
5 Recommendation from a friend/relative/associate
6 Finding a low-cost replacement furnace/air handler
7 Other (Specify): ________________________
88 Refused
99 Don’t know

12. [IF YES TO “Forced air furnace” AT S2Q1b & NO AT S2Q2a] Do you recall having the choice between a furnace with a standard furnace motor and a furnace equipped with an ELECTRONICALLY COMMUTATED MOTOR?

1 Yes
2 No
88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

13. [IF YES TO Q12] Why did you decide not to purchase a replacement furnace equipped with an ELECTRONICALLY COMMUTATED MOTOR?

[OPEN END, DO NOT READ]

1 ELECTRONICALLY COMMUTATED MOTOR was too expensive
2 It wasn’t worth the potential energy savings
3 Didn’t know much about ELECTRONICALLY COMMUTATED MOTOR motors
77 Other (please specify)__________
88 Refused
99 Don’t know

13a. [IF YES TO “Forced air furnace” AT S2Q1b & NO AT S2Q2a and YES TO Q12] Let’s assume that it costs an extra $400 to purchase a furnace/air handler equipped with an
ELECTRONICALLY COMMUTATED MOTOR. What minimum rebate level would have persuaded you to get a replacement furnace/air handler equipped with an ELECTRONICALLY COMMUTATED MOTOR?

1. $150
2. $200
3. $250
4. $300
5. The full $400 price difference
77. No rebate would have persuaded me

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

14. [IF YES TO “Forced air furnace” AT S2Q1b] During the winter season, was your OLD furnace fan set to run continuously (set to “ON” at the thermostat) or did it run intermittently (set to “AUTO” at the thermostat)?

1. It ran continuously – set to “on”
2. It ran intermittently – set to “auto”
88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

15. [IF YES TO “Forced air furnace” AT S2Q1b] During the summer season, was your OLD furnace fan set to run continuously (set to “on” at the thermostat) or did it run intermittently (set to “auto” at the thermostat)?

1. It ran continuously – set to “on”
2. It ran intermittently – set to “auto”
3. It didn’t run at all / didn’t use in the summer
88. Refused [DO NOT READ]
16. [IF YES TO “Forced air furnace” AT S2Q1b] Now thinking about your NEW furnace fan, during the winter season is your NEW furnace fan set to run continuously (set to “ON” at the thermostat) or does it run intermittently (set to “AUTO” at the thermostat)?

1. It runs continuously – set to “on”
2. It runs intermittently – set to “auto”
88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

17. [IF YES TO “Forced air furnace” AT S2Q1b] During the summer season, is your NEW furnace fan set to run continuously (set to “ON” at the thermostat) or does it run intermittently (set to “AUTO” at the thermostat)?

1. It runs continuously – set to “on”
2. It runs intermittently – set to “auto”
3. It doesn’t run at all / don’t use in the summer
88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

SECTION 5 – AIR CONDITIONERS (PARTICIPANTS ONLY)

1a. [IF YES AT S2Q2c or S2Q2d] You have indicated that you recently installed a central air conditioner with an Energy Star® qualified system. What factors were most important to you when you decided to purchase the particular central air conditioner that day?

[OPEN END, DO NOT READ]

1. Finding a replacement central air conditioner fast
2. Finding an energy efficient replacement central air conditioner
3. Receiving a rebate from a energy conservation program
4. Recommendation from my contractor
5 Recommendation from a friend/relative/associate

6 Finding a low-cost replacement central air conditioner

7 Other (Specify): ______________________

88 Refused

99 Don’t know

1b. [IF MORE THAN ONE RESPONSE TO Q1a] Which factor was most important?

[OPEN END, DO NOT READ]

1 Finding a replacement central air conditioner fast

2 Finding an energy efficient replacement central air conditioner

3 Receiving a rebate from a energy conservation program

4 Recommendation from my contractor

5 Recommendation from a friend/relative/associate

6 Finding a low-cost replacement central air conditioner

7 Other (Specify): ______________________

88 Refused

99 Don’t know

2. [IF YES AT S2Q2c or S2Q2d] Do you recall having the choice between an Energy Star® rated central air conditioner and a non-Energy Star® rated central air conditioner?

1 Yes

2 No

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]
3. [IF YES AT S2Q2c or S2Q2d] Why did you decide to purchase an Energy Star® rated central air conditioner?

[OPEN END, DO NOT READ]

1 For the potential energy savings
2 Recommendation from my contractor
3 Recommendation from a friend/relative/associate
77 Other (please specify)_______________
88 Refused
99 Don’t know

4. [IF YES AT S2Q2c and YES AT S2Q5c] I would now like to focus on your decision to get a replacement Energy Star® rated central air conditioner through the rebate program.

When was your Energy Star® rated central air conditioner replaced? (PLEASE GET SPECIFIC MONTH AND YEAR)

I had my central air conditioner replaced in ________ (mm/yyyy)

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

5a. [IF YES AT S2Q2c and YES AT S2Q5c] When you first decided to replace your central air conditioner, were you planning to buy one that met Energy Star® Standards?

1 Yes
2 No

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

5b. [IF NO AT Q5a] When you chose your replacement central air conditioner, were you aware that it met Energy Star® Standards?
6. **[IF YES AT S2Q2c and YES AT S2Q5c]** Do you recall having a choice between an Energy Star® central air conditioner THAT WOULD BE ELIGIBLE FOR THE REBATE and a non-Energy Star® central air conditioner THAT WOULD NOT BE ELIGIBLE FOR THE REBATE?

1 Yes

2 No

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

7. **[IF YES AT Q6]** If there was no rebate, how much more expensive was the Energy Star® air conditioning system that you bought compared to a non-Energy Star® air conditioning system?

It was more expensive by (try to get a specific number)$________________$

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

8a. **[IF YES AT S2Q2c and YES AT S2Q5c]** If the rebate had not been available, how likely would you have been to spend an additional [INSERT AC REPLACEMENT REBATE LEVEL (COL AZ)] on a replacement central air conditioner that met Energy Star® Standards? Would you have been:

1 Extremely likely

2 Very likely

3 Somewhat likely

4 Not very likely

5 Not at all likely
88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

8b.  [FOR ALL EXCEPT THOSE SAYING “EXTREMELY LIKELY” AT Q8a] If the rebate had not been available, how would your replacement central air conditioner purchase have been different?

[OPEN END, DO NOT READ]

1  Would have made exactly the same purchase

2  Would have bought a less efficient central air conditioner

3  Would have bought a central air conditioner that met Energy Star® Standards but would have done so at a later date

4  Would not have bought any central air conditioner

77  Other (Specify): __________________________

88  Refused

99  Don’t know

9.  [IF YES AT S2Q2c and NO AT S2Q5c] You have indicated that you did not receive a rebate for your recently installed Energy Star® rated central air conditioner.

Were you aware that the rebate programs provided customers with rebates between $350 and $500 for upgrading or replacing their existing central air conditioner with an Energy Star® rated central air conditioner? [An Energy Star® rated central air conditioner meets or exceeds a premium level of energy efficiency]

1  Yes

2  No

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

10a.  [IF YES AT Q9] Why did you decide not to participate in the program?
[OPEN END, DO NOT READ]

1  Was not eligible for the program

2  Did not understand the rules of the program

3  Contractor advised against it

4  It was too much work/time to get the rebate

77  Other (please specify)________

88  Refused

99  Don’t know

10b.  [IF “Was not eligible for the program” AT Q10a] Why were you not eligible for the program?

[OPEN END, DO NOT READ]

1  Missed the program deadline

2  Decided not to get an Energy Star® central air conditioner

3  Type of replacement central air conditioner did not qualify

4  Contractor was not part of the program

5  I was not replacing an existing central air conditioner

77  Other (please specify)________

88  Refused

99  Don’t know

11.  [IF YES TO “Air conditioner” AT S2Q1 & NO AT S2Q2c or S2Q2d] You have indicated that you have recently installed a central air conditioner that was not Energy Star® rated. What factors were most important to you when you decided to purchase the central air conditioner that day?

[OPEN END, DO NOT READ]
1. Finding a replacement central air conditioner fast

2. Finding an energy efficient replacement central air conditioner

3. Receiving a rebate from a energy conservation program

4. Recommendation from my contractor

5. Recommendation from a friend/relative/associate

6. Finding a low-cost replacement central air conditioner

7. Other (Specify): ______________________

88. Refused

99. Don’t know

12. [IF MORE THAN ONE RESPONSE TO Q11] Which factor was most important?

[OPEN END, DO NOT READ – repeat if necessary]

1. Finding a replacement central air conditioner fast

2. Finding an energy efficient replacement central air conditioner

3. Receiving a rebate from a energy conservation program

4. Recommendation from my contractor

5. Recommendation from a friend/relative/associate

6. Finding a low-cost replacement central air conditioner

7. Other (Specify): ______________________

88. Refused

99. Don’t know

13. [IF YES TO “Air conditioner” AT S2Q1 & NO AT S2Q2c or S2Q2d] Do you recall having the choice between a standard central air conditioner and an Energy Star® rated air conditioner?
1. Yes

2. No

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

14. [IF YES TO Q13] Why did you decide to not purchase an Energy Star® rated central air conditioner?

[OPEN END, DO NOT READ]

1. It was too expensive

2. It wasn’t worth the potential energy savings

3. Having an energy efficient central air conditioner wasn’t important to me

4. Didn’t know much about Energy Star® central air conditioners

77. Other (please specify)____________

88. Refused

99. Don’t know

14a. [IF YES TO Q13] Let’s assume that it cost an extra $600 to purchase an Energy Star® rated central air conditioner over a standard minimum efficiency unit. What minimum rebate level would have persuaded you to purchase an Energy Star® rated central air conditioner?

1. $200

2. $250

3. $300

4. $350

5. $400

5. $500
6 The full $600 difference in price

77 No rebate would have persuaded me

88 Refused

99 Don’t know

15a. [IF YES TO “Air conditioner” AT S2Q1] Since you had the new central air conditioner installed, have you generally kept the thermostat setting for your central air conditioner at the same level as before, a little colder (lower temperature in the house), or a little higher (warmer temperature in the house)?

1 The same

2 A little colder

3 A little warmer

4 Haven’t used my central air conditioner system

5 I didn’t have an air conditioner before

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

15b. [IF A LITTLE COLDER at 15a] Approximately how many degrees lower is your thermostat set now for air conditioning compared to before:

Colder by _______ Degrees (TRY TO GET A NUMBER)

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

15c. [IF A NUMBER IS GIVEN AT 15b] Is this in Celsius or Fahrenheit?

1 Celsius

2 Fahrenheit

88 Refused [DO NOT READ]
15d. [IF A LITTLE WARMER at 15a] Approximately how many degrees higher is your thermostat set now for air conditioning compared to before?

Warmer by _____ degrees (try to get a number)

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

15e. [IF A NUMBER IS GIVEN AT 15d] Is this in Celsius or Fahrenheit?

1 Celsius

2 Fahrenheit

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

16a. [IF YES TO “Air conditioner” AT S2Q1] Since you had the new central air conditioner installed, would you say that the number of hours you operate your central air conditioner are about the same as before, more frequently (more hours) or less frequently (fewer hours)?

1 The same

2 More frequently

3 Less frequently

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

16b. [IF MORE FREQUENTLY AT 16a] Approximately how many MORE hours per day do you operate your central air conditioner

______________ Hours per day (TRY TO GET NUMBER)

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]
16c.  **[IF LESS FREQUENTLY AT 16a]** Approximately how many LESS hours per day do you operate your central air conditioner

__________________ Hours per day (TRY TO GET NUMBER)

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

**SECTION 6 – CAC TUNE UP (PARTICIPANTS ONLY)**

**[THIS SECTION IS TO BE ASKED ONLY TO THOSE SAYING YES AT S2Q5d]**

You indicated you participated in the rebate program by getting your central air conditioner tuned up.

1. When did you get your central air conditioner tuned up? (PLEASE GET SPECIFIC MONTH AND YEAR)

I tuned up my air conditioner in ________ (mm/yyyy)

2. What factors were most important to you when you decided to get your central air conditioner tuned up?

**[OPEN END – DO NOT READ]**

1 Finding someone to tune up my central air conditioner fast

2 My warrantee requires that I regularly tune-up my central air conditioner

3 Receiving the rebate that was offered

4 Recommendation from my contractor

5 Recommendation from a friend/relative/associate

6 Finding a low-cost tune up

7 Save on my energy bills

77 Other (Specify): ______________________

88 Refused
3. [IF MORE THAN 1 ANSWER AT Q2] Which factor was most important?

[DO NOT READ]

1. Finding someone to tune up my central air conditioner fast
2. My warranteer requires that I regularly tune-up my central air conditioner
3. Receiving the rebate that was offered
4. Recommendation from my contractor
5. Recommendation from a friend/relative/associate
6. Finding a low-cost tune up
7. Save on my energy bills
77. Other (Specify): ______________________
88. Refused
99. Don’t know

4. Were you already planning on getting your central AC tuned up when you heard about this rebate program?

1. Yes
2. No
88. Refused [DO NOT READ]
99. Don’t know [DO NOT READ]

5. [IF YES AT Q4] When you chose to get your central air conditioner tuned up, were you aware that you would be eligible for a rebate?

1. Yes
2. No
6. If the rebate had not been available, how likely would you have been to spend an additional $50 getting your air conditioner tuned up? Would you have been:

1  Extremely likely
2  Very likely
3  Somewhat likely
4  Not very likely
5  Not at all likely

88  Refused [DO NOT READ]
99  Don’t know [DO NOT READ]

7. [FOR ALL EXCEPT THOSE SAYING “EXTREMELY LIKELY” ABOVE] If the rebate had not been available, how would your decision to get your central air conditioner tuned up have been different?

[OPEN END, DO NOT READ]

1  Would have made exactly the same purchase
2  Would not have had my central air conditioner tune up
3  Would have had my central air conditioner tuned up but done so at a later date

77  Other (Specify): ____________________

88  Refused
99  Don’t know

8a. Have you ever had your central air conditioner tuned up before?

1  Yes
2. No

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

8b. [IF YES AT Q8a] When was it last tuned up?

1. Last year

2. 2-4 years ago

4. 5 of more years ago

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

9. How old is your central air conditioner?

1. Less than 1 year old

2. 2-5 years old

3. 5-10 years old

4. 10-15 years old

5. Over 15 years old

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

11. Excluding the $50 rebate, approximately how much did you pay to have your central air conditioner tuned up?

I paid $_________ and then received a rebate of $50.

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]
12a. Since the contractor completed the work, have you generally kept the thermostat setting for your central air conditioner at the same level as before, a little colder (lower temperature in the house), or a little higher (warmer temperature in the house)?

1 The same
2 A little colder
3 A little warmer
4 Haven’t used my central air conditioner system yet

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

12b. [IF A LITTLE COLDER AT Q12a] Approximately how many degrees lower is your thermostat set now for air conditioning compared to before:

Colder by ______ Degrees (TRY TO GET A NUMBER)

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

12c. [IF A NUMBER IS GIVEN AT Q12b] Is this in Celsius or Fahrenheit?

1 Celsius
2 Fahrenheit

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

12d. [IF A LITTLE WARMER AT Q12a] Approximately how many degrees higher is your thermostat set now for air conditioning compared to before?

Warmer by _____ degrees (try to get a number)

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]
12e. **[IF A NUMBER IS GIVEN AT Q12d]** Is this in Celsius or Fahrenheit?

1  Celsius

2  Fahrenheit

88  Refused **[DO NOT READ]**

99  Don’t know **[DO NOT READ]**

13. Since the contractor completed the work, would you say that the number of hours you operate your central air conditioner is about the same as before, more frequently (more hours) or less frequently (fewer hours)?

1  The same

2  More frequently

3  Less frequently

88  Refused **[DO NOT READ]**

99  Don’t know **[DO NOT READ]**

14a. **[IF MORE FREQUENTLY AT Q13]** Approximately how many MORE hours per day do you operate your central air conditioner

______________ Hours per day (TRY AND GET NUMBER)

88  Refused **[DO NOT READ]**

99  Don’t know **[DO NOT READ]**

14b. **[IF LESS FREQUENTLY AT Q13]** Approximately how many LESS hours per day do you operate your central air conditioner

______________ Hours per day (TRY AND GET NUMBER)

88  Refused **[DO NOT READ]**

99  Don’t know **[DO NOT READ]**
SECTION 7 - CONTRACTOR ASSISTANCE AND EFFICIENCY QUESTIONS (ASK ONLY IF ANSWERED YES TO AT LEAST ONE OF S2Q5A THROUGH S2Q5D – IE THOSE WHO GOT REBATE)

The next several questions deal with the contractor you used for the work and / or services you undertook.

1. How did you find the contractor who ultimately performed the work?

[OPEN END, DO NOT READ]

1 General internet search
2 Local listings directory
3 OPA website
4 HRAI website
5 Have used them before
6 Friend/family/colleague
77 Other (please specify)________________________
88 Refused
99 Don’t know

2. Did the contractor encourage you to purchase equipment or undertake service that was eligible for a rebate?

1 Yes
2 No
88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

3. How influential was your contractor in your decision?

1 Very influential – I went with what was recommended to me
2. Quite influential – I considered the recommendation and also did some independent research

3. Not very influential – I did the research and told the contractor what I wanted.

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

4. Approximately how many separate contractor quotes did you receive before undertaking the work?

1. One

2. Two

3. Three

77. Other (please specify)_____________________

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

5. How satisfied would you say you are with the contractor who performed the work. Please use a scale from 1-7 where 1 means very dissatisfied and 7 means very satisfied.

1. Very dissatisfied

2. 

3. 

4. 

5. 

6. 

7. Very satisfied

88. Refused [DO NOT READ]
6. And how would you rate the contractor on the following dimensions. Please use a scale from 1 to 7 where 1 means poor and 7 means excellent. You can of course choose any number in between.

[ROTATE]

<table>
<thead>
<tr>
<th>Dimension</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Refused</th>
<th>D/K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall job quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractor timeliness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity when explaining</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the rebate program</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Did the contractor have to contact you after completing the work to complete or check any information required for the rebate forms?

1 Yes

2 No

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

8a. And was the contractor as helpful as they could have been when it came to completing the paperwork for the rebate?

1 Yes

2 No

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

8b. [IF NO AT Q8a] What could have been improved?
1. Understanding communicating the process more clearly
2. Filling out the paperwork sooner
3. Keeping me updated on when the rebate application would be submitted
4. Communicating when I could expect to receive the rebate
77. Other (please specify)____________________
88. Refused
99. Don’t know

9. How long did you have to wait before receiving your rebate?

[OPEN END, DO NOT READ]

1. Less than 1 month
2. 1 to 2 months
3. 2 to 3 months
4. More than 3 months
5. I’m still waiting for my rebate
77. Other (please specify)____________________
88. Refused
99. Don’t know

10. [IF NOT “STILL WAITING” AT Q9] Were you satisfied with the speed with which you received your rebate?

1. Yes
2. No
SECTION 8 - PARTICIPATION IN OTHER PROGRAMS – ASK EVERYONE

1. Have you participated in other energy saving programs recently?
   1. Yes
   2. No

2. [IF YES AT Q1] And which of the following energy savings programs have you participated in:

<table>
<thead>
<tr>
<th>Program</th>
<th>Yes</th>
<th>No</th>
<th>Refused</th>
<th>D/K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every Kilowatt Counts coupon program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>offering rebates for compact fluorescent lights, outdoor solar lights,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LED Christmas lights and other energy saving products</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer Savings Challenge Program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great Refrigerator Round-Up / fridge pick-up and recycling program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Saver program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enbridge / Union Gas programmable thermostat program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enbridge / Union Gas gas water heater conversion program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enbridge / Union Gas Energy Star® high-efficiency furnace</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government energy audit program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government energy retrofit program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hydro One’s PowerCost Monitor program  □  □  □  □  □
2006 Hot and Cool Savings Program  □  □  □  □  □
Other (please specify)________________________  □  □  □  □  □

3. [IF YES TO “Great Refrigerator Round-Up / fridge pick-up and recycling program” AT Q2] When did you participate in the Great Refrigerator Round Up program? (PLEASE GET SPECIFIC MONTH AND YEAR)

I participated in ______ (mm/yyyy)

4. Would you say you are very concerned, somewhat concerned, not very concerned or not at all concerned about each of the following issues:

READ AND ROTATE

1 – Very concerned

2 – Somewhat concerned

3 – Not very concerned

4 – Not at all concerned

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>Refused</th>
<th>D/K</th>
</tr>
</thead>
<tbody>
<tr>
<td>The environmental impacts of electricity generation</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>The environmental impacts of electricity consumption by consumers</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>The environmental impacts of electricity consumption by business and industry</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

5. Do you think that individual consumers such as yourself can definitely, likely, likely not or definitely not make an important contribution to reducing the overall reduction of electrical energy use in the province?

1   Definitely
2. Likely
3. Likely not
4. Definitely not
5. Depends [DO NOT READ]
88. Refused [DO NOT READ]
99. Don’t know [DO NOT READ]

6. Are you familiar with any standards or ratings currently in place that rate the energy efficiency of appliances?

[OPEN END, DO NOT READ]
1. Energuide
2. Energy Star®
3. Canadian Standards Association standards
77. Other (SPECIFY ________________)
88. Refused
99. Don’t know

7. Have you ever heard the term “conservation culture”?
1. Yes
2. No
88. Refused [DO NOT READ]
99. Don’t know [DO NOT READ]

8. I’d like to read you a list of opinions that we often hear expressed. For each one, please tell me whether you totally agree, somewhat agree, somewhat disagree or totally disagree.

1. Totally agree
2 Somewhat agree

3 Somewhat disagree

4 Totally disagree

5 Neither agree nor disagree

6 Depends [DO NOT READ]

88 REFUSED [DO NOT READ]

99 DK [DO NOT READ]

I am prepared to pay more for an environmentally friendly product

To preserve people's jobs in this country, we must accept higher levels of pollution in the future

I have enough trouble worrying about my own problems without worrying about others

SECTION 9 - DEMOGRAPHICS

And finally, for classification purposes, I have a few questions about your household.

1. How long have you lived at your current residence?

   1 Less than 1 year

   2 Less than 3 years

   3 Between 3 and 5 years
4. Between 5 and 10 years

5. More than 10 years

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

1a. [If LESS THAN 1 OR 3 YEARS] When did you move into your current residence? (PLEASE GET SPECIFIC MONTH AND YEAR)

I moved into my current residence in ________ (mm/yyyy)

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

2a. How many people, including children, other family members and permanent guests, lived in your home in the summer of 2007 (last summer)?

_______ people [RECORD NUMBER]

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

2b. How many people, including children, other family members and permanent guests, lived in your home in the summer of 2006 (the summer before last)?

_______ [RECORD NUMBER]

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

3. [IF Furnace Replacement (col U or AU) = 0] What is the main heating system in your home? Is it:

[RESPONDENT MUST CHOOSE ONE ONLY]

1. Forced air furnace (hot air vents)

2. Furnace (boiler) with hot water or steam radiators
3 Electric baseboards

4 Electric radiant heating

5 Heating stove (burning wood, pellets, etc…)

77 Other (please specify)________________________

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

4. [IF 1 OR 2 AT Q3 OR Furnace Replacement (col U or AU) = 1] What is the main energy source for heating in your home?

[RESPONDENT MUST CHOOSE ONE ONLY]

1 Electricity

2 Natural Gas

3 Oil

4 Propane

5 Wood

77 Other (please specify)________________________

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

5a. Do you have any supplementary sources of heating in your home?

1 Yes

2 No

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]
5b. [If yes AT Q5a] Is it:

1. Electric baseboards
2. Electric space heaters
3. Heating stove (burning wood, pellets, etc…)
4. Natural gas fireplace
5. Electric fireplace
6. Wood fireplace
7. Other (please specify)________
8. Refused [DO NOT READ]
9. Don’t know [DO NOT READ]

7. What fuel do you use to heat your water for showers, baths, dishwashing and laundry? Is it:

[RESPONDENT MUST CHOOSE ONE ONLY]

1. Electricity
2. Natural Gas
3. Oil
4. Propane
5. Solar
6. Other (please specify)________________________
7. Refused [DO NOT READ]
8. Don’t know [DO NOT READ]

8. What fuel do you use to cook with? Is it:

[RESPONDENT MUST CHOOSE ONE ONLY]
9. What is the source of energy for your dryer?

[RESPONDENT MUST CHOOSE ONE ONLY]

   1 Electricity
   2 Natural Gas
   3 Propane
   4 Wood
   77 Other (please specify)________________________
   88 Refused [DO NOT READ]
   99 Don’t know [DO NOT READ]

10a. Do you normally use a room/window air conditioner during the summer?

   1 Yes
   2 No
   88 Refused [DO NOT READ]
   99 Don’t know [DO NOT READ]

10b. [IF YES AT Q10A] How many room/window air conditioners do you normally use during a typical summer?
11a. Do you have a pool?

1. Yes
2. No
88. Refused [DO NOT READ]
99. Don’t know [DO NOT READ]

11b. [IF YES AT Q11a] Do you have a pool heater?

1. Yes
2. No
88. Refused [DO NOT READ]
99. Don’t know [DO NOT READ]

11c. [IF YES AT Q11b] What is the source of energy used to heat your pool?

1. Electricity
2. Natural Gas
3. Propane
4. Solar
12a. Do you have a hot tub or spa?

1  Yes
2  No

88  Refused [DO NOT READ]
99  Don’t know [DO NOT READ]

12b. [IF YES AT Q12a] What is the source of energy used to heat your hot tub or spa?

1  Electricity
2  Natural Gas
3  Propane
4  Solar

77  Other (please specify)________________________

88  Refused [DO NOT READ]
99  Don’t know [DO NOT READ]

13. How many working refrigerators do you have in your home?

[OPEN END – DO NOT READ]

1  One
2  Two
3  Three
4  Four or more
14. And what type of home do you live in? Is it a:

1. Single family detached house,
2. Single family semi-detached house,
3. Townhouse or row house,
4. Duplex, triplex, four-plex
5. Condominium/apartment
6. Other (please specify)________________________

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

15. In what year was your home built?

1. Before 1970
2. 1970-1979
3. 1980-1989
4. 1990-1999
5. 2000-present

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

16. Do you currently own or rent your home?

1. Own
2. Rent
17. And what is the approximate square footage of your home. Please include the basement in the estimate if it is a finished living space. [IFCLARIFICATION IS NEEDED - including kitchen, bedrooms, bathrooms, foyers, dens and hallway]

1. Less than 1000 sq ft
2. 1001 to 1500 sq ft
3. 1501 to 2000 sq ft
4. 2001 to 2500 sq ft
5. 2501 to 3000 sq ft
6. 3001 to 3500 sq ft
7. 3501 to 4000 sq ft
8. more than 4000 sq ft

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

18. Approximately how many weeks would you say the members of your household were away from home during Summer 2007 (last summer)?

_____ [RECORD # WEEKS – MIN:0; MAX:16]

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

19. And approximately how many weeks would you say the members of your household were away from home during Summer 2006 (the summer before last)?

_____ [RECORD # WEEKS – MIN:0; MAX:16]

88 Refused [DO NOT READ]
20a. Do you have a secondary home such as a summer or winter home or a cottage?

1  Yes
2  No
88  Refused [DO NOT READ]
99  Don’t know [DO NOT READ]

20b. [IF YES AT Q20A] Approximately how many days in total do you spend at your secondary home in the WINTER?

1  Less than 7 days
2  7 to 14 days (between 1 to 2 weeks total)
3  14 – 28 days (roughly 2 to 4 weeks)
4  30 – 60 days (between 1 and 2 months)
5  more than 60 days (more than 2 months)
88  Refused [DO NOT READ]
99  Don’t know [DO NOT READ]

20c. [IF YES AT Q20A] Approximately how many days in total do you spend at your secondary home in the SUMMER?

1  Less than 7 days
2  7 to 14 days (between 1 to 2 weeks total)
3  14 – 28 days (roughly 2 to 4 weeks)
4  30 – 60 days (between 1 and 2 months)
5  more than 60 days (more than 2 months)
88  Refused [DO NOT READ]
21. [ASK IF YES TO ANY OF S2Q5a, b, c, d] Now, thinking of your participation in the [INSERT PROGRAM NAME – COL AS] run by the Heating, Refrigeration and Air Conditioning Institute of Canada and the Ontario Power Authority, could you please rate your level of agreement with the following statements. Please use a scale from 1 to 7 where 1 means strongly disagree and 7 means strongly agree. You can of course choose any number in between.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Refused</th>
<th>D/K</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ROTATE] The program has shown me</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>that I can save energy and money</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[ROTATE] The program made me feel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>good about my ability to save energy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and help protect the environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[ROTATE] My household didn’t have</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>to significantly adjust our current</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lifestyle in order to achieve energy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>savings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without the financial incentives, I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>would have been unlikely to involve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>my household in an energy savings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>program</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The program shows that</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>individuals can make a difference</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in terms of energy consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

22. Which is the last level of education that you have completed?

[DO NOT READ]

- 1 Grade school or less
- 2 Some high school
- 3 High school grad
- 4 Vocational/Technical school
5 Some university
6 University grad
7 Postgraduate degree
88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

23. For statistical purposes only, please tell me which of the following categories applies to your total household income for the year 2006? [F1]

[READ - CODE ONE ONLY – STOP ONCE RESPONDENT CONFIRMS CATEGORY]

1 Under $20,000
2 $20,000 to under $40,000
3 $40,000 to under $60,000
4 $60,000 to under $80,000
5 $80,000 to under $100,000
6 $100,000 and over
88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

SECTION 10 – HOME VISIT – [ASK THIS SECTION IF YES AT S2Q5a, b, or c]

[NAVIGANT TO PROVIDE QUOTA FOR HOME VISITS TO NORTHSTAR]

1. In order to provide the OPA and [INSER UTILITY NAME] with the information they need to maximize the positive environmental impacts that programs such as this rebate program can provide, we’ve been asked to schedule short home visits with a number of program participants. A home visit will be conducted by the marketing research firm “BBW” and would last no more than 15 minutes. Can we go ahead and schedule a visit with you? [IF THEY SEEM UN-EASY OR HAVE ANY QUESTION, PLEASE PROVIDE THEM WITH THE CONTACT INFORMATION OF THEIR UTILITY – NAVIGANT TO PROVIDE NORTHSTAR]
1. Yes
2. No

2. **[IF YES AT Q1]** We will be visiting your area on **[PROVIDE DATE AND TIME OPTIONS – MAY 20-31]**. What date and time would be most convenient for you?

   [ENTER DAY] __________

   [ENTER MONTH] __________

   [ENTER TIME] __________

3. **[IF YES AT Q1]** What is the best number to reach you on in the event that we need to contact you prior to the scheduled visit?

   [ENTER AREA CODE] __________

   [ENTER NUMBER] __________

   [EXTENSION? as required] __________

4. **[IF YES AT Q1]** Is there another number we can reach you on in the event that we need to contact you prior to the scheduled visit – just in case we are unable to reach you on the first number?

   [ENTER AREA CODE] __________

   [ENTER NUMBER] __________

   [EXTENSION? as required] __________

   [READ TO RESPONDENT] I would like to give you a telephone number that you can use should you need to reschedule this home visit. Do you have a pen or pencil handy? The number is as follows XXX-XXX-XXXX. [GIVE TELEPHONE NUMBER]

   *If you have any questions or concerns please feel free to contact BBW at [XXXXXX]*

   Thank you very much. Your answers will help Ontario Power Authority and [insert utility name] evaluate their energy efficiency efforts to better serve customers.
Hot and Cool Savings Rebate Program Non-Participant Telephone Survey

Sample to be drawn from telephone listings in local utility’s territory to ensure we have respondent NAME, ADDRESS AND POSTAL CODE to enable survey responses to be matched with billing history from local utility.

SECTION 1: Screener

Good morning/afternoon/evening.

[IF CONTACT NAME IS AVAILABLE] May I please speak with [INSERT NAME]?

[IF CONTACT NAME IS UNAVAILABLE] I’d like to speak with the person most knowledgeable about the heating and cooling system in your home? Would that be you?

[IF NO / REFUSED] Could I please speak with the person that is most knowledgeable about the heating and cooling system in your home?

[If appropriate person is not available, schedule callback]

[ONCE APPROPRIATE PERSON IS ON THE PHONE] My name is______. I’m calling from the Logit Group, a public opinion and marketing research firm, on behalf of your utility company [INSERT UTILITY NAME FROM DATABASE] and the Ontario Power Authority. Our firm has been commissioned to conduct an important survey. The information you provide will help the Ontario Power Authority and your utility company [INSERT UTILITY NAME FROM DATABASE] to evaluate the effectiveness of their current rebate program and improve services to residential customers like you.

Please, be assured that we are not selling anything. Your participation in the study will in no way result in sales or solicitation calls.

1. We are interested in people’s occupations, do you or does anyone in your household, work for any of the following types of companies…?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>An advertising agency or public relations firm</td>
<td>☐</td>
</tr>
<tr>
<td>A market research company</td>
<td>☐</td>
</tr>
<tr>
<td>A radio or television station</td>
<td>☐</td>
</tr>
<tr>
<td>A newspaper or magazine</td>
<td>☐</td>
</tr>
</tbody>
</table>

   IF “Yes” TO ANY THANK & TERMINATE

2. Record gender [DO NOT ASK]
SECTION 2: PROGRAM AWARENESS & USAGE

1a. Do you currently have central air conditioning in your home?

1  Yes
2  No

1b. Since September 2006, have you replaced or installed any of the following:

   [ROTATE]

   Yes   No
   1. Forced air furnace or air handler system  □   □
   2. [IF YES at Q1a] Air conditioner  □   □
   3. Programmable Thermostat  □   □

1c. [IF YES at Q1a] Since September 2006, have you received an air conditioner tune-up?

1  Yes
2  No

2a. [IF YES TO “Forced air furnace or air handler system” at Q1b] Specifically, since September 2006 have you replaced an existing forced air furnace or air handler system with one using an electronically commutated motor, ECM system? An Electronically Commutated Motor is a brushless motor technology in forced air heating application, which can reduce the electrical consumption of the furnace motor by as much as 60% over a standard motor.

1  Yes
2  No

2b. [IF YES TO “Air conditioner” at Q1b] Specifically, since September 2006 have you REPLACED an existing central air conditioner with an Energy Star® qualified system? [An Energy Star® rated central air conditioner meets or exceeds a premium level of energy efficiency]

1  Yes
2  No
2c.  **[IF NO TO “Programmable Thermostat” at Q1b]** Do you have a programmable thermostat currently installed in your home?

1  Yes

2  No

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

Programs run by the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) and the Ontario Power Authority called the “Hot Savings Rebate Program” and the “Cool Savings Rebate Program”, provided customers with rebates of up to $750 for upgrading or replacing their existing central air conditioner or furnace. Under these programs, rebates were available for:

- Replacement of an existing forced air/furnace or air handler system with one using an electronically-commutated motor, or ECM system
- Programmable thermostats
- Replacement of an existing central air conditioner with an Energy Star®-qualified system.
- Central air conditioner tune-ups

3a.  Before today, were you aware of this rebate program?

1  Yes

2  No

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

3b.  **[IF YES AT 3a]** How did you first become aware of this rebate program?

[OPEN END, DO NOT READ]

1  Newspaper

2  Radio
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>TV</td>
</tr>
<tr>
<td>4</td>
<td>Internet</td>
</tr>
<tr>
<td>5</td>
<td>Electric bill</td>
</tr>
<tr>
<td>6</td>
<td>Insert in electric bill</td>
</tr>
<tr>
<td>7</td>
<td>Letter from electric utility</td>
</tr>
<tr>
<td>8</td>
<td>Friend, relative, word of mouth</td>
</tr>
<tr>
<td>9</td>
<td>Announcement by public official</td>
</tr>
<tr>
<td>10</td>
<td>School, church, community group</td>
</tr>
<tr>
<td>11</td>
<td>Contractor</td>
</tr>
<tr>
<td>12</td>
<td>Equipment supplier recommended</td>
</tr>
<tr>
<td>77</td>
<td>Other (please specify)________________________</td>
</tr>
<tr>
<td>88</td>
<td>Refused</td>
</tr>
<tr>
<td>99</td>
<td>Don’t know</td>
</tr>
</tbody>
</table>

3c. [IF YES AT 3a] When did you first become aware of this rebate program?

[OPEN END, DO NOT READ]

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Before October 2006</td>
</tr>
<tr>
<td>2</td>
<td>Between October 2006 and March 2007</td>
</tr>
<tr>
<td>3</td>
<td>After April 2007</td>
</tr>
<tr>
<td>4</td>
<td>When I received the rebate</td>
</tr>
<tr>
<td>88</td>
<td>Refused</td>
</tr>
<tr>
<td>99</td>
<td>Don’t know</td>
</tr>
</tbody>
</table>

4. [ASK ALL] Do you recall receiving a rebate under this program?
[OPEN END, DO NOT READ]

1 Yes

2 No

3 Supposed to get one, but haven’t received it yet

88 Refused

99 Don’t know

[IF Q4 = 1 OR 3. TERMINATE AND THANK – DO NOT CONTINUE WITH OTHER QUESTIONS]

SECTION 3: FURNACES

[FOR RESPONDENTS WHO PURCHASED ECM AFTER SEPTEMBER 2006, BUT DID NOT GET A REBATE]

1. [IF YES AT S2Q2a and NO AT S2Q4] You have indicated that you DID NOT receive a rebate for your recently installed forced air furnace or air handler system using an electronically commutated motor.

Were you aware that the rebate programs provided customers with rebates between $100 and $250 for upgrading or replacing their existing furnace with either a mid or high efficiency furnace equipped with an ELECTRONICALLY COMMUTATED MOTOR? [IF NECESSARY, EXPLAIN ELECTRONICALLY COMMUTATED MOTOR – An Electronically Commutated Motor, is a brushless motor technology in forced air heating application, which can reduce the electrical consumption of the furnace motor by as much as 60% over a standard motor]

1 Yes

2 No

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

2a. [IF YES AT Q1] Why did you decide not to participate in the program?

[OPEN END, DO NOT READ]

1 Was not eligible for the program
2. Did not understand the rules of the program

3. Contractor advised against it

4. It was too much work/time to get the rebate

77. Other (please specify)________

88. Refused

99. Don’t know

2b. [IF “Was not eligible for the program” AT Q2a] Why were you not eligible for the program?

[OPEN END, DO NOT READ]

1. Missed the program deadline

2. I was not replacing an existing mid or high efficiency furnace

3. Type of replacement furnace did not qualify

4. Contractor was not part of the program

77. Other (please specify)________

88. Refused

99. Don’t know

[FOR RESPONDENTS WHO PURCHASED NEW FURNACE WITHOUT ECM AFTER SEPTEMBER 2006]

3. [IF YES TO “Forced air furnace” AT S2Q1b & NO/DK AT S2Q2a] You have indicated that you have recently installed a forced air furnace or air handler system that did not use an electronically commutated motor (ECM) system. What factors were most important to you when you decided to purchase the particular furnace/air handler that day?

[OPEN END, DO NOT READ]

1. Finding a replacement furnace/air handler fast

2. Finding an energy efficient replacement furnace/air handler
3. Receiving a rebate from a energy conservation program

4. Recommendation from my contractor

5. Recommendation from a friend/relative/associate

6. Finding a low-cost replacement furnace/air handler

77. Other (Specify): ______________________

88. Refused

99. Don’t know

4. [IF MORE THAN ONE RESPONSE TO Q3] Which factor was most important?

[OPEN END, DO NOT READ]

1. Finding a replacement furnace/air handler fast

2. Finding an energy efficient replacement furnace/air handler

3. Receiving a rebate from a energy conservation program

4. Recommendation from my contractor

5. Recommendation from a friend/relative/associate

6. Finding a low-cost replacement furnace/air handler

77. Other (Specify): ______________________

88. Refused

99. Don’t know

5. [IF YES TO “Forced air furnace” AT S2Q1b & NO/DK AT S2Q2a] Do you recall having the choice between a furnace with a standard furnace motor and a furnace equipped with an ELECTRONICALLY COMMUTATED MOTOR?

1. Yes

2. No
6. [IF YES TO Q5] Why did you decide not to purchase a replacement furnace equipped with an ELECTRONICALLY COMMUTATED MOTOR?

[OPEN END, DO NOT READ]

1  ELECTRONICALLY COMMUTATED MOTOR was too expensive

2  It wasn’t worth the potential energy savings

3  Didn’t know much about ELECTRONICALLY COMMUTATED MOTORS

77  Other (please specify)____________

88  Refused

99  Don’t know

7. [IF YES TO “Forced air furnace” AT S2Q1b & NO/DK AT S2Q2a and YES TO Q5] Let’s assume that it costs an extra $400 to purchase a furnace/air handler equipped with an ELECTRONICALLY COMMUTATED MOTOR. What minimum rebate level would have persuaded you to get a replacement furnace/air handler equipped with an ELECTRONICALLY COMMUTATED MOTOR?

[OPEN END, DO NOT READ CODE CLOSEST VALUE TO RESPONSE]

1  $150

2  $200

3  $250

4  $300

5  The full $400 price difference

77  No rebate would have persuaded me

88  Refused [DO NOT READ]
8. [IF YES TO “Forced air furnace” AT S2Q1b] During the winter season, was your OLD furnace fan set to run continuously (set to “ON” at the thermostat) or did it run intermittently (set to “AUTO” at the thermostat)?

1  It ran continuously – set to “on”

2  It ran intermittently – set to “auto”

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

9. [IF YES TO “Forced air furnace” AT S2Q1b] During the summer season, was your OLD furnace fan set to run continuously (set to “on” at the thermostat) or did it run intermittently (set to “auto” at the thermostat)?

1  It ran continuously – set to “on”

2  It ran intermittently – set to “auto”

3  It didn’t run at all / didn’t use in the summer

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

10. [IF YES TO “Forced air furnace” AT S2Q1b] Now thinking about your NEW furnace fan, during the winter season is your NEW furnace fan set to run continuously (set to “ON” at the thermostat) or does it run intermittently (set to “AUTO” at the thermostat)?

1  It runs continuously – set to “on”

2  It runs intermittently – set to “auto”

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

11. [IF YES TO “Forced air furnace” AT S2Q1b] During the summer season, is your NEW furnace fan set to run continuously (set to “ON” at the thermostat) or does it run intermittently (set to “AUTO” at the thermostat)?
1. It runs continuously – set to “on”

2. It runs intermittently – set to “auto”

3. It doesn’t run at all / don’t use in the summer

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

SECTION 4 – CAC REPLACEMENT

[FOR RESPONDENTS WHO PURCHASED ENERGY STAR® CAC AFTER SEPTEMBER 2006, BUT DID NOT GET A REBATE]

1. [IF YES AT S2Q2b and NO AT S2Q4] You have indicated that you did not receive a rebate for your recently installed Energy Star® rated central air conditioner.

Were you aware that the rebate programs provided customers with rebates between $350 and $500 for upgrading or replacing their existing central air conditioner with an Energy Star® rated central air conditioner? [An Energy Star® rated central air conditioner meets or exceeds a premium level of energy efficiency]

1  Yes

2  No

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

2a. [IF YES AT Q1] Why did you decide not to participate in the program?

[OPEN END, DO NOT READ]

1  Was not eligible for the program

2  Did not understand the rules of the program

3  Contractor advised against it

4  It was too much work/time to get the rebate
77 Other (please specify)________
88 Refused
99 Don’t know

2b. [IF “Was not eligible for the program” AT Q2a] Why were you not eligible for the program?

[OPEN END, DO NOT READ]

1 Missed the program deadline
2 Decided not to get an Energy Star® central air conditioner
3 Type of replacement central air conditioner did not qualify
4 Contractor was not part of the program
5 I was not replacing an existing central air conditioner
77 Other (please specify)________
88 Refused
99 Don’t know

[FOR RESPONDENTS WHO PURCHASED A NON-ENERGY STAR CAC AFTER SEPTEMBER 2006]

3. [IF YES TO “Air conditioner” AT S2Q1 & NO/DK AT S2Q2b] You have indicated that you have recently installed a central air conditioner that was NOT Energy Star® rated. What factors were most important to you when you decided to purchase the central air conditioner that day?

[OPEN END, DO NOT READ]

1 Finding a replacement central air conditioner fast
2 Finding an energy efficient replacement central air conditioner
3 Receiving a rebate from a energy conservation program
4 Recommendation from my contractor
5. Recommendation from a friend/relative/associate

6. Finding a low-cost replacement central air conditioner

77. Other (Specify): ______________________

88. Refused

99. Don’t know

4. [IF MORE THAN ONE RESPONSE TO Q3] Which factor was most important?
   [OPEN END, DO NOT READ]

1. Finding a replacement central air conditioner fast

2. Finding an energy efficient replacement central air conditioner

3. Receiving a rebate from a energy conservation program

4. Recommendation from my contractor

5. Recommendation from a friend/relative/associate

6. Finding a low-cost replacement central air conditioner

77. Other (Specify): ______________________

88. Refused

99. Don’t know

5. [IF YES TO “Air conditioner” AT S2Q1b & NO/DK AT S2Q2b] Do you recall having the choice between a standard central air conditioner and an Energy Star® rated air conditioner?

1. Yes

2. No

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]
6. [IF YES TO Q5] Why did you decide to not purchase an Energy Star® rated central air conditioner?

[OPEN END, DO NOT READ]

1. It was too expensive
2. It wasn’t worth the potential energy savings
3. Having an energy efficient central air conditioner wasn’t important to me
4. Didn’t know much about Energy Star® central air conditioners
77. Other (please specify)____________
88. Refused
99. Don’t know

7. [IF YES TO Q5] Let’s assume that it cost an extra $600 to purchase an Energy Star® rated central air conditioner over a standard minimum efficiency unit. What minimum rebate level would have persuaded you to purchase an Energy Star® rated central air conditioner?

[OPEN END, DO NOT READ CODE CLOSEST VALUE TO RESPONSE]

1. $200
2. $250
3. $300
4. $350
5. $400
6. $500
7. The full $600 difference in price
77. No rebate would have persuaded me
88. Refused
8. [IF YES TO “Air conditioner” AT S2Q1b] Since you had the new central air conditioner installed, have you generally kept the thermostat setting for your central air conditioner at the same level as before, a little colder (lower temperature in the house), or a little higher (warmer temperature in the house)?

1. The same
2. A little colder
3. A little warmer
4. Haven’t used my central air conditioner system
5. I didn’t have an air conditioner before

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

8b. [IF A LITTLE COLDER at 8] Approximately how many degrees lower is your thermostat set now for air conditioning compared to before:

Colder by ______ Degrees (TRY TO GET A NUMBER)

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

8c. [IF A NUMBER IS GIVEN AT 8b] Is this in Celsius or Fahrenheit?

1. Celsius
2. Fahrenheit

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

8d. [IF A LITTLE WARMER at 8] Approximately how many degrees higher is your thermostat set now for air conditioning compared to before?
Warmer by _____ degrees (try to get a number)

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

8e. [IF A NUMBER IS GIVEN AT 8d] Is this in Celsius or Fahrenheit?

1 Celsius
2 Fahrenheit

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

11. [IF YES TO “Air conditioner” AT S2Q1] Since you had the new central air conditioner installed, would you say that the number of hours you operate your central air conditioner are about the same as before, more frequently (more hours) or less frequently (fewer hours)?

1 The same
2 More frequently
3 Less frequently

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

11a. [IF MORE FREQUENTLY AT 11] Approximately how many MORE hours per day do you operate your central air conditioner

______________ Hours per day (TRY TO GET NUMBER)

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

11b. [IF LESS FREQUENTLY AT 11] Approximately how many LESS hours per day do you operate your central air conditioner

______________ Hours per day (TRY TO GET NUMBER)
SECTION 5-CAC TUNE UPS

[FOR RESPONDENTS WHO RECEIVED A CAC TUNE-UP AFTER SEPTEMBER 2006 BUT DID NOT RECEIVE REBATE]

1. [IF YES AT S2Q1c and NO AT S2Q4] You have indicated that you did not receive a rebate for your recently tuned up central air conditioner.

Were you aware that the rebate programs provided customers with a rebate of $50 for tuning up their existing air conditioner?

1 Yes
2 No

88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

2a. [IF YES AT Q1] Why did you decide not to participate in the program?

[OPEN END, DO NOT READ]

1 Was not eligible for the program
2 Did not understand the rules of the program
3 Contractor advised against it
4 It was too much work/time to get the rebate
77 Other (please specify)________

88 Refused
99 Don’t know

2b. [IF “Was not eligible for the program” AT Q2a] Why were you not eligible for the program?
1. Missed the program deadline
2. I tuned up my CAC myself
3. Contractor was not part of the program
77. Other (please specify)________
88. Refused
99. Don’t know

**[FOR RESPONDENTS WHO DID NOT RECEIVE A CAC TUNE-UP AFTER SEPTEMBER 2006]**

3. **[IF YES AT S2Q1a and NO AT S2Q1c and NO for REPLACED AIR CONDITIONER S2Q1b]**
You have indicated that you have not tuned up central air conditioner after September 2006. Have you ever had your central air conditioner tuned up before?

1. Yes
2. No
88. Refused [DO NOT READ]
99. Don’t know [DO NOT READ]

4. **[IF YES AT Q3]** When was your central air conditioner last tuned up?

**[OPEN END, DO NOT READ]**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Less than 2 years ago (after Spring 2006)</td>
</tr>
<tr>
<td>2</td>
<td>Between 2 and 5 years ago (2003 - 2006)</td>
</tr>
<tr>
<td>3</td>
<td>Between 6 and 8 years ago (2002 – 2000)</td>
</tr>
<tr>
<td>4</td>
<td>More than 8 years ago (Before 2000)</td>
</tr>
</tbody>
</table>
88. Refused [DO NOT READ]
99. Don’t know [DO NOT READ]
5. **[IF YES AT S2Q1a and NO AT S2Q1c and NO for REPLACED AIR CONDITIONER S2Q1b]**
   How old is your central air conditioner?

   **[OPEN END, DO NOT READ]**

   1  Less than 1 year old  
   2  2-5 years old  
   3  5-10 years old  
   4  10-15 years old  
   5  Over 15 years old  
   88  Refused  
   99  Don’t know

6. **[IF YES AT S2Q1a and NO AT S2Q1c and NO for REPLACED AIR CONDITION S2Q1b]**
   Were you aware that the rebate programs provided customers with a rebate of $50 for tuning up your existing air conditioner?

   1  Yes  
   2  No  
   88  Refused **[DO NOT READ]**  
   99  Don’t know **[DO NOT READ]**

6a. **[IF YES AT Q6]** Why did you choose not to participate in the rebate program by having your central air conditioner tuned up?

   **[OPEN END, DO NOT READ]**

   1  Did not want to tune up my air conditioner  
   2  Did not understand the program rules  
   3  Too expensive  
   4  Too much work/time to get the rebate
5  Hardly use my central air conditioner

6  Doesn’t need to be tune up/Tuned up recently

77  Other (please specify)________

88  Refused

99  Don’t know

7.  [IF YES AT S2Q1a and NO AT S2Q1c and NO for REPLACED AIR CONDITIONER S2Q1b AND NOT ANSWER 6 FOR Q6a] Let’s assume that it cost $175 for a contractor to tune up your central air conditioner. What minimum rebate level would persuade you to get your central air conditioner tune up?

[OPEN END, DO NOT READ CODE CLOSEST VALUE TO RESPONSE]

1  $50

2  $100

3  $150

4  The full $175

5  No rebate would persuade me

88  Refused

99  Don’t know

8.  [IF YES AT S2Q1a and NO AT S2Q1c and NO for REPLACED AIR CONDITIONER S2Q1b] Are you likely to tune up your central air conditioner within the next year?

1  Yes

2  No

88  Refused

99  Don’t know

9.  [IF NO FOR Q8] What are the reasons why you don’t want tune up your central air conditioner?
(OPEN END, DO NOT READ, BUT SELECT ALL THAT APPLY)

1. My central air conditioner does not need a tune up
2. I hardly use my central air conditioner
3. I didn’t know I had to tune up my air conditioner
4. Too expensive
5. I would rather just replace my central air conditioner
77. Other (please specify)_____
88. Refused
99. Don’t know

SECTION 6-PROGRAMMABLE THERMOSTATS

[ALL EXCEPT THOSE WHO ALREADY HAD A PROGRAMMABLE THERMOSTAT INSTALLED IN THEIR HOME BEFORE SEPTEMBER 2006]

1. [ASK TO ALL EXCEPT THOSE WHO ANSWERED “YES” TO S2Q2C AND “YES” TO S2Q4] Are you aware that the rebate program provided customers with a rebate between $50 and $75 for upgrading a standard non-programmable thermostat to a programmable thermostat?

1. Yes
2. No

88. Refused [DO NOT READ]
99. Don’t know [DO NOT READ]

[FOR RESPONDENTS WHO HAVE A NON-PROGRAMMABLE THERMOSTAT AND AWARE OF THE PROGRAM]

2a. [IF NO TO “PROGRAMMABLE THERMOSTATS” AT S2Q1b, NO TO S2Q2C, AND YES AT S6Q1] Why did you choose not to participate in the rebate program by upgrading your existing standard non-programmable thermostat with a new programmable thermostat?

[OPEN END, DO NOT READ]
1. Did not want a programmable thermostat

2. Did not understand the program rules

3. Too expensive

4. Wanted to install a programmable thermostat on my own

5. The contractor never mentioned it to me

6. Too much work/time to get the rebate

7. Other (please specify)________

8. Refused

9. Don’t know

2b. [IF “Didn’t want a programmable thermostat” at Q2a]. And why didn’t you want a programmable thermostat?

[OPEN END, DO NOT READ]

7. Existing thermostat works fine

8. I manually change the temperature on my existing thermostat

9. I keep the house relatively constant temperature

10. Too expensive

11. Too complicated to use

77. Other (please specify)_____

88. Refused

99. Don’t know

3. [IF NO TO “PROGRAMMABLE THERMOSTATS” AT S2Q1b, NO TO S2Q2C, AND YES AT Q1] Let’s assume that it cost $200 for the purchase and installation of a programmable thermostats by contractor. What minimum rebate level would persuade you to install a programmable thermostat?
1 $50
2 $100
3 $150
4 The full $ 200
7 A free programmable thermostat and I will pay for the installation cost
8 No rebate would persuade me
88 Refused
99 Don’t know

4. [IF NO TO “PROGRAMMABLE THERMOSTATS” AT S2Q1b AND NO TO S2Q2C] Are you likely to install a programmable thermostat within the next year?

1 Yes
2 No
88 Refused
99 Don’t know

5. [IF NO FOR Q4] What are the reasons why you don’t want a programmable thermostat?

(OPEN END, DO NOT READ, BUT SELECT ALL THAT APPLY)

1 Existing thermostat works fine
2 I manually change the temperature on my existing thermostat
3 I keep the house relatively constant temperature
4 Too expensive
5 Too complicated to use
77 Other (please specify)_____
6a. [IF YES AT PROGRAMMABLE THERMOSTAT S2Q1B AND NO/DK AT S2Q4 AND YES AT Q1] Why did you choose not to participate in the rebate program for upgrading your standard non-programmable thermostat with your new programmable thermostat?

[OPEN END, DO NOT READ]

1. Was not eligible for the program
2. Did not understand the program rules
3. Wanted to install a programmable thermostat on my own
4. The contractor never mentioned it to me
5. Too much work/time to get the rebate
77. Other (please specify)_______
88. Refused
99. Don’t know

6b. [IF “Was not eligible for the program” AT Q6a] Why were you not eligible for the program?

[OPEN END, DO NOT READ]

1. Missed the program deadline
2. Installed the programmable thermostat myself
3. Already had an existing programmable thermostat
4. Contractor was not part of the program
5. Type of programmable thermostat not eligible
SECTION 8 - PARTICIPATION IN OTHER PROGRAMS – ASK EVERYONE

1. Have you participated in other energy saving programs recently?

1  Yes

2  No

88  Refused [DO NOT READ]

99  Don’t know [DO NOT READ]

2. [IF YES AT Q1] And which of the following energy savings programs have you participated in:

[ROTATE]

<table>
<thead>
<tr>
<th>Program</th>
<th>Yes (1)</th>
<th>No (2)</th>
<th>Refused (88)</th>
<th>D/K (99)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every Kilowatt Counts coupon program offering rebates for compact fluorescent lights, outdoor solar lights, LED Christmas lights and other energy saving products</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer Savings Challenge Program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great Refrigerator Round-Up / fridge pick-up and recycling program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Saver program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enbridge / Union Gas programmable thermostat program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enbridge / Union Gas gas water heater conversion program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enbridge / Union Gas Energy Star® high-efficiency furnace program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government energy audit program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. [IF YES TO “Great Refrigerator Round-Up / fridge pick-up and recycling program” AT Q2] When did you participate in the Great Refrigerator Round Up program? (PLEASE GET SPECIFIC MONTH AND YEAR)

I participated in _______ (mm/yyyy)

4. Would you say you are very concerned, somewhat concerned, not very concerned or not at all concerned about each of the following issues:

READ AND ROTATE

1 – Very concerned

2 – Somewhat concerned

3 – Not very concerned

4 – Not at all concerned

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>Refused (88)</th>
<th>D/K (99)</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

The environmental impacts of electricity generation

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>Refused (88)</th>
<th>D/K (99)</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

The environmental impacts of electricity consumption by consumers

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>Refused (88)</th>
<th>D/K (99)</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

The environmental impacts of electricity consumption by business and industry

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>Refused (88)</th>
<th>D/K (99)</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

5. Do you think that individual consumers such as yourself can definitely, likely, likely not or definitely not make an important contribution to reducing the overall reduction of electrical energy use in the province?

1  Definitely
2. Are you familiar with any standards or ratings currently in place that rate the energy efficiency of appliances?

[OPEN END, DO NOT READ]

1. Energuide

2. Energy Star®

3. Canadian Standards Association standards

77. Other (SPECIFY ________________)

88. Refused

99. Don’t know

6. Have you ever heard the term “conservation culture”?

1. Yes

2. No

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

8. I’d like to read you a list of opinions that we often hear expressed. For each one, please tell me whether you totally agree, somewhat agree, somewhat disagree or totally disagree.

1. Totally agree
2 Somewhat agree
3 Somewhat disagree
4 Totally disagree
5 Neither agree nor disagree
6 Depends [DO NOT READ]

88 REFUSED [DO NOT READ]
99 DK [DO NOT READ]

READ AND ROTATE

(I) (2) (3) (4) (5) (6) Refused  D/K

☐ ☐ ☐ ☐ ☐ ☐ 88

☐ ☐ ☐ ☐ ☐ ☐ 99

I am prepared to pay more for an environmentally friendly product

☐ ☐ ☐ ☐ ☐ ☐ ☐ 0 0

To preserve people's jobs in this country, we must accept higher levels of pollution in the future

☐ ☐ ☐ ☐ ☐ ☐ ☐ 0 0

I have enough trouble worrying about my own problems without worrying about others

☐ ☐ ☐ ☐ ☐ ☐ ☐ 0 0

SECTION 9 - DEMOGRAPHICS

And finally, for classification purposes, I have a few questions about your household.

1. How long have you lived at your current residence?

1 Less than 1 year
2 Less than 3 years
3 Between 3 and 5 years
4 Between 5 and 10 years

5 More than 10 years

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

1a. [if LESS THAN 3 YEARS] When did you move into your current residence? (PLEASE GET SPECIFIC MONTH AND YEAR)

I moved into my current residence in ________ (mm/yyyy)

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

2a. How many people, including children, other family members and permanent guests, lived in your home in the summer of 2007 (last summer)?

_______ people [RECORD NUMBER]

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

2b. How many people, including children, other family members and permanent guests, lived in your home in the summer of 2006 (the summer before last)?

_______ [RECORD NUMBER]

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

3. What is the main heating system in your home? Is it:

[RESPONDENT MUST CHOOSE ONE ONLY]

1 Forced air furnace (hot air vents)

2 Furnace (boiler) with hot water or steam radiators
3 Electric baseboards

4 Electric radiant heating

5 Heating stove (burning wood, pellets, etc…)

77 Other (please specify)________________________

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

4. [IF 1 OR 2 AT Q3] What is the main energy source for heating in your home?

[RESPONDENT MUST CHOOSE ONE ONLY]

1 Electricity

2 Natural Gas

3 Oil

4 Propane

5 Wood

77 Other (please specify)________________________

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

5a. Do you have any supplementary sources of heating in your home?

1 Yes

2 No

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

5b. [IF YES AT Q5A] Is it:
1. Electric baseboards

2. Electric space heaters

3. Heating stove (burning wood, pellets, etc…)

4. Natural gas fireplace

5. Electric fireplace

6. Wood fireplace

77. Other (please specify)________

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

7. What fuel do you use to heat your water for showers, baths, dishwashing and laundry? Is it:

[RESPONDENT MUST CHOOSE ONE ONLY]

1. Electricity

2. Natural Gas

3. Oil

4. Propane

5. Solar

77. Other (please specify)________________________

88. Refused [DO NOT READ]

99. Don’t know [DO NOT READ]

8. What fuel do you to use to cook with? Is it:

[RESPONDENT MUST CHOOSE ONE ONLY]

1. Electricity
9. What is the source of energy for your dryer?

[RESPONDENT MUST CHOOSE ONE ONLY]

1. Electricity
2. Natural Gas
3. Propane
77. Other (please specify)________________________
88. Refused [DO NOT READ]
99. Don’t know [DO NOT READ]

10a. Do you normally use a room/window air conditioner during the summer?

1. Yes
2. No
88. Refused [DO NOT READ]
99. Don’t know [DO NOT READ]

10b. [IF YES AT Q10A] How many room/window air conditioners do you normally use during a typical summer?

[OPEN END – DO NOT READ]
11a. Do you have a pool?

1 Yes

2 No

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

11b. [IF YES AT Q11a] Do you have a pool heater?

1 Yes

2 No

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

11c. [IF YES AT Q11b] What is the source of energy used to heat your pool?

1 Electricity

2 Natural Gas

3 Propane

4 Solar

77 Other (please specify)________________________
12a. Do you have a hot tub or spa?

1 Yes

2 No

12b. [IF YES AT Q12a] What is the source of energy used to heat your hot tub or spa?

1 Electricity

2 Natural Gas

3 Propane

4 Solar

77 Other (please specify)________________________

13. How many working refrigerators do you have in your home?

[OPEN END – DO NOT READ]

1 One

2 Two

3 Three

4 Four or more

88 Refused
14. And what type of home do you live in? Is it a:

1 Single family detached house,

2 Single family semi-detached house,

3 Townhouse or row house,

4 Duplex, triplex, four-plex

5 Condominium/apartment

77 Other (please specify)________________________

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

15. In what year was your home built?

1 Before 1970

2 1970-1979

3 1980-1989

4 1990-1999

5 2000-present

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

16. Do you currently own or rent your home?

1 Own

2 Rent

88 Refused [DO NOT READ]
17. And what is the approximate square footage of your home. Please include the basement in the estimate if it is a finished living space. [IF CLARIFICATION IS NEEDED - including kitchen, bedrooms, bathrooms, foyers, dens and hallway]

1  Less than 1000 sq ft
2  1001 to 1500 sq ft
3  1501 to 2000 sq ft
4  2001 to 2500 sq ft
5  2501 to 3000 sq ft
6  3001 to 3500 sq ft
7  3501 to 4000 sq ft
8  more than 4000 sq ft

88  Refused [DO NOT READ]
99  Don’t know [DO NOT READ]

18. Approximately how many weeks would you say the members of your household were away from home during Summer 2007 (last summer)?

_____ [RECORD # WEEKS – MIN:0; MAX:16]

88  Refused [DO NOT READ]
99  Don’t know [DO NOT READ]

19. And approximately how many weeks would you say the members of your household were away from home during Summer 2006 (the summer before last)?

_____ [RECORD # WEEKS – MIN:0; MAX:16]

88  Refused [DO NOT READ]
99  Don’t know [DO NOT READ]
20a. Do you have a secondary home such as a summer or winter home or a cottage?

1 Yes
2 No
88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

20b. [If yes AT Q20a] Approximately how many days in total do you spend at your secondary home in the WINTER?

1 Less than 7 days
2 7 to 14 days (between 1 to 2 weeks total)
3 14 – 28 days (roughly 2 to 4 weeks)
4 30 – 60 days (between 1 and 2 months)
5 more than 60 days (more than 2 months)
88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]

20c. [If yes AT Q20a] Approximately how many days in total do you spend at your secondary home in the SUMMER?

1 Less than 7 days
2 7 to 14 days (between 1 to 2 weeks total)
3 14 – 28 days (roughly 2 to 4 weeks)
4 30 – 60 days (between 1 and 2 months)
5 more than 60 days (more than 2 months)
88 Refused [DO NOT READ]
99 Don’t know [DO NOT READ]
21. Which is the last level of education that you have completed?

[DO NOT READ]

1 Grade school or less

2 Some high school

3 High school grad

4 Vocational/Technical school

5 Some university

6 University grad

7 Postgraduate degree

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]

22. For statistical purposes only, please tell me which of the following categories applies to your total household income for the year 2006? [F1]

[READ - CODE ONE ONLY – STOP ONCE RESPONDENT CONFIRMS CATEGORY]

1 Under $20,000

2 $20,000 to under $40,000

3 $40,000 to under $60,000

4 $60,000 to under $80,000

5 $80,000 to under $100,000

6 $100,000 and over

88 Refused [DO NOT READ]

99 Don’t know [DO NOT READ]
If you have any questions or concerns please feel free to contact BBW at [XXXXXX]

Thank you very much. Your answers will help Ontario Power Authority and [insert utility name] evaluate their energy efficiency efforts to better serve customers.
APPENDIX D: HOT AND COOL SAVINGS PROGRAM CONTRACTOR INTERVIEW GUIDES

See following pages
HCSP PARTICIPANT CONTRACTOR Interview Guide

| Contractor Name |  |
| Contractor Company |  |
| Contactor Number |  |
| HRAI Member? |  |

INTRODUCTION (Survey initiation) ****************************

Identify yourself, Navigant and our work for the OPA in evaluating the Hot and Cool Savings Programs (HCSP).

Explain that we’re calling a number of contactors at random in order to gather their input on the program so that we can make some recommendations to the OPA for program enhancements.

Ask if the person with whom you are speaking is the right person we should be speaking with. If yes, proceed with call.

If not, ask who we should be speaking with:

Name  __________________

Number  __________________

Ask if they have 10 minutes to speak now. If they are willing to speak, proceed. If not, schedule a call:

Date to call back  ________________

Number to call back on  ________________

PROGRAM AWARENESS QUESTIONS

1. Are you aware of this rebate program?

   1   Yes
2. How did you first become aware of this rebate program?

1 Through Company
2 Other Contractors
3 HRAI
4 Online
5 Customers recommendation
6 Other

77 DK/Refused

3. What were your motivations for joining the program?

[do not read – record all that apply]

1 More customers
2 More revenue
2 Ability to offer rebates to my customers
3 Company signed us up/Company made me join
4 Customers were asking about it
5 No reason
6 Other

77 DK/Refused

4. [If more than one] What was your PRIMARY motivation for joining the program?

1 More customers
2 More revenue

3 Ability to offer rebates to my customers

4 Company signed us up/Company made me join

5 Customers were asking about it

6 No reason

7 Other

77 DK/Refused

5. When did you first join the program?

1 2006

2 2007

3 2008

77 DK/REFUSED

6. Did you do participate in any training activities for this program?

1 Yes

2 No

77 DK/Refused

7. [If yes] Where did you receive your training?

1 Online through HRAI

2 HRAI workshop

3 In house training through company

4 Other

77 DK/REFUSED
8. Do you believe the HRAI and the OPA was effective at promoting the rebate program to both members and non-members of the HRAI?

1  Yes
2  No
77  DK/Refused

PROGRAM PARTICIPATION/DRIVER QUESTIONS

1. Approximately what percentage of the customers who ended up receiving a rebate from the program do you believe were already aware of the rebate program before you visited their home?

1 _____% were aware of rebate

2. Do you actively promote the rebate program to your customers (7 point scale, 1 being never, 7 being always)?

3. Would you say that you promote each of the different types of equipment and services covered under the program equally – if not, ask which ones are more aggressively promoted and why.

4. Approximately what percentage of your customers purchasing a new furnace/air handler or new CAC are choosing equipment that is eligible for the rebate (this is choosing an ECM or choosing an Energy Star® CAC– code for ECM separate than Energy Star® CAC

1 _____% of furnace / air handler purchasers buy ECM

2 _____% of CAC purchasers buy Energy Star® CAC

Similar questions were asked in the measure-specific sections below, could drop them, or put this specific question in each of the relevant sections.

5. To what extent have the number of products and services covered by the rebate helped you to sell additional products and services that you wouldn’t otherwise sell. For example, PT when selling furnace, new CAC when selling furnace, etc. (7 point scale, 1 definitely no, 7 being definitely yes)

6. What do you think are the primary motivators behind your customers’ decision to participate in the rebate program (check all that apply)?

1  Having an energy efficient furnace/air conditioner
2  Value of the rebate
3  Reduction in energy bills
4  Being “green”
5  Getting the best deal
77  DK/Refused

7.  (IF MORE THAN ONE) What is the primary motivator?
1  Having an energy efficient furnace/air conditioner
2  Value of the rebate
3  Reduction in energy bills
4  Being “green”
5  Getting the best deal
77  DK/Refused

8.  How much time do you generally spend explaining the rebate program for your customers to fully understand the process?
1  I spend on average _______ mins explaining the rebate program

9.  Do you recall seeing any promotions or advertising for either the Hot Savings or the Cool Savings rebate program?
1  Yes
2  No
77  DK/Refused

10. Do you recall who promoted the rebate program?
1  HRAI
2  OPA
3  Local utility

4  Other (specify)_____  77  DK/Refused

11. Do you believe the program has been effectively promoted to the general public?

1  Yes

2  No

3  DK/Refused

12. If yes – Why?

1  ______ (record)

13. If no – Why Not?

1  ______ (record)

14. Do you support the program rules that customers are required to only use contractors who are registered in the program?

1  Yes

2  No

3  DK/Refused

INSTALLATION EQUIPMENT USE QUESTIONS

Programmable Thermostat

1. In the case of programmable thermostats, do you program the thermostats on behalf of your customers upon completion of the installation?

1  Yes

2  No

77  DK/Refused
2. Do you ask them what temperature or do you suggest an appropriate temperature?
   1. Ask customer
   2. Recommend Temperature
   77 DK/Refused

3. If recommend, what temperature do you set/recommend the programmable thermostats?
   1. Summer – during day when no one home? _______ C
   2. Summer – when people at home? _______ C
   3. Summer – when people sleeping? _______ C
   4. Winter – during day when no one home_______C
   5. Winter- when people at home_______C
   6. Winter- when people at sleeping_______C

4. How much do you generally charge for the equipment and installation of a programmable thermostat?
   1. Charge $_______ for programmable thermostat & installation
   2. Charge $ _______ for installation of programmable thermostat only

5. What do you do with the old non-programmable thermostats that you remove during the replacement process?
   1. Leave at the customer’s home
   2. Dispose in garbage
   3. Return to company depot
   4. Dispose at a hazard material collection depot
   5. Dispose with Clean Air Foundation (Bin they send back to CAF – Switch the Stat)
   77 DK/Refused
6. [If dispose with CAF], How would you rate your ease of interactions with Clean Air Foundation for the disposal of non-programmable thermostat? (7 point scale, 1 very difficult, 7 being very easy)

7. [If not dispose with CAF], Are you aware of the free disposal service program called “Switch the Stat” offered by the Clean Air Foundation?

1 Yes
2 No
77 DK/Refused

8. [If aware] Why aren’t you using their disposal service?

1 Not registered
2 Unsure of how it works
3 I already dispose of them properly
4 Someone at the company disposes of them properly
4 Other_______________
77 DK/Refused

CAC Replacement

1. Before your customers are aware of the rebate, what percentage of your CAC customers specifically ask for an Energy Star® CAC?

1 %____ request Energy Star® CAC

77. DK/REFUSED

1. Approximately what percentage of your customers purchasing a new CAC are choosing equipment that is eligible for the rebate (this is choosing an Energy Star® CAC--

1 ______% of CAC purchasers buy Energy Star® CAC

Similar questions were asked in the measure-specific sections below, could drop them, or put this specific question in each of the relevant sections.
2. On average, what SEER level of air conditioners are you replacing when you install a rebate-qualified CAC?

   1. SEER Level_______

   77. DK/REFUSED

3. What percentage of the CACs you are replacing in the program are at the end of their useful life?

   1. _____% are at the end of their useful life

   77. DK/REFUSED

4. What would you say the average SEER level was for customers who replaced their CAC with a non-Energy Star rated CAC (i.e., those customers who bought a new CAC, but not an Energy Star® CAC)

   1. SEER Level_______ during Hot Savings period (Nov’06 – Mar’07)

   2. SEER Level_______ during Cool Savings period (Apr’07 – Mar’08)

5. [If different SEER Level for Hot Savings and Cool Savings], Why are they different?

6. [If SEER Level during Cool Savings period is not 13] What do you expect the average SEER level will be for customers who replace their CAC with a non-Energy Star® rated CAC will be for this spring and summer

   1. SEER Level_______

   77. DK/REFUSED

7. Was size of CAC do you typically install in a single family detached home?

   1 SIZE _______ tons

   77. DK/REFUSED

8. Regardless if there was a rebate or not, what percentage of your customers do you think would be willing to pay extra for the Energy Star® label?

   1. _____% would pay extra
9. On average, how much extra would you say these customers are prepared to pay for an Energy Star® rated CAC above the minimum 13 SEER level CAC, without considering the rebate?

1. less than $200
2. $200 to $400
3. $400 - $600
4. more than $600
77. DK/REFUSED

10. Excluding the rebate for a minute, what is the approximate incremental cost of going from a SEER 13 CAC to a Tier 1 Energy Star® (SEER 14) CAC for your typical CAC installation?

1. Difference of $____
77. DK/REFUSED

11. Excluding the rebate for a minute, what is incremental cost of going from SEER 13 to a Tier 2 Energy Star® (SEER 15)?

1. Difference of $____
77. DK/REFUSED

12. How readily available are Energy Star® CACs? (7 point scale, 1 being almost impossible to get, 7 being extremely easy to get)

13. Given the rebates levels that were available for customers, would you say that buying Energy Star CACs (minimum SEER 14) is generally a “good investment” for your customers?

1. Yes
2. No
77. DK/REFUSED

14. Would you say that buying Energy Star® CACs (minimum SEER 14) is generally a “good investment” for your customers if the rebate was not available?

1. Yes
2. No

77 DK/REFUSED

**ECM Furnaces**

1. Before they are aware of the rebate, what percentage of your furnace / air handler customers specifically ask for one equipped with an ECM?

   1. %_____ request ECM

   77. DK/REFUSED

2. Approximately what percentage of your customers purchasing a new furnace/air handler are choosing equipment that is eligible for the rebate (this is choosing an ECM)

   1. _____% of furnace / air handler purchasers buy ECM

   77. DK/REFUSED

3. For your customers who bought a furnace or air handler equipped with an ECM, what do you think is the primary reason they bought one with an ECM?

   1. Potential energy savings

   2. Wanted the rebate

   3. Other ________

   77. DK/REFUSED

4. For your customers who bought a furnace or air handler equipped with a conventional motor and not an ECM), what do you think is the primary reason they bought one with a conventional motor?

   1. Cheaper than ECM

   2. Not worth energy savings

   3. Not recommended based on their usage/furnace type

   4. Other_______

   77. DK/REFUSED
5. If the rebate program was not available, what percentage of your customers do you think would get an ECM?

1. %_____ would get an ECM

77. DK/REFUSED

6. Do you recommend that your customers with an ECM leave the fan control setting on their thermostat set to “auto” or “on” during the winter?

1. Auto (intermittent)

2. On (continuous operation)

77. DK/REFUSED

7. Do you recommend that your customers with an ECM and that have CAC leave the fan control setting on their thermostat set to “auto” or “on” during the summer?

1. Auto (intermittent)

2. On (continuous operation)

77. DK/REFUSED

8. Do you recommend that your customers with an ECM and that DO NOT have CAC leave the fan control setting on their thermostat set to “auto” or “on” during the summer?

1. Auto (intermittent)

2. On (continuous operation)

77. DK/REFUSED

9. Excluding the rebate, what is the incremental cost difference between a furnace with an ECM and a furnace WITHOUT an ECM?

1. Difference of $_____

77. DK/REFUSED

10. Is the incremental cost to go to an ECM different between a mid-efficiency and a high-efficiency furnace?
1. Yes

2. No

77. DK/REFUSED

11. [If yes] How much?
   1. Difference of $____

77. DK/REFUSED

12. How readily available are furnaces with ECMs? (7 point scale, 1 being almost impossible to get, 7 being extremely easy to get)

13. How readily available are replacement air handlers with ECMs? (7 point scale, 1 being almost impossible to get, 7 being extremely easy to get)

14. In general and given the rebates that were available for customers, would you say that buying an ECM is generally a “good investment” for your customers?
   1. Yes

   2. No

77. DK/REFUSED

15. Would you say that buying an ECM is generally a “good investment” for your customers if the rebate was not available?
   1. Yes

   2. No

77 DK/REFUSED

CAC Tune Up

1. What percentage of your customers are aware they should regularly tune up their CAC?

   1. ____% are aware that they should regularly tune up their air conditioner

77. DK/Refused
2. In general, what percentage energy savings do you think that customers can expect from a CAC tune-up?
   
   1. ___% energy savings

   77. DK/Refused

3. What would you estimate the average SEER level of the CACs you tuned-up under the rebate program was?
   
   1. Average SEER level was _________

   77. DK/REFUSED

4. What would you estimate the average age of the CACs you tuned-up under the rebate program was?
   
   1. Average age was _________

   77. DK/REFUSED

5. What percentage of your customers who got a rebate under the program generally tune up their air conditioners every year?
   
   1. ______% of the customers get their CAC tuned up every year

   77. DK/REFUSED

6. How frequently do you recommend your customers tune up their air conditioners if they are less than five years old?
   
   1. Every ______ years

   77. DK/REFUSED

7. How frequently do you recommend your customers tune up their air conditioners if they are more than five years old?
   
   1. Every ______ years

   77. DK/REFUSED

8. Excluding the rebate, how much on average do you charge for a CAC tune up?
1. I charge $____ for a CAC tune up

77. DK/REFUSED

ALL

1. On a scale of 1 – 7 (with 1 being not very influential and 7 being very influential) how influential would you say each of the different rebates available through the program over the past year were in encouraging customers to do something (such as getting a CAC tune-up or buying an Energy Star® CAC instead of a non-Energy Star® CAC) they would not otherwise do if the rebate hadn’t been available?

   a. programmable thermostat rebate (code 1 – 7)
   b. Tier 1 Energy Star® CAC rebate
   c. Tier 2 Energy Star® CAC rebate
   d. Mid-efficiency furnace with ECM rebate
   e. High efficiency furnace with ECM rebate
   f. Combination high-efficiency furnace with ECM and Tier 2 Energy Star® CAC rebate
   g. CAC tune up rebate

77. DK/REFUSED

2. In general, do you believe the rebate levels are set at the right level?

   1. YES
   2. NO

77. DK/REFUSED

3. [If no] Should they be higher or lower?

   1. Higher
   2. Lower

77. DK/REFUSED
4. Specifically, which rebate?
   a. Installation of a programmable thermostat rebate
   b. Tier 1 Energy Star® CAC rebate
   c. Tier 2 Energy Star® CAC rebate
   d. Mid-efficiency furnace with ECM rebate
   e. High efficiency furnace with ECM rebate
   f. Combination high-efficiency furnace with ECM and Tier 2 Energy Star® CAC rebate
   g. CAC tune up rebate
   h. ___ (letter) should be higher/lower
   i. 77. DK/REFUSED

5. What percentage of the rebate forms do end up mailing in yourself on behalf of the customer?
   1. I mail in _____% of the rebate forms
      77. DK/REFUSED

6. Over the past year, have you ever had any rebate forms come back to you from CF&R (the rebate company) requesting additional information?
   1. YES
   2. NO
      77. DK/REFUSED

7. [IF YES] Approximately what percentage of the rebate forms over the past year were returned to you requesting additional information?
   1. _____% of the rebate forms were returned to me
      77. DK/REFUSED

8. Do you believe CF&R provided you with sufficient information to address the issue?
1. YES

2. NO

77. DK/REFUSED

PROGRAM ASSISTANCE AND EFFICIENCY QUESTIONS

1. Do you believe you get adequate training from the HRAI for your participation in the rebate program? (7 point scale, 1 definitely no, 7 being definitely yes)

2. [IF BELOW 5] How could the training be improved?
   a. Record answer

3. Do you believe the training you received from HRAI has resulted in higher customer satisfaction than otherwise would have been the case without the training?
   1. YES
   2. NO

77. DK/REFUSED

4. Are you satisfied with the support and/or assistance you might require during the rebate program? (7 point scale, 1 extremely unsatisfied, 7 being extremely satisfied)

5. [IF BELOW 5] How could the support and/or assistance be improved?
   a. Record answer

6. Are you satisfied with the effectiveness of the program materials and forms provided through CF&R Services? (7 point scale, 1 extremely unsatisfied, 7 being extremely satisfied)

7. [IF BELOW 5] How could the effectiveness be improved?
   a. Record answer

8. Are you satisfied with the timeliness of the program materials and forms provided through CF&R Services? (7 point scale, 1 extremely unsatisfied, 7 being extremely satisfied)

9. [IF BELOW 5] How could the timeliness be improved?
a. Record answer

10. Would you prefer the rebate forms to be submitted online (via the internet) or do you prefer the rebate forms remain in the paper format?

1. online
2. paper

77. DK/REFUSED

11. Overall, how satisfied are you with the rebate program? (7 point scale, 1 extremely unsatisfied, 7 being extremely satisfied)

12. How could the rebate process be improved?

**Contractor Size/type**

1. Thinking of this past year, approximately how many of the following services do you typically perform during a typical MONTH in high season?

   a. Furnace replacements?
   b. CAC replacements?
   c. CAC tune ups?
   d. Thermostat installations?

2. Now, approximately what percent of these jobs have received a rebate from the Hot or Cool Savings program?

   a. Furnace replacements?
   b. CAC replacements?
   c. CAC tune ups?
   d. Thermostat installations?

3. Other comments??
Thank you very much. Your answers will help Ontario Power Authority and the HRAI evaluate its energy efficiency efforts to better serve customers. Remember: your answers to this survey are confidential and will be used only for this research.

Thank you. We appreciate your taking the time to answer our questions.
NON-PARTICIPANT CONTRACTOR Interview Guide

<table>
<thead>
<tr>
<th>Contractor Name</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor Company</td>
<td></td>
</tr>
<tr>
<td>Contactor Number</td>
<td></td>
</tr>
<tr>
<td>HRAI Member?</td>
<td></td>
</tr>
</tbody>
</table>

INTRODUCTION (Survey initiation) *******************************

Identify yourself, Navigant and our work for the OPA in evaluating the Hot and Cool Savings Programs (HCSP).

Explain that we’re calling a number of contactors at random in order to gather their input on the program so that we can make some recommendations to the OPA for program enhancements.

Ask if the person with whom you are speaking is the right person we should be speaking with. If yes, proceed with call.

If not, ask who we should be speaking with:

Name  ____________

Number  ____________

Ask if they have 10 minutes to speak now. If they are willing to speak, proceed. If not, schedule a call:

Date to call back  ____________

Number to call back on  ____________

PROGRAM AWARENESS QUESTIONS

1. Are you enrolled in this rebate program?

   1  Yes
2  No

99  Comment_____________________________________

If Yes – Thank and Terminate. If NO, continue:

2. Do you provide services to the residential market?

   1  Yes

   2  No

77  DK/Refused

99  Comment_____________________________________

If No, Terminate.

3. If Yes - are you aware of the Hot and Cool Savings rebate program?

   1  Yes

   2  No

77  DK/Refused

99  Comment_____________________________________

If Not aware of the program, read: The “Hot Savings Rebate Program” and the “Cool Savings Rebate Program” are programs run by the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) and the Ontario Power Authority. They provide customers with rebates of up to $750 for upgrading or replacing their existing central air conditioner or furnace. Under these programs, rebates were available for:

- Replacement of an existing forced air/furnace or air handler system with one using an electronically-commuted motor (ECM) system.

- Programmable thermostats

- Replacement of an existing central air conditioner with an Energy Star®- qualified system.

- Central air conditioner tune-ups
4. **If Aware, Read:** How did you first become aware of this rebate program?

1. Through Company
2. Other Contractors
3. HRAI
4. Online
5. Customers recommendation
6. Other __________________________

77. DK/Refused
99. Comment_____________________________________

5. Have you ever previously been enrolled in this rebate program?

1. Yes

2. No  **(SKIP TO 9)**

99. Comment_____________________________________

6. **If previously enrolled: Read**– when did you terminate your involvement?

1. 2008
2. 2007
3. 2006

77. DK/Refused
99. Comment_____________________________________

7. **If Yes** – why did you terminate your involvement?

[do not read – record all that apply]

1. I lost interest
2 Customers not interested

3 Too complicated

4 Too much paperwork

5 Customers complained about rebates not being accurate

6 Customers complained about rebates not being timely

7 Issues with program materials

8 Other _____________________________

77 DK/Refused

99 Comment____________________________

8. [If more than one] What was your PRIMARY motivation for terminating your involvement?

1 I lost interest

2 Customers not interested

3 Too complicated

4 Too much paperwork

5 Customers complained about rebates not being accurate

6 Customers complained about rebates not being timely

7 Issues with program materials

8 Other _____________________________

77 DK/Refused

99 Comment____________________________

9. Why did you not enrol in the rebate program?

[do not read – record all that apply]
1. Never considered enrolling

2. Enrolment too cumbersome

3. Costs too much

4. Don’t see the point/value

5. Have heard negative things about the program

6. Don’t like dealing with HRAI

7. Told by HRAI that I’m not eligible

8. No reason

9. Already offer other rebates to my customers

Which rebates?__________________________

10. Other ________________________

77. DK/Refused

99. Comment_____________________________

10. [If more than one] What was your PRIMARY motivation for not enrolling in the program?

1. Never considered enrolling

2. Enrolment too cumbersome

3. Costs too much

4. Don’t see the point/value

5. Have heard negative things about the program

6. Don’t like dealing with HRAI

7. Told by HRAI that I’m not eligible

8. No reason
9 Already offer other rebates to my customers

10 Other ______________________

77 DK/Refused

99 Comment__________________________

11. Do you believe the HRAI and the OPA was effective at promoting the rebate program to both members and non-members of the HRAI?

1 Yes

2 No

77 DK/Refused

99 Comment__________________________

12. Do you recall seeing any promotions or advertising for either the Hot Savings or the Cool Savings rebate program?

1 Yes

2 No

77 DK/Refused

99 Comment__________________________

13. Do you recall who promoted the rebate program?

1 HRAI

2 OPA

3 Local utility

4 Other ______________________________

77 DK/Refused

99 Comment__________________________
14. Do you believe the program has been effectively promoted to the general public?

1 Yes

2 No

3 DK/Refused

99 Comment______________________________

15. If Yes – Why?

1 ______ (record)

16. If No – Why Not?

   i. ______ (record)

17. Do you support the program rules that customers are required to only use contractors who are registered in the program?

1 Yes

2 No

3 DK/Refused

99 Comment______________________________

18. What might convince you to enrol in the Hot and Cool Savings rebate program?

1 More customers asking for it

2 Better rebates

3 Easier enrolment for contractors

4 Broader program advertising/public awareness campaigns

5 Rebates to include new installs (not simply replacements)

6 Incentives for contractors
7 More information available on how contractors can enrol

8 Nothing – not interested

77 DK/Refused

99 Comment_______________________________

PROGRAM PARTICIPATION/DRIVER QUESTIONS

19. Thinking about this past 12-months, approximately what percentage of your customers who replace their furnace/air handler, purchase a unit equipped with an ECMs?

_____% of furnace / air handler purchasers buy ECM

20. Thinking about this past 12-months, approximately what percentage of your customers who replace their CAC, purchase an Energy Star® certified unit?

_____% of CAC purchasers buy Energy Star® CAC

21. What do you think are the primary motivators behind your customers’ decision to purchase/install more energy efficient equipment (check all that apply)?

1 Having an energy efficient furnace/air conditioner

2 Reduction in energy bills

3 Being “green”

4 Getting the best deal

77 DK/Refused

99 Comment_______________________________

22. (IF MORE THAN ONE) What is their primary motivator?

1 Having an energy efficient furnace/air conditioner

2 Reduction in energy bills

3 Being “green”
Getting the best deal

DK/Refused

Comment______________________________

Contractor Size/type

23. Thinking of this past year, approximately how many of the following services do you typically perform for residential customers during a typical MONTH in high season?

a. Furnace replacements? ________________

b. CAC replacements? ________________

c. CAC tune ups? ________________

d. Thermostat installations? ________________

24. Other comments? ________________________

EXIT **********************************

Thank you very much. Your answers will help Ontario Power Authority and the HRAI evaluate its energy efficiency efforts to better serve customers. Remember: Your answers to this survey are confidential and will be used only for this research.

Thank you. We appreciate your taking the time to answer our questions.